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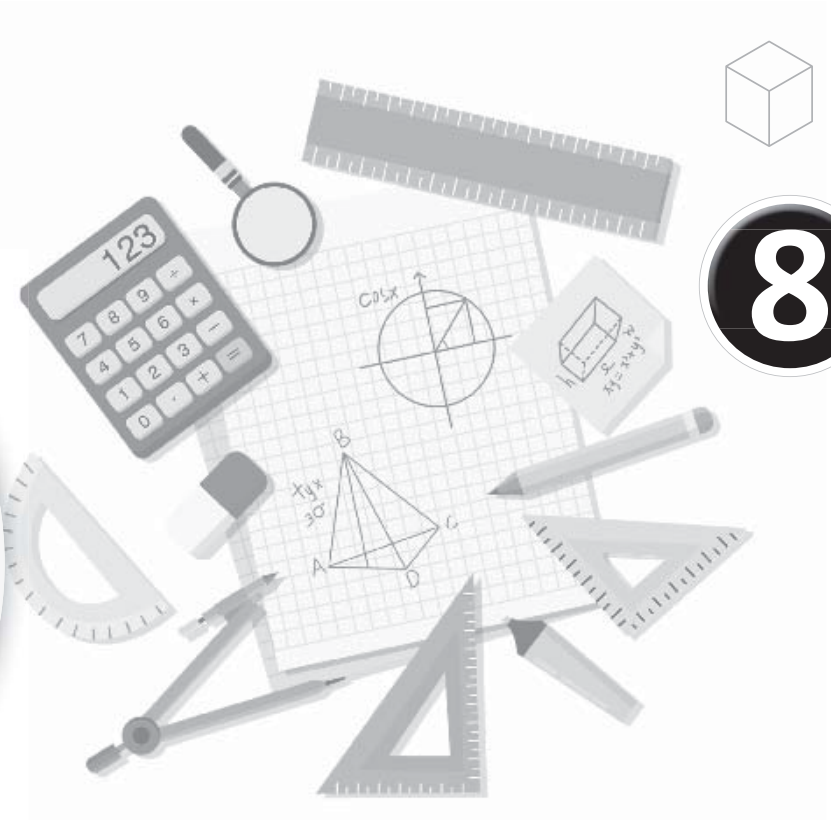
MATHEMATICS

ANSWER KEY

8



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1 Rational Numbers

Exercise 1.1

1. (a) $\frac{7}{5}$ is a rational numbers as 5 and 7 are integers and denominator is 5 not 0.

(b) $\frac{119}{205}$ is a rational numbers as 119 and 205 are integers and denominator is 205not 0.

(c) $\frac{-25}{43}$ is a rational numbers as –25 and 43 are integers and denominator is 43not 0.

(d) $\frac{0}{35}$ is a rational numbers as 0 and 35 are integers and denominator is 35not 0.

(e) $\frac{95}{0}$ is not a rational number. Though 95 and 0 are integers the denominator is 0 and division by 0 has no meaning.

(f) $\frac{-7}{19}$ is a rational numbers as –7 and 19 are integers and denominator is 19not 0.

(g) –215 is a rational number as $-215 = \frac{-215}{1}$ and –215 and 1 are integers and denominator is not zero.

(h) 110 is a rational number as $110 = \frac{110}{1}$ and 110 and 1 are integers and denominator is not zero.

2. (a) $\frac{8}{12}$ is not in standard form at they have common factors (2 and 4) other than 1. When we divide numerator and denominator by common factor 4, we get $\frac{8 \div 4}{12 \div 4} = \frac{2}{3}$. $\frac{2}{3}$ is the standard form of $\frac{8}{12}$.

(b) $\frac{16}{24}$ is not in standard form as they have common factors (2, 4, 8) other than 1. When we divide 8 numerator and denominator by common factor 8, we get $\frac{16 \div 8}{24 \div 8} = \frac{2}{3}$. $\frac{2}{3}$ is the standard form of $\frac{16}{24}$.

(c) $\frac{54}{81}$ is not in standard form as they have common factors [3, 9, 27] other than 1. When we divide numerator and denominator by common factor 27, we get $\frac{54 \div 27}{81 \div 27} = \frac{2}{3}$. $\frac{2}{3}$ is the standard form of $\frac{54}{81}$.

(d) $\frac{21}{28}$ is not in standard form as they have a common factor 7 other than 1. When we divide numerator and denominator by common factor 7, we get $\frac{21 \div 7}{28 \div 7} = \frac{3}{4}$. $\frac{3}{4}$ is the standard form of $\frac{21}{28}$.

(e) $\frac{-14}{28}$ is not in standard form as they have common factors [2, 7, 14] other than 1. When we divide numerator and denominator by common factor 14, we get $\frac{-14 \div 14}{28 \div 14} = \frac{-1}{2}$. $\frac{-1}{2}$ is the standard form of $\frac{-14}{28}$.

(f) $\frac{18}{15}$ is not in standard form as they have a common factor 3 other than 1. When we divide numerator and denominator by common factor 3, we get $\frac{18 \div 3}{15 \div 3} = \frac{6}{5}$. $\frac{6}{5}$ is the standard form of $\frac{18}{15}$.

(g) $\frac{-346}{692}$ is not in standard form as they have common factors [2, 346] other than 1. When we divide numerator and denominator by common factor 346, we get $\frac{-346 \div 346}{692 \div 346} = \frac{-1}{2}$. $\frac{-1}{2}$ is the standard form of $\frac{-346}{692}$.

(h) $\frac{7}{35}$ is not in standard form as they have

a common factor 7 other than 1. When we divide numerator and denominator by common factor 7, we get $\frac{7 \div 7}{35 \div 7} = \frac{1}{5}$. $\frac{1}{5}$ is the standard form of $\frac{7}{35}$.

3. (a) $\frac{4}{5} = \frac{-12}{\boxed{-15}} = \frac{20}{\boxed{25}}$

$-12 \times 5 = -60$, in order to get -60 4 should be multiplied by -15.

$-15 \times 20 = -300$, in order to get -300 – 1–12 should be multiplied by25.

(b) $\frac{-5}{7} = \frac{-15}{\boxed{21}} = \frac{-35}{\boxed{49}}$

$7 \times -15 = -105$, in order to get -105, -5 should be multiplied by 21.

$-35 \times 21 = -735$, in order to get -735.–15 should by multiplied by 49.

(c) $\frac{-3}{\boxed{8}} = \frac{6}{-16} = \frac{\boxed{-9}}{24}$

$-16 \times -3 = 48$, in order to get 48, 6 should be multiplied by 8.

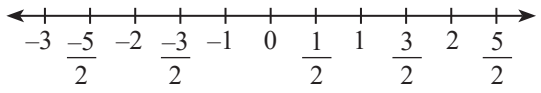
$24 \times 6 = 144$, in order to get 144, -16 should be multiplied by -9.

(d) $\frac{16}{24} = \frac{8}{\boxed{12}} = \frac{-32}{\boxed{-48}}$

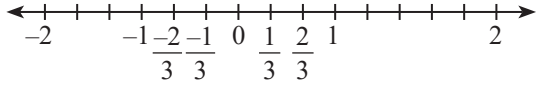
$24 \times 8 = 192$, in order to get 192, 16 should be multiplied by 12.

$12 \times -32 = -384$, in order to get -384, -32 should be multiplied by -48.

4. (a)



(b)



5. (a) $\frac{-2}{7}, \frac{3}{7}$

[Both, the denominators are same. On comparing numerators we get $-2 < 3$. Hence, $\frac{-2}{7} < \frac{3}{7}$].

(b) $\frac{-2}{7}, \frac{-2}{7}$

[Both, the numerators and denominatos are same. Hence, $\frac{-2}{7} = \frac{-2}{7}$].

(c) $\frac{-11}{19}, \frac{7}{19}$

[Both, the denominators are same. On comparing numerators we get $-11 < 7$. Hence, $\frac{-11}{19} < \frac{7}{19}$].

(d) $\frac{-5}{8}, \frac{-3}{4}$

L.C.M. of 8 and 4 is 8. To make the denominators same we,

$\frac{-5 \times 1}{8 \times 1} = \frac{-5}{8}, \frac{-3 \times 2}{4 \times 2} = \frac{-6}{8}$

2	4, 8
2	2, 4
2	1, 2
	1

LCM = $2 \times 2 \times 2 = 8$

$\frac{-5}{8}, \frac{-6}{8}$ [Denominator are same on comparing numarators, we get $-5 > -6$ therefore, $\frac{-5}{8} > \frac{-6}{8} \Rightarrow \frac{-5}{8} > \frac{-3}{4}$]

6. (a) $\frac{-4}{12}$ $\boxed{<}$ $\frac{-5}{-8}$ $\left[\frac{-5}{-8}, \frac{5}{8}\right]$ [Dividing both numerator and denominator by -1]

L.C.M. of 12 and 8. To makes the denominators same we,

$\frac{-4 \times 2}{12 \times 2} = \frac{-8}{24}, \frac{5 \times 3}{8 \times 3} = \frac{-15}{24}$

$= 2 \times 2 \times 3 \times 2$

$= 24$

2	12, 8
2	6, 4
3	3, 2
2	1, 2
	1

$\frac{-8}{24}, \frac{15}{24}$ [Denominators are same on comparing numerators we get $-8 < 15$ therefore, $\frac{-8}{24} < \frac{15}{24} \Rightarrow \frac{-4}{12} < \frac{-5}{-8}$].

(b) $\frac{-4}{9} \boxed{<} \frac{-3}{-7}$

L.C.M. of 9 and 7 is 63. To make denominators same we,

$\frac{-4 \times 7}{9 \times 7} = \frac{-28}{63}, \frac{-3 \times 9}{7 \times 9} = \frac{-27}{63}$

3	9, 7
7	3, 7
3	3, 1
	1, 1

$= 3 \times 7 \times 3$

$= 63$

$\frac{-28}{63}, \frac{-27}{63}$ [Denominators are same on comparing numerators we get $-28 < -27$]

Therefore, $\frac{-28}{63} < \frac{-27}{63} \Rightarrow \frac{-4}{9} < \frac{-3}{7}$.

(c) $\frac{-7}{8} \boxed{<} \frac{14}{17}$

L.C.M. of 8 and 17 is 136. To make denominators same we,

$\frac{-7 \times 17}{8 \times 17} = \frac{-119}{136}, \frac{14 \times 8}{17 \times 8} = \frac{112}{136}$

2	8, 17
2	4, 17
2	2, 17
17	1, 17
	1, 1

$= 2 \times 2 \times 2 \times 17$

$= 136$

$\frac{-119}{136}, \frac{112}{136}$ [Denominators are same on comparing numerators we get $-119 < 112$]

Therefore, $\frac{-119}{136} < \frac{112}{136} \Rightarrow \frac{-7}{8} < \frac{14}{17}$.

(d) $\frac{-2}{9} \boxed{=} \frac{8}{-36}$ [or $\frac{-8}{36}$ dividing both numerator and denominator by -1]

L.C.M. of 9 and 36 is 36. To make denominators same we,

$\frac{-2 \times 4}{9 \times 4} = \frac{-8}{36}, \frac{-8 \times 1}{36 \times 1} = \frac{-8}{36}$

3	9, 36
3	3, 12
2	1, 4
2	1, 2
	1

$= 3 \times 3 \times 2 \times 2$

$= 36$

$\frac{-8}{36}, \frac{-8}{36}$ [Both numerator and denominators are same].

Therefore, $\frac{-8}{36} < \frac{-8}{36} \Rightarrow \frac{-2}{9} < \frac{8}{-36}$.

7. (a) $\frac{2}{5}, \frac{-1}{2}, \frac{8}{-15}, \frac{-3}{10} \left[\frac{8}{-15} = \frac{-8}{15}\right]$

L.C.M. of 5, 2, 15 and 10 is 30. To make denominators same we,

$\frac{2 \times 6}{5 \times 6} = \frac{12}{30}, \frac{-1 \times 15}{2 \times 15} = \frac{-15}{30},$

$\frac{-8 \times 2}{15 \times 2} = \frac{-16}{30}, \frac{-3 \times 3}{10 \times 3} = \frac{-9}{30}$

2	5, 2, 15, 10
5	5, 1, 15, 5
3	1, 1, 3, 1
	1, 1, 1, 1

$= 2 \times 5 \times 3$

$= 30$

$\frac{12}{30}, \frac{-15}{30}, \frac{-16}{30}, \frac{-9}{30}$ [Denominators are same, while comparing numerators we get

Therefore, $\frac{-16}{30} < \frac{-15}{30} < \frac{-9}{30} < \frac{12}{30}$

$\Rightarrow \frac{8}{-15} < \frac{-1}{2} < \frac{-3}{10} < \frac{2}{5}$

(b) $\frac{8}{9}, \frac{7}{12}, \frac{-3}{4}, \frac{-8}{-11} \left[\frac{-8}{-11} = \frac{8}{11}\right]$

[Dividing both numerator and denominator by -1]

L.C.M. of 9, 12, 4 and 11 is 396. To make denominators same we,

$\frac{8 \times 44}{9 \times 44} = \frac{352}{396}, \frac{7 \times 33}{12 \times 33} = \frac{231}{396},$

$\frac{-3 \times 44}{4 \times 44} = \frac{-297}{396}, \frac{8 \times 36}{11 \times 36} = \frac{288}{396}$

2	4, 9, 11, 12
2	2, 9, 11, 6
3	1, 9, 11, 3
3	1, 3, 11, 1
11	1, 1, 11, 1
	1, 1, 1, 1

$= 2 \times 2 \times 3 \times 3 \times 11$

$= 396$

$\frac{352}{396}, \frac{231}{396}, \frac{-297}{396}, \frac{288}{396}$ [Denominators are same, while comparing numerators we get

$-297 < 231 < 288 < 352$]

Therefore, $\frac{-288}{396} < \frac{-297}{396} < \frac{231}{396} < \frac{352}{396}$

$\Rightarrow \quad \frac{-3}{4} < \frac{7}{12} < \frac{-8}{-11} < \frac{8}{9}$

8. (a) $\frac{-7}{10}, \frac{8}{-15}, \frac{19}{30}, \frac{-2}{-5}\left[\frac{-2}{-5} = \frac{2}{5}\right]$

[Dividing both numerator and denominator by –1]

L.C.M. of 10, 15, 30 and 5 is 30. To make denominators same we,

$\frac{-7 \times 3}{10 \times 3} = \frac{-21}{30}, \frac{8 \times 2}{-15 \times 2} = \frac{16}{-30}, = \frac{-16}{30}$

$\frac{19 \times 1}{30 \times 1} = \frac{19}{30}, \frac{2 \times 6}{5 \times 6} = \frac{12}{30}$

5	5, 10, 15, 30
2	1, 2, 3, 6
3	1, 1, 3, 3
	1, 1, 1, 1

$= 5 \times 2 \times 3$

$= 30$

$\frac{-21}{30}, \frac{16}{30}, \frac{19}{30}, \frac{12}{30}$ [Denominators are same, while comparing numerators we get,

$19 > 12 > -16 > -21$]

Therefore, $\frac{19}{30} > \frac{12}{30} > \frac{-16}{30} > \frac{-21}{30}$

$\Rightarrow \quad \frac{19}{30} > \frac{-2}{-5} > \frac{8}{-15} > \frac{-7}{10}$

(b) $\frac{7}{8}, \frac{6}{7}, \frac{-3}{4}, \frac{9}{10}$

LCM of 8, 7, 4 and 10 is 280. To make denominator same we,

2	8, 7, 4, 10
2	4, 7, 2, 5
2	2, 7, 1, 5
7	1, 7, 1, 5
5	1, 1, 1, 5
	1, 1, 1, 1

$\frac{7 \times 35}{8 \times 35} = \frac{245}{280}, \frac{6 \times 40}{7 \times 40} = \frac{240}{280}, \frac{-3 \times 70}{4 \times 70} = \frac{-210}{280}, \frac{9 \times 28}{10 \times 28} = \frac{252}{280}$

$\frac{252}{280} > \frac{245}{280} > \frac{240}{280} > \frac{-210}{280}$

$\frac{9}{10} > \frac{7}{8} > \frac{6}{7} > \frac{-3}{4}$

9. $\frac{-42}{98}$ [Common factors of = 42 and 98 are 1, 2, 3, 6, 7, 14, 21, and 42]

$\frac{-42 \div 14}{98 \div 14} = \frac{-3}{7}$

10. (a) True (b) False (c) True

Exercise 1.2

1. (a) $\frac{3}{7} + \frac{1}{7} = \frac{3+1}{4} = \frac{4}{7}$

(b) $\frac{8}{15} + \frac{7}{15} = \frac{8+7}{15} = \frac{15}{15} = 1$

(c) $\frac{-4}{13} + \frac{-5}{13} = \frac{-4+(-5)}{13} = \frac{-9}{13}$

(d) $\frac{2}{33} + \frac{-4}{33} = \frac{2+(-4)}{33} = \frac{-2}{33}$

(e) $\frac{-8}{17} + \frac{13}{20}$

LCM of 17 abd 20 is 340. To make equivilent denominator we,

2	20, 17
2	10, 17
5	5, 17
17	1, 17
	1, 1

$2 \times 2 \times 5 \times 17 = 340$

$\frac{-8 \times 20}{17 \times 20} = \frac{-160}{340}, \frac{13 \times 17}{20 \times 17} = \frac{221}{340}$

$\frac{-160}{340} + \frac{221}{340} = \frac{-160+221}{340} = \frac{61}{340}$

(f) $\frac{13}{35} + \frac{18}{35}$

$\frac{13+18}{35} = \frac{31}{35}$

2. (a) $\frac{3}{6} + \frac{-3}{6} = \frac{3-3}{6} = \frac{0}{6} = 0$

(b) $\frac{-5}{9} + \frac{1}{3} = 9$ is a multiple of 3 or 3 is a factor of 9.

$\frac{1}{3} = \frac{1}{3} \times \frac{3}{3} = \frac{3}{9}$

$\frac{3}{9}$ is an equivalent rational number to $\frac{1}{3}$.

$\frac{-5}{9} + \frac{1}{3} = \frac{-5}{9} + \frac{3}{9} = \frac{-5+3}{9} = \frac{-2}{9}$

(c) $\frac{3}{21}$ and $\frac{5}{7}$

21 is a multiple of 7 or 7 is a factor of 21.

$\frac{5}{7} = \frac{5 \times 3}{7 \times 3} = \frac{15}{21}$

$\frac{15}{21}$ is an equivalent rational number to $\frac{5}{7}$

$\frac{3}{21} + \frac{5}{7} = \frac{3}{21} + \frac{15}{21} = \frac{3 + 15}{21} = \frac{18}{21} = \frac{3}{7}$

(d) $\frac{-3}{9} + \frac{15}{18}$

[18 is a multiple of 9 or 9 is a factor of 18]

$\frac{-3}{9} = \frac{-3 \times 2}{9 \times 2} = \frac{-6}{18}$

$\frac{-3}{9} + \frac{15}{18} = \frac{-6}{98} + \frac{15}{18} = \frac{-6 + 15}{18} = \frac{9}{18} = \frac{1}{2}$

(e) $\frac{3}{7}$ and $\frac{-1}{14}$

[14 is multiple of 7 or 7 is a factor of 14]

$\frac{3}{7} = \frac{3 \times 2}{7 \times 2} = \frac{6}{14}$

$\frac{6}{14}$ is an equivalent rational number to $\frac{3}{7}$

$\frac{3}{7} + \frac{-1}{14} = \frac{6}{14} + \frac{-1}{14} = \frac{6 + (-1)}{14} = \frac{5}{14}$

(f) $\frac{8}{25}$ and $\frac{8}{50}$ [50 is a multiple of 25 or 25 is a factor if 50]

$\frac{8}{25} = \frac{8 \times 2}{25 \times 2} = \frac{16}{50}$, $\frac{16}{50}$ is an equivalent number to $\frac{8}{25}$

$\frac{8}{25} + \frac{8}{50} = \frac{16}{50} + \frac{8}{50} = \frac{8 + 16}{50} = \frac{24}{50} = \frac{12}{25}$

3. (a) $\frac{-5}{7} + \frac{1}{5}$ [7 and 5 are co-prime numbers]

$\frac{-5 \times 5}{7 \times 5} = \frac{-25}{35}$, $\frac{1 \times 5}{5 \times 7} = \frac{7}{35}$

$\frac{-5}{7} + \frac{1}{5} = \frac{-25}{35}, \frac{7}{35} = \frac{-25 + 7}{35} = \frac{-18}{35}$

(b) $\frac{-3}{7} + \frac{2}{5}$ [7 and 5 are co-prime numbers]

$\frac{-3}{7} \times \frac{5}{5} = \frac{-15}{35}$, $\frac{2 \times 7}{5 \times 7} = \frac{14}{35}$

$\frac{-3}{7} + \frac{2}{5} = \frac{-15}{35} + \frac{14}{35} = \frac{-15 + 14}{35} = \frac{-1}{35}$

(c) $\frac{-2}{5} + \frac{2}{5} = \frac{-2 + 2}{5} = \frac{0}{5} = 0$

(d) $\frac{3}{5} + \left(\frac{-4}{7}\right)$ [7 and 5 are co-prime numbers]

$\frac{3 \times 7}{5 \times 7} = \frac{21}{35}$, $\frac{-4 \times 5}{7 \times 5} = \frac{-20}{35}$

$\frac{21}{35} + \left(\frac{-20}{35}\right) = \frac{21 + (-20)}{35} = \frac{1}{35}$

(e) $\frac{3}{5} + \frac{1}{6}$ [5 and 6 are co-prime numbers]

$\frac{3 \times 6}{5 \times 6} = \frac{18}{30}$, $\frac{1 \times 5}{6 \times 5} = \frac{5}{30}$

$\frac{18}{30} + \frac{5}{30} = \frac{18 + 5}{30} = \frac{23}{30}$

(f) $\frac{-18}{20} + \frac{6}{11}$ (20 and 11 are co-prime numbers)

$\frac{-18 \times 11}{20 \times 11} = \frac{-198}{220}$, $\frac{6 \times 20}{11 \times 20} = \frac{120}{220}$

$\frac{-18}{20} + \frac{6}{11} = \frac{-198}{220} + \frac{120}{220} = \frac{-198 + 120}{220} = \frac{-78}{220} = \frac{-39}{110}$

4. (a) $\frac{-13}{210} + \frac{-3}{140}$

LCM of 210 and 140 is 420. To make denominator same we,

$\frac{-13 \times 2}{210 \times 2} = \frac{-26}{420}$, $\frac{-3 \times 3}{140 \times 2} = \frac{-9}{420}$

$\frac{-13}{210} + \frac{-3}{140} = \frac{-26}{420} + \left(\frac{-9}{420}\right) = \frac{-26 + (-9)}{420} = \frac{-35}{420} = \frac{-1}{12}$

(b) $\frac{-21}{81} + \frac{5}{18}$

LCM of 81 and 18 is 162. To make denominator same we,

3	81, 18
2	27, 6
3	27, 3
3	9, 1
3	3, 1
	1, 1

$3 \times 2 \times 3 \times 3 \times 3 = 162$

$\frac{-21 \times 2}{81 \times 2} = \frac{-42}{162}$, $\frac{5 \times 9}{18 \times 9} = \frac{45}{162}$

$\frac{-21}{81} + \frac{5}{18} = \frac{-42}{162} + \frac{45}{162} = \frac{-42 + 45}{162} = \frac{3}{162} = \frac{1}{54}$

(c) $\frac{13}{60} + \frac{-6}{36}$

LCM of 60 and 36 is 180. To make denominator same we,

2	36, 60
2	18, 30
3	9, 15
3	3, 5
5	1, 5
	1, 1

$2 \times 2 \times 3 \times 3 \times 5 = 180$

$\frac{13 \times 3}{60 \times 3} = \frac{39}{180}, \frac{-6 \times 5}{36 \times 5} = \frac{-30}{180}$

$\frac{13}{60} + \frac{-6}{36} = \frac{39}{180} + \frac{-30}{180} = \frac{39 + (-30)}{180} = \frac{9}{180}$

$= \frac{1}{20}$

(d) $\frac{6}{40} + \frac{1}{25}$ LCM of 40 and 25 is 200.

[To make denominator same we;]

$\frac{6 \times 5}{40 \times 5} = \frac{30}{200}, \frac{1 \times 8}{25 \times 8} = \frac{8}{200}$

$\frac{6}{40} + \frac{1}{25} = \frac{30}{200} + \frac{8}{200} = \frac{30 + 8}{200} = \frac{38}{200}$

$= \frac{19}{100}$

2	40, 25
2	20, 25
2	10, 25
5	5, 25
5	1, 5
	1, 1

(e) $\frac{16}{18} + \frac{-16}{27}$

LCM of 18 and 27 is 54. To make denominator same we,

2	18, 27
3	9, 27
3	3, 9
3	1, 3
	1, 1

$= 2 \times 3 \times 3 \times 3 = 54$

$\frac{16 \times 3}{18 \times 3} = \frac{48}{54}, \frac{-16 \times 2}{24 \times 2} = \frac{-32}{54}$

$\frac{16}{18} + \frac{-16}{27} = \frac{48}{54} + \left(\frac{-32}{54}\right)$

$= \frac{48 + (-32)}{54} = \frac{16}{54} = \frac{8}{27}$

(f) $\frac{11}{70} + \frac{-2}{105}$

LCM of 70 and 105 is 270 To make denominators same we,

5	70, 105
7	14, 21
2	2, 3
3	1, 3
	1, 1

$= 5 \times 7 \times 2 \times 3 = 210$

$\frac{11 \times 3}{70 \times 3} = \frac{33}{210}, \frac{-2 \times 2}{105 \times 2} = \frac{-4}{210}$

$\frac{11}{70} + \frac{-2}{105} = \frac{33}{210} + \frac{-4}{210} = \frac{33 + (-4)}{210} = \frac{29}{210}$

5. (a) Commulative property

(b) Associative property of addition

(c) Commulative property

(d) Additive identity

(e) Addtive inverese

(f) Associative property of additon

6. (a) $\frac{2}{7} + \frac{4}{9} + \frac{4}{9} + \boxed{\frac{2}{7}}$

[Comnulative property]

(b) $\frac{7}{13} + \left(\frac{4}{9} + \frac{7}{8}\right)$

$\left(\frac{7}{13} + \frac{4}{9}\right) + \frac{7}{8}$ [Associative prop of addition]

(c) $\frac{-8}{13} + \frac{-2}{9} = \frac{-2}{9} + \frac{-8}{13}$ [Commulative property]

(d) $\frac{-4}{12} + \left(\frac{-2}{9} + \frac{-8}{13}\right) = \left(\frac{-4}{12} + \boxed{\frac{-2}{9}}\right) + \frac{-8}{13}$

[Associative property]

(e) $\frac{-7}{19} + \boxed{0} = \frac{-7}{19}$ [Additive identity]

(f) $\frac{-7}{19} + \boxed{\frac{7}{19}} = 0$ [Additive inverse]

(g) $\boxed{\frac{3}{5}} + 0 = \frac{3}{5}$ [Additive identity]

(h) $\boxed{0} + \frac{2}{7} = \frac{2}{7}$ [Additive identity]

7. To show: $\left(\frac{-2}{5} + \frac{4}{9}\right) + \left(\frac{-3}{4}\right) = \frac{-2}{5} + \left[\frac{4}{9} + \left(\frac{-3}{4}\right)\right]$

LHS

$\frac{-18 + 20}{45} + \left(\frac{-3}{4}\right) = \frac{2}{45} + \left(\frac{-3}{4}\right) = \frac{8 + (-135)}{180}$

$= \frac{-127}{180}$

(LCM of $\frac{-2}{5} + \frac{4}{9}$)

RHS

$\frac{-2}{5} + \left[\frac{16 + 5 - 27}{36}\right] = \frac{-2}{5} + \frac{11}{36} = \frac{-72 + -55}{180}$

$= \frac{-127}{180}$

LHS = RHS, Hence, $\left(\frac{-2}{5} + \frac{4}{9}\right) + \left(\frac{-3}{4}\right) = \frac{-2}{5} + \left[\frac{4}{9} + \left(\frac{-3}{4}\right)\right]$

8. To verify a + (b + c) = (a + b) + c

$a = \frac{-4}{9}$, $b = \frac{7}{11}$, $c = \frac{5}{8}$

LHS: $\frac{-4}{9} + \left(\frac{7}{11} + \frac{5}{8}\right) = \frac{-4}{9} + \frac{56 + 55}{88}$

$= \frac{-4}{9} + \frac{111}{88} = \frac{-352 + 999}{792} = \frac{647}{792}$

RHS

$\left(\frac{-4}{9} + \frac{7}{11}\right) + \frac{5}{8} = \frac{-44 + 63}{99} + \frac{5}{8} = \frac{19}{99} + \frac{5}{8}$

$\frac{152 + 495}{792} = \frac{647}{792}$

LHS = RHS

Hence, a + (b + c) = (a + b) + c

9. Additive inverse is always the opposite of numbers

(a) $\frac{1}{3} = \frac{-1}{3}$

(b) −18 = 18

(c) 0 = 0

(d) $\frac{-3}{11} = \frac{3}{11}$

10. (a) $\left(\frac{-3}{17}\right) + \left(\frac{-12}{5}\right) = \left(\frac{-12}{5}\right) + \left(\frac{-3}{17}\right)$

[Commulative property]

(b) $-12 + \left(\frac{7}{12} + \frac{-9}{11}\right) = \left(-12 + \frac{7}{12}\right) + \frac{-9}{11}$

[Associative property of addition]

(c) $\frac{-16}{7} + \boxed{0} = 0 + \frac{-16}{7} = \frac{-16}{7}$

[Additive identity]

Exercise 1.3

1. (a) $\frac{3}{7} - \frac{2}{7} = \frac{3 - 2}{7} = \frac{1}{7}$

(b) $\frac{11}{30} - \frac{3}{20} = \frac{11 - 3}{20} = \frac{8}{20}$

(c) $\frac{-38}{114} - \left(\frac{-52}{114}\right) - \frac{38 - (-52)}{114} = \frac{38 + 52}{114}$

$= \frac{14}{114}$

(d) $\frac{-14}{110} - \frac{15}{110} = \frac{-14 - 15}{110} = \frac{-29}{110}$

(e) $\frac{70}{89} - \left(\frac{-19}{89}\right) = \frac{70 - (-19)}{89} = \frac{89}{89}$

(f) $\frac{47}{90} - \frac{30}{90} - \frac{47 - 30}{90} = \frac{17}{90}$

(g) $\frac{5}{18} - \frac{2}{3}$

[18 is a multiple of 3 or 3 is a factor of 18]

$\frac{2}{3} \times \frac{6}{6} = \frac{12}{18}$, $\frac{12}{18}$ is an equivalent fraction to $\frac{12}{18}$

$\frac{5}{18} - \frac{2}{3} = \frac{5}{18} - \frac{12}{18} = \frac{5 - 12}{18} = \frac{-7}{18}$

(h) $\frac{-16}{25} - \left(\frac{-1}{5}\right)$ [25 is a multiple of 5 or 5 is a factor of 25]

$\frac{-1 \times 5}{5 \times 5} - \frac{-5}{25}$

$\{\frac{-5}{25}$ is an equivalent fraction to $\frac{-16}{25}\}$

$\frac{-16}{25} - \left(\frac{-1}{5}\right) = \frac{-16}{25} - \left(\frac{-5}{25}\right) = \frac{-16}{25} + \frac{5}{25}$

$= \frac{-16 + 5}{25} = \frac{-11}{25}$

(i) $\frac{-11}{40} - \frac{7}{20}$ [40 is a multiple of 20 or 20 is a factor of 40]

$\frac{7 \times 2}{20 \times 2} = \frac{14}{40}$

$\left[\frac{14}{40}\right.$ is an equivalent fraction to $\left.\frac{7}{20}\right]$

$\frac{-11}{40} - \frac{7}{20} = \frac{-11}{40} - \frac{14}{40} = \frac{-11 - 14}{40} = \frac{-25}{40}$

$= \frac{-5}{8}$

(j) $\frac{-5}{11} - \frac{2}{3}$ [11 and 3 are co-prime numbers]

$\frac{-5 \times 3}{11 \times 3} = \frac{-15}{33}$, $\frac{2 \times 11}{3 \times 11} = \frac{22}{33}$

$\frac{-5}{11} - \frac{2}{3} = \frac{-15}{33} - \frac{22}{33} = \frac{-15 - 22}{33}$

$= \frac{-37}{33}$

(k) $\frac{12}{25} - \left(\frac{-7}{35}\right)$

LCM of 25 and 35 is 175. To make equiualent fractions we,

2	25, 35
2	5, 7
2	1, 7
	1, 1

$5 \times 5 \times 7 = 175$

$\frac{12 \times 7}{25 \times 7} = \frac{84}{175}, \frac{-7 \times 5}{35 \times 5} = \frac{-35}{175}$

$\frac{12}{25} - \left(\frac{-7}{35}\right) \frac{84}{175} - \left(\frac{-35}{175}\right) = \frac{84 - (-35)}{175}$

$= \frac{84 + 35}{175} = \frac{119}{175} = \frac{17}{25}$

(l) $\frac{14}{15} - \left(\frac{-2}{5}\right)$ [15 is a multiple of 5 or 5 is a factor of 15)

$\frac{-2 \times 3}{5 \times 3} = \frac{-6}{15}$

$\frac{14}{15} - \left(\frac{-6}{15}\right) = \frac{14}{15} + \frac{6}{15} = \frac{14 + 6}{15} = \frac{20}{15}$

$= \frac{4}{3}$

2. (a) $\frac{3}{8} - \frac{2}{7} = \frac{2}{7} - \frac{3}{8}$

LCM of 8 and 7 is 56

2	8, 7
2	4, 7
2	2, 7
7	1, 7
	1, 1

$2 \times 2 \times 2 \times 7 = 56$

$\frac{21 - 14}{56} = \frac{14 - 21}{56}$

$= \frac{7}{56} \neq \frac{-7}{56}$

LHS ≠ RHS

Hence, this statement is false.

(b) $\left(\frac{2}{7} - \frac{4}{9}\right) - \frac{1}{8} = \frac{2}{7} - \left(\frac{4}{9} - \frac{1}{8}\right)$

This statement is false as associate property does not hold good for subtraction of rational numbers.

(c) $\frac{3}{8} + 0 = \frac{1}{4}$

$\frac{3}{8} + \frac{0}{1} = \frac{1}{4}$

[LCM of 8 and 1 is 8]

$\frac{3 + 0}{8} = \frac{1}{4}$

$\frac{3}{8} \neq \frac{1}{4}$

LHS ≠ RHS

Hence, this statement is false

(d) $\frac{5}{13} - \left(\frac{-5}{13}\right) = 0$

$\frac{5}{13} + \frac{5}{13} = 0$

$\frac{5 + 5}{13} = 0$

$\frac{10}{13} \neq 0$

LHS ≠ RHS

Hence, this statement is false

(e) $\frac{5}{11} - \left(\frac{5}{11}\right) = 0$

$\frac{5 - 5}{11} = 0$

$\frac{0}{11} = 0$

LHS = RHS

Hence, this statement is true.

(f) $\frac{4}{9} + 0 = \frac{4}{9}$

$\frac{4}{9} + \frac{0}{1} = \frac{4}{9}$

[LCM of 9 and 1 is 9]

$\frac{4 + 0}{9} = \frac{4}{9}$

$\frac{4}{9} = \frac{4}{9}$

LHS = RHS

Hence, this statement is true.

3. (a) $\frac{-6}{9} - \left(\frac{-2}{5}\right)$

LCM of 9 and 5 is 45. To make the denominaotr same we,

5	5, 9
3	1, 9
3	1, 3
	1, 1

$5 \times 3 \times 3 = 45$

$\frac{-6 \times 5}{9 \times 5} = \frac{-30}{45}, \frac{-2 \times 9}{5 \times 9} = \frac{-18}{45}$

$\frac{-6}{9} - \left(\frac{-2}{5}\right) = \frac{-30}{45} - \left(\frac{-18}{45}\right)$

$= \frac{-30}{45} + \frac{18}{45}$

$= \frac{-30 + 18}{45} = \frac{-12}{45} = \frac{-4}{15}$

(b) $\frac{7}{24} - \frac{11}{16}$

LCM of 24 and 16. To make the denominator same we,

2	24, 16
2	12, 8
2	6, 4
2	3, 2
3	3, 1
	1, 1

$= 2 \times 2 \times 2 \times 2 \times 3 = 48$

$\frac{7 \times 2}{24 \times 2} = \frac{14}{48}, \frac{11 \times 3}{16 \times 3} = \frac{33}{48}$

$\frac{7}{24} - \frac{11}{16} = \frac{14}{48} - \frac{33}{48} = \frac{14 - 33}{48} = \frac{-19}{48}$

(c) $\frac{10}{63} - \left(\frac{-6}{7}\right)$

63 is a multiple of 7 or 7 is a factor of 63.

$\frac{-6 \times 9}{7 \times 9} = \frac{-54}{63}, \frac{10}{63} - \left(\frac{-6}{7}\right) = \frac{10}{63} - \left(\frac{-54}{63}\right)$

$= \frac{10}{63} + \frac{54}{63} = \frac{10 + 54}{63} = \frac{64}{63}$

(d) $\frac{11}{13} - \left(\frac{-5}{26}\right)$

26 is multiple of 13 or 13 is a factor of 26.

$\frac{11 \times 2}{13 \times 2} = \frac{22}{26}, \frac{11}{13} - \left(\frac{-5}{26}\right) = \frac{22}{26} - \left(\frac{-5}{26}\right)$

$= \frac{22}{26} + \frac{5}{26} = \frac{22 + 5}{26}$

$= \frac{27}{26}$

4. (a) $\frac{5}{6} + \frac{3}{9} - \left(\frac{-5}{7}\right)$

LCM of 6, 9 and 7 is 126. To make equivalent denominator we,

2	6, 9, 7
3	3, 9, 7
3	1, 3, 7
7	1, 1, 7
	1, 1, 1

$= 2 \times 3 \times 3 \times 7 = 126$

$\frac{5 \times 21}{6 \times 21} = \frac{105}{126}, \frac{3 \times 14}{9 \times 14} = \frac{42}{126}, \frac{-5 \times 18}{7 \times 18} = \frac{-90}{126}$

$\frac{5}{6} + \frac{3}{9} - \left(\frac{-5}{7}\right) = \frac{105}{126} + \frac{42}{126} - \left(\frac{-90}{126}\right)$

$= \frac{105 + 42 - (-90)}{126} = \frac{105 + 42 + 90}{126} = \frac{237}{126}$

$= \frac{79}{42}$

(b) $\frac{-4}{11} + \left(\frac{-2}{3}\right) - \left(\frac{-5}{9}\right)$

LCM of 11, 3 and 9 is 99. To make denominators same we,

3	11, 3, 9
3	11, 1, 3
11	11, 1, 1
	1, 1, 1

$\frac{-4 \times 9}{11 \times 9} = \frac{-36}{99}, \frac{-2 \times 33}{3 \times 33} = \frac{-66}{99}, \frac{-5 \times 11}{9 \times 11}$

$= \frac{-55}{99}$

$\frac{-4}{11} + \left(\frac{-2}{3}\right) - \left(\frac{-5}{9}\right) = \frac{-36}{99} + \left(\frac{-66}{99}\right) - \left(\frac{-55}{99}\right)$

$= \frac{-36 + (-66) - (-55)}{99} = \frac{-36 - 66 + 55}{99} =$

$\frac{-102 + 55}{99} = \frac{-47}{99}$

(c) $\frac{-2}{9} + \left(\frac{-5}{6}\right) = \frac{1}{2}$

LCM of 9, 6 and 2 is 18. To make denominator same we,

$\frac{-2 \times 2}{9 \times 2} = \frac{-4}{18}, \frac{-5 \times 3}{6 \times 3} = \frac{-15}{18}, \frac{1 \times 9}{2 \times 9}$

$= \frac{9}{18}$

$\frac{-2}{9} + \left(\frac{-5}{6}\right) - \frac{1}{2} = \frac{-4}{18} + \left(\frac{-15}{18}\right) \quad \frac{9}{18}$

$= \frac{-4 + (-15) - 9}{18} = \frac{-4 - 15 - 9}{18} = \frac{-28}{18} = \frac{-14}{9}$

5. Sum of $\frac{3}{2}$ and $\frac{-31}{18}$

LCM of 2 and 28 is 28.

$\frac{3 \times 14}{2 \times 14} = \frac{42}{28}, \frac{-31 \times 1}{28 \times 1} = \frac{-31}{28}$

$\frac{52^4}{28} + \left(\frac{-31}{28}\right), \frac{52^4 + (-31)}{28} = \frac{11}{28}$

2	2, 28
2	1, 14
7	1, 7
	1, 1

Sum of $\frac{-5}{3}$ and $\frac{-8}{7}$

$\frac{-5}{3} + \left(\frac{-8}{7}\right)$ [LCM of 3 and 7 is 21]

2	3, 7
2	1, 7
	1, 1

$\frac{-5 \times 7}{-3 \times 7} = \frac{-35}{21}, \frac{-8 \times 3}{7 \times 3} = \frac{-24}{21}$

$\frac{-35}{21} + \frac{-24}{21} = \frac{-35 + (-24)}{21}$

$= \frac{-59}{21}$

$\frac{11}{28} - \frac{-59}{21}$ [LCM of 28 and 21]

$\frac{11 \times 3}{28 \times 3} = \frac{33}{84}, \frac{-59 \times 4}{21 \times 4} = \frac{-236}{84}$

$\frac{33}{84} - \left(\frac{-236}{84}\right)$

$= \frac{33 + 236}{84} = \frac{269}{84}$

2	28, 21
2	14, 21
3	7, 21
7	7, 7
	1, 1

$2 \times 2 \times 3 \times 7 = 84$

Exercise 1.4

1. (a) $\frac{12}{18} \times \frac{7}{36} = \frac{84}{756} = \frac{1}{9}$

(b) $\frac{5}{13} \times \frac{3}{7} = \frac{15}{91}$

(c) $\frac{-1}{5} \times \frac{15}{7} = \frac{-15}{85} = \frac{-3}{17}$

(d) $\frac{-35}{25} \times \frac{5}{7} = \frac{-175}{175} = -1$

(e) $\frac{13}{45} \times \frac{-25}{36} = \frac{-325}{1620} = \frac{-65}{324}$

(f) $\frac{81}{200} \times \frac{50}{27} = \frac{4050}{5400} = \frac{3}{4}$

2. (a) $\frac{13}{17} \div \frac{39}{51} = \frac{13}{17} \times \frac{51}{39} = \frac{1 \times 3}{1 \times 3}$

Common factor of 13 and 39 is 13

Common factor of 17 and 51 is 17

$= \frac{3}{3} = \frac{1}{1}$

(b) $\frac{11}{12} \div \frac{5}{6} = \frac{11}{12} \times \frac{6}{5} = \frac{66}{60} = \frac{11}{10}$

(c) $\frac{7}{14} \div \frac{21}{28} = \frac{7}{14} \times \frac{28}{21} = \frac{1}{1} \times \frac{2}{3} = \frac{2}{3}$

Common factor of 14 and 28 is 14.

Common factor of 7 and 21 is 7.

(d) $\frac{17}{33} \div \frac{5}{11} = \frac{17}{33} \times \frac{11}{5} = \frac{17}{3} \times \frac{1}{5} = \frac{17}{15}$

Common factor of 11 abd 33 is 11.

Common factor of 11 and 55 is 5.

(e) $\frac{-5}{11} \div \frac{-81}{55} = \frac{-5}{1\cancel{11}} \times \frac{\cancel{-55}^{-5}}{81} = \frac{25}{81}$

(f) $\frac{4}{9} \div \frac{2}{8} = \frac{\cancel{4}^{2}}{9} \times \frac{8}{\cancel{2}_{1}} = \frac{16}{9}$

[Common factor 2 and 4 is 2]

(g) $\frac{27}{25} \div \left(\frac{-9}{35}\right) = \frac{27}{25} \times \frac{-35}{9} = \frac{3}{5} \times \frac{-7}{1}$

$= \frac{-21}{5}$

[Common factor of 9 and 27 is 9]

[Common factor of 25 and 35 is 5]

(h) $\frac{11}{30} \div \left(\frac{-11}{2}\right) = \frac{11}{30} \times \frac{-2}{11} = \frac{-1}{15}$

[Common factor of 11 and 11 is 11]

[Common factor of 2 and 30 is 2]

(i) $\frac{-5}{2} \div \frac{1}{8} = \frac{-5}{1\cancel{2}} \times \frac{\cancel{8}^{4}}{1} = \frac{-5}{1} \times \frac{4}{1}$

$= \frac{-20}{1} = -20$

[Common factor of 2 and 8 is 2]

(j) $1\frac{7}{9} \div 1\frac{1}{3} = \frac{16}{9} \div \frac{4}{3} = \frac{16}{9} \times \frac{3}{4} = \frac{4}{3}$

[Common factor of 4 and 16 is 4.]

[Common factor of 3 and 9 is 3]

3. (a) $\left(\frac{-8}{5} \times \frac{3}{4}\right) + \left(\frac{7}{8} \times \frac{-16}{25}\right)$

$\frac{-24}{20} + \frac{-112}{200}$

200 is a multiple of 20 or 20 is a factor of 200.

$\frac{24 \times 10}{20 \times 10} = \frac{-240}{200}$

$\frac{-240}{200} + \frac{-112}{200} = \frac{-2}{25}$

$\frac{-240 + (-112)}{200} = \frac{-240 - 112}{200} = \frac{-352}{200} = \frac{-44}{25}$

(b) $\left(\frac{-7}{25} \times \frac{-15}{18}\right) + \left(\frac{-3}{5} \times \frac{4}{9}\right)$

$= \left(\frac{-7}{5} \times \frac{-3}{18}\right) + \left(\frac{-1}{5} \times \frac{4}{3}\right)$

[Common factor of 15 and 25 is 5]

[Common factor of 3 and 9 is 3]

$\frac{21}{90} + \frac{-4}{15}$ 90 is a multiple of 15 or 15 is a factor of 90.

$\frac{21 + (-24)}{90} = \frac{21 - 24}{90} = \frac{-3}{90} = \frac{-1}{30}$

(c) $\left(\frac{-3}{4} \times \frac{8}{15}\right) + \left(\frac{2}{3} \times \frac{-3}{8}\right) - \left(\frac{-4}{7} \times \frac{1}{2}\right)$

$= \left(\frac{-1}{1} \times \frac{2}{5}\right) + \left(\frac{1}{1} \times \frac{-1}{4}\right) - \left(\frac{-2}{7} \times \frac{1}{1}\right)$

Common factor of 3 and 15 is 3, Common factor of –4 and 2 is 2

Common factor of 4 and 8 is 4

Common factor 3 and 3 is 3

$= \frac{-2}{5} + \frac{-1}{4} - \left(\frac{-2}{7}\right)$

LCM of 5, 4 and 7 is 140

5	5, 4, 7
7	1, 4, 7
2	1, 4, 1
2	1, 2, 1
	1, 1, 1

$= 5 \times 7 \times 2 \times 2 = 140$

$\frac{-56 + (-35) - (-40)}{140} = \frac{-56 - 35 + 40}{140}$

$\frac{-91 + 40}{140} = \frac{-51}{140}$

4. To show: $\left(\frac{-5}{9} \times \frac{4}{15}\right) \times \frac{-3}{4} = \frac{-5}{9} \times \left(\frac{4}{15} \times \frac{-3}{4}\right)$

[Common factor of 5 and 15 is 5]

[Common factor of 4 and 4 is 4]

[Common factor of 3 and 3 is 3]

LHS $= \frac{-5}{9} \times \frac{4}{15} \times \frac{-3}{4}$

$= \frac{-1}{3} \times \frac{1}{3} \times \frac{-1}{1}$

$= \frac{1}{9}$

RHS $= \frac{-5}{9} \times \left(\frac{4}{15} \times \frac{-3}{4}\right)$

[Common factor of 3 and 15 is 3]

[Common factor of 4 and 4 is 4]

[Common factor of 5 and 5 is 5]

$= \frac{-1}{9} \times \frac{1}{1} \times \frac{-1}{1}$

$= \frac{1}{9}$

$\frac{1}{9} = \frac{1}{9}$ ∴ LHS = RHS

Hence, $\left(\frac{5}{9} \times \frac{4}{15}\right) \times \frac{3}{4} = \frac{-5}{9} \times \left(\frac{4}{15} \times \frac{-3}{4}\right)$

5. To show: $\frac{-2}{4}\left(\frac{4}{5} + \frac{-8}{15}\right) = \left(\frac{-2}{4} \times \frac{4}{5}\right) + \left(\frac{-2}{4} \times \frac{-8}{15}\right)$

LHS $= \frac{-2}{4}\left(\frac{4}{5} + \frac{-8}{15}\right)$

LCM of 5 and 15 is 15

5	5, 15
7	5, 5
	1, 1

$3 \times 15 = 15$

$= \frac{-2}{4} \times \left(\frac{12 + 80\ (-8)}{15}\right)$

$= \frac{-2}{4} \times \frac{4}{15}$

$= \frac{-8}{60} = \frac{-2}{15}$

RHS $= \left(\frac{-2}{4} \times \frac{4}{15}\right) + \left(\frac{-3}{4} \times \frac{-8}{15}\right)$

$\frac{-8}{20} + \frac{16}{60}$

LCM of 20 and 60 is 60

$\frac{-24 + 16}{60} = \frac{-8}{60} = \frac{-2}{15}$

$= \frac{-2}{15} = \frac{-2}{15}$

∴ LHS = RHS

Hence, $\frac{-2}{4}\left(\frac{4}{5} + \frac{-8}{15}\right) = \left(\frac{-2}{4} \times \frac{4}{5}\right) + \left(\frac{-2}{4} \times \frac{-8}{15}\right)$

6. To verify: a × (b × c) = (a × b) × c

$a = \frac{-5}{9}$, $b = \frac{4}{15}$, $c = \frac{-5}{9}$

$= \frac{-5}{9} \times \left(\frac{4}{15} \times \frac{-5}{9}\right) = \left(\frac{-5}{9} \times \frac{-4}{15}\right) \times \frac{-5}{9}$

$= \frac{-5}{9} \times \left(\frac{4}{3} \times \frac{-1}{9}\right) = \left(\frac{-1}{9} \times \frac{4}{3}\right) \times \frac{-5}{9}$

[Common factor of 5 and 15 is 5.]

$\frac{-5}{9} \times \frac{-4}{27} = \frac{-4}{27} \times \frac{-5}{9}$

$\frac{20}{243} = \frac{20}{243}$

LHS = RHS

Hence, a × (b × c) = (a × b) × c

7. (a) Associative property of multiplication

(b) Commulative prperty of multiplication

(c) Distributive property of over addition

8. (a) $(-4) \div \left(\frac{-2}{5}\right) \times \frac{3}{4}$

$-4 \times \frac{-5}{2} \times \frac{3}{4} = -1 \times \frac{-5}{2} \times \frac{3}{1} = \frac{15}{2}$

(b) $\frac{8}{15} \div \frac{4}{5} \times \frac{2}{3}$

$\frac{8}{15} \times \frac{5}{4} \times \frac{2}{3} = \frac{80}{180} = \frac{4}{9}$

[Common factor of 80 and 180 is 20]

9. (a) $(80 - 4) + (600 - 2) + (230 + 4)$

$= (80 + 600 + 230) + (-4 - 2 + 4)$

$910 + (-2)$

$= 910 - 2$

$= 908$

(b) $\left(\frac{7}{35} + \frac{17}{20}\right) + \frac{31}{38}$

$\left(\frac{1}{5} + \frac{17}{20}\right) + \frac{31}{38}$ [LCM of 5 and 20 is 20]

$\frac{4 + 17}{20} + \frac{31}{38}$

$\frac{21}{20} + \frac{31}{38}$ [LCM of 20 and 38 is 380.]

$\frac{399 + 31}{380} = \frac{709}{380}$

(c) $782 + 980 + 218 = 700 + 82 + 800 + 90 + 200 + 18$

$= (700 + 800 + 200) + (82 + 18) + 90$

$= 1700 + 100 + (100 - 10)$

$= 1900 - 10$

$= 1890$

10. (a) $\left(\frac{6}{17} \times \frac{11}{17}\right) = \left(\frac{7}{20} \times \frac{7}{20}\right) = \frac{49}{400} \times \frac{66}{289}$

$= \frac{3234}{115600} = \frac{1617}{57800}$

(b) $\frac{3}{4} \times \left(\frac{18}{31} + \frac{13}{31}\right) = \frac{3}{4} \times \left(\frac{31}{31}\right) = \frac{3}{4} \times \frac{1}{1} = \frac{3}{4}$

(c) $273 \times (43 + 57) = 273 \times 100 = 27300$

11. Cost of $2\frac{1}{2}$m silk cloth = ₹$13\frac{3}{4} = \frac{4 + 13 + 3}{4}$

$= \frac{52 + 3}{4} = \frac{55}{4}$

Cost of 1m silk cloth = $\frac{55}{4} \div 2\frac{1}{2}$

$\left(\frac{2 \times 2 + 1}{2} = \frac{4 + 1}{2} = \frac{5}{2}\right)$

$= \frac{55}{4} \div \frac{5}{2} = {}^{11}\cancel{55}/\cancel{4}_{2} \times {}^{1}\cancel{2}/\cancel{5}_{1} \times \frac{11}{2} =$ ₹5.5

Cost of 4m of silk cloth: ₹(5.5×4) = ₹22

Hence, 4m of sild cloth costs ₹22

12. Only (d) $\left(\frac{3}{4} + \frac{4}{5}\right) \div \frac{1}{3} = \left(\frac{3}{4} \div \frac{1}{3}\right) + \left(\frac{4}{5} \div \frac{1}{3}\right)$

Review Exercise

1. (a) $\frac{9}{13}$ is a rational number as 9 and 13 are integers and denominator is 13 not zero.

(b) $\frac{8}{19}$ is a rational number as 8 and 19 are integer and denominator is 19 not zero.

(c) $\frac{6}{12}$ is a rational number as 6 and 12 are integer and denominator is 12 not zero.

(d) $\frac{0}{7}$ is a rational number as 0 and 7 are integers and denominator is 7 not zero.

(e) $\frac{16}{0}$ is not a rational number, though 0 and 16 are integers, but the denominator is 0 and division by 0 has no meaning.

2. (a) $\frac{32}{40} = \frac{32 \div 8}{40 \div 8} = \frac{4}{5}$

[Dividing numerator and denominator by a common factor 8]

(b) $\frac{-8}{60} = \frac{-8 \div 4}{60 \div 4} = \frac{-2}{15}$

[Dividing numerator and denominator by a common factor 4]

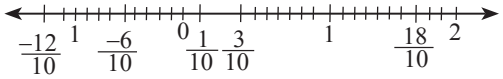
(c) $\frac{3}{-4}$

[Already is standard from]

(d) $\frac{-2}{-8} = \frac{-2 \div 2}{-8 \div 2} = \frac{-1}{-4} = \frac{1}{4}$

[Dividing numerator and denominator by a common factor 2]

3.



4. (a) $\frac{-8}{19}$ < $\frac{-7}{19}$ [Both denominator are same on comparing numerators we get $-8 < 7$, hence $\frac{-8}{19} < \frac{7}{19}$]

(b) $\frac{-13}{20}$ < $\frac{3}{20}$ [Both denominator are same comparing numerator we get $3 > -13$, hence $\frac{-13}{20} < \frac{3}{20}$

(c) $\frac{7}{8}$ > $\frac{3}{8}$ [Both denominator are same comparing numrators we get $7 > 3$, hence $\frac{7}{8} > \frac{3}{8}$]

(d) $\frac{3}{4}$ > $\frac{-2}{3}$ [LCM of 4 and 3 is 12]

To make denominators same we,

2	4, 3
2	2, 3
3	1, 3
	1, 1

$2 \times 2 \times 3 = 12$

$\frac{3}{4} \times \frac{3}{3} = \frac{9}{12}$, $\frac{-2 \times 4}{3 \times 4} = \frac{-8}{12}$

$\frac{9}{12}$, $\frac{-8}{12}$ [Denominator are same on comparing numerators we get, $9 > -8$]

Therefore, $\frac{9}{12} > \frac{-8}{12} = \frac{3}{4} > \frac{-2}{3}$

(e) $\frac{7}{8}$ > $\frac{6}{7}$

LCM of 8 and 7 is 56. To make denominators same we,

2	7, 8
2	7, 4
2	7, 2
7	7, 1
	1, 1

$\frac{7 \times 7}{8 \times 7} = \frac{49}{56}$, $\frac{6 \times 8}{7 \times 8} = \frac{48}{56}$

$\frac{49}{56}$, $\frac{48}{56}$ [Denminators are same on comparing numerators we get, $49 > 48$]

Therefore, $\frac{49}{56} > \frac{48}{56} = \frac{7}{8} > \frac{6}{7}$

5. (a) $\frac{-2}{3} + \frac{3}{4}$ = [LCM of 3 and 4 is 12. To make denominators same we]

$\frac{-2 \times 9}{3 \times 4} = \frac{-8}{12}$, $\frac{3 \times 3}{4 \times 3} = \frac{9}{12}$

$\frac{-2}{3} + \frac{3}{4} = \frac{-8}{12} + \frac{9}{12} = \frac{-8 + 9}{12} = \frac{1}{12}$

(b) $\frac{8}{15} + \left(\frac{-3}{25}\right)$

LCM of 15 and 25 is 75 To make denominator same we,

5	15, 25
5	3, 5
3	3, 1
	1, 1

$= 5 \times 5 \times 3 = 75$

$\frac{8 \times 5}{15 \times 5} = \frac{40}{75}$, $\frac{3}{25} \times \frac{3}{3} = \frac{-9}{75}$

$\frac{8}{15} + \left(\frac{-3}{25}\right) = \frac{40}{75} + \left(\frac{-9}{75}\right) = \frac{40 - 9}{75} = \frac{31}{75}$

6. (a) Commulative property of addition

(b) Associative property of addition

(c) Commulative property of multiplication

(d) Associative property of multiplication

(e) Multiplication by zero

(f) Additive identity

(g) Multipliative identity

(h) Distributive property of multiplication over addition

7. (a) $\frac{3}{8} \times \frac{2}{3} = \frac{2}{3} \times \frac{3}{8}$ [This statement is true due to commulative property of multiplication]

(b) $\frac{7}{9} \div \frac{1}{2} = \frac{1}{2} \div \frac{7}{9}$

$\frac{7}{9} \times \frac{2}{1} = \frac{1}{2} \times \frac{9}{7} = \frac{14}{9} \neq \frac{9}{14}$

[LHS ≠ RHS Hence, this statent is false]

(c) $\frac{18}{49} - \frac{2}{3} = \frac{2}{3} - \frac{18}{49}$

LCM of 49 and 3 is 147. To make denominators same we,

3	49, 3
7	49, 1
7	7, 1
	1, 1

$7 \times 7 \times 3 = 147$

$\frac{18 \times 3}{49 \times 3} = \frac{54}{147}$, $\frac{2 \times 49}{3 \times 49} = \frac{98}{147}$

$\frac{-54}{147} \neq \frac{44}{147}$

LHS ≠ RHS, hence this statement is false.

(d) $\frac{13}{43} + \frac{7}{20} = \frac{7}{20} + \frac{13}{43}$ [Commulative property]

LHS = RHS, hence this statement is true.

8. $\frac{3}{20} \times \frac{2}{3} + \frac{3}{20} \times \frac{13}{43}$

$\frac{3}{20} \times \left(\frac{2}{3} + \frac{13}{43}\right)$ LCM of 3 and 43 is 129

3	3, 43
43	1, 43
	1, 1

$3 \times 43 = 129$

$\frac{3}{20} \times \frac{86 + 39}{129}$

$\frac{3}{20} \times \frac{125}{129}$

$= \frac{1}{4} \times \frac{25}{43}$

[Common factor of 125 and 20 is 5]

[Common factor of 3 and 129 is 3]

$= \frac{25}{172}$

9. (a) $\frac{17}{4} \div \frac{17}{8} = \frac{17}{4} \times \frac{8}{17} = 2$ [Common factor of 8 and 4 is 4]

(b) $-3 \div \frac{1}{6} = -3 \times 6 = -18$

(c) $8\frac{1}{4} \div -17 = \frac{17}{2} \times \frac{-1}{17} = \frac{-1}{2}$

(d) $\frac{51}{5} \div \frac{34}{5} = \frac{51}{5} \times \frac{5}{34} = \frac{51}{34} = \frac{3}{2}$

(e) $-65 \div 19\frac{1}{2} = -65 \div \frac{39}{2} = -65 \times \frac{2}{39} = \frac{-130}{39} = \frac{-10}{3}$

[Common factor of 130 and 39 is 13]

(f) $3\frac{9}{10} \div 2\frac{3}{5}$

$= \frac{39}{10} \div \frac{12}{5} = \frac{39}{10} \times \frac{5}{13}$

$= \frac{3}{2}$

[Common factor of 13 and 39 is 13]

[Common factor of 10 and 5 is 10]

(g) $2\frac{1}{3} \div 1\frac{17}{18}$

$= \frac{7}{3} \div \frac{35}{18} = \frac{7}{3} \times \frac{18}{35}$

$= \frac{6}{5}$

[Common factor of 3 and 18 is 3]

[Common factor of 7 and 35 is 7]

(h) $\frac{7}{8} \div \left(\frac{-7}{16}\right)$

$= \frac{7}{8} \times \frac{-16}{7} = -2$

[Common factor of 8 and 16 is 8]

10. Area of rectangle: Length × Breath

$15\frac{1}{3}\text{m} \times 8\frac{1}{2}\text{m}$

$[15\frac{1}{3} = \frac{3 \times 15 + 1}{3} = \frac{45 + 1}{3} = \frac{46}{3}]$

$[8\frac{1}{2} = \frac{2 \times 8 + 1}{2} = \frac{16 + 1}{2} = \frac{17}{2}]$

$= {}_{23}\cancel{\frac{46}{3}} \times \frac{17}{\cancel{2}_{1}} = \frac{391}{3} = 130\frac{1}{3}$

11. Cost of $\frac{1}{2}$kg of potatoes = $₹12\frac{1}{2}$

Cost of $2\frac{1}{2}$kg of potatoes: $12\frac{1}{2} \times 2\frac{1}{2}$

$[12\frac{1}{2} = \frac{2 \times 12 + 1}{2} = \frac{24 + 1}{2} = \frac{25}{2}$

$[2\frac{1}{2} = \frac{2 \times 2 + 1}{2} = \frac{4 + 1}{2} = \frac{5}{2}]$

$\frac{25}{2} \times \frac{5}{2} = \frac{₹125}{4} = ₹31.25$

Cost of 1kg of onion = ₹27

Cost of $2\frac{1}{4}$kg of onions = $27 \times 2\frac{1}{4}$

$= \frac{9}{4} \times 27 = 60.75$ $[2\frac{1}{4} = \frac{4 \times 2 + 1}{4} = \frac{8 + 1}{4} = \frac{9}{4}]$

Total money spent: Total cost of Onions + Potatoes

= ₹31.25 + 60.75

= ₹92

Hence, Rahul has spent a total of ₹92.

12. Let mohan's salary be x.

Money donated to Ashram = $\frac{1}{20}$ of x

Money spent on School fee = $\frac{1}{5}$ of x

Money spent on food = $\frac{1}{6}$ of x

Total money spent = $\frac{1}{20}x + \frac{1}{5}x + \frac{1}{6}x$

2	20, 5, 6
2	10, 5, 3
5	5, 5, 3
3	1, 1, 3
	1, 1, 1

$= \frac{3x + 12x + 10x}{60} = \frac{25x}{60}$

$= \frac{25x}{60}$

Total salary − expenses = Sauifs

$\frac{x}{1} = \frac{25x}{60} = ₹21000$

$\frac{60x - 25x}{60} = 21000,\ 35x = 1260000$

$x = \frac{1260000}{35} = ₹36000$

Hence, Mohan's total salary is ₹36000.

Multiple Choice Question

1. **Answer:** (a) multiplication and (c) addition

2. **Answer:** (c) both a and b

3. **Answer:** (a) 1 as their HCF

4. **Answer:** (b) $\frac{-p}{q}$

5. **Answer:** (c) $\frac{b}{a}$

6. **Answer:** (d) all of these

7. **Answer:** (d) all of these

8. **Answer:** (a) $\frac{10}{7}$

9. **Answer:** (b) $\frac{-2}{3}$

10. $\frac{-5}{8} - (\frac{-5}{6} = \frac{-5}{8} + \frac{5}{6}$ [LCM of 8 and 24]

2	8, 6
2	4, 3
2	2, 3
3	1, 3
	1, 1

LCM = $2 \times 2 \times 2 \times 3 = 24$

$\frac{-5 \times 3}{8 \times 3} = \frac{-15}{24}, \frac{-5 \times 4}{6 \times 4} = \frac{20}{24}$

$\frac{-15}{24} + \frac{20}{24} = \frac{-15 + 20}{24} = \frac{5}{24}$

(b) $\frac{5}{24}$

11. (b) $\frac{-7}{5}$

12. (b) is a negative rational integer.

Check Your Progress

1. 1

2. No

3. $\frac{7}{2}$ (Absolate value is always positive)

4. $\frac{5}{6} \times \frac{1}{2} + \frac{5}{6} \times \frac{1}{2}$

$= \frac{5}{6} \times \left(\frac{1}{2} + \frac{1}{2}\right) = \frac{5}{6} \times \frac{1}{2} = \frac{5}{6} \times \frac{1}{1} = \frac{5}{6}$

5. No, as only negative number lie to the left of origin on a number line and $\frac{1}{5}$ is a positive number.

6. $\frac{-1}{2} \times 4 = \frac{-4}{2} = -2$

7. $\frac{4}{11} - \left(\frac{-3}{7}\right)$ [11 and 7 are both co-prime numberes]

$\frac{4 \times 7}{11 \times 7} = \frac{28}{77}, \frac{-3 \times 11}{7 \times 11} = \frac{-33}{77}$

$\frac{4}{11} - \left(\frac{-3}{7}\right) = \frac{28}{77} - \left(\frac{-33}{77}\right) = \frac{28}{77} + \frac{33}{77} = \frac{61}{77}$

8. $\frac{26}{30}, \frac{27}{30}, \frac{28}{30}, \frac{29}{30}$

9. $\frac{1}{2} \div \frac{1}{2} = \frac{1}{2} \times 2 = \frac{2}{2} = 1$

10. 1

2 Linear Equations in One Varibale

Exercise 2.1

1. (a) $x - 7 = 5$

$x - 7 + 7 = 5 + 7$ [Adding 7 to both the sides]

$x = 12$

(b) $x - 5 = 4$

$x - 5 + 5 = 4 + 5$ [Adding 5 to both the sides]

$x = 9$

(c) $x - 7 = 18$

$x - 7 + 7 = 18 + 7$ [Adding 7 to both the sides]

$x = 25$

(d) $x - 30 = 72$

$x - 30 + 30 = 72 + 30$ [Adding 30 to both the sides], $x = 102$

(e) $x - 23 = -143$

$x - 23 + 23 = -143 + 23$ [Adding 23 to both the sides]

$x = -120$

(f) $y - 15 = -22$

$y - 15 + 15 = -22 + 15$ [Adding 15 to both the sides]

$y = -7$

(g) $x - 10 = 63$

$x - 10 + 10 = 63 + 10$ [Adding 10 to both the sides]

$x = 73$

(h) $x - 39 = 10$

$x - 39 + 39 = 10 + 39$ [Adding 39 to both the sides], $x = 49$

(i) $x - 15 = -29$

$x - 15 + 15 = -29 + 15$ [Adding 15 to both the sides], $x = -14$

(j) $t - 114 = 26$

$t - 114 + 114 = 26 + 114$ [Adding 114 to both the sides]

$t = 140$

(k) $x - 86 = -42$

$x - 86 + 86 = -42 + 86$ [Adding 86 to both the sides]

$x = 44$

(l) $K - 64 = 164$

$K - 64 + 64 = 164 + 64$ (Adding 64 to both the sides)

$K = 228$

2. (a) Let the number be x Then, 2x is the twice of the number

$2x = 20$

$\frac{2x}{2} = \frac{20}{2}$ [Dividing both sides by 2]

$x = 10$

(b) Let the number be x then 5x is five times of the number $5x = 10$

$\frac{5x}{5} = \frac{10}{5}$ [Dividing both sides by 5]

$x = 2$

(c) Let the number be x $\frac{x}{2}$ is the half of x

$\frac{x}{2} = 26$ [Multiplying both sides by 2]

$\frac{x}{2} \times 2 = 26 \times 2$

$x = 52$

(d) Let sonu's pocket's money be x, Then 4x is four times Sonu's pocket money

$4x = 120$

$\frac{4x}{4} = \frac{120}{4}$ [Dividing both sides by 4]

$x = 30$

Hence, Sonu's pocket money is ₹30

(e) Let the number be x. Multiplied by 9 is 9x

$9x = 216$ [Dividing both sides by 9]

$\frac{9x}{9} = \frac{216}{9}$

$x = 24$

(f) Let the number be 8x is eight times the number

$8x = 72$ [Dividing both sides by 8]

$\frac{8x}{8} = \frac{72}{8}$, $x = 9$

(g) Let the amount be x.

10 times the amount will be 10x

$10x = 300$

$\frac{10x}{10} = \frac{300}{10}$ [Dividing both side by 10]

$x = 30$

(h) Let the number be 3 by 2 times x is $\frac{3}{2} \times x = 6x$

$\frac{3}{2} = 150$ [Multiplying both sides by 2]

$\frac{3x}{2} \times 2 = 150 \times 2$

$3x = 300$

$\frac{3x}{3} = \frac{300}{3}$ (Dividing both sides by 3)

$x = 100$

3. (a) $8b = 6b + 10$

$8b - 6b = 6b + 10 - 6b$

[Subtracting 6b from both the sides]

$2b = 10$ [Dividing both the sides by 2]

$\frac{210}{2} = \frac{10}{2}$

$b = 5$

(b) $4 = 5a - 6$

$4 + 6 = 5a - 6 + 6$ [Adding 6 to both the sides]

$10 = 5a$

$\frac{10}{5} = \frac{5a}{5}$ [Dividing 5 from both the sides]

$a = 2$

(c) $13r = -12r + 100$

$13r + 12r = -12r + 10$ [Adding 12r to both the sides]

$25r = 100$

$\frac{25r}{25} = \frac{100}{25}$ [Dividing 25 from both the sides]

$r = 4$

(d) $185 = -135 + 62$

$188 + 135 = -135 + 135 + 62$

[Adding 135 to both the sides]

$315 = 62$ [Dividing 31 from both the sides]

$\frac{315}{31} = \frac{62}{31}$

$s = 2$

(e) $5t - 3 = 12$

$5t - 3 + 3 = 12 + 3$ [Adding 3 to both the sides]

$5t = 15$ [Dividing 5 from both the sides]

$\frac{5t}{5} = \frac{15}{5}$

$t = 3$

(f) $3(u + 1) = 6$

$\frac{3(u + 1)}{3} = \frac{6}{3}$ [Dividing 6 from the both sides]

$u + 1 = 2$

$u + 1 - 1 = 2 - 1$ [Subtract -1 from the both sides]

$u = 1$

(g) $7 (v - 9) = 35$

$\frac{7(v - 9)}{7} = \frac{35}{7}$ [Dividing 7 from the both sides]

$v - 9 = 5$

$v - 9 + 9 = 5 + 9$ [Adding 9 from the both sides]

$v = 14$

(h) $8(w + 3) + 2 = 42$

$8(w + 3) + 2 - 2 = 42 - 2$ [Subtract 2 from the both sides]

$\frac{8(w + 3)}{8} = \frac{40}{8}$ (Dividing both sides by 8)

$w + 3 = 5$

$w + 3 - 3 = 5 - 3$ [Subtract 3 from the both sides]

$w = 2$

(i) $16 - 3 (x - 7) = -14$

$16 - 3 (x - 7)\ 16 = 14 - 16$ [Subtract 16 from both the sides]

$\frac{-3(x - 7)}{3} = \frac{-30}{3}$

$x - 7 = 10$

$x - 7 + 7 = 10 + 7$ [Adding 7 to 10]

$x = 17$

(j) $3(y + 5) = 15$

$\frac{3(y + 5)}{3} = \frac{15}{3}$ [Dividing 3 from the both sides]

$y + 5 = 5$

$y + 5 - 5 = 5 - 5$ [Subract 5 from the both sides]

$y = 0$

(k) $12(3 - z) = 48$

$\frac{12(3 - z)}{12} = \frac{48}{12}$

[Dividing 12 from both the sides]

$3 - z = 4$

$3 - z - 3 = 4 - 3$

[Subract 3 from both the sides]

$-z = 1$

$z = -1$

$-(-z) = -4$ [Subract from both the sides]

$z = -4$

(l) $5a + 8(2a - 9) = 54$

$5a + 16a - 72 = 54$ [Solving brackets]

$21a = 126$

$\frac{21a}{21} = \frac{126}{21}$ [Dividing both sides by 21]

$a = 6$

(m) $\frac{b}{6} = 5$

$\frac{b}{6} \times 6 = 5 \times 6$ [Multiplying both sides by 6]

$b = 30$

(n) $\frac{c}{3} = 20$

$\frac{c}{3} \times 3 = 20 \times 3$ [Multiplying both sides by 3]

$c = 60$

(o) $\frac{d}{3} = 4$

$\frac{d}{3} \times 3 = 4 \times 3$ [Multiplying both sides by 3]

$d = 12$

(p) $\frac{e}{4} = \frac{1}{2}$

$e \times 2 = 1 \times 4$ [Cross multiplying]

$2a = 4$

$\frac{2a}{2} = \frac{4}{2}$ [Dividing both sides by 2]

$a = 2$

4. (a) Let the number be x

$\frac{1}{5}$ of the number is $\frac{x}{5}$

$\frac{x}{5} \times 5 = 60 \times 5$

[Multiplying both sides by 5]

$x = 300$

(b) Let the number be $\frac{1}{10}$ of the number is $\frac{x}{10}$

$\frac{x}{10} = 49$

$\frac{x}{10} \times 10 = 49 \times 10$ [Multiplying both the sides by 10]

$x = 490$

(c) Let the number be 10% of $x = \frac{10}{100} \times x = \frac{x}{10}$

$\frac{x}{10} = 63$

$\frac{x}{10}$ $x = 63 \times 10$ [Multiplying both the sides by 10]

$x = 630$

(d) Let the length of the stick be x

$\frac{1}{5}$ of the length of the stick is $\frac{x}{5}$

$\frac{x}{5} = 5$

$\frac{x}{5} \times 5 = 5 \times 5$ [Multiplying both the sides by 5]

Hence, the length of the stick is 25cm.

5. (a) Let the number be x

$x - 62 = 48$

$x = 48 + 60$ [Transposing]

$x = 110$

(b) Let the number be x

$x - 32 = 68$

$x - 32 + 32 = 68 + 32$ [Transposing]

$x = 100$

(c) Let the number be x

$x - 20 = 80$

$x = 80 + 20$ [Transposing]

$x = 100$

(d) Let Dolly's age be x.

Dolly's age $- 4$ = Pinky's age

$x - 4 = 18$

$x = 18 + 4$ [Transposing]

$x = 22$

(e) Let the total number of students in class be x

$x - 4 = 32$

$x = 32 + 4$ [Transposing]

$x = 36$

6. (a) $\frac{36}{r+2} = 12$

$36 = 12(r + 2)$ [Cross-multiplying]

$36 = 12r + 24$

$36 - 24 = 12r$ [Transposing]

$12 = 12r$

$\frac{12}{12} = \frac{12r}{12}$ [Dividing both sides by 12]

$r = 1$

(b) $\frac{3}{3} + 7 = \frac{23}{3} + 2$

$\frac{5}{3} - \frac{25}{3} = 2 - 7$ [Transposing]

$\frac{s - 2s}{3} = \frac{-5}{1}$

$-s \times 1 = -5 \times 3$ [Cross multiply]

$-s = -15$

$-(-s) = -(-15)$ [Subtracting both the sides]

$s = 15$

(c) $\frac{t}{3} - 7 = \frac{2t}{3} + 2$

$\frac{t}{3} - \frac{2t}{3} = 2 + 7$ [Transposing]

$\frac{t - 2t}{3} = 9$

$\frac{-t}{3} = \frac{9}{1}$

$-t \times 1 = 9 \times 3$ [Cross-multiple]

$-t = 27$

$-(-t) = -27$ [Subtaracting both the sides]

$t = -27$

(d) $\frac{3}{2v} + \frac{7}{2v} = 5$

$\frac{3 + 7}{2v} = 5$

$10 = 5 \times 2v$ [Cross-multiplying]

$10 = 10v$

$\frac{10}{10} = \frac{10v}{10}$ [Dividing both sides by 10]

$v = 1$

(e) $\frac{w + 4}{6} = 3$

$w + 4 = 3 \times 6$ [Cross-multiplying]

$w + 4 = 18$

$w + 4 - 4 = 18 - 4$ [Subtract 4 from both the sides]

$w = 14$

(f) $\frac{x}{2} - \frac{x - 4}{6} = \frac{5}{3}$

[LCM of 2 and 6 is 6]

$\frac{3x - x + 4}{6} = \frac{5}{3}$

$\frac{2x + 4}{6} = \frac{5}{3}$

$(2x + 4) \times 3 = 5 \times 6$ [Cross multiplying]

$6x + 12 = 30$

$6x = 30 - 12$ [Transposing]

$6x = 18$

$\frac{6x}{6} = \frac{18}{6}$ [Dividing both sides by 6]

$x = 3$

(g) $\frac{z - 17}{2} = 2z - 17$

$z - 17 = 2\ (2z - 7)$

$z - 17 = 4z - 14$ (Cross-multiplying)

$z - 4z = 17$

$-3z = 3$ [Transpoing]

$\frac{-3z}{-3} = \frac{3}{-3}$ [Dividing both sides by -3]

$z = -1$

(h) $7 - z = \frac{2x - 7}{5}$

$5(7-x) = 2x - 7$ [Cross-multiplying]

$35 - 5x = 2x - 7$

$35 + 7 = 2x + 5x$

$7x = 42$

$\frac{7x}{7} = \frac{42}{7}$ [Dividing both sides by 7]

$x = 6$

7. (a) $\frac{x}{2} - \frac{x}{3} = 4$

$(x = 24)\ \frac{24}{2} - \frac{24}{3}$

LCM of 2 and 3 is 6

$\frac{24 \times 3}{2 \times 3} = \frac{72}{6}, \frac{24 \times 2}{3 \times 2} = \frac{48}{6}$

$\frac{72}{6} - \frac{48}{6}$

$\frac{72 - 48}{6} = \frac{24}{6} = 4$

(b) $\frac{5}{2} - \frac{5}{3}$

$\frac{5 \times 3}{2 \times 3} = \frac{15}{6}, \frac{5 \times 2}{3 \times 2} = \frac{10}{6}$

$\frac{15}{6} - \frac{10}{6} = \frac{5}{6}$

(c) $\frac{20}{2} - \frac{20}{3}$

$\frac{20 \times 3}{2 \times 3} = \frac{60}{6}, \frac{20 \times 2}{3 \times 2} = \frac{40}{6}$

$\frac{60}{6} - \frac{40}{6} = \frac{60 - 40}{6} = \frac{20}{6} = \frac{10}{3}$

(d) $\frac{24}{5 \times 2} - \frac{24}{5 \times 3}$

$\frac{24}{10} - \frac{24}{15}$

LCM of 10 and 15 is 30

$\frac{24 \times 3}{10 \times 3} = \frac{72}{30}, \frac{24 \times 2}{15 \times 2} = \frac{48}{30}$

$\frac{72}{30} - \frac{48}{30} = \frac{72 - 48}{30}$

$\frac{24}{30} = \frac{4}{5}$

Hence, the solution for $\frac{x}{2} - \frac{x}{3} = 4$ is x = 24.

8. (a) $\frac{x + 2}{6} - \left(\frac{11 - x}{3} - \frac{1}{4}\right) = \frac{3x - 4}{12}$

$\frac{x + 2}{6} - \left(\frac{4(11 - x) - 3}{12}\right) = \frac{3x - 4}{12}$

$\frac{x + 2}{6} - \left(\frac{44 - 4x - 3}{3}\right) = \frac{3x - 4}{12}$

$\frac{x + 2}{6} - \left(\frac{41 - 4x}{12}\right) = \frac{3x - 4}{12}$

$\frac{x + 2}{6} + \left(-\frac{41 + 4x}{12}\right) = \frac{3x - 4}{12}$

$\frac{x + 2}{6} - \frac{41 + 4x}{12} = \frac{3x - 4}{12}$

$\frac{2x + 4 - 41 + 4x}{12} = 3x - 4$

$\frac{6x - 37}{12} = \frac{3x - 4}{12}$

$\frac{6x - 37}{12} \times 12 = \frac{3x - 4}{12} \times 12$

[Multiplying both sides by 12]

$6x - 37 = 3x - 4$

$6x - 3x = -4 + 37$ [Transposing]

$3x = 33, \frac{3x}{3} = \frac{33}{3}$ [Multiplying both sides 3]

$x = 11$

(b) $\frac{2}{3x} - \frac{3}{2x} = \frac{1}{12}$

LCM of LHS

$\frac{4x - 9x}{3x \times 2x} = \frac{1}{12}$

$\frac{-5x}{6x^2} = \frac{1}{12}$

$-5x \times 12 = 1 \times 6x^2$ [Cross-multiplying]

$-60x = 6x^2$

$\frac{-60x}{6x} = \frac{6x^2}{6x}$

[Dividing 6x from both the sides]

$x = -10$

(c) $\frac{3y + 5}{5} - \frac{5y + 7}{6} = \frac{y - 2}{3}$

$\frac{6(3y + 5) - 5(5y + 7)}{30} = \frac{y - 2}{3}$

[LCM of 5 and 6 is 30]

$\frac{18y + 30 - 25y - 35}{30} = \frac{y - 2}{3}$

$\frac{-7y - 5}{30} = \frac{y - 2}{3}$

$3(-7y - 5) = 30(y - 2)$ (Cross-multiplying)

$-21y - 15 = 30y - 60$

$-21y - 30y = -60 + 15$

$-51y = -45$

$y = \frac{-45}{-51}$

$y = \frac{15}{17}$

(d) $\frac{a - 5}{3} = \frac{a - 3}{5}$

$5(a - 5) = 3(a - 3)$ [Cross-multiplying]

$5a - 25 = 3a - 9$

$5a - 3a = -9 + 25$ [Transposing]

$2a = 16$

$\frac{2a}{2} = \frac{16}{2}$ [Dividing both sides by 2]

$a = 8$

(e) $\frac{3x - 2}{5x + 4} = \frac{7}{6}$

$(3x - 2) \times 6 = 7(5x + 4)$ [Cross-multiplying]

$18x - 12 = 35x + 25$

$18x - 35x = 28 + 12$

$-17x = 40$

$\frac{-17x}{-17} = \frac{40}{-17}$ [Dividing both sides by –17]

$x = \frac{-40}{17}$

(f) $3x - 4(2x - 5) = 2(x - 1) + \frac{2}{3}$

$3x - 8x + 20 = 2x - 2 + \frac{2}{3}$

$-5x - 2x = -2 + \frac{2}{3} - 20$

$-7x = \frac{-22}{1} + \frac{2}{3}$

$-7x = \frac{-66 + 2}{3}$

$\frac{-7x}{1} = \frac{-64}{3}$

$-7x \times 3 = -64 \times 1$ [Cross-multiplying]

$-21x = -64$

$\frac{-21x}{-21} = \frac{-64}{-21}$ [Dividing both sides by –21]

$x = \frac{64}{21}$

Exercise 2.2

1. Let the first number be x and second number be y

$2x = y$

$x + y = 96$

$x + 2x = 96,\ 3x = 96$

$\frac{3x}{3} = \frac{96}{3}$ [Dividing both sides by 3]

$x = 32$

$y = 2x = 2 \times 32 = 64$

Hence, the 2 numbers are 32 & 64.

2. Let x be the bigger number and y be the samller number

$x - y = 18,\ x = 18 + y$

$x + y = 86$

$18 + y + y = 86,\ 18 + 2y = 80$

$2y = 86 - 18$ [Transposing]

$2y = 68$

$\frac{2y}{2} = \frac{68}{2}$ [Dividing both sides by 2]

$y = 34$

$x = 18 + y$

$x = 18 + 34$

$x = 52$

Hence, the 2 numbers are 34 and 52.

3. Let the smaller part be x and greater part be y

$x = y + 12,\ x + y = 72$

$y + 12 + y = 72$

$2y = 72 - 12$ [Transposing]

$2y = 60$

$\frac{2y}{2} = \frac{60}{2}$ [Dividing both sides by 2]

$y = 30$

$x = y + 12$

$x = 30 + 12,\ x = 42$

Hence, the 2 numbers are 30 and 42

4. Let the number be x

Number multiplied by $4 = 4 \times x = 4x$

Dimnished by $7 = 4x - 7$

$4x - 7 = 65$

$4x = 65 + 7$ [Transposing]

$4x = 72$

$\frac{4x}{4} = \frac{72}{4}$ [Dividing both sides by 4]

$x = 18$

Hence, the number is 18.

5. Let x be the bigger number y be the smaller number

$x = 2y$

$50 - x = 40 - y + 2$

$50 - 2y = -y + 42$

$-2y + y = 42 - 50$

$-y = -8$

$y = 8$

$x = 2y$

$x = 2 \times 8 = 16$

Hence, the 2 numbers are 8 and 16.

6. Let the current age of baby be x

After 4 years, baby will be 5 times old

$x + 4 = 5x$

$x - 5x = -4$ [Transposing]

$-4x = -4$

$\frac{-4x}{-4} = \frac{-4}{-4}$ [Dividing both sides by -4]

Hence, the baby is currently 1 year old.

7. Let Neha's current age be x. Pooja mother's current age = 4x

After, 5 years

$3(x + 5) = 4x + 5$

$3x + 15 = 4x + 5$

$3x - 4x = 5 - 15$ [Transposing]

$-x = -10$

$x = 10$

$4x = 4 \times 10 = 40$

Hence, Neha's age is 10 years and Pooja mother's age is 40 years.

8. Let son's current age be x. His father's current age

After 2 year

$2(x + 2) = x + 24 + 2$

$2x + 4 = x + 26$

$2x - x = 26 - 4$

$x = 22$

$x + 24 = 22 + 24 = 46$

Hence, his son's current age is 22 and his father's current age is 46.

9. Let the cost of one table and one chair be x and y respectively.

Cost of 3 tables = $3 \times x = 3x$

Cost of 2 chair = $2 \times y = 2y$

$3x + 2y = 745$

$x = 40 + y$

$3(40 + y) + 2y = 745$

$120 + 3y + 2y = 745$, $120 + 5y = 745$

$5y = 745 - 120$ [Transposing]

$y = \frac{625}{5}$, $y = 125$

$x = 40 + y$, $40 + 125 = 165$

Hence, cost of 1 chair and 1 table is ₹125 and ₹165 respectively.

10. Let the 10 paise coins be x and 25 paise coins be y

$10x + 25y = ₹3.10$

[1₹ = 100p, ₹3.10 = $3.10 \times 100p = 310p$]

$x + 3 = y$, $y = x - 3$

$10x + 25 (x - 3) = 3.10$

$10x + 25x - 75 = 3.10$

$35x = 3.10 + 75$

$35x = 385$

$\frac{35x}{35} = \frac{385}{35}$

[Dividing both sides by 35]

$x = 11$

$y = x - 3$, $y = 11 - 3$, $y = 8$

Hence, the number of 10 paise coins is 11 and the number of 25 paise is 8.

11. (a) Let the first number be x other 2 conscutive number are $(x + 1)$, $(x+ 1 + 1) = x + 2$

$x + (x + 1) + (x + 2) = 48$

$3x + 3 = 48$

$3x = 48 - 3$ [Transporing], $3x = 45$

$\frac{3x}{3} = \frac{45}{3}$ [Dividing both sides by 3]

$x = 15$

$x + 1 = 16$, $x + 2 = 15 + 2 = 17$

Hence, the 3 consecutive numbers are 15, 16 and 17

(b) $x + (x + 1) + (x + 2) = 96$

$3x + 3 = 96$

$3x = 96 - 3$ [Transposing]

$3x = 93$

$\frac{3x}{3} = \frac{93}{3}$ [Dividing both sides by 3]

$x = 31$

$x + 1 = 31 + 1 = 32$

$x + 2 = 31 + 2 = 33$

Hence, the 3 consecutive numbers are 31, 32 and 33.

(c) Three consecutive number are

$x, (x + 2), (x + 2 + 2) = x + 4$

$x + (x + 2) + (x + 4) = 342$

$3x + 6 = 342$

$3x = 342 - 6$ [Transposing]

$3x = 336$

$\frac{3x}{3} = \frac{336}{3}$ [Dividing both sides by 3]

$x = 112$

$x + 2 = 112 + 2 = 114$

$x + 4 = 112 + 4 = 116$

Hence, the 3 numbers are 112, 114 and 116.

12. (a) Let the sweets worth ₹110 be x

Cost of the sweets worth ₹110 = 110x

Cost of 30kg of sweets worth ₹80 = ₹(80 × 30) = ₹2400

$110x + 2400 = 100(x + 30) = 110x + 2400 = 100x + 8000$

$110x - 100x$ [Transposing] $3000 - 2400 = 10x = 600$, $\frac{10x}{10} = \frac{600}{10}$ [Dividing both sides by 10]

$x = 60$,

Therefore, 60kg of worth of sweets should be mixed with 30kg of sweets at ₹80kg to produce a mixture with costs ₹100 per kg

(b) We have to mix butter at the rate of Rs. 140 per kg and butter of rate Rs. 150 per kg to produce a mixture which has a rate of Rs. 144 per kg.

We have to mix 20kg of butter worth Rs. 150 per kg and we have to find the weight of butter worth Rs. 140 per kg to produce the mixture.

Let the weight of the butter worth Rs. 140 per kg be x.

Then, the total weight of the mixture is x + 20

Now, we will find the toal cost of the mixture as.

$x(140) + 20(150) = 140x + 3000$

And the cost of the butter per kg will be $\frac{140x + 3000}{x + 20}$

Also, we are given that the cost of the mixture is 144per kg

Hence, we will have the equation,

$\frac{140x + 3000}{x + 20} = 144$

On cross-multiplying we will get,

$140x + 3000 = 144x + 2880$

Then,

$3000 - 2880 = 144x - 140x$

$= 120 = 4x$

On dividing the equation throughout by 4, we will have,

$x = 30$

Hence, we have to take 30kg of butter worth 140 per kg.

Review Exercise

1. (a) $7x - 9 = 12$

$7x - 9 + 9 = 12 + 9$ [Adding 9 to both sides]

$7x = 21$

$\frac{7x}{7} = \frac{21}{7}$ [Dividing 7 from both the sides]

$x = 3$

(b) $\frac{15}{4} - 7x = 9$

$-7x = \frac{9}{1} + \frac{-15}{4}$ [Transposing]

$-7x = \frac{36 - 15}{4}$

$-7x \times 4 = 21$

$-28x = 21$

$\frac{-28x}{-28} = \frac{21}{-28}$ [Dividing –28 from both the sides]

$x = \frac{-21}{28}$

$x = \frac{-3}{4}$

(c) $\frac{3x + 4}{5x - 3} = \frac{2}{3}$

$(3x + 4) \times 3 = 2(5x - 3)$ [Cross-multiplying]

$9x + 12 = 10x - 6$

$9x - 10x = -6 - 12$

$-x = -18$

$x = 18$

(d) $\frac{4y + 3}{5 - y} = \frac{-3}{7}$

$7(4y + 3) = -3(5-y)$ [Cross-multiplying]

$28y + 21 = -15 + 3y$

$28y - 3y = -15 - 21$

$25y = -36$

$\frac{25y}{25} = \frac{-36}{25}$

[Dividing 25 from both the sides]

$y = \frac{-36}{25}$

(e) $\frac{(2x + 3) - (5x - 4)}{5x + 8} = \frac{5}{3}$

$\frac{2x + 3 - 5x - 4}{5x + 8} = \frac{5}{3}$

$\frac{-3x + 7}{5x + 8} = \frac{5}{3}$

$3(-3x + 7) = (5x + 8)$ [Cross-multiplying]

$-9x + 21 = 25x + 40$

$-9x - 25x = 40 - 21$

$-34x = 19$

$\frac{-34x}{-34} = \frac{19}{-34}$ [Dividing both sides by -34]

$x = \frac{-19}{34}$

(f) $\frac{2m -(6 - 5m)}{9m - (3 + 2m)} = \frac{5}{3}$

$\frac{2m -6 - 5m}{9m - 3 - 2m} = \frac{5}{3} = \frac{7m - 6}{7m - 3} = \frac{5}{3}$

$3(7m - 6) = 5(7m - 3)$ [Cross-multiplying]

$21m - 18 = 35m - 15$

$21m - 35m = -15 + 18$

$-14m = 3$

$\frac{-14m}{-14} = \frac{3}{-14}$ [Dividing both sides by -14]

$m = \frac{-3}{14}$

2. Let the first number be x. Others consectives numbers are $(x + 4), (x + 4 + 4) = x + 8$

$x + (x + 4) + (x + 8) = 144$

$3x + 12 = 144$

$3x = 144 - 12$ [Transposing]

$3x = 132$

$\frac{3x}{3} = \frac{132}{3}$ [Dividing both sides by 3]

$x = 44$

$x + 4 = 44 + 4 = 48$

$x + 8 = 44 + 8 = 52$

Hence, the 3 numbers are 44, 48 and 52.

3. Let the ratio of the number be x.

$5:3 = 5x, 3x$

$5x - 3x = 28$

$2x = 28$

$\frac{2x}{2} = \frac{28}{2}$ [Dividing both sides by 2]

$x = 14$

$5x = 5 \times 14 = 70$

$3x = 3 \times 14 = 42$

Hence, the numbers are 70 & 42.

4. Let Sheena's present age be x

Her mother's present age = 5x

After 5 years

$x + 5 = \frac{1}{3}(5x + 5)$

$x + 5 = \frac{5}{3} + \frac{5}{3}$

$\frac{x + 5}{1} = \frac{5x + 3}{3}$

$3(x + 5) = 5x + 3$ [Cross-multiplying]

$3x + 15 = 5x + 3$

$3x - 5x = 3 - 15$

$-2x = -12$

$x = \frac{-12}{-2}$, $x = 6$, $5x = 5 \times 6 = 30$

Hence, Sheena's present age is 6 years and her mother's age is 30 years.

5. Let Mohan's age be x

Lakhan's age = x + 15

After 3 years

Lakhan's age = x + 15 + 3 = x + 18

3 years ago

Mohan's age = x - 3

$8(x - 3) = x + 18$

$8x - 24 = x + 18$

$8x - x = 18 + 24$

$7x = 42$

$\frac{7x}{7} = \frac{42}{7}$ [Dividing both sides by 7]

$x = 6$

Hence Mohan is 6 years old and Lakhan is (x + 15) years old i.e. (6 + 15) = 21 years old

6. Let ten's place be x and one's place be 2x

Orignal number: $10x + 2x = 12x$

Reverse numbers: $10 \times 2x + x = 20x + x = 21x$

$12x + 18 = 21x$

$18 = 21x - 12x$ [Transposing]

$18 = 9x$, $x = \frac{18}{9}$, $x = 2$

Orignal number: $10x + 2x$

$= 10 \times 2 + 2 \times 2 = 20 + 4 = 24$

Hence, the orignal number is 24.

7. Let the denominator be x.

Numberator = x – 1

$\frac{x - 1 + 2}{x - 2} = \frac{10}{7}$, $\frac{x + 1}{x - 2} = \frac{10}{7}$

$7(x + 1) = 10(x - 2)$ [Cross-multiplying]

$7x + 7 = 10x - 20$

$7x - 10x = -20 - 7$

$-3x = -27$

$\frac{-3x}{-3} = \frac{-27}{-3}$ [Dividing both sides by –3]

$x = 9$

Hence the Denominator = 9, Numerator = x – 1 = 9 – 1 = 8

Fraction is $\frac{8}{9}$

8. Step-by-step explanation

Let the speed of a car be: x (in km).

Time travelled by the car: 6 hours.

Distance travelling by car: $d = s \times t$

$= 6x$ (in km).

Speed of the second car: 4x/5 (in km)

Time travelled by the second car: 6 hours

Distance travelled by them:

$d = s \times t$

$= 6 \times \frac{4x}{5}$

$= \frac{24x}{5}$ (in km)

Total distance travelled by them:

$6x + \frac{24x}{5}$ km

But, the total distance covered by them/ between the two cities are given as 540km.

Therefore, we get,

$6x + \frac{24x}{5} = 540$

$\frac{30x + 24x}{5} = 540$

$\frac{54x}{5} = 540$

{Transposing 54/5 to RHS...}

$x = 540 \left(\frac{5}{54}\right)$

$x = 50$

Speed of first car: x = 50km/h

Speedd of second car: 4x/5 = 4(50)/5 = 40 km/h

9. $\frac{-3 + x}{3 + x} = 6$

$-3 + x = 6(3 + x)$ [Cross multiplying]

$-3 + x = 18 + 6x$

$-3 - 18 = 6x - x$ [Transposing]

$-21 = 6x - x$, $5x = -21$, $\frac{5x}{5} = \frac{-21}{5}$ [Dividing both sides by 5]

$x = \frac{-21}{5}$

10. Let the ratio of angle of triangle be 1x, 2x and 3x

Sum of angle of triangle is 180

$1x + 2x + 3x = 180°$, $6x = 180°$, $\frac{6x}{6} = \frac{180}{6}$ [Dividing both sides by 6]

$x = 30°$

$1x = 1 \times 30 = 30°$, $2x = 2 \times 30° = 60°$, $3x = 3 \times 30° = 90°$

Hence, the angles of triangle are 30°, 60° and 90 ° respectively.

11. $(x + 7)^2 - (x - 7)^2 = 28x$

$(x + 7)(x + 7) - 1(x - 7)^2 - 28x$

$x(x + 7) + 7(x + 7) - 1 (x - 7)^2 - 28x$

$x^2 + 7x + 7x + 49 - 1(x - 7)(x - 7) - 28x$

$x^2 + 14x + 49 - 1(x - 7) - 7(x - 7) - 28x$

$x^2 + 14x + 49 - 1(x(x - 7) - 7(x - 7)) - 28x$

$x^2 + 14x + 49 - 1(x^2 - 7x - 7(x - 7)) - 28x$

$x^2 + 14x + 49 - 1(x^2 - 7x - 7x + 49) - 28x$

$x^2 + 14x + 49 - x^2 + 14x - 49 - 28x$

$x^2 - x^2 + 14x + 14x - 28 + 49 - 49$

$0 + 28x - 28x + 0$

$= 0$

12. (a) $\frac{2x + 1}{3} = 5$

$2x + 1 = 5 \times 3$ [Cross multiplying]

$2x + 1 = 15$

$2x = 15 - 1$ [Transposing]

$2x = 14$

$\frac{2x}{2} = \frac{14}{2}$ [Dividing both sides by 2]

$x = 7$

(b) $\frac{x - 1}{2} + \frac{x + 1}{3} = 1$

$\frac{3(x - 1) + 2(x + 1)}{6} = 1$ [LCM of 2 & 3 is 6]

$3x - 3 + 2x + 2 = 6$ [Cross-multiplying]

$5x - 1 = 6$

$5x = 6 + 1$ [Transposing]

$\frac{5x}{5} = \frac{7}{5}$ [Dividing both sides by 5]

$x = \frac{7}{5}$

(c) $\frac{y}{5} + \frac{y}{3} = y - 2$

$\frac{3y + 5y}{15} = y - 2$ [LCM of 3 and 5 is 15]

$8y = 15(y - 2)$

$8y = 15y - 30$ [Cross-multiplying]

$8y - 15y = -30$

$-7y = -30$

$\frac{-7y}{-7} = \frac{-30}{-7}$ [Dividing both sides by -7]

$y = \frac{30}{7}$

(d) $9x + 36 = 4x + 91$

$9x - 4x = 91 - 36$ [Transposing]

$5x = 55$

$\frac{5x}{5} = \frac{55}{5}$ [Dividing both sides by 5]

$x = 11$

(e) $\frac{x}{6} - 2 = x + 1$

$\frac{x}{6} = x + 1 + 2$ [Transposing]

$\frac{x}{6} = x + 3$

$x = 6(x + 3]$ [Cross-multiplying]

$x = 6x + 18, x - 6x = 18$ [Transposing]

$-5x = 18$

$\frac{-5x}{-5} = \frac{18}{-5}$ [Dividing both sides by -5]

$x = \frac{-18}{5}$

Case Study Questions

13. Let the total assets of Mala be x

Property given to her son = $\frac{1}{4}x$

Property given to her daughter = $\frac{2}{3}x$

Property left that is given to maid = ₹15000

$x - \left[\frac{1}{4}x + \frac{2}{3}x\right] = 15000$

$x - \left[\frac{3x + 8x}{12}\right] = 15000, \frac{x}{1} - \frac{11x}{12} = 15000$

$\frac{12x - 11x}{12} = 15000$

$x = 15000 \times 12$

$x = 180,000$

Hence, the total worth of Mala's assests is ₹1,80,000

14. Let Ritu's age be x, Rani's age is 2x

Five years ago

Ritu's age = x - 5, Rani's age = 2x - 5

$3(x - 5) = (2x - 5), 2x - 5 = 3x - 15$

$2x - 3x = -15 + 5$ [Transprosing]

$2x = 2 \times 10 = 20$

Hence, Ritu's persent age is 10 years and Rani's age is 20 years

Multiple Choice Questions

1. (a) $4x - 8 = 2x + 6$

$4x - 5 = 6 + 8$ [Transposing]

$2x = 14$

$\frac{2x}{2} = \frac{14}{2}$ [Dividing both sides by 2]

$x = 7$

Answer: (c) x = 7

2. $2x + \frac{3}{10} = \frac{-5}{2}$

$2x = \frac{-5}{2} - \frac{3}{10}$ [Transposing]

$2x = \frac{-25 - 3}{10}$

$2x = \frac{22}{10}$

$2x \times 10 = -28$ [Cross multiplying]

$20x = -28$, $\frac{20x}{20} = \frac{-28}{20}$

[Dividing both sides by 20]

$x = \frac{-7}{5}$

Answer: (d) $x = \frac{-7}{5}$

3. $x - \frac{15}{2} = 19 + \frac{15}{2}$

[Adding $\frac{15}{2}$ to both the sides]

$x = \frac{38 + 15}{2}$, $x = \frac{53}{2}$

Answer: (d) $\frac{53}{2}$

4. $25y - 50 = -50$

$25y = -50 + 80$ (Tranposing), $25y = 30$

$\frac{25y}{25} = \frac{30}{25}$ [Dividing both sides by 25]

$y = \frac{6}{5}$

Answer: (d) $\frac{6}{5}$

5. $5(z - 3) - 4(z - 2) = 0$

$5x - 15 - 4z + 8 = 0$

$z - 7 = 0$

$z - 7 + 7 = 0 + 7$ [Adding 7 to both the sides]

$z = 7$

Answer: (a) 7

6. $\frac{5m}{6} + \frac{5m}{4} = \frac{19}{12}$

$\frac{20m + 18m}{24} = \frac{19}{12}$

$\frac{38m}{24} = \frac{19}{12}$, $38m \times 12 = 24 \times 19$

[Cross-multiplying]

$456m = 456m$

$\frac{456m}{456} = \frac{456}{456}$

[Divding 456 from both the sides]

$m = 1$

Answer: (c) 1

7. $y - \frac{y}{2} = \frac{7}{2}$

$= \frac{7}{2}$

$2(y) = 7 \times 2$ [Cross-Multiplying]

$2y = 14$

$\frac{2y}{2} = \frac{14}{2}$ [Dividing 2 from both the sides]

$y = 7$

Answer: (d) 7

8. $\frac{a - 1}{5} = \frac{a - 7}{2}$

$2(a - 1) = 5\ (a - 7)$ [Cross-Multiplying]

$2a - 2 = 5a - 35$

$2a - 5a = -35 + 2$

$-3a = -33$

$\frac{-3a}{-3} = \frac{-33}{-3}$ [Dividing –3 from both the sides]

Answer: (a) 11

9. Let the number be x

Five times the number = 5x

$5x + 4 = 39$

$5x = 39 - 4$ [Transporing]

$5x = 35$

$\frac{5x}{5} = \frac{35}{5}$ [Dividing 5 from both the sides]

$x = 7$

Answer: (c) 7

10. Let the number be x. Other consecutive even numbers = $x + 2$, $(x + 2 + 2) = x + 4$

$x + (x + 2)\ (x + 4) = 42$

$3x + 6 = 42$

$6x = 42 - 6$ [Transposing]

$6x = 36$

$\frac{3x}{3} = \frac{36}{3}$ [Dividing 3 from both the sides]

$x = 12$, $x + 2 = 12 + 2 = 14$

$x + 4 = 12 + 4 = 16$

Answer: (b) 12, 14, 16

11. $3a - 5a = \frac{-8}{5}$ [Transposing]

$\frac{-2a}{1} = \frac{-8}{5}$

$-2a \times 5 = -8 \times 1$ [Cross multiplying]

$10a = -8$

$\frac{-10a}{-10} = \frac{-8}{-10}$ [Dividing 10 from both the sides]

$a = \frac{4}{5}$

Answer: (b) $\frac{4}{5}$

12. Let the first number be x. Other numbers are

$(x + 1), (x + 1 + 1) = x + 2$

$x + (x + 1) + (x + 2) = 51$

$3x + 3 = 51$

$3x = 51 - 3$ [Transposing]

$3x = 48$

$\frac{3x}{3} = \frac{48}{3}$ [Dividing 3 from both the sides]

$x = 16$

Middle no. $= x + 1$

$= 16 + 1 = 17$

Answer: (d) 17

13. Let the Ravi's present age be 5x

Let Shyam's present age be 7x

Let Ravi's age after 4 years = $5x + 4$

Let Shyanis age after 4 years = $7x + 4$

After 4 year

$\frac{5x + 4}{7x + 4} = \frac{3}{4}$

$4(5x + 4) = 3(7x + 4)$

$20x + 16 = 21x + 12$

$20x - 21x = 12x - 16x$

$x = 4$

Present age of Shyam = $7x$

$= 7 \times 24 = 28$

Answer: (d) 28years

Check Your Progress

1. Yes

2. No

3. No, as it has 2 variable x & y

4. $8x = 12 + 5x$, $8x - 5x = 12$ [Transposing],

$\frac{3x}{3} = \frac{12}{3}$ [Dividing both sides by 3]

$x = 4$

5. $\frac{x}{2} + 3 = 4$, $\frac{x}{2} = 4 - 3$, $\frac{x}{2} = 1$

$x \times 1 = 2 \times 1$ [Cross multiplying]

$x = 2$

6. $ax + b = 0$

$ax + b - b = 0 - b$ [Subtracting both sides by b]

$ax = -b$

$\frac{ax}{a} = \frac{-b}{a}$ [Dividing both sides by 0]

$x = \frac{-b}{a}$

8. Let the number be x

$2x + 3 = 15$

$2x = 15 - 3$ [Transposing]

$2x = 12$

$\frac{2x}{2} = \frac{12}{2}$ [Dividing both sides by 2]

$x = 6$

9. Let the number be x

$\frac{1}{2}x + 10 = 12$

$\frac{1}{2}x = 12 - 10$ [Transposing]

$\frac{1}{2}x = 2$

$\frac{1}{2}x = 2 = 2 \times 2$ [Multiplying both sides by 2]

$x = 4$

10. Let the missing number be x

$2(10 + x) = 36$

$2\left(\frac{10 + x}{2} - \frac{36}{2}\right)$ (Dividing both sides by 2)

$10 + x = 18$

$x = 18 - 10$ [Transposing]

$x = 8$

3 Understanding Quadrilaterals

Exercise 3.1

1. A convex quadrilateral is a four-sided polygon that has interior angles that measure less than 180 degrees each. The diagonals are contained entirely inside of these quadrilaterals.

2. (a) Yes (b), (c), (d) and (e)

3. (a) four

(b) four

(c) four

(d) two

(e) four

(f) two

(g) 360°

(h) opposite

(i) four

(j) less than

4. Sum of angles of a quadrilateral = 360°

$\angle P + \angle Q + \angle R + \angle S = 360°$

$60° + 70° + 120° + \angle S = 360°$

$250° + \angle S = 360$, $\angle S = 360° = 250°$, $\angle S = 110°$

5. Let the three equal angles be x°

Right angle = 90°

$90° + \angle x + \angle x + \angle x = 360°$

$3x = 270°$, $x = 90°$

Hence all four angles measures 90°

6. Let the angles ratio be x

2:3:4:6 = 2x, 3x, 4x and 6x

Sum of angles of a quadrilateral = 360°

$2x + 3x + 4x + 6x = 360°$

$15x = 360°$, $x = \frac{360°}{15}$

$x = 24°$, $2x = 2 \times 24° = 48°$, $3x = 3 \times 24° = 72°$, $4x = 4 \times 24° = 96°$, $6x = 6 \times 24° = 144°$

Hence, the angles measures; 48°, 72°, 96° and 144° respectively.

7. Given : The four angles of a quadrilateral are in ratio of 7:8:10:11

We assume ratio coefficient = x, So Our angles = 7x, 8x, 10x and 11x

And we know from angle sum property of quadrilateral that sum of all four internal angle is 360°, So $7x + 8x + 10x + 11x = 360°$, $36x = 360°$, $x = 10°$

Therefore,

Our angles of quadrilateral are : $7(10°°) = 70°$, $8(10°) = 80°$, $10(10°°) = 100°°$ and $11(10°) = 110°$

8. Given: Both the paris of opposite angles of a quadrilateral are equal and supplementary.

Let ABCD be a quadrilateral, such that

$= \angle A = \angle C$, $\angle B = \angle D$ and also $\angle A + \angle C = 180°$, $\angle B + \angle D = 180°$

Now, $\angle A + \angle A = 180°$

$= 2\angle A = 180°$

$= \angle A = 90°$

Similarly, $\angle B = 90°$

Hence, each angle is a right.

9. Given: $\angle A = \angle A = 50°$

$\angle A + \angle D = 180°$ [co-interior angles are supplementory]

$50° + \angle D = 180°$

$\angle D = 180°$

Similarly, $\angle A + \angle C = 180°$ [co-interior angles are supplementary]

$\angle C = 130°$

Hence, $\angle C = \angle D = 130°$

10. Parallelogram

11. A quadrilateral in which two pairs of opposite sides are parallel is a parallelogram. A quadrilateral in which only one pair of opposite sides is parallel is called a trapezium.

12. It is a parallelogram two pairs of opposite sides are parallel and equal

(i) If AB = AD then you can say that AB = BC = CD = AD

A parallelogram having all sides equal is called a RHOMBUS.

(ii) If DAB = 90º. This means that all angles will be right angles, as opposite angles of parallelogram are equal, and sum of co-interior angles is 180º.

A parallelogram each of whose angles is 90º is called a RECTANGLE.

(iii) If AB = AD and DAB = 90º, this means that all angles will be right angles as opposite angles of parallelogram are equal, and sum of co-interior angles is 180º, and all sides will be equal.

A parallelogram each of whose angles is 90º, and all sides are equal, is called a SQUARE.

13. (a) Sum of exterior angles of the polygon = 360°

$130° + 95° + \angle x = 360°$

$\angle x = 360° - 225°$, $\angle x = 135°$

(b) $\angle x° + 65° + 40° + 80° + 90° = 360°$

$\angle x + 275° = 360°$, $\angle x = 360° - 275°$

$\angle x = 85°$

14. Interior angle and number of sides of polygon are related as – $180 \frac{(n-2)}{n} = 140$

$180 (n - 2) = 140n$

$180n - 360 = 140n$

$180n - 140n = 360$

$40n = 360$

$n = \frac{360}{40}$

$n = 9$

So, number of sides of regular polygon is 9.

15. The total sum of all exterior angles = 360°

Each exterior angle = $\frac{\text{Sum of exterior angles}}{\text{Number of sides}}$

$= \frac{360°}{9} = 40°$

Each exterior angle = 40°

Exercise 3.2

1. From the properties of a parallelogram, The opposite angles are congruent. The consecutive angles are supplementary.

Let the measure of Angle A = 80°

A and C are opposite angles.

$\angle A = \angle C$

So, $\angle C = 80°$

A and D are consecutive angles.

$\angle A + \angle D = 180°$

$80° + \angle D = 180°$

$\angle D = 180° - 80°$

$\angle D = 100°$

D and B are opposite angles.

$\angle D = \angle B$

So, $\angle B = 100°$

Therefore, the measures of the remaining angles are 100°, 80°, and 100°

2. Let the adjacent angles of the parallelogram be 2x and 3x.

We know that sum of adjacent angles of a parallelogram is 180.

$= 2x + 3x = 180$

$= 5x = 180$

$= x = 36$

Therefore, adjacent angles are $2 \times 36 = 72$ and $3 \times 36 = 108$

We know that the opposite angles of a parallelogram are equal.

Thus, the angles of the parallelogram are 72, 108, 72, 108.

3. Let the measure of Angle B be 'x'.

According to question, Angle A is 3 times the measure of Angle B.

So, the measure of Angle A be '3x'.

Since ABCD is a parallelogram, so the measure of opposite angle is equal and consecutive angles are supplementary.

On putting the values, we get;

$3x + x = 180°$

$4x = 180°$

$x = \frac{180}{4} = 45°$

$\angle B = x = 45°$

$\angle A = 3x = 3 \div 45° = 135°$

and $\angle B = \angle D = 45°$

Hence The measure of $\angle A$, $\angle B$, $\angle C$ and $\angle D$ are 135°, 45°, 135° and 45° respectively.

4. As per question,

Parallel sides of parallelogram are – 5 m and 6 m

As we know that,

Opposite sides of parallelogram are parallel and equal.

Perimeter of any figure can be determined by adding the length of sides of outer border of the figure.

So, for determining the value of perimeter of parallelogram we will use the formula

Perimeter = 2(l + b) = 2(Sum of both sides)

So, for determining the value of perimeter of parallelogram we will put the value of sides given in the question in above formula,

Thus we will get,

Perimeter =2(5 + 6) = 2 × 11 = 22m

5. Since we have given that

Ratio of adjacent sides are 2:5.

Let the length of first side be 2x.

Let the length of second side be 5x.

Perimeter = 56 m

So, According to question, we get that

$2x + 5x + 2x + 5x = 56$

$14x = 56$

$x = \frac{56}{14}$

$x = 4$

Hence, the length of side would

$2x = 2 \times 4 = 8cm$

$5x = 5 \times 4 = 20cm$

Therefore, length of sides are 8cm, 20cm, 8cm, 20cm.

6. Perimeter of a parallelogram = 220 m

$2(l + b) = 220m$

Let the smaller side be x.

Then, the larger side is (x + 50)

Putting the value..

$2(x + 50 + x) = 220$

$2x + 50 = \frac{220}{2}$

$2x + 50 = 110$

$2x = 110 - 50$

$2x = 60$

$x = \frac{60}{2}$

$x = 30$

Smaller side = 30 m

Larger side = 30 + 50 = 80 m

7. We know that in parallelogram, sum of adjacent angles is 180o

$\therefore \ (3y - 4)^o + (3y + 10)^o = 180^o$

$3y - 4 + 3y + 10 = 180^o$

$6y - 6 = 180^o$

$6y = 174^o$

$y = 174^o/6$

$y = 29^o.$

$(3y - 4)^o = (3 \times 29 - 4)^o = 83^o$

$(3y + 10)^o = (3 \times 29 + 10)^o = 97^o$

We know that, in parallelogram opposite angles are equal.

$\therefore$ Four angles of parallelogram are $83^o, 97^o, 83^o$ and 97^o.

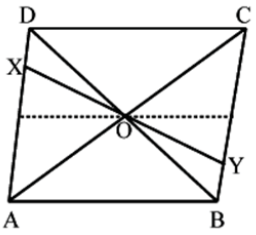
8. The parallelogram is a type of quadrilateral, which has certain geometrical properties which are unchangeable. With the absence or presence of these properties we can figure out that the quadrilateral is a parallelogram or not.

Similarly, the two diagonals of a parallelogram bisects each other at equal proportions (1:1).

But, the diagonals of the given quadrilateral, divides one diagonal in the ratio of 2:3.

So, it's a violation of the geometrical characteristics. And, that's why we cannot consider the given quadrilateral as a parallelogram.

9. In parallelogram ABCD.



Diagonals AC and BD intersect each other at O.

$\therefore$ O is the mid-point of AC and BD.

Throught O, XY is drawn such that X lies on AD and Y, on BC.

(a) OB = OD ($\because$ O is mid-point of BD)

(b) $\because$ AD ||BC and BD is transversal

$\because$OBY = $\because$ODX (Alternate angles)

(c) $\angle$BOY = $\angle$DOX

(Vertically opposite angles)

(d) Now in ΔBOY and ΔDOX.

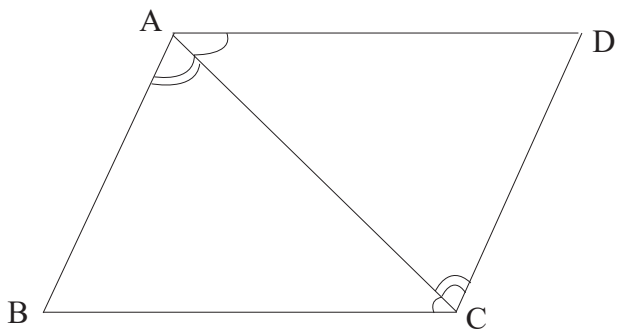
$\because$OB=OD$\angle$OBY=$\angle$ODX$\angle$BOY=$\angle$DOX

$\therefore\Delta$BOY$\cong\Delta$DOX (ASA axiom)

$\therefore$ OY =OX (c.p.c.t)

Hence XY is bisected at O.

10.



The diagonal AC divides the parallelogram ABCD into two triangles ABC and ADC.

Considering triangles ABC and ADC,

We know that the opposite sides of a parallelogram are parallel and congruent.

So, AD = BC

AD||BC

We know that the alternate interior angles are equal.

$\angle$BAC = $\angle$DCA

$\angle$BCA = $\angle$DAC

Common side = AC

We observe that one side and two angles made on this side are equal.

By ASA criteria, the triangles ABC and ADC are similar.

Therefore, ΔABC $\cong$ ΔADC.

11. (a) Since D is opposite to B. So, y = 105°

(Since opposite angles f parallelogram are equal) $\angle$B + $\angle$C = 180° $\angle$B + $\angle$C = 180°

(The adjacent angles in a parallelogram are supplementary

x + 105° = 180°)

x + 105° = 180°

Therefore 180° − 105° = 75°

180° – 105° = 75°

x = z = 75

°x = z = 75° [Since opposite angles of a parallelogram are equal]and adjacent angles are supplementary.]

Therefore, value of x = 75°,y = 105° and $\angle$z = 75°

(b) From the above figure,

$\angle$SPR = $\angle$PRQ

40° = 40°… [because alternate angles are equal]

Now consider the triangle PQR, We know that, sum of measures of interior angles of triangle is equal to 180°.

$\angle RPQ + \angle PQR + \angle PRQ = 180°$

$z + 110° + 40° = 180°$

$z + 150° = 180°$

$z = 180° - 150°$

$z = 30°$

Then, $\angle QPR = \angle PRQ$

$Z = x$

$30° = 30°$… [because alternate angles are equal]

We know that, in parallelogram opposite angles are equal.

So, $\angle Sy = \angle Q = 110°$

Therefore, value of $x = 30°$, $y = 110°$ and $\angle z = 30°$

(c) $\angle P + \angle S = 180°$ [Adjacent angles of parallelogram]

$\angle y + 70° = 180°$

$y = 180° - 70° = 110°$

Now, $\angle P = \angle R$ [Opposite angles are equal]

$= y = z$

$= z = 110°$

Also, $y = z$ [Alternate angles]

$x = 110°$

Hence, $x = 110°$, $y = 110°$ and $z = 11$

12. In a parallelogram, we know that the diagonals bisect each other.

Therefore SO = OQ.

This given $20 = x + y$.

Similarly, PO = OR,

$15 = y + 3$.

We obtain

$y = 15 - 3 = 12$cm.

Substituting the value of y in the first relation, we get $20 = x + 12$.

$x = 20 - 12$

$x = 8$

Hence, the value of x = 8 cm

y = 12cm

Exercise 3.3

1. (a) two pairs of parallel sides **yes**

(b) two pairs of equal sides **No**

(c) one pari of equal sides **Yes**

(d) two of its angles are right angles **Yes**

(e) diagonals bisect each other **Yes**

(f) equal diagonals at right angles **Yes**

(g) four equal sides **Yes**

(h) equal and perpendicular diagonals **No**

2. Perimeter of the square field = 14.4

No. of sides in a square = 4

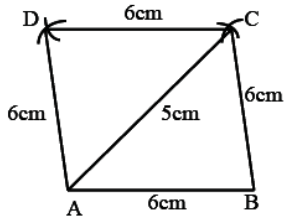
$14.4 = 4xS$

$S = 14.4/4$

$= 3.6$

Therefore one side of the square measures 3.6.

3.



AB, BC, CD, AD are the sides of the rhombus and

AC and BD are the diagonals of the rhombus

Where

AC = 30

BD = 16

and o is the point where diagonals are bisect each other

As we know the property of rhombus that diagonals are bisect each other then

AO = CO = 15

BO = OD = 8

Since diagonals are perpendicular to each other then we can apply Pythagoras theorem on it

By applying Pythagoras theorem on ΔAOD

AD^2 = A0^2 + OD^2

AD^2 = 15^2 + 8^2

AD^2 = 289

AD = 17

Since all the sides of the rhombus are congruent

Hence of the side of the rhombus is 17cm.

4. (i) Draw a line segment AB=5 cm.

(ii) With centre A and radius 6 cm and with centre B and radius 5 cm, draw arcs interesting each other at C. [All sides of rhombus are same]

(iii) Join AC and BC.

(iv) Again with centers C and A and radius 5 cm, draw arcs intersecting each other at D.

(v) Join AD and CD.

Then ABCD is the required rhombus.

5. Since, all the sides of a rhombus are equal, so for the rhombus ABCD let AB = 4 cm and angle A = 60°.

The steps of construction are as follows:

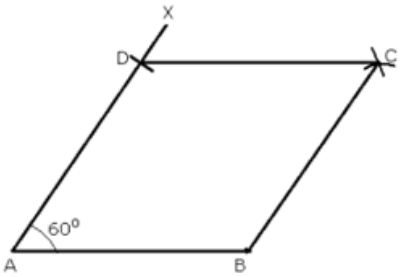
i) Draw AB = 4 cm.

ii) At A draw BAX = 60°. With A as centre, draw an arc of radius 4 cm to meet the ray AX at D.

iii) With B and D as centres and radius 4 cm draw two arcs cutting each other at C.

iv) Join CD and BC.

ABCD is the required rhombus.



6. According to given data:

The diagonals of a parallelogram are not perpendicular to each other. Their fore it is not a Rhombus.

Because Rhombus diagonal should be a perpendicular to each other.

7. PQ = QR = RS = SP = QS... (since all sides of rhombus are equal)

= SRQ and SPQ are equilateral triangles.

= $\angle R = \angle P = 60°$

Now,

$\angle S + \angle R = 180°$

$\angle S + 60° = 180°$

$= \angle S = 120°$

Hence,

$\angle R = \angle P = 60°$ and $\angle S = \angle Q = 120°$

8. Let ABCD be the rhombus where, AC = 10cm and BD = 24cm

Let AC and BD intersect each other at O. Now, diagonals of rhombus bisect each other at right angles.

Thus, we have

$AO = \frac{1}{2} \times AX = \frac{1}{2} \times 10 = 5cm$ and

$BO = \frac{1}{2} \times BD = \frac{1}{2} \times 24 = 12cm$

In right angled ΔAOB,

$= (AB)^2 = (AO)^2 + (BO)^2$

$= (AB)^2 = (5)^2 + (12)^2$

$= (AB)^2 = 25 + 144$

$= (AB)^2 = 169$

$\therefore AB = 13cm$

$\therefore$ The length of each side of rhombus is 13cm.

Exercise 3.4

1. (a) two pairs of equal sides **Yes**

(b) all its sides equal **No**

(c) diagonals are equal **Yes**

(d) diagonals bisect each other **Yes**

(e) diagonlas are perpendicular **No**

(f) diagonals are perpendicular and bisect each other **No**

(g) diagonals are equal and bisect each other **Yes**

(h) diagonals are equal, bisect each other and are perpendicular to each other. **No**

2. Since, all four angles in rectangles are equal to 90

The diagonals will always be equal and cut at midpoints in right angles. This is the definition of squares and rectangles.

So, the given statement is wrong which leaves cardboard as a non-rectangular figure.

3. Pythagoras theorm states that in a right-angled triangle, the square on the hypotenuous remaining two sides.

Since, ABCD is a rectangle angles A, B, C and D are rt. angles.

First, we consider the ΔACD, and applying Pythagoras theorm we get,

$AC^2 = DA^2 + CD^2$ ....(a)

Similarly, we get from rt. angle triangle BDC we get,

$BD^2 = BC^2 + CD^2$

$= BC^2 + AB^2$ ...[In a rectangle opposite sides are equal, ∴CD = AB] .....(b)

4. 1]draw base 5 cm

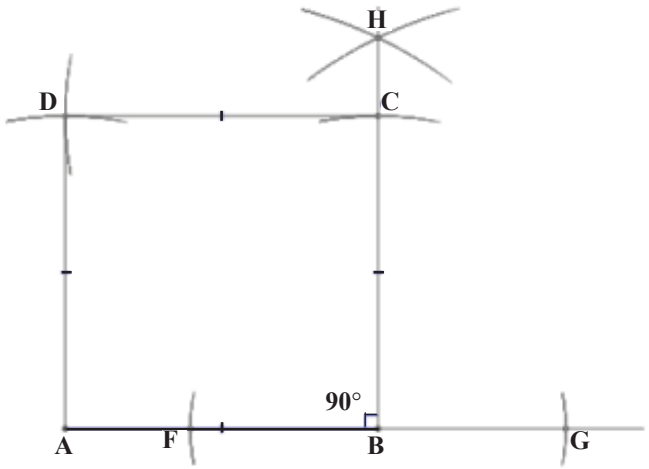
2] draw angles from both end points of 90 degrees

3] from first end point mark an arc of 5 cm same from other

4] join the points of intersection of two arcs to the segments that is the 90 degrees lines.

see the figure for better understanding

[from the figure ignore points f and g]



5. As per data given in the question,

It is given that,

Side of rectangle are in ratio of 1 :2

Perimeter of rectangle = 24 cm

As we know that,

Perimeter of rectangle can be determined by using the formula *Perimeter* = $2(l + b)$

So, let the length and breadth of rectangle are x and 2x respectively.

So, in order to determine the value of length and breadth we will put the assumed value of length and breadth of rectangle in above formula.

Thus we will get,

Perimeter = $2(x + 2x)$

$=> 24 = 2 \times 3x$

$=> 6x = 24$

$=> x = \frac{24}{6} = 4$

So, value of length and breadth of the rectangle will be

Length = x = 4cm

Breath = $2x = (2 \times 4) = 8$cm

Hence, value of length and breadth of the rectangle will be

Length = x = 4cm

Breadth = $2x = (2 \times 4) = 8$cm

6. In ΔADC and ΔCBA,

BC = DA (Opposite sides of the rectangle)

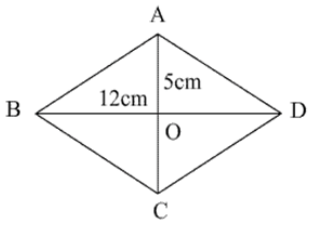
AB = CD

∠B = ∠D = 90

YES, BY SAS ΔABX ≅ ΔXBA

7. The rectangle has two diagonals equal in length. But according to question, the diagonals are uneven. Hence we can say that the quadrilateral is not a rectangle. It is either parallelogram or rhombus.

8.



Let the diagonal AC and BD intersect at rigth angles at O, Join AB, BC, CD and DA.

Then AO = 5cm; BO = 12cm. and AOB is a right triangle.

$\therefore$ AB = $\sqrt{12^2 + 5^2}$ = $\sqrt{169}$ = 13cm

Similarly, in triangle AQD, DC and BC are = 13cm

Hence each side is 13cm and it will be a rhombus.

9. No, if the diagonals of the quadrilateral are perpendicular to each other then such a quadrilateral is not always a rhombus.

As we know the conditions of rhombus,

1. It should always be a parallelogram.
2. All the sides of the quadrilateral should be equal.
3. The diagonals are perpendicular to each other.

So here given only, "Diagonals of the quadrilateral are perpendicular to each other."

Hence, we can't say a given quadrilateral is always rhombus.

10. According to Pythagoras therem

Length of the diagonal $\sqrt{l^2 + b^2}$

Length of diagonal = $\sqrt{100 + 576}$

= Length of diagonal = $\sqrt{676}$ = 26cm

Review Exercise

1. Let their quadrilateral be ABCD

Let the 4th angle be x,

Now,

78 + 56 + 30 + x = 360° (angle sum property of interior angles of a quadrilateral)

= 264 + x = 360°

= x = 264 = 360°

= x = 96°

$\therefore$ the measure of fourth angle is 96°.

2. x + x + x + 160º = 360º

= 3x + 160º = 360º

= 3x = 200º

= x = 66.66º

3. (a) Sum of interior angles of a polygon with n sides = (n – 2) × 180°

Sum of interior angles of a polygon = 540°

Equating both we can determine the number of sides

(n – 2) × 180° = 540°

By further calculation

n – 2 = 540/180

n – 2 = 3

So we get

n = 3 + 2 = 5

Number of sides in polygon =5

(b) Sum of interior angles of a polygon = 180(p – 2).

720° = 180 (p – 2) [Since, sum = 720° (Given)]

= 720°/180º = (p – 2)

= 4 = (p – 2)

= p = 4 + 2

= p = 6

Thus, we see that the polygon has 6 sides.

(c) (n – 2) × 180°, where n is the number of sides.

(n – 2) × 180° = 1620

= n – 2 = 1620/180 = 9

= n = 9 + 2 = 11

Number of sides in polygon =11

(d) If the sum of its interior angles is 16 right angle

Sum of interior angles of a polygon = 180^o (n − 2)

= 180^o (n − 2) = 16 × 90^o

= (n − 2) = 8

= n = 10

Number of sides in polygon = 10

4. **(a)** If the sum of its interior angles is 870o

Sum of interior angles of a polygon = 180^o(n − 2)

180^o(n − 2) = 580

= (n − 2) = 580/180

= n = 29/9

= n = 47/9

No, there is not existence of such polygon because n is not an integer.

(b) If the sum of its interior angle is 870°

Sum of interior angles of a polygon = 180° (n − 2)

180° (n − 2) = 870°

$= (n - 2) = \frac{29}{6}$

$= n = \frac{41}{6}$

No, their is not exist of such polygon because n is not an integer.

(c) If the sum of its interior angles is 2520^o

Sum of interior angles of a polygon = 180^o(n − 2)

180^o(n − 2) = 2520

= (n − 2) = 2520/180

= (n − 2) = 14

= n = 16

It is possible to have a polygon, sum of whose interior angles is 2520.

(d) If the sum of its interior angles is 4500o

Sum of interior angles of a polygon = 180^o(n − 2)

180^o(n − 2) = 4500

= (n − 2) = 4500/180

= (n − 2) = 25

= n = 27

It is possible to have a polygon, sum of whose interior angles is 4500.

5. Sum of interior angles of a regular polygon = (n − 2)180°

Sum of exterior angles of a regular polygon is always 360 degrees

= (n − 2) 180 = 6 × 360

= n − 2 = 12

= n = 14

∴ Number of sides of the polygon is 14.

6. Exterior angle = $\frac{360°}{n}$ (n is number of sides of a polygon)

Interior angle = $\frac{(n-2)180°}{n}$

$= \frac{2}{7} = \frac{360°}{(n-2)180°}$

= n − 2 = 7

= n = 9

Hence, the number of sides in the polygon is 9.

7. . A regular polygon is defined as a polygon that has all the sides of equal length and all the angles of the same measure. An equilateral triangle is a regular polygon that has three sides. A square is a regular polygon that has four sides.

In a regular polygon, the sum of an interior angle and its exterior angle is 180°180°. We will use this property to find the measure of the exterior angle of the regular polygon given in the question. Its interior angle has measure 150°150°. Therefore, the exterior angle has measure 180° − 150° = 30°180° − 150° = 30°.

Regular polygons have the property that the sum of all its exterior angles is 360°360°. Using this property, we can see that number

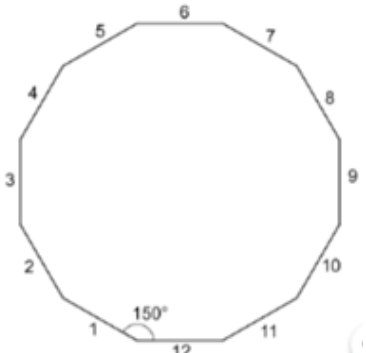
of sides = $\frac{\text{Sum of exterior angles}}{\text{measure of one exterior angle}}$

Substituting the respective values, we get the following.

number of sides = $\frac{360°}{30°}$

∴ number of sides = 12

Therefore, the number of sides of the regular polygon with interior angle 150° is 12. This regular polygon looks like the follwing,



8. Given : A = 105° and a parallelogram ABCD.

Find: ∠B , ∠C and ∠D

We know that opposite angles if parallelogram is equal

∠A = ∠C

and, ∠B = ∠D

therefore, ∠C = 105°

Now, ∠A + ∠B = 180° (adjacent angles)

∠B + 105° = 180°

∠B= 180° – 105°

∠B = 75°

Then ∠B = ∠D

So, ∠D = 75°

Hence the of ∠B = 75°, ∠C= 105° and ∠D= 75°.

9. Given: 2 adjacent angles of a parallelogram are in ratio 3:5

To find: All the angles of the parallelogram

Step-by-step explanation:

Let the llgm be ABCD (llgm is the short form of parallelogram)

<A = 3x <B = 5x

<C = <A = 3x (Vertically opposite angles are equal)

<D = <B = 5x (Vertically opposite angles are equal)

<A + <B + <C + <D = 360 (Angles Sum Property of a quadilateral)

3x + 5x + 3x + 5x = 360

16x = 360

x = 360/16 = 22.5

5 × 22.5 = 112.5, 3 × 22.5 = 67.5

10. Diagnols of parallelogram bisects each other..

Therefore,

2y + 13 = 5y + 4

9 = 3y

y = 3

x + 8 = 16 – x

2x = 8, x = 41

11. RE||TN

∴∠ETN = ∠TER = 43

∠A = 90°

In ΔREA,

∠ERA + ∠AER = ∠NAE (Exterior angle property)

= b + 43° = 90° = b = 90° − 43° = b = 47°

So, a − b = 90° − 47° = 43°

Answer: (a)43

12. Let breadth be x.

2(L + b) = 98

2(2.5x + x) = 98

2 × 3.5x = 987x = 98

x = $\frac{98}{7}$

x = 14

2.5x = 14 × 2.5 = 35

So

14 and 35 will be the side of rectangle.

13. In a parallelogram opposite angles are equal.

So, angle D= 120°

Sum of its interior angle is 360°

So 120 + A + 120 + C = 360

Angle A = C

So 2C = 360 – 240

=120

C = 60°

14. Interior angle = (n – 2) × 180°

Where n is the number of sides in a polygon.

Interior angle = (n – 2) × 180° (Octagon has 8 sides)

= 6 × 180° = 1080°

Multiple Choice Question

1. **Answer:** (d) Parallelogram

2. **Answer:** (c) Rhombus

3. **Answer:** (d) Rhombus

4. **Answer:** (b) Rectangle

5. **Answer:** (d) Rectangle

6. **Answer:** (c) Parallelogram

7. **Answer:** (c) Trapezium

8. Let us assume that, the angles of a quadrilateral are x , 2x , 3x and 4x respectively.

so,

sum of all angles of quadrilateral = 360° { By angle sum property.}

then,

= x + 2x 3x + 4x = 360°

= 10x = 360°

= x = 36°

therefore,

= Largest angle = 4x = 4 × 36° = 144°

Answer: (d) 144°

9. **Answer:** (a) 360°

10. Sum of all 4 angles in a quadrilateral is 360°

3 angles = 70°

So, fourth angle = 360° − 70° − 70° − 70° = 150°

Answer: (a) 150°

Check your progress

1. Let ∠A (70°), ∠B, ∠C and ∠D be angles of rhombus ABCD.

Sum of adjacent angles of rhoumbus is 180°.

∠A + ∠B = 180°

70° + ∠B = 180°

∠B = 180° – 70°

∠B = 110°

Opposite angles of rhombus is are equal.

∠C = ∠A = 70°

∠D = ∠B = 110°

Hence, angles of rhombus are 70°, 110°, 70° and 110°.

2. Let ABCD be a parallelogram with Angle A = 85°; Angle C = Angle A.

Angle A + Angle B + Angle C + Angle D = 360°

(Opposite angles of a parallelogram are equal)

85°+ Angle B + Angle 85°+ Angle D = 360°

Angle B + Angle D + 170° = 360°

(Angle sum property of a quadrilateral)

Angle B + Angle D = 360° - 170° = 190° .... (1)

But, Angle B = Angle D

(Opposite angles of a parallelogram are equal)

= From Equation (1)

Angle B + Angle B = 190°

2 Angle B = 190°

Angle B = 190°/2 = 95°

So, Angle B = Angle D = 95° and Angle A = Angle C = 85°

3. As we know that formula of the perimeter of rhombus;

Perimeter = 4 × side

Accroding to question

= Perimeter of rhombus = 4 × side

= 60 = 4 × side

= Side = 60/4

= Side = 15cm

4. Given, two adjacent angles of a parallelogram are in the ratio 2 : 3

Let the angles be 2x and 3x.

Then,

$2x + 3x = 180°$ [$\because$ adjacent angles of a parallelogram are supplementary]

$=5x = 180° = x = 36°$

Hence, the measures of the angles are $2x = 2 \times 36° = 72°$ and $3x = 3 \times 36° = 108°$

5. Let the ratio of the angles be x

Sum of all angles in a quadrilateral is 360°.

Now,

$3x + 3x + 4x + 5x = 360°$

$15x = 360°$

$x = 24°$

Therefore, $x = 24°$

Hence, Largest angle $= 5 \times 24° = 120°$

6. Each interior angle of a regular hexagon is 120°

interior angle is given by: $\frac{2n-4}{n} \times 90°$

$= \frac{2 \times 6 - 4}{6} \times 90°$

$= 120°$

7. An octagon is a polygon made up of 8 sides. It has eight angles. Octagon = Octa + gon where octa means eight and gon means sides.

8. The sum of the exterior angles of a polygon is 360°

9. $\frac{(n-2)180°}{n}$

10. The interior angle of regular polygon is $\frac{(n-2)180°}{n}$

Putting n = 10, we get interior angle = 144 degree

Exterior angle = 180-Interior angle

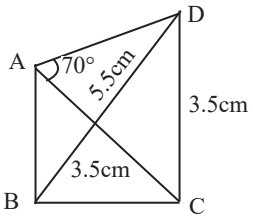
Exterior angle = 180-144

= 36 degree

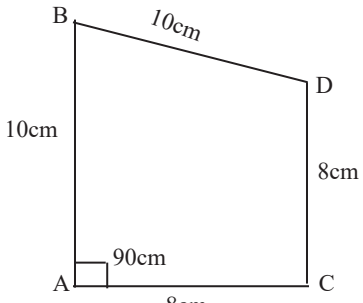
4 Pratical Geometry

Exercise 4.1

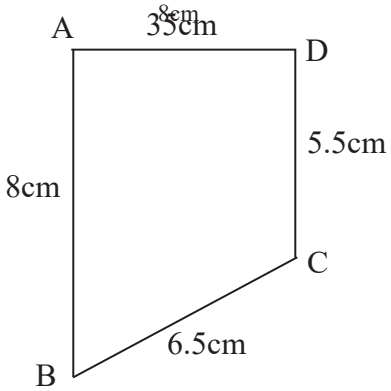
1. (i)



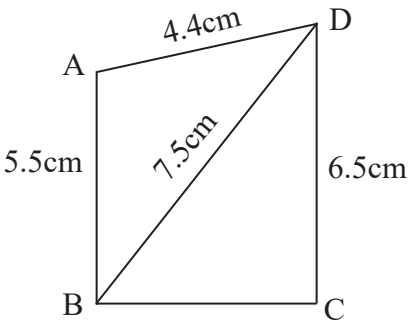
(ii)



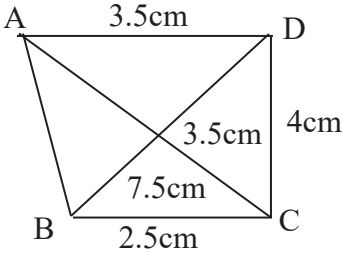
(iii)



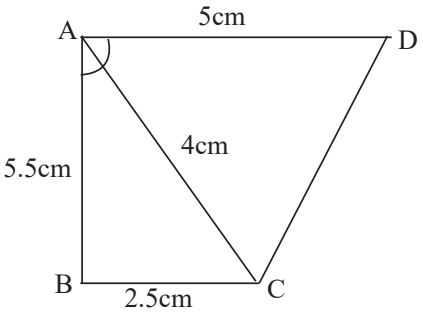
(iv)



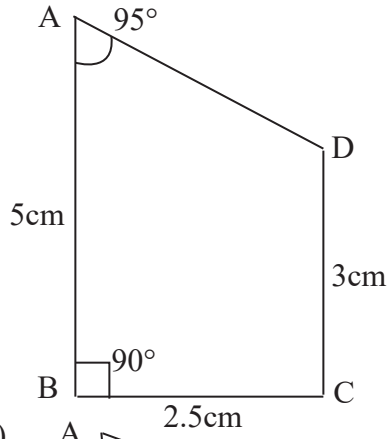
(v)



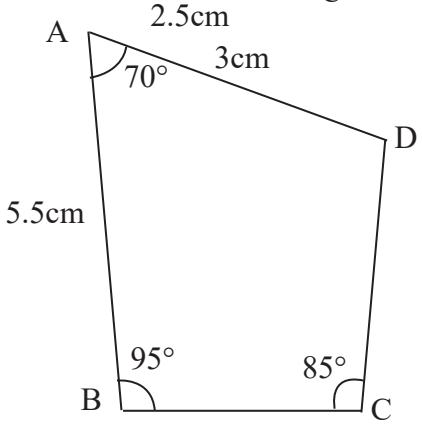
(vi)



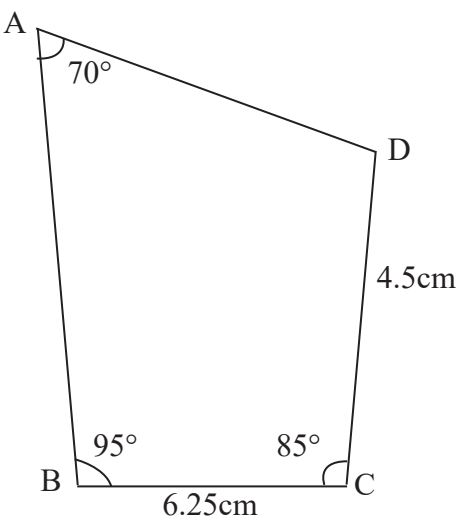
(Vii)



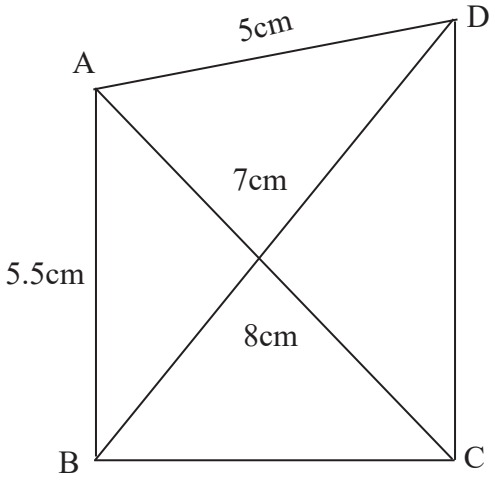
(Viii)



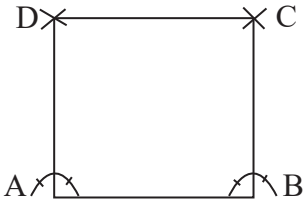
(xi)



(x)



2. (a)



Step-1: Draw AB = 5.5cm

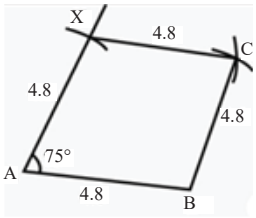
Step-2: Construct 90° angles at A and B

Step-3: taking radius = 5.5cm, draw an arc at D and C.

Step-4: Join AD, BC and CD

Hence, ABCD is the required square.

(b)



Step 1: Draw line segment AB = 6 cm.

Step 2: Construct Angle BAX = 60°.

Step 3: With A as the center and radius equal to 6 cm , draw an arc on ray AX.

Step 4: Mark the point of intersection as D.

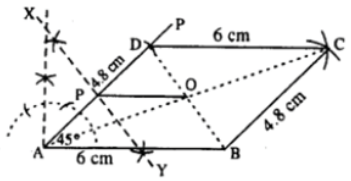
Step 5: With D as the center and radius equal to 6 cm, draw an arc.

Step 6: With B as the center and the same radius, draw another arc such that it intersects the previous arc at C.

Step 7: Join points C, D and points C, B.

ABCD is the required rhombus.

(c).



Steps 1: Draw AB = 6 cm.

Steps 2: Draw ∠PAB = 45°.

Steps 3: Cut AD = 4.8 cm.

Steps 4: From D, draw an arc of radius 6 cm.

Steps 5: From B, draw an arc of radius 4 cm which meets first arc at C.

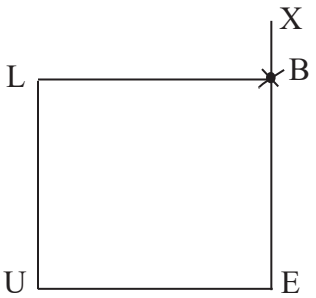
Steps 6: Join BC, CD, AD. Thus ABCD is the required ||gm.

Steps 7: Draw perpendicular bisector XY of AD which cuts AD at P.

Steps 8: Join AC and BD which intersect at O.

Steps 9: Join OP and measure it. OP = 3 cm

3.



Draw a line segemtn UE = 4.1cm

At E contruct and angle of 75°

At EX cut-of length EB = 5cm

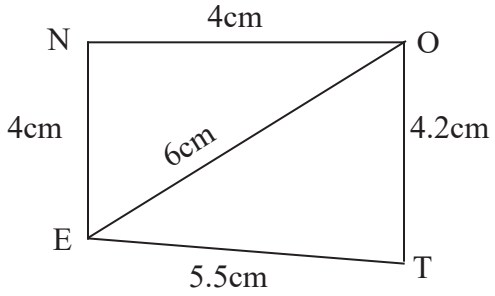
With B as centre and radius as 3.5

Draw an arc

With U as centre and radius as 4.2cm draw another are, meeting the previous are (Step 4) in C.

Join U∠ and ∠B . Then BLUE is the required qualiteral.

4.



Draw an line segement ET = 5.5cm

With T as Centre and 4.2cm as radious, draw an arc.

With E as Centre and 6cm as radius, draw another are meeting the are of step 2 isn O.

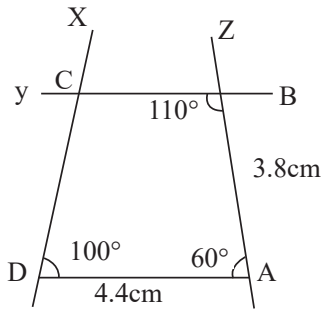
Join OT and OE.

With centre O radious 4cm an arc:

With E as centre and 4cm radious draw another arc meeting the arct of step 5 in N.

Join ON and EN. Note is the required quadrilateral.

5.



Draw a line segemnt DA = 4.4cm

At D, Construct an angle CDA of 100°

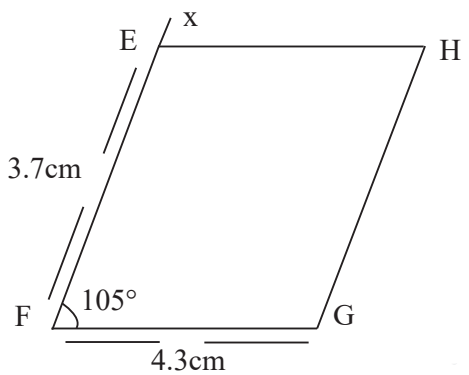
At A, Construct and angle ADC of 60°

At AZ, cut ofs AB = 4cm

At, B constract and angle ABC of 110°

At ∠4, meet Dx at C, Then ABCD is the required Quadrialteral.

6.



Draw a line segment FG = 4.3 cm

At, F construct an angle EFT = 105°

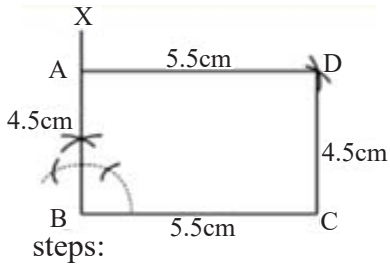
From Fx, Cit off BE = 3.7cm

With E as centre and radius 5.3cm. draw an arc.

With G as centre and radious 3.7cm draw another are meeting the previouse are (Step 4) at H

Join EH and GH. EFGJ is a required parallelogram.

7.



steps:

1. Draw BC = 5.5cm
2. At B, draw XBC = 90
3. Cut BA = 4.5cm
4. From A, draw an arc of radius 5.5cm
5. From C, draw an arc of radius 4.5cm which meets first arc at D.
6. Join AD and CD.

Thus ABCD is the required rectagnle.

8. We know that each angle of a rectangle is right (i.e. 90°) and its opposite sides are equal and parallel.

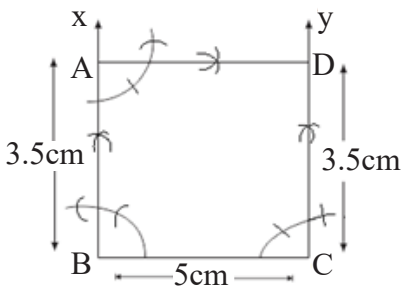
To construct a rectangle whose adjacent sides are of lengths 4.5cm and 3.5cm, use the following steps

(i) Draw a line segment BC of length 4.5cm.

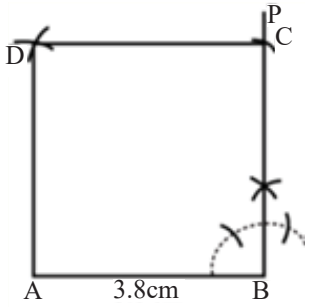
(ii) Now, generate an angle of 90° at points B and C of the line segment BC and plot the parallel lines BX and CY at these points.

(iii) Cut AB and CD of length 3.5cm on BX and CY, respectively.

(iv) Draw an angle 90° at one of the point A or D and join both points by a line segment AD of length 4.5cm.Thus, ABCD is the required rectangle with adjacent sides of length 4.5cm and 3.5cm.



9.



Step: 1. Draw AB = 3.8cm.

2. At B, draw ∠PBA = 90

3. Cut BC = 3.8cm

4. From A and C, draw arcs of radiii 3.8cm each which interect at D.

5. Join AD and CD.

Thus ABCD is the required square.

10. Steps of construction:

Step 1: Draw AC=6.2cm

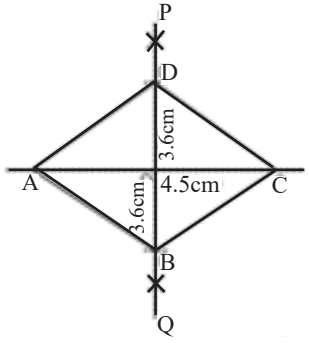
Step 2: Draw the perpendicular bisector of AC that is POQ. which bisects AC at point O.

Step 3: From OP cut OB equal to half of BD that is 3.6cm and from OQ cut OD equal to half of BD that is 3.6cm

Step 4: Join AB, BC, CD° and DA. Then, ABCD is the required square.

Diagram with labelling:

ABCD is the required square.



Review Exercise

1. D Step-by-step explanation:

Step 1 : Draw a line segment PQ = 3 cm

Step 2 : Draw an angle of 105° at P on PQ using protector

Step 3 : Take a length of 5.6 cm from P on angle drawn in step 2 and label it S

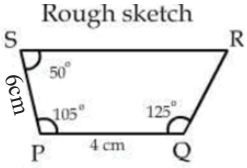
Step 4 : Draw an angle of 50° at S on PS using protector

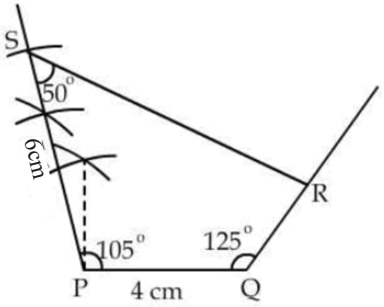
Step 5 : Draw an angle of 125° at Q on PQ using protector

Step 6 : angle drawn in step 4 & 5 intersects ar R

Quadrilateral PQRS is constructed in which PQ = 3 cm, P = 105°, Q = 125°, S = 50°, and SP = 5.6 cm.

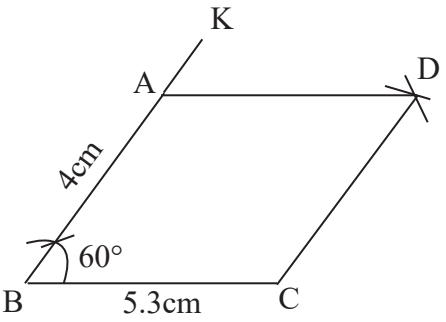
Rough sketch





PQRS is a required quadrilateral.

2.



1.Draw a line segment BC = 5cm

2. At B, construct ∠CBK = 60°

3. From BK, cutoff BA = 7cm

4. With A as centre and radious 5cm, draw and arc.

5. With C as centre and radious 7 cm draw another arc metting the previous arc (step 4) at D.

6. Join AD and CD. ABCD is a required parallelogram as shown in fig.

3. Steps of Construction:

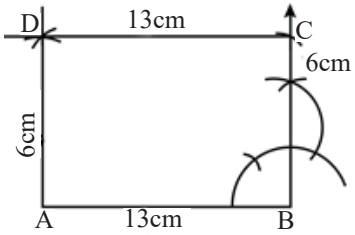
(i) Draw a line segment AB = 13 cm.

(ii) At B, draw a perpendicular and cut off BC 6 cm.

(iii) With centre A and radius 8.5 cm and with centre C and radius13 cm, draw arcs intersecting each other at D.

(iv) Join AD and CD.

ABCD is the required rectangle.



4. Given that : PQ=6.5cm and QS=7cm

We know that, all sides of a rhombus are equal.

So,

PQ = QR = RS = SP = 6.5cm

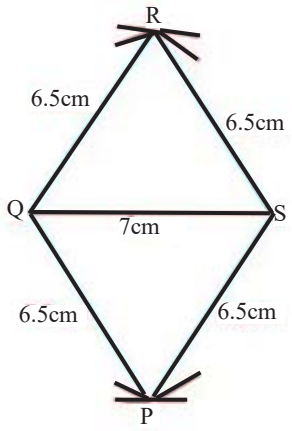
To construct rhombus, we follow these step :

Step 1 :- Draw a line QS=7 cm

Step 2 :- Now take radius of 6.5 cm and draw two arc on both side of line QS , by taking center Q

Step 3 :- Now take radius of 6.5 cm and draw two arc on both side of line QS , by taking centerS. Both arcs meet at P and R.

Step 4 :- Now join PQ, PS, SR and QR



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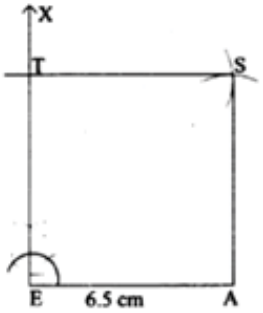


Steps:

(i) Draw a line segment EA = 6.5cm

(ii) At E, contructed EX ⊥ EA.

(iii) With E as centre, drawn an arc of radius. 6.5cm and let it cut EX at T.

(iv) With A and T as centre drawn an arc of radius 6.5cm each and let them cut at S.

(v) Joined TS and AS.

(vi) EAST is the required square.

6. 1. Draw AB = 7.8cm

2. At B draw ∠ABX = 60°

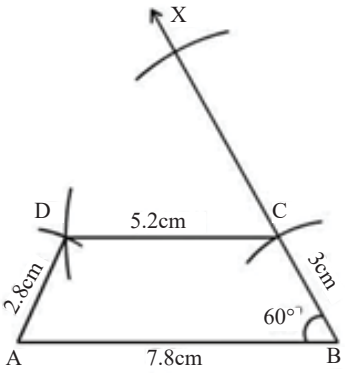
3. With B as the center and 3cm as radius draw an arc intersecting ray BX at C

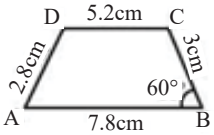
4. With C as the center and 5.2 cm as the radius draw an arc

5. With A as the center and 2.8 cm as the radius draw arc intersecting the arc of number 4 at D

6. Join CD and AD

7. We get trapezium ABCD





7. 1) Draw a line segment AB of length 4 cm.

2) With B as centre draw a ray BX such that ∠ABC = 60°

3) Again with B as centre and radius 4 cm draw an arc on ray BX. Mark the point of intersection as C.

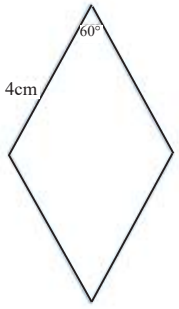
4) With C as centre and radius 4 cm draw an arc.

5) With A as centre and radius 4 cm draw another arc such that both the arcs intersect each other.

6) Mark the point of intersection as D.

7) Joint points A, D and points B, C

Thus ABCD is required rhombus



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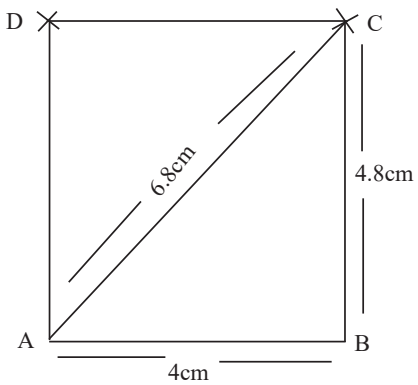


Draw AB = 4cm

With A as centre and radius 6.8cm, draw an arc.

With, B as centre and radius 4.8 cm draw another arc, cutting the previous arc at c.

Join BC and AC

With A as centre and radious 4.8cm, draw and arc. A

With C as centre and radious 4cm draw another arc, cutting the previously drawn arc at D.

Join DA and DC.

Then ABCD is required parellelogram.

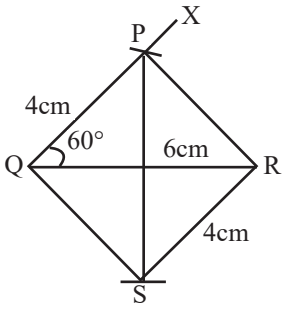
9. Step 1: Draw a line QR= 5cm

Step 2: At Q draw ∠RQX= 60º

Step 3: Cut PQ= 4.2cm at the ray QX

Step 4: Draw another arc from P– with 6cm as radius.

Step5: From R take 4.2cm and cut the arc drawn in step4 and the point of intersection is S. now join SP and SR.



10. Step 1: Draw a line AC= 3.5cm

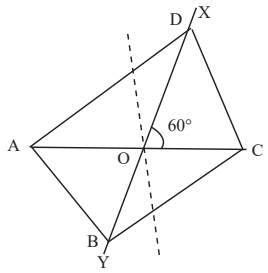
Step 2:Bisect AC at O.

Step 3: At O draw □COX= 60o

Step 4: Set the value OB= 1.15cm and OD=1.15cm (divided the value 4.3 into 2.15 and 2.15)

Step 5: Now join AB,BC,CD,DA

∴ The constructed parallelogram looks like:



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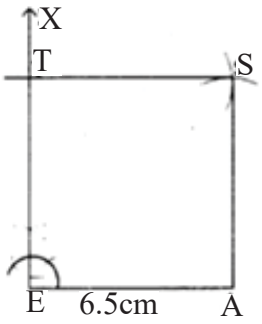


Steps:

(i) Draw a line segment EA = 6.5cm

(ii) At E, constructed EX ⊥ EA.

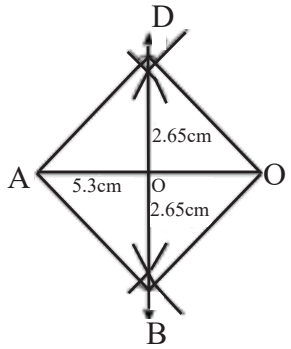
(iii) With E as centre, drawn an arc of radius 6.5cm and let it cut EX at T.

(iv) With A and T as centre drawn an arc of radius 6.5cm each and let them cut at S.

(v) Joined TS and AS.

(vi) EAST is the required square.

12.



Steps of Construction:

(i) Draw a line segment AC = 5.3 cm.

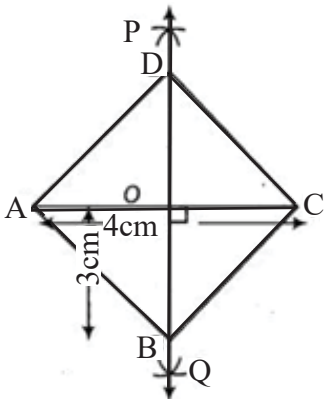
(ii) Draw its perpendicular bisector intersecting AC at O.

(iii) From O, cut off OD = OB = 2.65 cm = (1/2BD).

(iv) Join AB, BC, CD and DA

ABCD is the required square.

13.



We know that, all sides of a rhombus are equal and the diagonals of a rhombus are perpendicular bisectors of one another.

So, to construct a rhombus whose diagonals are 4 cm and 6 cm use the following steps.

1.Draw the diagonal say AC = 4 cm

2.Taking A and C as centres and radius more than ½ AC draw arcs on both sides of the line segment AC to intersect each other.

3.Cut both arcs intersect each other at P and Q, then join PQ.

4. Let PQ intersect AC at the point O. Thus, PQ is perpendicular bisector of AC.

5.Cut off 3 cm lengths from OP and OQ, then we get points B and D.

6. Now, join AB, BC, CD, and DA .

Thus, ABCD is the required rhombus

14. One of the angle is 30°.

= Its adjacent angle is 180°-30°=150°.

Construct a line segment AB of 7cm.

Draw an arc of radius 5cm of 30° by taking A as a centre.

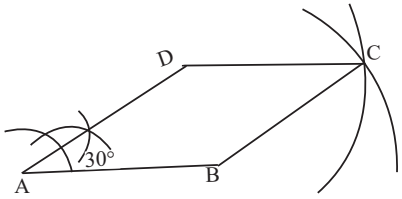
Draw an arc of radius 5cm of 150° by taking B as a centre.

Now,

Join the two arcs with a line segment.

(Its measurement should be of 5cm as Rhombus has all equal sides).

Hence a Rhombus is constructed.



15. Step 1 : Draw segment AB of length 4 cm.

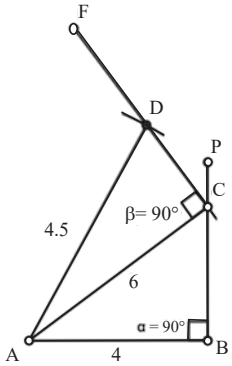
Step 2 : Draw angle ABP of 90 degrees.

Step 3 : Taking A as centre draw arc of radius 6 cm which cuts the segment BP. ...

Step 4 : Join AC.

Step 5 : Draw angle ACD of 90 degrees.

Step 6 : Taking A as centre draw arc of radius 4.5 cm which cuts the segment CF



16. If we have the length and the breadth of a rectangle then we can draw a unique rectangle because we know already that all the vertex angles are equal to 90□. Hence, only two measurements are required.

Multiple Choice Question

1. Opposite angles of a parallelogram are equal. If one angle of a parallelogram is = x °

Then, according to the previously mentioned property of parallelogram :

The opposite angle of x° is = x° (as opposite angles are equal)

So, the difference between the opposite angles:

= x° – x°

= 0

(This will be considered as the final result.)

Answer: (d) 0°

2. We know that interior angles on the same side of a transversal are supplementary. Similarly, ∠B + ∠C = 180°, ∠C + ∠D = 180° and ∠A + ∠B = 180°. Therefore, the sum of any two adjacent angles of a parallelogram is equal to 180°.

Answer: (b) 180°

3. (b) bisect each other

4. (c), (a) or (b)

5. (d), (a) or (b)

5 Data Handling

Exercise 5.1

1.

Marks obtainded	Tally marks	Frequency
1	|	1
2	|||	3
5	||	2
6	|	1
7	|	1
9	|	1
10	|||	3
11	|	1
12	𝍸	5
13	|||	3
14	||	2
15	||	2
16	||	2
18	|||	3
19	|||	3
20	|||	3

(a) 20

(b) 1

(c) 20 – 1 = 19

2.

Weight (in kg)	Tally marks	Frequency
30 - 40	𝍸 |	**6**
40 - 50	𝍸	**5**
50 - 60	||||	**4**
60 - 70	𝍸 𝍸 |	**11**
70 - 80	𝍸 |	**6**
80 - 90	𝍸 |	**6**
90 - 100	||	**2**

(a) 60 – 70

(b) 50 – 60

(c) 60

(d) Class marks of second class intevals = $\left(\frac{40 + 50}{2}\right)\frac{90}{2} = 45$

Class mark of third class intervals = $\left(\frac{50 + 60}{2}\right) = \frac{110}{2} = 55$

3.

Temperature (in° C)	Tally marks	Frequency
20-30	||	**2**
30-40	𝍸 𝍸 𝍸 ||||	**19**
40-50	𝍸 |	**6**

4.

Rainfall (in mm)	Tally marks	Frequency
0-10	𝍸 ||	7
10-20	𝍸 |	6
20-30	𝍸 ||||	9
30-40	𝍸 ||	7
40-50	||||	4
50-60	||	2

(a) Class size = upper limit - lower limit

(b) 20

(c) 30 = 10 – 0 = 0

(d) Class mark = $\left(\frac{\text{Upper limit + Lower limit}}{2}\right)$

$= \left(\frac{20 + 30}{2}\right) = \frac{50}{2} = 25$

5. (a) 30

(b) Class size = Upper limit – Lower limit = 10

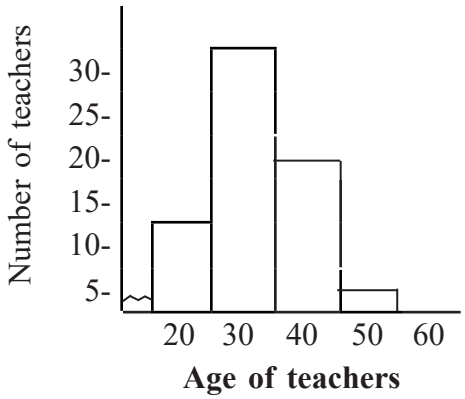
(c) 14

(d) 60 – 70

(e) 30 – 40

Exercise 5.2

1.



2. (a) 4000 – 5000

(b) 7000 – 8000

(c) 4 + 6 + 30 = 40 workers

(d) 4 + 6 + 30 + 10 = 50 workers

3. (a) Weight of students (in kg)

(b) 30 – 40

(c) 51 + 100 = 150

(d) 30 + 20 = 50

4. (a) (20 + 40 + 20) students = 80 students

(b) (40 + 10) = 50 students

(c) group 1

(d) Group I and III each

5. (a) 20 students

(b) (10 + 15 + 5 + 20)students = 50 students

(c) (5 + 20 + 30 + 15 + 10) = 80 students

(d) (15 + 10) = 25 students

Exercise 5.3

1. Sum of all the items

= ₹(9600 + 9000 + 6600 + 5400 + 4440)

= ₹35,040

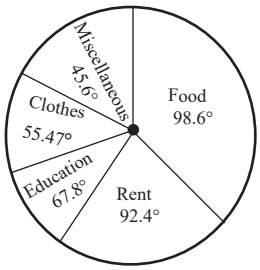
Central angle for amount spent on food = $\frac{9600}{35,040} \times 360 = 98.6\%$

Central angle for amount spent on rent = $\frac{9000}{35,040} \times 360 = 92.4°$

Central angle for amount spent on clothes = $\frac{5400}{35,040} \times 360 = 55.47°$

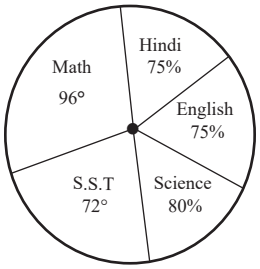
Central angle for amount spent on education = $\frac{6600}{35,040} \times 360 = 67.8°$

Central angle for amount spent on miscellaneous = $\frac{4440}{35,040} \times 360 = 45.6°$



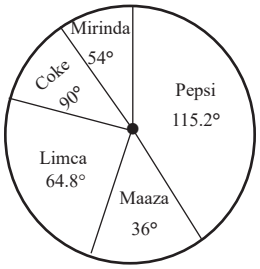
2.

Subject	Marks	Measure of central tendency = $\frac{\text{Value of all the observations}}{\text{sum of all values of the observation}} \times 100$
Hindi	90	$\frac{90}{432} \times 360 = 75°$
English	90	$\frac{90}{432} \times 360 = 75°$
Maths	96	$\frac{96}{432} \times 360 = 80°$
Science	84	$\frac{84}{432} \times 360 = 70°$
S.S.T	72	$\frac{72}{432} \times 360 = 60°$
Total	432	= 360°



3.

Drinks	Percentage	Measure of central tendency = $\frac{\text{Value of all the observations}}{\text{sum of all values of the observation}} \times 100$
Mirinda	15	$\frac{15}{100} \times 360 = 54°$
coke	25	$\frac{25}{100} \times 360 = 90°$
pepsi	32	$\frac{32}{100} \times 360 = 115.2°$
Maaza	10	$\frac{10}{100} \times 360 = 36°$
Limca	18	$\frac{18}{100} \times 360 = 648°$
Total	100	



4. Total sale = ₹4320

(a) Sales of biscuits

$= \frac{\text{Central angle of sales of biscuits}}{360°} \times$

Total sales $= \frac{60}{360} \times 4320 = ₹720$

(b) Sales of bread $= \frac{\text{Central angle of sales of bread}}{360°}$

$\times$ total sales $= \frac{80}{360} \times 4320 = ₹960°$

(c) Difference between sales of bread and sales of biscuits = ₹(960 – 720) = ₹240

(d) Sales of soft drinks $= \frac{\text{Central angle of sales of soft drinks}}{360°} \times$ Total sales

$= \frac{40}{360} \times 4320 = ₹480$

5. (a) In S.S.T Rahul has scored 90 marks

Total marks = 450, Central angle of marks obtainded in S.S.T = 72°

Marks scored in S.S.T $= \frac{72}{360} \times 450° = 90°$

(b) Math and Science each 80%

(c) Marks scored in English $= \frac{68}{360} \times 450° = 85°$

Marks scored in Hindi $= \frac{60}{360} \times 450 = 75°$

Marks scored more in English than Hindi = 85 – 75 = 10

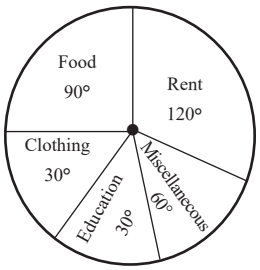
(d) Marks scored in Science $= \frac{80}{360} \times 450° = 100$

Marks scored in S.S.T $= \frac{72}{360} \times 450° = 90°$

Marks scored more in science than S.S.T = 100 – 90 = 10 marks

6.

Head	Expenditure in (₹)	Measurement of central tendency
Rent	8000	$\frac{8000}{24000} \times 360° = 120°$
Education	4000	$\frac{4000}{24000} \times 360° = 60°$
Food	6000	$\frac{6000}{24000} \times 360° = 90°$
Clothing	2000	$\frac{2000}{24000} \times 360° = 30°$
Miscellaneous	4000	$\frac{4000}{24000} \times 360° = 60°$
Total	24000	

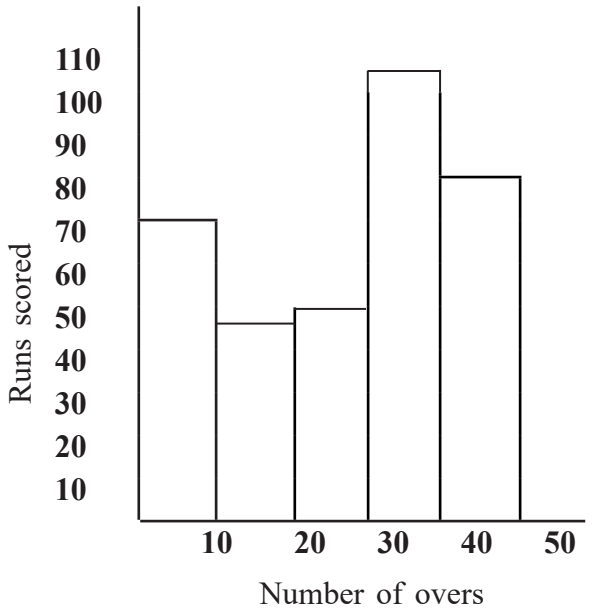


Review Exercise

1.

Weight (in kg)	Tally marks	Frequency
10-20	𝍸 𝍸 𝍸	**15**
20-30	𝍸	**5**
30-40	𝍸 ||	**7**
40-50	𝍸	**5**
50-60	||||	**4**
60-70	|||	**3**

2.



3. (a) Number of students scored less than 20 marks = Number of students between class interval 0 – 10 + 10 – 20 = 1 + 5 = 6

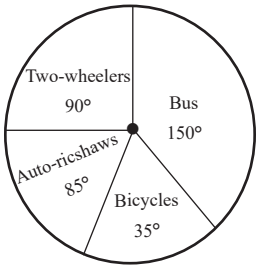
(b) Number of students scored more than 80 marks: Number of students between class interval, 40 – 50, 80 – 90 and 90 – 10 = 4 + 2 = 6

(c) 40–50

(d) Total number of students = 1 + 5 + 4 + 2 + 8 + 7 + 5 + 3 + 4 + 2 = 41

4.

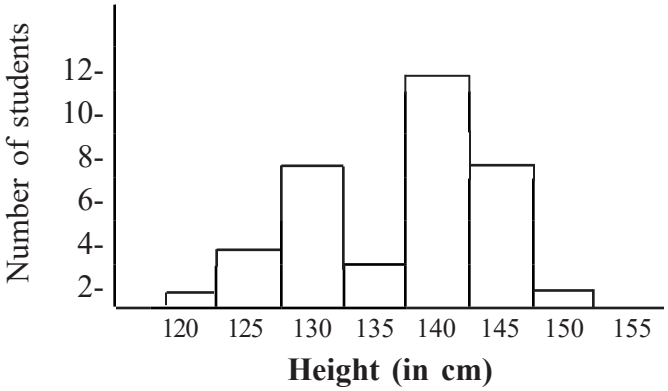
Mode of Transport	Number of students	Central angles
Bus	900	$\frac{900}{2160} \times 360° = 150°$
Auto-rickshaws	510	$\frac{510}{2160} \times 360° = 85°$
Two-wheelers	540	$\frac{540}{2160} \times 360° = 90°$
Bicycles	210	$\frac{210}{2160} \times 360° = 35°$
	2160	360°



5. (a) 30% of income is spent upon food which is the highest, hence the expenditure on food is maximum.

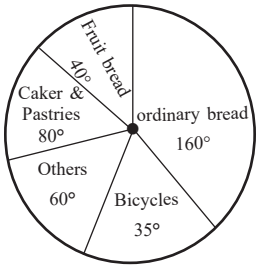
(b) Expenses on food = $\frac{30}{360} \times 60000 = ₹5000$

6.



7.

Types of item	Sales (in ₹)	Height (in cm)
Ordinary bread	**320**	$\frac{320}{720} \times 360 = 160°$
fruit bread	**80**	$\frac{80}{720} \times 360 = 40°$
cakes/pastries	**160**	$\frac{160}{720} \times 360 = 80°$
Biscuit	**120**	$\frac{120}{720} \times 360 = 60°$
Others	**40**	$\frac{40}{720} \times 360 = 20°$
Total	**720**	



8.

Teperature	Tally marks	Frequency
23.5 – 27.5	|||	3
27.5 – 31.5	𝍸	5
30.5 – 35.5	||||	4
35.5 – 39.5	||||	4
39.5 – 43.5	𝍸 𝍸 |	10

Multiple Choice Questions

1. (c) Class size

2. (b) Upper class limit

3. (b) 360°

4. (a) 40

5. Cricket = $\frac{144}{360} \times 100 = 40\%$ (c) 40%

6. (a) 16

7. Class mark = $\frac{\text{Upper limit + Lower limit}}{2}$

$= \frac{25 + 30}{2} = \frac{55}{2} = 27.5$ (b) 27.5

6 Square and Square Roots

Exercise 6.1

1. (a) $28^2 = 28 \times 28 = 784$

(b) $392 = 39 \times 39 = 1521$

(c) $62^2 = 62 \times 62 = 3844$

(d) $9^2 = 9 \times 9 = 81$

(e) $216^2 = 216 \times 216 = 46656$

(f) $406^2 = 406 \times 406 = 164{,}836$

2. (a), (b), (c) cannot be perfect squares are 7, 3 and 7 are the unit digits of these numbers. There cannot be any number with unit digit's 2, 3, 7 or 8 as a perfect square.

3. (a) $79^2 = 79 \times 79$; $9 \times 9 = 8(1)$

(b) $34^2 = 34 \times 34$; $4 \times 4 = 1(6)$

(c) $482 = 48 \times 48$; $8 \times 8 = 1(4)$

(d) $252 = 25 \times 25$; $5 \times 5 = 2(5)$

(e) $672 = 67 \times 67$; $7 \times 7 = 4(9)$

(f) $512 = 51 \times 51$; $1 \times 1 = (1)$

4. (a) $72^2 = 5184 = 4$

(b) $26^2 = 676 = 3$

(c) $346^2 = 119716 = 6$

(d) $156^2 = 24336 = 5$

(e) $3^2 = 9 = 1$

(f) $9^2 = 81 = 2$

5. (a) The square of a number is equal to the sum of that many odd number starting from $1 + 3 + 5 + 7 + 9 + 11 + 13 + 15 = 8^2 = 64$.

(b) $1 + 3 + 5 + 7 + 9 + 11 + 13 + 15 + 7 = 9^2 = 81$

(c) $1 + 3 + 5 + 7 = 4^2 = 16$

6. (a) $7^2 = 1 + 3 + 5 + 7 + 9 + 11 + 13$

(b) $11^2 = 1 + 3 + 5 + 7 + 9 + 11 + 13 + 15 + 17 + 19 + 21$

(c) $15^2 = 1 + 3 + 5 + 7 + 9 + 11 + 13 + 15 + 17 + 19 + 21 + 23 + 25 + 27 + 29$

(d) $23^2 = 1 + 3 + 5 + 7 + 9 + 11 + 13 + 15 + 17 + 19 + 21 + 23 + 25 + 27 + 29 + 31 + 33 + 35 + 37 + 39 + 41 + 43 + 45$

7. 5^{th} term of triangular number = 10 = 1, 1 + 2 = 3, 3 + 3 = 6, 6 + 4 = 10, 10 + 5 = 15

6^{th} terms of triangular number = 15 + 6 = 21

By adding 5th and 6th term we get the square of (5 + 1)th term = 6^{th} term = 15 + 21 = $36 = 6^2$

$= 15 + 21 = 36 = 6^2$

8. (a) 8th triangular numbe = 36, 9th triangular number = 45

After adding 8th and 9th triangular number, we will get square of (8 + 1)th term = 9th term

$36 + 45 = 81 = 9^2$

(b) 18^{th} triangular number: 91

14^{th} triangular number: 105

After adding 13th and 14^{th} we will get square of (13^{th} + 11^{th} term = 14^{th} terms)

$= 91 + 105 = 196 = 14^2$

9. When the sum of squares of 2 numbers is equal the square of another number say that these numbers form a pythagorean triplet

(a) 4, 5, 6

$62 = 42 + 5^2$

$36 = 16 + 25$

$36 \neq 41$

Hence, it is not a perfect square

(b) 6, 8, 10

$10^2 = 8^2 + 6^2$

$100 = 64 + 36$

$10 = 10$

Hence, it is perfect square

(c) 26, 10, 24

$26^2 = 10^2 + 24^2$

$676 = 100 + 576$

$676 = 67$

Hence, it is a perfect square

(d) 7, 8, 10

$10^2 = 7^2 + 8^2$

$100 = 49 + 64$

$100 \neq 113$

Hence, it is not a perfect square.

10. (a) A Pythagorean trlpet 2m, $m^2 + 1$

$2m = 10$

$= m = 5$

$m^2 - 1 = 5^2 - 1 = 25 - 1 = 24$

$m^2 + 1 = 5^2 + 1 = 26$

Hence 10, 24 & 26 will from a Pythagorean triplet.

(b) For every natural number $m > 1$

$m > 1$

($2m$, $m^2 - 1$, $m^2 + 1$ is a Pythagorean triplet, then

$2m = 12$ (Given)

$m = 6$

$m = 6$

So, we get the triplet (12, 35, 37)

11. (a) 784

2	784
2	392
2	196
2	98
7	49
7	7
	1

$\sqrt{784} = \sqrt{2 \times 2 \times 2 \times 2 \times 7 \times 7}$

$= 2 \times 2 \times 7$

$= 28$

(b) 7744

2	7744
2	3872
2	1936
2	968
2	484
2	242
11	121
11	11
	1

$\sqrt{7744} = \sqrt{2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 11 \times 11}$

$= 2 \times 2 \times 2 \times 11$

$= 88$

(c) 1764

2	1764
2	882
3	441
3	147
7	49
7	7
	1

$\sqrt{1764} = \sqrt{2 \times 2 \times 3 \times 3 \times 7 \times 7}$

$= 2 \times 3 \times 7$

$= 42$

(d) 11025

3	11025
3	3675
5	1125
5	245
7	49
7	7
	1

$\sqrt{11025} = \sqrt{3 \times 3 \times 5 \times 5 \times 7 \times 7}$

$= 3 \times 5 \times 7$

$= 105$

12. (a) $(-4)^2 = -4 \times -4 = +16$

(b) $(-8)^2 = -8 \times -8 = +64$

(c) $(-9)^2 = -9 \times -9 = 81$

(d) $\left(-\frac{3}{4}\right)^2 = -\frac{3}{4} \times -\frac{3}{4} = \frac{9}{16}$

(e) $(0.4)^2 = \left(\frac{4}{10}\right)^2 = \frac{4}{10} \times \frac{4}{10} = \frac{4 \times 4}{10 \times 10} = \frac{16}{100} = \frac{4}{25}$

(f) $(-5)^2 = -5 \times -5 = +25$

(g) $(-0.7)^2 = \left(-\frac{7}{10}\right)^2 = -\frac{7}{10} \times -\frac{7}{10} = \frac{49}{100} = 0.49$

(h) $\left(-\frac{4}{5}\right)^2 = -\frac{4}{5} \times -\frac{4}{5} = \frac{16}{25}$

(i) $\left(-\frac{2}{3}\right)^2 = \frac{2}{3} \times -\frac{2}{3} = \frac{4}{9}$

13. $(2.2)^2 = \left(\frac{22}{10}\right)^2 = \frac{22}{10} \times \frac{22}{10} = \frac{22 \times 22}{10 \times 10} = \frac{484}{100} = 4.84$

14. $(85)^2 = 85 \times 85 = 7225$

15. $11^2 = 121$

$101^2 = 10201$

$10101^2 = 102030201$

$1010101^2 = 1020304030201$

16. (a) $3^2 + 4^2 + 12^2 = 13^2$

(b) $4^2 + 5^2 + 20^2 = 21^2$

(c) $6^2 + 7^2 + 42^2 = 43^2$

(d) $8^2 + 9^2 + 7^2 = 73^2$

[When we multiply first and second number we yert the third numbers] [

[Fourth number = Third number + 1]

Exercise 6.2

1. (a) 27, a = 2, b = 7

Column I (a^2)	Column II ($2 \times a \times b$)	Column III $(b)^2$
2^2	$2 \times 2 \times 7$	2
4	28	49
4 + 3 = 7	28 + 4 = 32	

Thus, $27^2 = 729$

(b) 49, a = 4, b = 9

Column I (a^2)	Column II ($2 \times a \times b$)	Column III $(b)^2$
4^2	$2 \times 4 \times 9$	9^2
16	72 + 8 = 80	81
16 + 8 = 24		

Thus, $49^2 = 2401$

(c) 58, a = 5, b = 8

Column I (a^2)	Column II ($2 \times a \times b$)	Column III $(b)^2$
5^2	$2 \times 5 \times 8$	8^2
25 + 8 = 33	80 + 6 = 86	64

Thus, $58^2 = 3364$

(d) 76, a = 7, b = 6

Column I (a^2)	Column II ($2 \times a \times b$)	Column III $(b)^2$
7^2	$2 \times 6 \times 7$	6^2
49 + 8 = 57	84 + 3 = 87	36

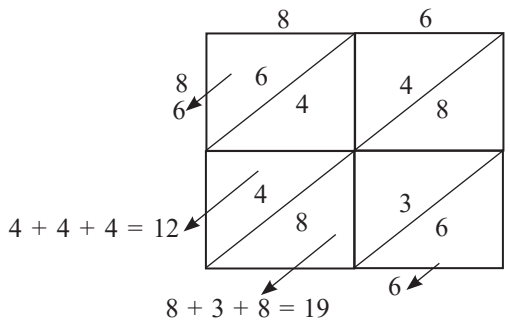
Thus $76^2 = 5776$

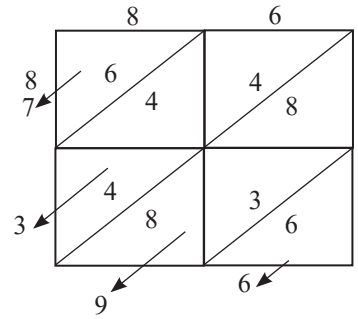
(e) 89, a = 8, b = 9

Column I (a^2)	Column II ($2 \times a \times b$)	Column III $(b)^2$
8^2	$2 \times 8 \times 9$	9^2
64 + 15 = 79	144 + 8 = 152	81

Thus $89^2 = 7921$

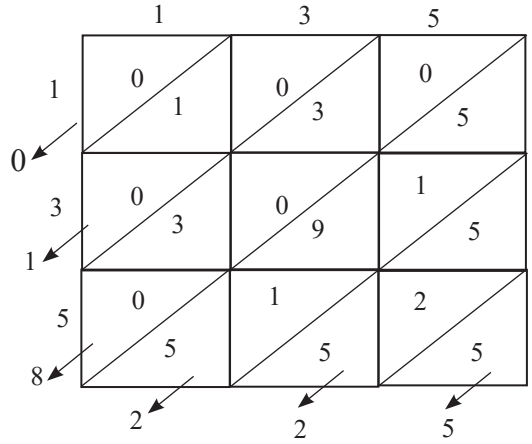
2. (a)





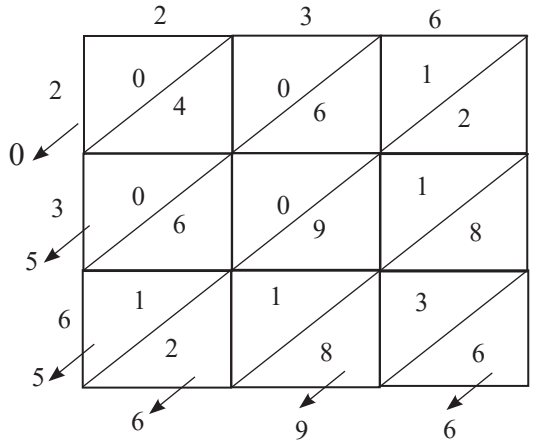
$86^2 = 7396$

(b)



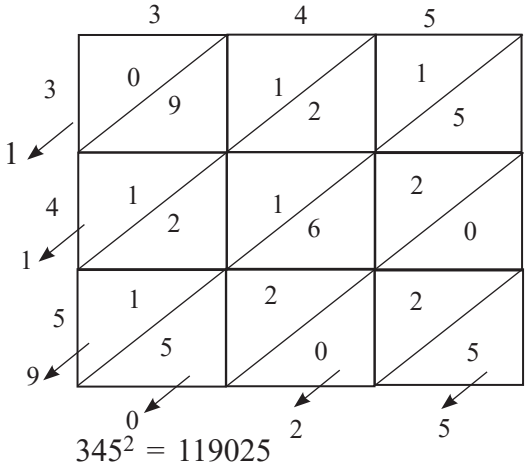
$135^2 = 18225$

(c)



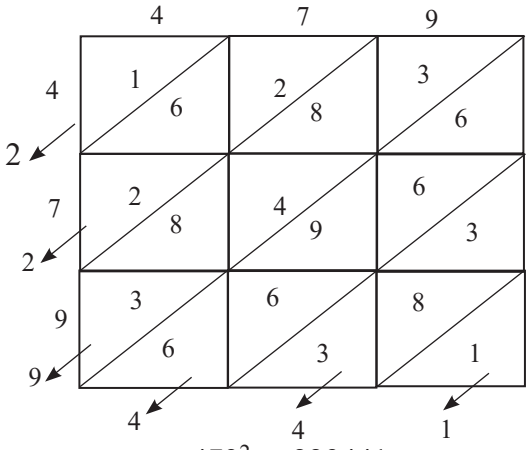
$236^2 = 55696$

(d)



$345^2 = 119025$

(e)



$479^2 = 229441$

3. (a) 45

Succesor of 4 = 5

$4 \times 5 = 20$

Add suffixing 25

$45^2 = 2025$

(b) 55

Succesor of 5 = 6

$5 \times 6 = 30$

Add suffixing 25 = $55^2 = 3025$

(c) 85

Succesor of 8 = 9

$9 \times 8 = 72$

Add suffixing, 25 = 7225

(d) 105

Succesor of 10 = 11

$10 \times 11 = 110$

Add suffixing $(105)^2 = 11025$

(e) 205

Succesor of 20 = 21

$20 \times 21 = 420$

Add suffixing $(205)^2 = 42025$

4. (a) $41 = 40 + 1$

$(40 + 1)^2 = 40^2 + 12 + 2 \times 4021$

$= 1600 + 1 + 80$

$= 1681$

(b) $38 = 30 + 8$

$(30 + 8)^2 = 30^2 + 8^2 + 2 \times 3028$

$= 900 + 64 + 480$

$= 1444$

(c) 57

$(50 + 7)^2 = 50^2 + 7^2 + 2 \times 50 \times 7$

$= 2500 + 49 + 700$

$= 3249$

(d) 34

$(30 + 4)^2 = 30^2 + 4^2 + 2 \times 30 \times 4$

$= 900 + 240 = 1156$

Exercise 6.3

1. (a) 9

(b) 12

(c) 24

(d) 16

(e) $2 \times 9 = 18$

(f) $2 \times 3 \times 5 = 30$

(g) $2 \times 3 \times 7 = 42$

(h) $7 \times 11 \times 13 = 1001$

2. (a) 324

2	324
2	162
3	81
3	27
3	9
3	3
	1

$\sqrt{324} = \sqrt{2 \times 2 \times 3 \times 3 \times 3 \times 3}$

$= 2 \times 3 \times 3$

$= 18$

(b) 16

2	16
2	8
3	4
3	2
	1

$\sqrt{16} = \sqrt{2 \times 2 \times 2 \times 2}$

$= 2 \times 2 = 4$

(c) 49

7	49
7	7
	1

$\sqrt{49} = \sqrt{7 \times 7}$

$= 7$

(d) 144

2	144
2	42
2	36
2	18
3	9
3	3
	1

$\sqrt{144} = \sqrt{2 \times 2 \times 2 \times 2 \times 3 \times 3}$

$= 2 \times 2 \times 3 = 12$

(e) 4

2	4
2	2
	1

$= 2 \times 2$

$= \sqrt{4} = \sqrt{2 \times 2} = 2$

3. (a) $\overline{529}$: 2bars
= 2 digits
(b) $\overline{5041}$: 2 bars
= 2 digits
(c) $\overline{4}$: 1bar
= 1 digit
(d) $\overline{151129}$:3bars
= 3digits
(e) $8\overline{48}\overline{24}1$: 3bars
= 3digits
(f) $\overline{36}$: 1bars
= 1 digit

4. (a) 2916
In units there is 6 so in so it must be 4 or 6 because 4^2= 16 or 6^2=36
we know that
50^2=2500
60^2=3600
so 2916 is nearest to 2500
so 54^2=2916
(b) 3844
In units digit there is so it must be 2 or 8 as $2^2 = 4$, $8^2 = 64$
$70^2 = 4900$
$60^2 = 3600$
So, 3844 is nearest to 3600 So, $62^2 = 3844$
(c) 9025
In units digits there is 5 it must be 5 as $5^2 = 25$
$90^2 = 8100$
$100^2 = 10000$
So, 9025 is nearest to 8100
So, $95^2 = 9025$
(d) 144
In units digit there is 4
it must be 2 or 8 as $2^2 = 4$, $8^2 = 64$
$10^2 = 100$
$20^2 = 400$
So, 144 is neares to 100
Hence, $12^2 = 144$
(e) 676
In unit digit it is 6 so, it must be 4 or 6 as $4^2 = 16$, $6^2 = 36$
$20^2 = 400$
$30^2 = 900$
676 is nearest to 400 hence, $26^2 = 676$
(f) 4225
In units digit it is 5 So, it must be 5 as $5^2 = 25$
$60^2 = 3600$
$70^2 = 4900$
4225 is nearest to 3600 hence $65^2 = 4225$

5. (a) a^2 (b) $2^6 = 64$
(c) $2^4 \times 3^2 = 16 \times 9 = 144$ (d) $7 \times {}^4y$
(e) $4a^3$ (f) ab^{23}

6. (a) 3969

3	3969
3	1323
3	441
3	147
7	49
7	7
	1

$\sqrt{3969} = \sqrt{3 \times 3 \times 3 \times 3 \times 7 \times 7}$
$= 3 \times 3 \times 7$
$= 63$
(b) 7744

2	7744
2	3872
2	1936
2	968
2	484
2	242
11	121
11	11
	1

$\sqrt{7744} = \sqrt{2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 11 \times 11}$
$= 2 \times 2 \times 2 \times 11$
$= 88$

(c) 5329

73	5329
73	73
	1

$\sqrt{5329} = \sqrt{73 \times 73}$

$= 73$

(d) 5184

2	5184
2	2592
2	1296
2	648
2	324
2	162
3	81
3	27
3	9
3	3
	1

$\sqrt{5184} = \sqrt{2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 3 \times 3}$

$= 2 \times 2 \times 2 \times 3 \times 3 = 72$

(e) $\frac{1024}{2401} = \sqrt{\frac{1024}{2401}} = \frac{32}{49}$

2	1024
2	512
2	256
2	128
2	64
2	32
2	16
2	8
2	4
2	2
	1

7	2401
7	343
7	49
7	7
	1

$\sqrt{1024} = \sqrt{2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2}$

$= 2 \times 2 \times 2 \times 2 \times 2 = 32$

$\sqrt{2401} = \sqrt{7 \times 7 \times 7 \times 7}$

$= 7 \times 7 = 49$

(f) $\frac{6561}{1764} \sqrt{\frac{6561}{1764}} = \frac{81}{42}$

3	6561
3	217
3	729
3	243
3	81
3	27
3	9
3	3
	1

2	1764
2	882
3	441
3	147
7	49
7	7
	1

$\sqrt{6561} = \sqrt{3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3}$

$= 3 \times 3 \times 3 \times 3$

$= 81$

$\sqrt{1764} = \sqrt{2 \times 2 \times 3 \times 3 \times 7 \times 7}$

$= 2 \times 3 \times 7 = 42$

7. $1^2 = 1$

$2^2 = 4$

$3^2 = 9$

$4^2 = 16$

$5^2 = 25$

$6^2 = 36$

Hence, the least square number divisible by 2, 3 and 4 is 36.

(d) 36

8. (a) 201

3	201
67	67
	1

$\sqrt{201} = \sqrt{67 \times 3}$

There are no pairs.

(b) 149

149	149
	1

$\sqrt{149} = \sqrt{149}$

There are no pairs.

(c) 625

5	625
5	125
5	25
5	5
	1

$\sqrt{625} = \sqrt{5 \times 5 \times 5 \times 5}$

$= 5 \times 5 = 25$

Hence, 625 is a perfect square.

(d) 8181

3	8181
3	2727
3	909
3	303
101	101
	1

$\sqrt{8181} = \sqrt{3 \times 3 \times 3 \times 3 \times 101}$

101 does'nt have a pair.

9. Area of square = Side × Side

$625m^2 = (Side)^2$

5	625
5	125
5	25
5	5
	1

Side $= \sqrt{625} = \sqrt{5 \times 5 \times 5 \times 5}$

Side = 25m

10. The smallest number divisible by 4, 6, 8 and 12 is 144

144 = 122

Hence, The smallest divisible by 4, 6, 8 and 12 is 144

Exercise 6.4

1. (a) 3969

	63
6	39 69
+6	36
123	369
	−369
	0

$\sqrt{3969} = 63$

(b) 54289

	233
2	5 42 89
+2	−4
43	142
	−129
	1389
	−1389
	00

(c) 8281

	91
9	82 81
+9	−81
181	181
	−181
	0

$\sqrt{8281} = 91$

(d) 53361

	231
2	5 33 61
+2	4
43	133
+3	129
461	461
	−461
	0

$\sqrt{53361} = 231$

(e) 6889

	83	
8	68 89	
+8	64	
163	489	
	−489	
	0	

$\sqrt{6889} = 83$

(f) 2116

	46	
4	21 16	
+4	16	
86	516	
	516	
	0	

(g) 423801

	651	
6	42 38 01	
+6	−36	
125	638	
+65	−625	
1301	1301	
	−1301	
	0	

$\sqrt{423801} = 651$

(h) 2601

	51	
5	8 607	
+5	−25	
101	101	
	−101	
	0	

$\sqrt{2601} = 51$

2.

2	396
2	198
3	99
3	33
11	11
	1

$\sqrt{396} = \sqrt{\underline{2 \times 2} \times \underline{3 \times 3} \times \mathbf{11}}$

We cannot make pairs as there is only one 11, hence 11 is the samllest number that must be mulitplied from 396 to make it a perfect square.

3.

2	9408
2	4704
2	2352
2	1176
2	588
2	294
3	147
7	49
7	7
	1

$\sqrt{9408} = \sqrt{\underline{2 \times 2} \times \underline{2 \times 2} \times \underline{2 \times 2} \times \mathbf{3} \times \underline{7 \times 7}}$

We cannot make pairs as there is only one 3, hence 3 is the smallest number that should be divided from 9408 to make it a perfect square.

4. Smallest 4-digit number: 1000

	31	
3	10 00	
+3	−9	
61	100	
	−61	
	39	

$32^2 - 1000 = 1024 - 1000 = 24$

$1000 + 24 = 1024$

Hence, 1024 is the smallest four digit number which is a perfect square.

5. (a) 46.24

	68	
6	4 6. 24	
+6	36	
128	10.24	
	−1024	
	0	

$\sqrt{46.24} = 6.8$

(b) 82.81

	91
9	82 . 81
+9	81
181	181
	−181
	0

$\sqrt{82.81} = 9.1$

(c) 4637.61

	681
6	46 37 . 61
+6	−36
128	1037
+8	−1024
1361	1361
	−1361
	00

$\sqrt{4637.61} = 68.1$

(d) 13.69

	37
9	13 . 69
+9	−9
127	469
	−469
	0

$\sqrt{13.69} = 3.7$

(e) 1772.71

	421035
4	17 72 . 71 00 00 00
+4	−16
82	172
+2	−164
841	871
+1	−841
84203	300000
+3	−252609
842065	4739100
	−4210325
	528775

$\sqrt{1772.7} = 42.1035$

(f) 8136.04

	902
9	81 36 . 04
+9	−81
812	3604
	−3604
	0

$\sqrt{8136.04} = 90.2$

6. (a) Area of square field = Side × Side

Area of square field = $(\text{Side})^2$

Area of square filed = $(63)^2$

$= 3969$

Hence, the area of field is $3969 m^2$

(b) Area of square room = $(12 \times 12) m^2$

$= 144 m^2$

Area of square tile = $(0.5 \times 0.5) m^2$

$= 0.25 m^2$

$[1cm = \frac{1}{100} m]$

So, $50cm = \frac{50}{100} m$

$= 0.50m$

Number of tiles required to pave the room:

$$\frac{\text{Area of square room}}{\text{Area of square tile}} = \frac{144}{0.50} = 288$$

Hence, 288 tiles are required to pave the room.

(c) Perimeter of square plot = 4 × Side

$81m = 4 \times \text{Side}$

$\text{Side} = \frac{81m}{4} = 20.25m$

Area of square plot = $(\text{Side})^2$

$= (20.25) m^2$

$= 410.0625 m^2$

Hence, the area of square plot is $410.0625 m^2$.

(d) $(\text{Hypotenuse})^2 = (\text{Side})^2 + (\text{Side})^2$

$(\text{Hypotenuse})^2 = (12)^2 + (5)^2$

$(\text{Hypotenuse})^2 = 144 + 25$

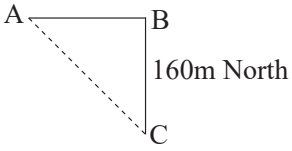
$(\text{Hypotenuse})^2 = 169$

$\text{Hypotenuse} = \sqrt{169}$

Hypotenuse = 13m

Hence, the length of hypotenuse is 13m.

(e) 630m West



$AC^2 = AB^2 + BC^2$

$AC^2 = 630^2 + 160^2$

$AC^2 = 396{,}900 + 25600$

$AC^2 = 422500$

$AC = \sqrt{4225000}$

$AC = 650$

Hence, Preeti walked 650m while returning.

7. 105625

	325
3	10 56 25
+3	−9
62	156
+2	−124
645	3225
	−3225
	0

$\sqrt{105625} = 325$

8.

	438
4	19 19 80
+4	−16
83	319
+3	249
868	7080
	−6944
	136

$(439)^2 - 191980$

$= 192721 - 191980$

$= 741$

Hence, 741 should be added to 19180 to make it a perfect square

$= 191980 + 741 = 192721$

$\sqrt{192721}$

	439
4	19 27 21
+4	−16
83	327
+3	−249
869	7821
	−7821
	0

Square root of 192721 is 439.

9. Area of square filed = Side × Side

$3136m^2 = Side^2$

$Side = \sqrt{3136}$

Hence, the length of the side of square field is 56m.

10. $\sqrt{3} = 1.73$

	173
1	3. 00 00
+1	−1
27	200
+7	−189
343	1100
	−1029
	071

Review Exercise

1. (a) 12 (b) 6

(c) 8 (d) 15

(e) 3 (f) $3 \times 7 = 21$

(g) $3 \times 3 \times 7 = 63$

2. (a) $\sqrt{\underline{2 \times 2} \times \underline{3 \times 3}} = 2 \times 3 = 6$

(b) $\sqrt{\underline{3 \times 3} \times \underline{6 \times 6}} = 3 \times 6 = 18$

(c) $\sqrt{\underline{8 \times 8} \times \underline{8 \times 8} \times \underline{8 \times 8}} = 8 \times 8 \times 8 = 512$

(d) $\sqrt{\underline{6 \times 6} \times \underline{8 \times 8} \times \underline{12 \times 12}} = 6 \times 8 \times 12 = 576$

3. (a) $\sqrt{81} = \sqrt{\underline{3 \times 3} \times \underline{3 \times 3}}$

$= 3 \times 3 = 9$

3	81
3	27
3	9
3	3
	1

(b) $\sqrt{324} = \sqrt{\underline{2 \times 2} \times \underline{3 \times 3} \times \underline{3 \times 3}}$

$= 2 \times 3 \times 3$

$= 18$

2	324
2	162
3	81
3	27
3	9
3	3
	1

(c) $\sqrt{625} = \sqrt{\underline{5 \times 5} \times \underline{5 \times 5}}$

$= 5 \times 5 = 25$

5	625
5	125
5	25
5	5
	1

(d) $\sqrt{4096} = \sqrt{\underline{2 \times 2} \times \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{2 \times 2} \times \underline{2 \times 2}}$

$= \sqrt{\underline{2 \times 2}}$

$= 2 \times 2 \times 2 \times 2 \times 2 \times 2$

$= 64$

2	4096
2	2048
2	1024
2	512
2	256
2	128
2	64
2	32
2	16
2	8
2	4
2	2
	1

4. (a) $\sqrt{m^{16}}$

$= m^8$

(b) $\sqrt{16x^4y^{16}}$

$= 4x^2y^8$

5. (a) $\left(\frac{6}{7}\right)^2 = \frac{6 \times 6}{7 \times 7} = \frac{36}{49}$

(b) $\left(\frac{10}{11}\right)^2 = \frac{10 \times 10}{11 \times 11} = \frac{100}{121}$

6. (a) $\sqrt{\frac{9}{64}} = \frac{\sqrt{3 \times 3}}{\sqrt{8 \times 8}}$ $\frac{3}{8}$

(b) $\sqrt{\frac{1}{16}} = \frac{\sqrt{1 \times 1}}{\sqrt{4 \times 4}}$ $\frac{1}{4}$

7. (a) $(-9)^2 = -9 \times -9 = 81$

(b) $(-7)^2 = -7 \times -7 = 49$

(c) $(-0.1)^2 = \left(\frac{1}{10}\right) \times \left(-\frac{1}{10}\right) = \frac{1}{100} = 0.01$

8. (a) 6241: In units digit there is 1 so, it must be 1 or 9 as $(1)^2 = 1$

$(9)^2 = 81$

$70^2 = 4900$

$80^2 = 6400$

6241 is nearest to 6400 hence, $79^2 = 6241$

(b) 1849: In unit digit it is 9 So, Itmust be 3 or 7 as $(3)^2 = 9$, $(7)^2 = 49$

$(40)^2 = 1600$

$(50)^2 = 2500$

1849 is nearest to 1000 hence, $(43)^2 = 1849$

(c) 2209: In units digit it is 9 so, it must be 3 or 7 as $(3)^2 = 9$, $(7)^2 = 49$

$(40)^2 = 1600$, $(50)^2 = 2500$

It is nearest to 2500, hence $(47)^2 = 2209$

9. (a)

	26
2	6.76
+2	−4
46	276
	−276
	0

$\sqrt{6.76} = 2.6$

(b)

	57
5	32.49
+5	−25
107	749
	−749
	0

$\sqrt{32.49} = 57$

(c)

	17
1	2.89
+1	−1
27	189
	−189
	0

$\sqrt{2.89} = 1.7$

(d)

	162
1	262.44
+1	−1
26	162
+6	−156
322	644
	−644
	0

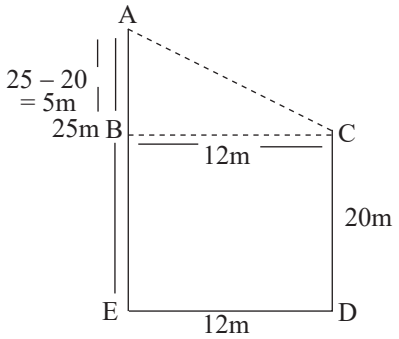
$\sqrt{262.44} = 16.2$

(e)

	191
1	364.81
+1	−1
29	264
+9	−261
381	381
	−381
	0

$= \sqrt{364.81} = 19.1$

10. (a) BC = 12m = ED



AB = AE − CD

= (25 − 20)m = 5m

$AC^2 = AB^2 + BC^2$

$AC^2 = (5)^2 + (12)^2$

AC^2 25 + 144

$AC^2 = 169$, AC = $\sqrt{169}$, AC = 13m

Hence, the distance between the building top is 13m.

(b) Area of squarical shaped tawn = Side × Side

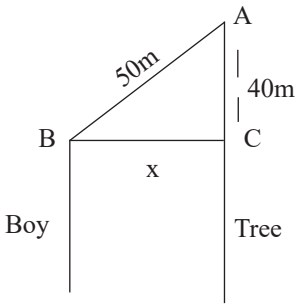
$729km^2 = (Side)^2$

Side = $\sqrt{729}$

= 27km

Hence, the length of town is 27 km

(c)



$AB^2 = AC^2 + BC^2$

$50^2 = 40^2 + x^2$

$2500 = 1600 + x^2$

$2500 - 1600 = x^2$

$x^2 = 900$, x = $\sqrt{900}$, x = 30m

Hence, the distance between tree and boy is 30 meters.

11. $\sqrt{1 + \frac{49}{576}} = \sqrt{1 + \frac{X}{24}}$

$\sqrt{1 \times 1\frac{7 \times 7}{24 \times 24}} = \sqrt{1 \times 1 + \frac{X}{24}}$

$X + \frac{7}{24} = X + \frac{X}{24}$

$\frac{X}{24} = \left(\frac{7}{24}\right)^2, \frac{X}{24} = \frac{7^2}{24^2}$

$X \times 24^2 = 24 \times 7^2$, $X \times 576 = 24 \times 49$

$576x = 1176$

$X = \frac{1176}{576}$

$X = 2.01416$

12. Let the bigger number be x and smaller number be y

$3y = x$, $y = \frac{x}{3}$

According the Question

$x \times y = 147$, $x \times \frac{x}{3} = 147$, $\frac{x^2}{3} = 147$

$x^2 = 147 \times 3$, $x^2 = 441$, $x = 21$

$y = \frac{x}{3} = \frac{21}{3} = 7$

Hence, the numbers are 21 & 7 respectively.

13. (a) $\sqrt{1296 \times 625} = \sqrt{\underline{36 \times 36} \times \underline{25 \times 25}} = 36 \times 25 = 900$

(b) $\sqrt{\frac{3.61}{72.25}} = \sqrt{\frac{1.9 \times 1.9}{8.5 \times 8.5}} = \frac{1.9}{8.5} = 0.2235$

14. $\sqrt{6.25} = \sqrt{2.5 \times 2.5}$

Hence, when 2.5 is multiplied by itself it becomes 6.25.

15. Let the number of students in the class be x.

Number of students = Number of rupees donated by each student = x

Total money donated = Number of students × Number of rupees donated by each student

$1764 = x \times x$

$x^2 = 1764$

$x = \sqrt{1764}$, $x = \sqrt{42 \times 42}$, $x = 42$

Hence, there are 42 students in the class.

16. Let the number of rows be x

Number of rows = Numbe of plants in each row = x

$3844 = x \times x$

$3844 = x^2$, $x = \sqrt{3844}$, $x = 62$

Hence, there are 62 rows of plants in the garden.

Multiple choice Question

1. (a) Even number

2. (d) $10^2 = 6^2 + 8^2$

3. (c) 225

4.

2	72
2	36
2	18
3	9
3	3
	1

$72 = \underline{2 \times 2} \times \mathbf{2} \times \underline{3 \times 3}$

Answer: (a) 2

5. $\sqrt{\frac{225}{441}} = \frac{\sqrt{15 \times 15}}{\sqrt{21 \times 21}} = \frac{15}{21}$

Answer: (d) $\frac{15}{21}$

6.

	12
1	1.44
+1	–1
22	44
	–44
	0

$\sqrt{1.44} = 1.2$

Answer: (c) 1.2

7. $\sqrt{0.09} = \sqrt{0.3 \times 0.3}$ (a) 0.3

8.

	12
1	$\overline{1}\overline{49}$
+1	–1
22	049
	–44
	5

Here, we get 5 as a remainder. Hence, we have to subtact 5 from 149 to make it a perfect square

Answer: (d) 5

9. $\frac{1}{\sqrt{0.09}} \times \sqrt{5.76} = \frac{1}{\sqrt{0.3 \times 0.3}} \times \sqrt{2.4 \times 2.4}$

$= \frac{1}{1} \times 8$

$= 8$

Answer: (a) 8

10. $\frac{\sqrt{144}}{\sqrt{256}} = \frac{\sqrt{12 \times 12}}{\sqrt{16 \times 16}} = \frac{12}{16} = \frac{3}{4}$

Answer: (b) $\frac{3}{4}$

11. (a) Smaller than the given fraction

12. $\sqrt{0.1}$

	0.316
0	0. $\overline{10}$0000
10	0.
03	10
+3	–9
61	100
+1	–61
62	3900
	–3756
	144

Answer: (b) 0.316

13.

	13
1	178
+1	1
23	78
	–69
	9

Hence, we get 9 as a remainder, Therefore we have to sub 9 from 178 to make it a perfect square.

Answer: (a) 9

14.

	22
2	$\overline{5}\overline{2}\overline{1}$
+2	4
42	121
	84
	37

$(23)^2 - 521 = 529 - 521 = 8$

Hence, 8 should be added to 521 to make it a perfect square

Answer: (c) 8

Check Your Progress

1. $1^2 = \underline{1}$

2. $14^2 - 13^2 = 196 - 169 = \underline{27}$

3. 0 or 1

4. 8 conescutive odd numbers = $(8)^2 = 64$

5. To be a pythagorean triplet

$(3)^2 = (1)^2 + (2)^2$

$9 = 1 + 4$

$9 \neq 5$

Hence, it is not a perfect square.

6. $\sqrt{10000} = \sqrt{100 \times 100} = 100$

7. $\sqrt{12} = \sqrt{\underline{2 \times 2} \times \mathbf{3}}$

The smallest number that should be multiplied by 12 to get a perfect square is 3.

8. $\sqrt{0.16} = \sqrt{\underline{0.4 \times 0.4}} = 0.4$

9.

	7
7	60
	–49
	11

$= 8^2 - 60 = 64 - 60$

$= 4$

Hence, 4 is the least number that should be added to 60 to get a perfect sqare.

10.

	3
9	84
	–81
	3

.

We get remainder as 3. Hence, we have to subtract 3 from 84 to make it a perfect square

7 Cubes and Cube Roots

Exercise 7.1

1. (a) $4^3 = 4 \times 4 \times 4 = 64$

(b) $9^3 = 9 \times 9 \times 9 = 729$

(c) $61^3 = 61 \times 61 \times 61 = 226981$

(d) $(-10)^3 = -10 \times -10 \times -10 = -1000$

(e) $\left(\frac{4}{5}\right)^5 = \frac{4}{5} \times \frac{4}{5} \times \frac{4}{5} = \frac{64}{125}$

(f) $\left(-\frac{3}{5}\right)^3 = \frac{-3}{5} \times \frac{-3}{5} \times \frac{-3}{5} = \frac{-27}{125}$

(g) $(2.2)^3 = \left(\frac{22}{10}\right)^3 = \frac{22}{10} \times \frac{22}{10} \times \frac{22}{10} = \frac{10648}{1000}$
$= 10.648$

(h) $(-0.4)^3 = \left(\frac{-4}{10}\right)^3 = \frac{-4}{10} \times \frac{-4}{10} \times \frac{-4}{10} = \frac{-64}{1000}$
$= 0.064$

(i) $(-0.3)^3 = \left(\frac{-3}{10}\right)^3 = \frac{-3}{10} \times \frac{-3}{10} \times \frac{-3}{10} = \frac{-27}{1000}$
$= -0.027$

(j) $(-0.7)^3 = \left(\frac{-7}{10}\right)^3 = \frac{-7}{10} \times \frac{-7}{10} \times \frac{-7}{10} = \frac{-343}{1000}$
$= 0.343$

2. (a) 7^3 : 6 triangular numbers

$\frac{6 \times 7}{2} = \frac{42}{2} = \frac{21}{43}$

Doubling it and adding $= 21 \times 2 + 1 = 43$

$\therefore 7^3 = 43 + 45 + 47 + 49 + 51 + 53 + 55$

(b) 12^3: 11 trinagular numbers

$\frac{11 \times 12}{2} = \frac{132}{2} = 66$

Doubling and adding $= 66 \times 2 + 1 = 133$

$12^3 = 133 + 135 + 137 + 139 + 141 + 143$
$+ 145 + 147 + 149 + 151 + 153 + 155$

(c) 4^3: 3 triangle numbers

$\frac{3 \times 4}{2} = \frac{12}{2} = 6$

$\frac{3 \times 4}{2} = 6 \times 2 + 1 = 13$

$4^3 = 13 + 15 + 17 + 19$

3. (a) $3\sqrt{23328} = 3\sqrt{\underline{2\times2\times2}\times\underline{2\times2}\times\underline{3\times3\times3}\times\underline{3\times3}}$
$= 3\sqrt{2^3 \times 2^2 \times 3^3 \times 3}$

2	23328
2	11664
2	5832
2	2916
2	1458
3	729
3	243
3	81
3	27
3	9
3	3
	1

It has two 2's and two 3's hence, it is not a perfect cube

(b) $3\sqrt{10648} = \sqrt{2\times2\times2\times11\times11\times11}$
$= 3\sqrt{2^3 \times 11^3}$
$= 2 \times 11 = 22$

2	10648
2	5324
2	2662
11	1331
11	121
11	11
	1

Its groups are froming cubes hence it is a perfect cube.

(c) $3\sqrt{52488} = 3\sqrt{\underline{2\times2\times2}\times\underline{3\times3\times3}\times\underline{3\times3\times3}\times\underline{3\times3}}$
$= 3\sqrt{2^3 \times 3^3 \times 3^3 \times 3^2}$

2	52488
2	26244
2	13122
3	6561
3	2187
3	729
3	243
3	81
3	27
3	9
3	3
	1

It has two 3's hence, it is not a perfect cube

(d) $3\sqrt{74088} = 3\sqrt{\underline{2\times2\times2}\times\underline{3\times3\times3}\times\underline{7\times7\times7}}$

$= 3\sqrt{2^3\times3^3\times7^3}$

$= 2 \times 3 \times 7 = 42$

2	74088
2	37044
2	18522
3	9261
3	3087
3	1029
7	343
7	49
7	7
	1

Its groups are froming cubes hence it is a perfect cube.

(e) $3\sqrt{36864}$

$= 3\sqrt{\underline{2\times2\times2}\times\underline{2\times2\times2}\times\underline{2\times2\times2}\times\underline{2\times2\times2}\times\underline{3\times3}}$

2	36864
2	18432
2	9216
2	4608
2	2304
2	1152
2	576
2	288
2	144
2	72
2	36
2	18
3	9
3	3
	1

It has two 3's hence, it is not a perfect cube

4.

	Digits	Cube of units Digits	Units digit of the Cube
(a)	387	$(7)^3 = 7 \times 7 \times 7 =$ 347**3**	3
(b)	83	$(83)^3 = 83 \times 83 \times 83$ $= 571187$	7
(c)	–81	$(-81)^3 = 81 \times 81 \times 81$ $= 531441$	1
(d)	680	$(680)^3 = 680 \times 680 =$ 462400	0
(e)	863	$(863)^3 = 863 \times 863 \times$ $863 = 642, 735, 647$	7
(f)	55	$55 \times 55 \times 55$	5

Exercise 7.2

1. (a) $(10)^3 = 10 \times 10 \times 10 = 1000$

(b) $(-7)^3 = -7 \times -7 \times -7 = -343$

(c) $\left(\frac{-1}{8}\right)^3 = \frac{-1}{8} \times \frac{-1}{8} \times \frac{-1}{8} = \frac{-1}{512}$

(d) $\left(\frac{2}{7}\right)^3 = \frac{2}{7} \times \frac{2}{7} \times \frac{2}{7} = \frac{8}{343}$

(e) $(0.4)^3 = \left(\frac{4}{10}\right)^3 = \frac{4}{10} \times \frac{4}{10} \times \frac{4}{10} = \frac{64}{1000} = 0.064$

(f) $(3.7)^3 = \left(\frac{37}{10}\right)^3 = \frac{37}{10} \times \frac{37}{10} \times \frac{37}{10} = \frac{50653}{1000} = 50.653$

(g) $(-8.1)^3 = \left(\frac{-81}{10}\right)^3 \frac{-81}{10} \times \frac{-81}{10} \times \frac{-81}{10} = \frac{-531441}{1000} = -531.441$

2. (a) 512

2	512
2	256
2	128
2	69
2	32
2	16
2	8
2	4
2	2
	1

$3\sqrt{2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2}$

$\sqrt{2^3 \times 2^3 \times 2^3}$

$= 2 \times 2 \times 2$

$= 8$

(b) 2197

2	2197
2	163
2	13
2	1

$3\sqrt{13 \times 13 \times 13}$

$3\sqrt{133}$

$= 13$

(c) 3375

3	3375
3	1125
3	375
5	125
5	25
5	5
	1

$3\sqrt{3375}$

$3\sqrt{3 \times 3 \times 3 \times 5 \times 5 \times 5}$

$3\sqrt{3^3 \times 5^3}$

$= 3 \times 5 = 15$

(d) 4.913

17	4913
17	289
17	17
	1

$3\sqrt{4.913}$

$3\sqrt{1.7 \times 1.7 \times 1.7}$

$3\sqrt{1.7^3}$

$= 1.7$

(e) $\frac{1331}{2744}$

11	1331
11	121
11	11
	1

2	2744
2	1372
2	686
2	343
2	49
2	7
2	1
2	4
2	2
	1

$\frac{\sqrt{1331}}{\sqrt{2744}} = \frac{3\sqrt{11 \times 11 \times 11}}{3\sqrt{2 \times 2 \times 2 \times 7 \times 7 \times 7}}$

$\frac{3\sqrt{11^3}}{\sqrt{2^3 \times 7^3}} = \frac{\sqrt{11}}{\sqrt{14}}$

(f) $\frac{-343}{9261} = \sqrt{\frac{-7 \times -7 \times -7}{3 \times 3 \times 3 \times 7 \times 7 \times 7}}$

$= 3\sqrt{\frac{-7^3}{3^3 \times 7^3}} = 3\sqrt{\frac{7}{21}}$

7	343
7	49
7	7
	1

3	9261
3	3087
3	1029
7	343
7	49
7	7
	1

(g) -6859

19	6859
19	361
19	19
	1

$\sqrt{-6859} = \sqrt{-19 \times -19 \times -19}$

$= \sqrt{-19^3}$

(h) $-0.001 = \frac{-1}{1000} = \sqrt{\frac{-1}{10000}}$

$= \sqrt{\frac{-1 \times -1 \times -1}{10 \times 10 \times 10}} = \sqrt{\frac{-1^3}{10^3}} = \frac{-1}{10}$

2	1000
2	500
2	250
5	125
5	25
5	5
	1

3. (a) 17576: The unit digit of 17576 is 6, Which can only be possible when unit digit is 6.

(b) 42875: The unit digit of 42875 is 5, Which can only be possible when unit digit is 5.

(c) 343000: The unit digit of 343000 is 0, Which can only be possible when unit digit is 0.

(d) 205379: The unit digit of 205379 is 9, Which can only be possible when unit digit is 9.

(e) –32768: The units digit –32768 is 2 Which can only be possible when unit digit is 2.

(f) –103823: The units digit –103823 is 3 Which can only be possible when unit digit is 7.

(g) 21952: The units digit 21952 is 2 Which can only be possible when unit digit is 8.

(h) 2197: The units digit 2197 is 7 Which can only be possible when unit digit is 3.

4. (a) 17576: 17 Biggest cube below 17 is 8, Hence the tens digit is 2.

(b) 42875: 42, Biggest cube below 42 is 27, Hence the tens digits is 3.

(c) 343000: 343, Biggest cube below or equal to 343 is, hence 7, hence the tens digit is 7.

(d) 205379: 205, Biggest cube below 205 is 125, hence the tens digits 5.

(e) –32768: -32, Biggest cube below –32 is –27, hence the tens digit is 3.

(f) –103823: –103, Biggest cube below –103 is 64, hence the tens digit is 4

(g) 21952: 21 Biggest cube below 21 is 8, hence the tens digit 2.

(h) 2197: 2 Biggest cube below 2 is 1, hence the tens digit is 1.

5. (a) 592 704: 701; The unit digit 4 hence, the unit digit of the root is 4 as 4 ^ 3 = 64

592: Biggest cube before 592 is 512 hence, tens digit is 8 as 8 ^ 3 = 572.

$3\sqrt{592704} = 84$

(b) 24389: 389; the unit digit is 9 hence, the units digit of the root is 9 as 9 ^ 3 = 729

24: Biggest cube before 24 is hence, the tens digit is 2 as 2 ^ 3 = 8

$3\sqrt{24389} = 29$

(c) 438976: 976: The unit digit is 6 hence, the unit digit of the root is 6 as 6 ^ 3 = 216

976: Biggest cube before 438 is, hence the tens digit is 7 as 7 ^ 3 = 343

$3\sqrt{438976} = 76$

(d) –185913: 913; The unit digit is 3 hence, the unit digit of the root is 7 as 7 ^ 3 = 343

$3\sqrt{-185913} = -57$

185; Biggest cube before 185 is 125, hence, the tens digit is 5 as 5 ^ 3 = 125

(e) 778688: 688: The unit dgit is 8 hence, the unit digit of the root is 8 as 2 ^ 3 = 8

6778; Biggest cube before 778 is 729, hence the tens digit is 9 as 9 ^ 3 = 729

$3\sqrt{778689} = 92$

(f) $\overline{91}\ \overline{125}$; 125: The unit digit is 125, hence, the unit digit of the root is 5 as 5 ^ 3 = 125

91: The biggest cube before 91 is 64, hence, the tens digit is 4 as 4 ^ 3 = 64

$3\sqrt{91125} = 45$

6. (a) $\overline{1}\ \overline{728}$: 2 group = 2 digits

(b) $\overline{216}$: 1 group = 1 digit

(c) $\overline{729}$: 1 groups = 1 digit

(d) $\overline{-1}\ \overline{331}$: 2 groups = 2 digits

(e) $\overline{132}\ \overline{651}$: 2 groups = 2 digits

(f) $\overline{9}\ \overline{663}\ \overline{597}$: 3 groups: 3 digits

(g) $\overline{1}\ \overline{860}\ \overline{867}$: 2groups; 2 digits

(h) $\overline{205}\ \overline{379}$: 2 groups: 2 digits

(i) $\overline{491}\ \overline{169}\ \overline{069}$: 3 groups = 3 digits

7. (a) $(25)^2 = (20 + 5)^3 = 20^3 + (3 \times 20^2 \times 5) + (3 \times 20 \times 5^2) + 5^3$

$= 8000 + (3 \times 400 \times 5) + (60 \times 25) + 125$

$= 8000 + 6000 + 1500 + 125$

$= 15625$

(b) $(68)3 = (60)^3 + (3(60^2)\ (8)) + (3(60)\ (8)^2) + (8)^3$

$= 216000 + (3 \times 3600 \times 8) + (3 \times 60 \times 64 + 512$

$= 216000 + 86400 + 11520 + 512$

$= 314432$

(c) $(84)^3 = (80 + 4)^3 = (80)^3 + (3 \times (80)^2 \times 4) + (3 \times 80 \times (4)^2) + 4^3$

$= 512000 + 3 \times 6400 \times 4 + 340 \times 16 + 64$

$= 512000 + 76800 + 3840 + 64$

$= 592704$

(d) $(29)^3 = (20 + 9)^3 = (3 \times (20)^2 \times 9) + (3 \times 20 \times (9)^2) + 9^3$

$= 8000 + (3 \times 400 \times 9) + (3 \times 20 \times 81) + 9^3$

$= 8000 + 10800 + 4860 + 729 = 24389$

8. (a) $-(1000) = -(10 \times 10 \times 10)$

$\therefore\ 3\sqrt{-1000} = \sqrt{-10 \times 10 \times 10}$

$= -10$

(b) $-216 = -(6 \times 6 \times 6)$

$\therefore 3\sqrt{-216} = 3\sqrt{-(6 \times 6 \times 6)}$

$= -6$

(c) $-512 = -(8 \times 8 \times 8)$

$\therefore\ 3\sqrt{-512} = 3\sqrt{-(8 \times 8 \times 8)}$

$= -8$

(d) $(-64) = -(4 \times 4 \times 4)$

$3\sqrt{-64} = 3\sqrt{-(4 \times 4 \times 4)}$

$= -4$

9. (a) $3\sqrt{125 \times 64}$

$3\sqrt{(5 \times 5 \times 5) \times (4 \times 4 \times 4)}$

$= 5 \times 4 = 20$

(b) $3\sqrt{512 \times 216}$

$3\sqrt{(8 \times 8 \times 8) \times (6 \times 6 \times 6)}$

$= 8 \times 6 = 48$

(c) $3\sqrt{8 \times 27}$

$3\sqrt{(2 \times 2 \times 2) \times (3 \times 3 \times 3)}$

$= (2 \times 3) = 6$

10. (a) $3\sqrt{\frac{216}{125}} = \sqrt{\frac{6 \times 6 \times 6}{5 \times 5 \times 5}} = 3\sqrt{\frac{6^3}{5^3}} = \frac{6}{5}$

(b) $3\sqrt{\frac{343}{64}} = \sqrt{\frac{7 \times 7 \times 7}{4 \times 4 \times 4}} = 3\sqrt{\frac{7^3}{4^3}} = \frac{7}{4}$

(c) $3\sqrt{\frac{64}{8}} = \sqrt{\frac{4 \times 4 \times 4}{2 \times 2 \times 2}} = 3\sqrt{\frac{4^3}{2^3}} = \frac{4}{2} = 2$

Review Exercise

1. (a) $15^3 = 15 \times 15 \times 15 = 3375$

(b) $26^3 = 26 \times 26 \times 26 = 17576$

(c) $(-49)^3 = -49 \times -49 \times -49 = -117.649$

2. (a) $3\sqrt{(25)^3} = 25$

(b) $3\sqrt{(5)^3} = 5$

(c) $3\sqrt{(8)^3} = 8$

(d) $\sqrt{13824}$

$= 3\sqrt{\underline{2 \times 2} \times 2 \times \underline{2 \times 2 \times 2} \times \underline{2 \times 2 \times 2} \times \underline{3 \times 3 \times 3}}$

$= 3\sqrt{2 \times 2 \times 2 \times 3}$

$= 24$

2	13824
2	6912
2	3456
2	1728
2	864
2	432
2	216
2	108
2	54
3	27
3	9
3	3
	1

(e) $\sqrt{250047}$

$= 3\sqrt{3\times3\times3\times3\times3\times3\times7\times7\times7}$

$= 3 \times 3 \times 7 = 63$

3	250047
3	83349
3	27783
3	9261
3	3087
3	1029
7	343
7	49
7	7
	1

(f) $3\sqrt{0.008} = 3\sqrt{0.2 \times 0.2 \times 0.2}$

$= 3\sqrt{(0.2)^3} = 0.2$

3. (a) $\overline{17}\ \overline{576}$: Unit digit is even, hence the root has to be even.

6 is the units digit of the cube. So the unit digit of the cube root will be 6, as $\sqrt{216} = 6$

The biggest cube below 17 is 8, hence the ten's digit of the root would be 2 as $3\sqrt{16} = 2$.

$\therefore 3\sqrt{17576} = 26$

(b) $1\overline{32}\ \overline{651}$: Unit digit is odd, hence the root has to odd

1 is the unit digit of the cube. So the unit digit of the cube root would be 1 as $3\sqrt{1} = 1$

The biggest cube below 132 is 125, hence the ten's digit of the cube root is 5 as $3\sqrt{125} = 5$

$\therefore 3\sqrt{132561} = 51$

(c) $\overline{830}\overline{584}$: Unit digit is even, hence the root has to be even.

4 is the unit digit of the cube, So, the unit digit of the root would be 4 as $3\sqrt{64} = 4$

The biggest cube below 830 is 729, hence the ten's digit of the cube root is 9 as $3\sqrt{729} = 9$

$\therefore 3\sqrt{830584} = 94$

4. (a) $n = 10\left[\frac{n(n+1)}{2}\right]^2 = \left[\frac{10(10+1)}{2}\right]^2 = \left[\frac{10(11)}{2}\right]^2$

$= \left[\frac{110}{2}\right]^2 = (55)^2 = 3025$

(b) $n = 25 = \left[\frac{n(n+1)}{2}\right]^2 = \left[\frac{25(25+1)}{2}\right]^2 =$

$\left[\frac{25 \times 26}{2}\right]^2 = \left[\frac{650}{2}\right]^2 = (325)^2 = 105625$

5. (a) $3\sqrt{3267} = 3\sqrt{3\times3\times3\times11\times11}$

$= 3\sqrt{3^3 \times 11^2}$

3	3267
3	1089
3	363
11	121
11	11
	1

It is not a perfect cube as there are two 11

Hence, the smallest number required to be multiplied to make it a perfect cube is 11.

(b) $385875 = 3\sqrt{3\times3\times\underline{5\times5\times5}\times\underline{7\times7\times7}}$

$3\sqrt{3^2 \times 5^3 \times 7^3}$

3	385875
3	128625
5	42875
5	8575
5	1715
7	343
7	49
7	7
	1

It is not a perfect cube as there are two 3.

Hence, the smallest number required to be multiplied to make it a perfect cube is 3.

(c) $\sqrt{-35721} = -3\sqrt{3\times3\times3\times3\times3\times3\times7\times7}$
$= -3\sqrt{3^3\times3^3\times7^2}$

3	35721
3	11907
3	3967
3	1323
3	441
3	147
7	49
7	7
	1

It is not perfect cube as there are two 7.

Hence, the smallest number required to be multiplied to make it a perfect cube is 7.

6. (a) $3\sqrt{690} < 3\sqrt{696} < 3\sqrt{700}$

$8.837 < 3\sqrt{696} < 8.879$

Moving from 690 to 700 i,e them digit we are and addition of 0.042

690 to 696: 1 digits $3\overline{)696} = \frac{0.042}{10} \times 6 = 0.0252$

$3\overline{)696} = 0.0252 + 8.837 = 8.8622$

7. $3\sqrt{2560} = 3\sqrt{2\times2\times2\times2\times2\times2\times2\times2\times2\times5}$
$= 3\sqrt{2^3\times2^3\times2^3\times5}$

2	2560
2	1280
2	640
2	320
2	160
2	80
2	40
2	20
2	10
5	5
	1

To make 5 as 5^3 we need to multiply 2560 by $5^2 = 25$ hence, the smallest number required by 2560 to make it a perfect cube is 25.

8. (a) $3\sqrt{\frac{-125}{512}} = 3\sqrt{\frac{-5\times-5\times-5}{8\times8\times8}} = 3\sqrt{\frac{-5^3}{8^3}} = \frac{5}{8}$

(b) $3\sqrt{\frac{-8}{64}} = 3\sqrt{\frac{-2\times-2\times-2}{4\times4\times4}} = 3\sqrt{\frac{-2^3}{4^3}} = \frac{-2}{4}$

(c) $3\sqrt{\frac{125}{27}} = 3\sqrt{\frac{5\times5\times5}{3\times3\times3}} = 3\sqrt{\frac{5^3}{3^3}} = \frac{5}{3}$

9. (a) $(21)^3 = (20+1)^3$

$20^3 + (3\times(20)^2\times1) + (1)^3 + (3\times20\times(1)^2$

$8000 + (3\times400\times1) + 1 + (60\times1)$

$8000 + 1200 + 1 + 60$

$= 9261$

(b) $(60)^3 = (60+0)^3$

$60^3 + (3\times60^2\times0) + 0^3 + (3\times60\times1^2)$

$= 216000 + 0 + 0 + 0$

$= 216000$

(c) $(8)^3 = (7+1)^3$

$(7)^3 + (3\times7^2\times1) + (3\times7\times1^2) + 1^3$

$343 + 3\times49\times1 + 21 + 1$

$343 + 147 + 22 = 512$

(d) $(15)^3 = (10+5)^3$

$= 10^3 + (3\times70^2\times5) + (3\times10\times5^2) + 5^3$

$= 1000 + (3\times100\times5) + (3\times10\times25) + 125$

$= 1000 + 1500 + 750 + 125$

$= 3375$

10. (a) (0.8)3

$\left(\frac{8}{10}\right)^3 = \frac{8}{10}\times\frac{8}{10}\times\frac{8}{10} = \frac{512}{1000} = 0.512$

(b) $(0.2)^3 = \left(\frac{2}{10}\right)^3 = \frac{2}{10}\times\frac{2}{10}\times\frac{2}{10} = \frac{8}{1000} = 0.008$

(c) $(0.5)^3 = \left(\frac{5}{10}\right)^3 = \frac{5}{10}\times\frac{5}{10}\times\frac{5}{10} = \frac{125}{1000} = 0.125$

Multiple Choice Questions

1. (b) an odd natural number

2. (a) an even natural number, To make 2^2 as 2^3 we have to multiply 2^2 by 2.

3.

2	32
2	16
2	8
2	4
2	2
	1

$3\sqrt{32} = 3\sqrt{2\times2\times2\times2\times2}$

$= 3\sqrt{2^3\times2^2}$

Hence, the smallest number required to make 32 a to make it a perfect cube we have to multiply it by 2.

Answer: (c) 2

4. $3\sqrt{32} = 3\sqrt{\underline{2\times2\times2}\times\underline{2\times2}}$

$= 3\sqrt{2^3\times2^2}$

To make 32 a perfect cube we have to divide it by 2^2 that is by 4.

Answer: (b) 4

5.

5	125
5	25
5	5
	1

$3\sqrt{-125} = 3\sqrt{(5\times5\times5)}$

$= 3\sqrt{-5^3}$

$= -5$

Answer: (b) –5

6. (a) a negative integer

7. (b) a positive integer

8. $3\sqrt{8\times64} = 3\sqrt{\underline{2\times2\times2}\times\underline{4\times4\times4}}$

$3\sqrt{2^3\times4^3} = 2\times4 = 8$

Answer: (c) 8

9. (d) none of these

10. $3\sqrt{-23} = -2$

Answer: (b) –2

11. (a) 216, as cube of and even number is always an even number.

12. (d) 343, as cube of an odd number is always an odd number.

13. $3\sqrt{1323} = 3\sqrt{\underline{3\times3\times3}\times\underline{7\times7}}$

$3\sqrt{3^3\times7^2}$

$3\sqrt{1323}$ will be a perfect cube when 7^2 will be equal to 7^3 which can only happen when 1323 will be multiplied by 7. Hence, 7 is the smallest number by which 1323 must be multiplied to make it a pefect cube.

3	1323
3	441
3	147
7	49
7	7
	1

Answer: (d) 7

14.

2	1600
2	800
2	400
2	200
2	100
2	50
5	25
5	5
	1

$3\sqrt{1600} = 3\sqrt{\underline{2\times2\times2}\times\underline{2\times2\times2}\times5\times5}$

$3\sqrt{2^3\times2^3\times5^2}$

5^2 does'nt from a group of three hence, 1600 must be divided from 25 to get a perfect cube

Answer: (b) 25

15. $\left(\frac{-2}{3}\right)^3 = \frac{-2\times-2\times-2}{3\times3\times3} = \frac{-8}{27}$ (c) $\frac{-8}{27}$

16. (b) $(-4)^3 = -64$ [As cube of negative integers is always negative.

Check Your Progress

1. $\sqrt[3]{64000}$

$= \sqrt[3]{\underline{2\times2\times2}\times\underline{2\times2\times2}\times\underline{2\times2\times2}\times\underline{5\times5\times5}}$

$= \sqrt[3]{2^3\times2^3\times2^3\times5^3}$

All the numbers are forming group of 3

Hence, 64000 is a perfect cube.

2	64000
2	32000
2	16000
2	8000
2	4000
2	2000
2	1000
2	500
2	250
5	125
5	25
5	5
	1

2. $(3)^3 = 3 \times 3 \times 3 = 27$, $(4)^3$

$= 4 \times 4 \times 4 = 64$

3.

3	9
3	3
	1

$\sqrt[3]{9} = \sqrt[3]{3 \times 3}$

$= \sqrt[3]{3^2}$

3^2 can be 3^2 only when 9 will be multiplied by 3. Hence, Smallest number that should be multiplied by 3 to make it a perfect cube is 3.

4. $\sqrt[3]{-1} = -1 \times -1 \times -1 = 1$

$\sqrt[3]{-(\underline{2 \times 2 \times 2} \times \underline{2 \times 2 \times 2} \times \underline{5 \times 5 \times 5})}$

$\sqrt[3]{-(2^3 \times 2^3 \times 5^3}$

$-(2 \times 2 \times 5)$

$= 20$

5. $\sqrt[3]{-8000}$

2	8000
2	4000
2	2000
2	1000
2	500
2	250
5	125
5	25
5	5
	1

$\sqrt[3]{(\underline{2 \times 2 \times 2} \times \underline{2 \times 2 \times 2} \times \underline{5 \times 5 \times 5}}$

$\sqrt[3]{(2)^3 \times (2)^3 \times (5)^3}$

$= -(2 \times 2 \times 5)$

$= -20$

6. $-(8 \times 27) = -(\underline{2 \times 2 \times 2} \times \underline{3 \times 3 \times 3})$

$= -(2^3 \times 3^3) = -(2 \times 3) = -6$

7. $\sqrt[3]{(27 \times 64)} = \sqrt[3]{(\underline{3 \times 3 \times 3} \times \underline{4 \times 4 \times 4})}$

$= \sqrt[3]{3^3 \times 4^3} = 3 \times 4 = 12$

8. $\sqrt[3]{\frac{-8}{125}} = \sqrt[3]{\frac{-2 \times -2 \times -2}{5 \times 5 \times 5}} = \sqrt[3]{\frac{-2^3}{5^3}} = \frac{-2}{5}$

9. Perfect cubes are 8 and 64 that are cubes of 2 & 4 respectively.

8 Comparing quntities

Exercise 8.1

1. (a) 28 (b) 13 (c) 45

2. (a) 40% (b) 58% (c) 7%

3. (a) $\frac{1}{25} = \frac{x}{100} = y\%$

$\frac{1}{25} = \frac{x}{100}$

$1 \times 100 = 25 \times x$

$100 = 25x, x = \frac{100}{25} = 4$

$\frac{x}{100} = y\% = \frac{4}{100} = \frac{y}{100}$

$4 \times 100 = 100 \times y$

$y = \frac{400}{100}, y = 4$

(b) $\frac{7}{10} = \frac{x}{100} = y\%$

$\frac{7}{10} = \frac{x}{100}$

$7 \times 100 = x \times 10$

$x = \frac{700}{10}$

$x = 70$

$\frac{70}{100} = y\%$

$\frac{70}{100} = \frac{y}{100}$ $70 \times 100 = 100 \times y$

$y = \frac{7000}{100}, y = 70$

4. $18\% = \frac{18}{100} = \frac{18 \div 2}{100 \div 2} = \frac{9}{50}$

= 9:50 (b) 9:50

5. 20% of x = 40

$\frac{20}{100} \times x = 40$

$20x = 40 \times 100$

20×4000

$x = \frac{4000}{20}, x = 200$

(c) 200

6. Let Kusum's monthly income be x

12% of income = Savings = $\frac{12}{100} \times x = 860$

$12x = 860 \times 100, x = \frac{86000}{12}, x = 7166.67$

Hence, Kusum's monthly income is ₹7166.67

7. Let the total cost of computer be x.

96% of x = ₹10464

$\frac{96}{100} \times x =$ ₹10464, $\frac{96x}{100} = 10464, x = \frac{10464 \times 100}{96}$

x = 10900

Hence, the total cost of computer is ₹10900.

8. Let his monthly income be x

For 1 Month Saving: 10% of x = $\frac{10x}{100}$

For 6 Month Saving = $6 \times \frac{10x}{100} = \frac{60x}{100}$

$\frac{60x}{100} = 5400, x = \frac{5400 \times 100}{60}, x = 9000$

Hence, his monthly income is ₹9000

9. 80% of half yearly = $\frac{80}{100} \times 1000 = 800$

72% of annual examination = $\frac{72}{100} \times 1200 = 864$

Net percentage of marks in both half yearly and annual examination

$$\frac{\text{Marks obtained in half year}}{\text{Total marks of both half yearly and annual examination}} + \frac{\text{Marks obtained in annal examination}}{\text{Total marks of both half yearly and annual examination}}$$

$= \frac{800 + 864}{1000 + 1200} \times 100$

$= \frac{1664}{2200} \times 100 = 75.64\%$

Hence, Kunal's net percentage of both examination is 75.64%.

Exercise 8.2

1.

	C.P (₹)	S.P (₹)	Profit [When SP > CP] (₹)	Loss [When CP > SP] (₹) CP – SP
(a)	115000	150000	SP – CP SP > CP 150000 > 115000 150000 – 115000 = 35000	
(b)	1250	900		CP > SP 1250 – 900 = 350
(c)	4460	5150	SP > CP, 5150 – 4460 = 690	
(d)	4892	4900	SP > CP, 4900 – 4892 = 8	
(e)	367000	381400	SP > CP, 381400 – 367000 = 14400	
(f)	835	900	SP > CP, 900 – 835 = 65	

2.

	C.P (₹)	S.P (₹)	Profit [SP - CP] (₹)	**Profit% = $\frac{\text{Profit} \times 100}{\text{C.P}}$ = %**
(a)	460	500	500 – 460 = 40	$\frac{40 \times 100}{460} = \frac{4000}{460}$ **= 8.69%**
(b)	840	900	900 – 840 = 60	$\frac{60 \times 100}{840} = \frac{6000}{840}$ **= 7.14%**
(c)	3500	3710	3710 – 3500 = 210	$\frac{210 \times 100}{900} = \frac{21000}{3500}$ **= 6%**
(d)	4500	4900	4900 – 4500 = 400	$\frac{400 \times 100}{4500} = \frac{40000}{4500}$ **= 8.89%**
(e)	3750	4125	4125 – 3750 = 375	$\frac{375 \times 100}{3750} = \frac{37500}{3750}$ **= 10%**

3.

	C.P (₹)	S.P [C.P + Profit] (₹)	Profit (₹)	Loss [CP - SP] (₹)
(a)	4640	3710	—	4640 – 3710 = 930
(b)	540	415	—	540 – 415 = 125
(c)	4750	4275	—	4750 – 4275 = 475
(d)	950	950 + 160 = 1110	160	—
(e)	40	40 + 2 = 42	2	—

4.

	C.P [SP + Loss] (₹) [SP - Profit]	S.P [C.P + Profit] (₹)	Profit (₹)	Loss (₹)
(a)	7252	7282 + 208 = 7490	208	
(b)	572 – 72 = 500	572	72	
(c)	9684	9684 – 684 = 9000		684
(d)	1973 – 273 = 1700	1973	273	
(e)	676000	67600 – 18500 = 657, 500		18500
(f)	7894 + 306 = 8200			306

5. $CP = \frac{100 \times SP}{100 - Loss\%}$, $CP = \frac{100 \times 600}{100 - 20} = \frac{60000}{80} = 750$

Hence, the cost of frock is ₹750.

6. CP = ₹5580, Tranporation fee: ₹170, Real CP = CP + Transportative

= ₹(5580 + 170) fee = ₹5750

Gain = SP – CP = ₹(6440 – 5750) = ₹690

$Gain\% = \frac{Profit \times 100}{C.P} = \frac{690 \times 100}{5750}$

$= \frac{69000}{5750} = 12\%$

7. CP of car: ₹73500, Money spent of repairing: ₹10300

Insurance money: ₹2600

Real CP: CP + Repairing fee + Insurance fee

= ₹(73500 + 10300 + 2600) = ₹86400

SP = 84240

CP > SP, 84200 < 86400

Hence, Loss, Loss = ₹(86400 – 84240)

= ₹2160

$Loss\% = \frac{Loss \times 100}{C.P} = 2160 \times 100 = 25\%$ or $2\frac{1}{2}\%$

8. Let CP be x

CP + 6% of CP = ₹6943

X + 6% of x = 6943

$X + \frac{6}{100} \times X = 6942$

$\frac{X}{1} + \frac{6x}{100} = 6943$

$\frac{100 \times 6x}{100} = 6943$

106x = 694300

$x = \frac{694300}{100}$

x = 6550

Hence, the cost price of T.V bought by Sheila is ₹6550.

9. Mass of zinc in 1kg of alloy = 28% of 1kg

$= \frac{28}{100} \times 1$

= 0.028kg = 280g

Hence, 1kg of alloy contain 280g of zinc.

10. Quality of carbon in 1kg of chalk = 3% of 1kg

$= \frac{3}{100} \times 1 = 0.03kg$

1kg = 1 × 100g = 0.003kg = (0.03 × 1000)kg = 300g

Quality of Calcium in 1kg of chalk = 10% of 1kg

$= \frac{10}{100} \times 1 = 0.10kg$

1kg = 1000g, 0.10kg = (0.10 × 1000)g = 10g

Quality of oxygen in 1kg of chalk: 12% of oxygen

$= \frac{12}{100} \times 1 = 0.12kg$

= 1kg = 1000g, 0.12kg = 10.12 × 1000g

= 120g

Exercise 8.3

1.

	Item	MP (₹)	Discount rate (%)	Discount [MP × $\frac{\text{Discount rate}}{100}$] (₹)	SP [MP-Discount] (₹)
(a)	**Shoe**	2300	20	$2300 \times \frac{20}{100} = 460$	2300 – 4600 = 1840
(b)	**Tape recorder**	4700	25	$4700 \times \frac{25}{100} = 1175$	4700 – 1175 = 3525
(c)	**Crockery set**	3224	$12\frac{1}{2} = \frac{25}{2} = 125$	$3224 \times \frac{12.5}{100} = 403$	3224 – 403 = 2821
(d)	**Refrigerator**	9850	10	$9850 \times \frac{10}{100} = 985$	9850 – 985 = 8865

2.

	Item	MP (₹)	SP (₹)	Discount [MP – SP] (₹)	Discount rate
(a)	**Pen set**	140	105	140 – 105 = 35	$\frac{35}{105} \times 100 = 33.34\%$
(b)	**Sewing Machine**	1300	1235	1300 – 1235 = 65	$\frac{65}{1300} \times 100 = 5\%$
(c)	**Fan**	1500	1200	1500 – 1200 = 300	$\frac{300}{1500} \times 100 = 20\%$
(d)	**Washing Machine**	14500	13775	14500 – 13775 = 725	$\frac{725}{14500} \times 100 = 5\%$

3.

	Item	Marked price (M.P) (₹)	Discount rate	Discount [MP × $\frac{\text{Discount rate}}{100}$] (₹)	SP = MP - Discount (₹)
(a)	**Sofa set**	2300	10%	$2300 \times \frac{10}{100} = 230$	2300 – 230 = 2070
(b)	**Dinning table**	4700	20%	$4700 \times \frac{20}{100} = 940$	4700 – 940 = 3760
(c)	**Double bed**	3224	15%	$3224 \times \frac{15}{100} = 483.6$	3224 – 483.6 = 2740.4
(d)	**Centre table**	9850	25%	$9850 \times \frac{25}{100} = 2462.50$	9850 – 2462.5 = 7387.5

4. Present population = 20700

Decrease in population previous year = Present population = 15% of present population

$= 20700 - \frac{15}{100} \times 20700$

$= (20700 - 3105) = 17595$

Hence, the population of the city previous year was 17595.

5. Total number of trees = 64

Number of Apple trees = 25% of 64

$= \frac{25}{100} \times 64 = 16$

Number of lemon trees = 62.5% of 64

$= \frac{625}{100} \times 64 = 40$

Percentage of Banana trees = 100 – (25 + 62.5)%

= (100 – 87.5)% = 12.5%

Number of Banana trees = 12.5% of 64

$= \frac{12.5}{100} \times 64 = 8$

Hence, there are 18, 40 and 8 Apple, Lemon and Banana trees respectively.

6. Let the income of Akhil be Rs.100

Then the income of Nikhil will be 20% less than Akhil = 100 – 20% of 100 = Rs. 80.

Therefore, Akhil's income is more than Nikhil's by = 100 – 80 = Rs. 20

Therefore, the required % (Akhil Income is more than Nikhil's)

$= \frac{\text{Difference in income}}{\text{Nikhil's income}} \times 100\% \frac{20}{80} \times 100\% = 25\%$

Therefore Akhil's income is 25% more than Nikhil's income.

7. **Given:** John's Income is 20% More Than that of Mr Thomas.

To do: Find how much% is income of Mr Thomas Less the John.

Let the income of Thomas be Rs 100

20% of Rs. 100 $= \frac{20}{100} \times 100 =$ Rs.20

John's income = Rs. (100 + 20) = Rs. 120

The income of Thomas less than that of John in percent $= \frac{20}{120} \times 100 = 16.67\%$

8. Let the number be 100.

Increased by 20%

= 100 + 20% of 100

$= 100 + 20 \frac{20}{\cancel{100}} \times \cancel{100}$

= 120

Then it is decreased by 20%

120 – 20% of 120

$= 120 - \frac{20}{100} \times 120$

120 – 24 = 96

Net decrease = 100 – 94 = 4

$\text{Net decrease percentage} = \frac{\text{Net decrease}}{\text{Orignal number} \times 100}$

$= \frac{4}{100} \times 100 = 4\%$

Hence, the net decrease is 4%

9. Let the value of machine 1 year ago be x.

x – 10% of x = 38700

$x - \frac{10}{100} \times x = 38700$

x – 0.1x = 38700

= 0.9x = 38700

$x = \frac{38700}{0.9}$

Hence, the value of machine one year ago was ₹43000.

10. Let say Price of commodity = P Rs per kg comsumption by lady = C kg

Total Expenditure = Price of Commodity = PC Rs

Price of a commodity rose by 10%

= New Price = P + (10/100)p = 1.1P Rs per kg

Consumption now = PC/(1.1P) = C/1.1kg

Reduction in consumption = C - C/1.1 = 0.1C/1.1 = C/11

Percantage Reduction in consumption = ((C/11/C) × 100 = 9.09%

A lady should reduce her consumption by 9.09%

Exercise 8.4

1. Present valure of car: ₹225000

Value of car after 1 year: Decrease by 20%

$= 225000 - \frac{20}{100} \times 225000$

= ₹180,000

Value of car after another year: Decrease by 20%

$= 180{,}000 = \frac{20}{100} \times 180000$

= ₹144000

Hence, the cost of car after 2 years will be ₹2,25,000

2. Let the total percentage of passangers at starting of the bus be x 100%

40% of passenger got down at station x.

Remaining passenger = 100% – 40% = 60%

75% of passengers got down = 60% – 75% of 60%

$60\% = \left(\frac{75}{100} \times \frac{60}{100}\right)$

$= 60\% - \left(\frac{4500}{100}\right) = 60\% - 45\% = 15\%$

Number of passegers = $\frac{12 \times 100}{15} = 80$

3. Total number of students = Number of students from school A, B, C and D

= 140 + 70 + 105 + 35

= 350

Hence, the orignal number of pasengers are 80% of students from school A = $\frac{\text{Number of students of school A}}{\text{Total number of students}} \times 100 = \frac{140}{350}$

$\times 100 = \frac{14000}{350} = 40\%$

Percentage of students from school B = $\frac{\text{Number of students of school B}}{\text{Total number of students}} \times 100 =$

$\frac{70}{350} \times 100 = \frac{7000}{350} = 20\%$

Percentage of students from school C

$= \frac{\text{Number of students of school C}}{\text{Total number of students}} \times 100 =$

$\frac{105}{350} \times 100 = 30\%$

Percentage of students from class D = $\frac{\text{Number of students of school D}}{\text{Total number of students}} \times 100 =$

$\frac{35}{350} \times 100 = 10\%$

4. Cost price of 1 quintal of sugar = ₹700

Cost price of 100 quintals of sugar = ₹(700 × 100) = ₹70000

Selling price of 50 quintals at ₹1000 per quintals = ₹(50 × 1000) = ₹50000

Selling price of remaining 50 quintals at ₹800 per quintal = ₹(500 × 800) = ₹40000

Total selling price = ₹(50000 + 40000) = ₹90000

Gain = S.P – C.P = ₹(90000 – 70000) = ₹20000

Gain = SP – C.P = ₹(90000 – 70000) = ₹20000

Gain% = $\frac{\text{Gain} \times 100}{\text{CP}} = \frac{20000 \times 100}{70000} = 28\frac{4}{7}\%$

5. Cost price of Bananas: ₹15 per dozen

Selling price of Bananas : ₹20 per dozen

Gain = S.P – C.P = (20 – 15) = ₹5

Gain% = $\frac{\text{Gain} \times 100}{\text{CP}} = \frac{5 \times 100}{15} = \frac{500}{15}$

$= 33\frac{1}{3}\%$

Exercise 8.5

1. $\text{S.I} = \frac{\text{P} \times \text{R} \times \text{T}}{100}$

$\text{S.I} = \frac{3000 \times 5 \times 2}{100}$

= ₹300

2. P = ₹4000, T = 2year, R = 5%

$\text{S.I} = \frac{\text{P} \times \text{R} \times \text{T}}{100} = \frac{4000 \times 5 \times 2}{100} =$ ₹400

3. P = ₹8000, R = 15%, T = 3years

$\text{S.I} = \frac{\text{P} \times \text{R} \times \text{T}}{100} = \frac{8000 \times 15 \times 3}{100} =$ ₹3600

4. P = ₹5000, R = 6%, T = 2years

$\text{S.I} = \frac{\text{P} \times \text{R} \times \text{T}}{100} = \frac{5000 \times 6 \times 2}{100} =$ ₹600

5. P = ₹2500, T = 8%, T = 2 years

$\text{SI} = \frac{\text{P} \times \text{R} \times \text{T}}{100} = \frac{25000 \times 8 \times 2}{100}$

A = S.T + P = ₹(4000 + 25000) = ₹29000

6. P = ₹2000, R = 12%, T = 1

$\text{S.I} = \frac{\text{P} \times \text{R} \times \text{T}}{100} = \frac{2000 \times 12 \times 1}{100} =$ ₹240

Amount = S.I + P

= ₹(240 + 20000)

= ₹20240

Hence, kuldeep will pay ₹20240 to his friend.

7. P = 64000, R = 7%, T = 3 years

$\text{S.I} = \frac{\text{P} \times \text{R} \times \text{T}}{100} = \frac{64000 \times 7 \times 3}{100}$

= ₹13440

A = S.I + P = ₹(13440 + 64000)

= ₹77440

Hence, Saroj will get ₹77440 on maturity.

Exercise 8.6

1. Conversion period is half-yearly, so there are 2 conversion periods in 1 year.

P = ₹6250, T = 2 conversion periods, Rate = 4% [Half of interest per annum]

$A = \text{Principal}\left(1 + \frac{\text{Rate}}{100}\right)^t = 6250\left(1 + \frac{8}{100}\right)^2$

$= 6250\left(\frac{100 + 4}{100}\right)^2 = 6250\left(\frac{104}{100}\right)^2 = 625 \times \frac{104}{100} \times \frac{104}{100}$

$A = \frac{67600000}{10000} = ₹6760$

C.I = A – P = ₹(6760 – 6250) = ₹510

Hence, Harish will get a compound interest of ₹510

2. Principal amount (P) = ₹16000

Rate of interest (R) = 10% Per annum or 5% per half year.

Time (n) = $n\frac{1}{2} = \frac{3}{2}$years

$\therefore A = P\left(1 + \frac{R}{100}\right)^{2n}$

$= 16000\left(1 + \frac{5}{100}\right)^{2\times3/2}$

$= 16000 \times \left(1 + \frac{105}{100}\right)^3$

Answer: ₹18522

3. Principal (p) = ₹1000

Rate(R) = 8% p.a

Peroid (T) = $1\frac{1}{2}$ year

$\therefore$ Intrest for the first half-year = $\frac{PRT}{100}$

$= \frac{1000 \times 8 \times 1}{100 \times 2} = ₹40.$

Amount after one half year = ₹1040

or, Principle for the second half-year

$= \frac{1040 \times 8 \times 1}{100 \times 2} = ₹\frac{4160}{100} = ₹41.60$

Amount after second half-year

= ₹1040 + 41.60 = ₹108.6

or, Principle for the third half-year = ₹1081.60

Intreset for the third half-year

$= \frac{1081.60 \times 8 \times 1}{100 \times 2} = ₹\frac{4326.40}{100} = ₹43.264$

$\therefore$ Compund intreset for the third half-year

or $1\frac{1}{2}$year = ₹40 + ₹41.60 + ₹43.264 = ₹124.864

4. Principal (Sum borrowed) (P) = ₹64000

Rate (R) = 10% p.a or 5% half-yearly

Peroid(T) = $1\frac{1}{2}$year or 3 half-years

Interest for the first half year = $\frac{PRT}{100}$

$= ₹\frac{64000 \times 5 \times 1}{100} = ₹3528$

$\therefore$ Total compount interest for 3 half-years or $1\frac{1}{2}$ years = ₹3200 + ₹3360 + ₹3528

= ₹10088

5. Amount = $P\left(1 + \frac{r}{n}\right)^m$

Compound Inerest = Amount – Principal

Given,

Principal = ₹8000

Time = 9 month

$\frac{12 \text{ month}}{9}$

Rate= 20%

$= 8000\left(1 + \frac{2}{4}\right)^{\frac{0}{12} \times 4}$

$= 8000\ (1 + 0.5)^3$

$= 8000 \times 1.15762 = 9261$

Amount is ₹9261

Compound interest will be = (9261 – 8000) ₹1261

6. $A = P\left(1 + \frac{R}{100}\right)^n$

$= 40{,}000\left(1 + \frac{7}{100}\right)^2$

$= 40{,}000(1.07)^2$

= 45, 796

Thus, the required amount is ₹45,796

Now,

CI = A – P

= ₹45,796 – ₹40,000

= ₹5,796

7. The amount after compounding a principal amount, P, at an intrest rate,i, for year t is,

$\text{Amount} = P \times \left(1 + \frac{i}{100}\right)^t$

In our case;

P = 50000

i = 8

There amount = $50000 \times \left(1 + \frac{8}{100}\right)^3$

Amount = 62985.6

Now, the compound interesed the end of 3 year is given as the difference between the amount at the end of the peroid and the principal amount.

Interest = 62985.6 – 50000

Interest = 12985.6

8. A = ?

P = ₹3200

R = 12%

$A = P\left(1 + \frac{r}{100}\right)^h$

$A = 3200 \left(1 + \frac{12}{100}\right)^2$

$A = 32\cancel{00} \frac{\cancel{112}}{\cancel{100}} \times \frac{\cancel{112}}{\cancel{100}} \frac{\cancel{56}}{28}$

$A = 32 \times \frac{28}{25} \times 112$

A = ₹4014.28

9. P = ₹1000

Rate = 4%

Time = 2 conversions periods

$A = P\left(1 + \frac{R}{100}\right)^t$

$A = 1000\left(1 + \frac{4}{100}\right)^2$

$= 1000(1.04)^2$

$= 1000 \times 1.0816$

= 1081.6

S.I = A – P = 1081.6 – 100

= 81.6

10. Conversion peroid is half-yerly. So there are 2 conversion periods in 1 year.

P = ₹64000, T = 2 Conversion periods, R = 5% [i.e half of interess per annum]

$A = \text{principal} \left(1 + \frac{\text{rate}}{100}\right)^t$

$= 6400 \left(1 + \frac{5}{100}\right)^2 = 64000 \left(\frac{105}{100}\right)^2$

$= 6400\ (1.05)^2 = 64000 \times 1.1025 =$ ₹70560

Compound interest = Amount - principal

= ₹(70560 – 64000)

Hence, total compound interest payable by Neena after 1 year if the interest is compounded half yearly is ₹6560.

Exercise 8.7

1. P = ₹50,000

R = 8%

Time = 2 years

Compounded half yearly so, Time = 4 conversion periods

P = ₹50,000, R = 4%

$A = 50000 \left(1 + \frac{4}{100}\right)^4$

$A = 50000(1.04)^4 =$ ₹58492.928

C.I = A–P, 58492.928 – 50000 = ₹8492.928

2. P = 50,000

Time = 6 months

R = 10% or $\frac{1}{2}$year

Compound quaterly So, Time = 2 conversion periods, R = $\frac{10}{2}$% = 2.5%

$A = 50000 \left(1 + \frac{2.5}{100}\right)^2 = 50000(1.25)^2 = 52531.25$

C.I = A – P = 52531.25 – 50000 = ₹2531.25

Hence, his compound interest after 6 months is 2531.25

3. $\text{S.I} = \frac{P \times R \times T}{100}$, $900 = \frac{P \times 6 \times 2}{100}$

$P = \frac{90000}{12}$, P = ₹7500

$\text{Amount} = 7500 \left(1 + \frac{6}{100}\right)^2 = 7500\ (1.06)^2 =$ ₹8427

C.I = A – P, 8427 – 7500 = ₹927

Hence, the compound interest is ₹927

4. Let principle amount = x

Simple interest = $\frac{P \times R \times T}{100}$

P = Principal = x

R = Rate = 10% per annum

T = Time = 3 years

= S.I = $\frac{x \times 10 \times 3}{100} = \frac{3x}{10}$

Compound interest = Amount - Principal

Amount = $P\left(1 + \frac{R}{100}\right)^T$

= $x = \left(1 + \frac{10}{100}\right)^3$

= $x = \left(1 + \frac{11}{10}\right)$

= C.I = $\frac{1331x}{1000} - x$

$\frac{1331x - 1000x}{1000}$

= $\frac{331x}{1000}$

Difference of C.I and S.I = 93

= $\frac{331x}{1000} = \frac{3x}{10} = 93$

$\frac{31x}{1000} = 93$

= $\frac{93 \times 1000}{31} = 3000$ Rs

5. Let Rate = R per% annum

P = Rs.4000

A = Rs.4410

Time = 2 years

Now,

Amount (A) = P(1 + R/100)n [When, A = Amount]

With compound interest

P = Present value

R = Annual interest rate

n = Time in years]

∴ A = P(1 + R/100)2

= 4410 = 4000 (1 + R/100)2

= (1 + R/100)2 = 4410/4000

= (1 + R/100)2 = 441/400

= (1 + R/100) = (441/400)

= R/100 = (21/20) – 1

= R/100 = (21 – 20)/20

= R/100 = 1/20

= R = 100/20

= R = 5

∴ Rate = 5% per annuam.

Exercise 8.8

1. Current population = 12500

Growth in population per anum = 2%

P = 1,25,000

R = 2%

T = 3

Population after 3 years = $P\left(1 + \frac{r}{100}\right)^t$

$125000\left(1 + \frac{2}{100}\right)^3 = 125000\left(\frac{100 + 2}{100}\right)^3 =$

$125000 \times \left(\frac{102}{100}\right)^3$

$= 125000 \times \frac{102}{100} \times \frac{102}{100} \times \frac{102}{100} = 132{,}651$

Hence, the population of the town after 3 year would be 132,651

2. Population in 2013 = 120000

Rate of Increase: 6%

Rate of Decrease = 5%

$P\left(1 + \frac{r}{100}\right)\left(1 - \frac{r}{100}\right) = 12000\left(1 + \frac{6}{100}\right)\left(1 - \frac{5}{100}\right)$

$12000\left(1 + \frac{6}{100}\right)\left(1 - \frac{5}{100}\right) = 120000$ (1 + 0.06)

(1 – 0.05) = 12000 (1.06) (0.95)

= 1,20,840

Hence, the population of the town in 2015 is 1,20,840

3. Initial count = 20, 000

Rate of increase in first hour: 10%

Rate of decrease in second hour: 10%

Rate of increase in third hour: 10%

Bacteria after three hours = $20000\left(1+\frac{10}{100}\right)\left(1-\frac{10}{100}\right)\left(1+\frac{10}{100}\right)$

= 20000 (1 + 0.10) (1 – 0.10) + (1 + 0.10)

= 20000 (1.10) (0.90 (1.10) = 21780

Hence, the bactria has grown upto 21780 at the end of three hours

4. Cost Price: ₹6,25,000

Rate of depriciatioon: 8%

Time = 2 years

Price after 2 years = $6,25,000\left(1-\frac{8}{100}\right)^2$

= 6,25,000 $(1–0.08)^2$ = 625000 $(0.92)^2$

= ₹529000

Hence, the cost of machine after 3 years is ₹529000

5. Cost Price = ₹56,000

Rate of depriciation: 10%

Time = 3 years

Cost after 3 years = $56000\left(1-\frac{10}{100}\right)^3$

= 5600 $(1 – 0.010)^3$ = 5600 $(0.90)^3$

= ₹40824

Hence, the cost of scooter after 3 years is ₹40824.

6. Cost = ₹348000

Rate of depriciation at first year: 10%

Rate of depriciation at second year: 20%

Value after 2 years = $348000\left(1-\frac{10}{100}\right)\left(1-\frac{20}{100}\right)$

348000 (1 – 0.10) (1 – 0.20) = 348000 (0.90) 0.80

= ₹250560

Hence, the car's value after 3 years is ₹250560.

7. Initial count: 500000

Increase rate per hour: 2%

Time: 2 hours

Bacteria count at the end of 2 hours = 500000 $\left(1+\frac{2}{100}\right)^2$ = 500000 $(1 + 0.02)^2$ = 500000 $(1.02)^2$ = 520,200

Hence the bacteria count after 2 hours is 520,200

8. Present value = ₹291600

Rate of depricitaion = 10%

Time = 3 years

$291600 = P\left(1-\frac{10}{100}\right)^3 = 291600 = P(1 – 0.10)^3$

$291600 = P(0.90)^3 = 291600 = P(0.729) = P = 0.729 \times 2916000$, P = 212576.4

Hence, the cost of machine after 3 year ago was ₹212576.4

Multiple Choice Questions

1. Let x be the CP of pen SP of 100 pens = 100x

Gain of 20 pens = 20x

CP = SP – Gain = 100 × 20x = 80x

$\text{Gain\%} = \frac{\text{Gain} \times 100}{\text{CP}}, \frac{20x \times 100}{80x} = 25\%$

Answer: (b) 25%

2. Let CP be x

SP = $\frac{6}{5}$ of cost price = $\frac{6}{5}$x

Gain = CP – CP

$\frac{6}{5}x - \frac{x}{5} = \frac{6x - 5x}{5} = \frac{x}{5}$,

$\text{Gain\%} = \frac{\text{Gain} \times 100}{\text{CP}} = \frac{x \times 100\%}{5} = \frac{20x}{x}$

= 20%

Answer: (b) 20%

3. Let the CP of watch be x

x + 8%x = 810, x + 0.08x = 810,

1.08x = 810, $x = \frac{810}{1.08}$, x = 750

Answer: (c) 750

4. SP = 100

Gain = 20 = SP – CP

20 = 100 – CP

CP = 80

$\text{Gain\%} = \frac{\text{Gain} \times 100}{\text{CP}}$

$\text{Gain\%} = \frac{20 \times 100}{80}$

$\text{Gain} = \frac{2000}{80} = 25\%$

Answer: (d) 25%

5. P = 10,000, R = 12%, T = $1\frac{1}{2}$ years

Compounded semi-annually = $1\frac{1}{2}$ years = 3 conversion periods

P = 1000, R = 6%, per conversion periods, T = 3 conversion periods

Amount = $10000\left(1 + \frac{6}{100}\right)^3 = 10000\ (1.06)^3$ = 11910.16

C.I = A – P = 11910 + 6 – 10000 = 1910.16

Answer: (c) 1910.16

6. Principal = 6250, Rate = 8%, Time = 1 years

Compounded Semi-annually

1year = 2 conversion periods

P = 65250, R = 4% per conversion perod

T = Conersion periods

Amount = Principal $\left(1 + \frac{\text{Rate}}{100}\right)^t = 6250\left(1 + \frac{4}{100}\right)^2 = 6250(1 + 0.04)2 = 6250\ (1.08)2$

= 6250 × 1.04 × 1.04

= 6760

C.I = A.P = 67600 – 6250 = 510

Answer: (b) 510

7. Cost price = 6000

Rate of depriciation = 10%

Time of = 3 years

Present value = $6000\left(1 - \frac{10}{100}\right)^3$

$60000\ (1 - 0.10)3 = 60000\ (0.90)^3$

= ₹43740

Answer: (c) 43740

8. Let the sum be Rs. P. Then,

$[P(1 + \frac{25}{2 \times 100})^2 - P] = 510$

$P[(\frac{9}{8})2 - 1] = 510.$

Sum = Rs.1920

So, S.I. = (1920 × 25 × 2)/(2 × 100) = RS. 480

9. Given, A = Rs. 4913,

n = 3

$6\frac{1}{4}\% = \frac{25}{4}\%$

P = ?

$\therefore 4913 = P\left(1 + \frac{25}{400}\right)^3$

$= 4913 = P\left(1 + \frac{1}{16}\right)^3$

$= 4913 = P\left(\frac{17}{16}\right)^3$

$= 4913 = P \times \frac{4913}{4096}$

P = Rs. 4096

10. Principal (P) = Rs 4000

Rate of Interest (r) = 10%

Time = 2 years and 3 months

Here first we take n = 2 years.

= Amount for first 2 years (A) = $P\left(1 + \frac{r}{100}\right)^n$

$= 4000\left(1 + \frac{10}{100}\right)^2$

$= 4000\left(1 + \frac{11}{10}\right)^2$

$= 4000 \times \frac{121}{100}$

= The amount after two years = RS. 4840

= Now, Principal = RS. 4840

Simple interest for last 3 month i.e. $\frac{1}{4}$years = $\frac{PRT}{100}\ \frac{4840 \times 10 \times 1}{100 \times 4}$ = RS. 121

= Amount after 2 years and 3 months = Rs. 4840 + Rs. 121 = 4961

= C.I = A – P

= Rs. 4961 – Rs. 4000

= Rs. 961

∴ The compound interest is Rs. 961

Check your progress

1. 25% of 200 = $\frac{25}{\cancel{100}_{1}} \times \frac{\cancel{200}}{2} = 50$

2. Total % of class – % of boys = % of girls
= (100 – 70)% = 30%

3. 20% of x = 20, $\frac{20}{100} \times x = 20$

$x = \frac{\cancel{20}^{1}}{} \times \frac{100}{\cancel{20}_{1}}$

x = = 100

4. $CP = \frac{100 + SP}{100 + Profit\%} = \frac{100 \times 150}{100 + 50\%}$

$= \frac{\cancel{250}}{\cancel{150}} = \frac{15000}{150} = 100$

5. Gain% $\frac{Gain \times 100}{Cost\ price}$%

CP = SP – Gain

= 40 – 10

= ₹30

$Gain\% = \left(\frac{10 \times 100}{30}\right)\%$

$= \frac{1000}{30}$

= 33.33%

6. S.P = M.P – Discount

7. Let the marked price be x.

CP = 100

Profit = 50%, i.e ₹5

After 50%

Discount sales price = ₹150

x – 50% of x = 150

$x - \frac{50}{100} \times x = 150$

x – 0.5x = 150

0.5x = 150

$x = \frac{150}{0.5}$

x = 300

8. Marketed price

9. SP = M.P – Discount

SP = 100 – 12% 100

S.P = 100 – 12

SP = ₹88

10. Let the C.P be 100

MP = 100 + 10%100

= 100 + 10 = ₹10

S.P = MP = Discount

110 = 10% of MP

= 110 - 10% 110

= ₹(110 – 11)

= ₹99

CP > SP

₹100 > ₹99

Hence, yes he sufferd a loss.

9 Algebraic Expressions and Identities

Exercise 9.1

1. **Polynomial:** More than one term and have non-negative integer exponents.

(a) $a^2 + 7a + 12$

(b) $b^{2/3} + b^3$

(h) $x^2 + 4x^3 - x + 1$

(i) $\frac{5}{x} + x + 3$

(j) $x^2q^2 + q^2z^2 + z^2x^2$

(k) $3x - \frac{1}{y}$

(l) $x\frac{2}{3}\ y - 4x^3y^23$

(m) $p2 + 3\sqrt{p - 9}$

2. (a) **Monomials:** Algebraic expressions with only number one term and with no negative exponent for any variable in the term.

: (c) x^3, (d) 5

(b) **Binomials:** Algebraic expressions with only number two terms and with no negative exponent for any variable in the term.

: (b) $b^{\frac{2}{3}} + b^3$, (f) $4s - t^{-1}$, (g) $7x^2\ y^{2/3}$ (k) $3x^2 - \frac{7}{y}$

(l) $x^{\frac{2}{3}}y - 4x^3\ y^{\frac{2}{3}}$

(c) **Trinomial:** Algebraic expressions with only number three and with no negative exponent for any variable in the term.

: (a) $a^2 + 7a + 12$ (j) $x^2q^2 + q^2z^2 + z^2x^2$ (m) $p^2 + 3\sqrt{p} - 9$

3. Degree of polynomial of one variable is the highest value of the exponent of the variable.

The degree of a polynomial of more than one variable is the highest value of the sum of the exponent of the variable

(a) $3a = 1$

(b) $5b^2 + 3b + 4 = 2$

(c) $3x + 5c = x + c = 2$

(d) $5xy + 3 = x + y = 2$

(e) $7x^3 + 8x^2y - 9xy^2 = 3$

(f) $\frac{3}{5}x^4 + xy = 4$

(g) $x^6 + x^4y^2 + xy^4 + y^3 = 6$

(h) $8a^3 + 3ab + 6a^4b + 4b = a^4 + b^1 = 5$

(i) $3x^3 + x^2y + y^3 = 3$

(j) $4x^6 - 4x^4 - 2x^2 + 3 = 6$

4. (a) $-7x^4 + 4x^3 + 7x^2 + 3x + 128$

(b) $4x^5 + 8x^4 + x^3 - 8x^2 + 8x + 125$

(c) $3x^3 - x^2 + 4x + 6$

(d) $x^3 - 5x^2 + 4x + 7$

(e) $5x^3 + 4x^2 + 4x - 8$

Exercise 9.2

1. (a)

	$3x^2$	+	$5x$	+	7
	x^2	+		+	1
+	$5x^2$	+	$4x$	+	2
	$9x^2$	+	$9x$	+	10

(b)

	$5x^2$	+	$3x^2$	+	$3x$		
		+	$4x^2$	–	$7x$	+	5
+	x^3			–		–	3
	$6x^3$	+	$7x^2$	–	$4x$	+	2

(c)

	$3a$	+	$2b$
+	$6a$	+	$9b$
	$9a$	+	$11b$

(d)

	$5x^2$	+	$7x$	+	3
	$12x^2$	–	$3x$	+	8
+	$6x^2$	–	$4x$	+	11
	$23x^2$	+	0	+	22

(e)

	x^2	+	y^2	–	6xy
–	x^2	+	y^2	–	6xy
	x^2	–	y^2	–	6xy
+		–	y^2	–	6xy
	x^2	+	0	–	24xy

(f)

	x^2	–	x	+	2
	x^2	+	x	+	3
+	$4x^2$	+	5x	+	111
	$6x^2$	+	5x	+	116

(g)

–	$2x^4$	+	x^3	+	$4x^2$
	x^8	+	$4x^4$	–	$4x^2 + 0$
+	$x^7 + x^5$	–		–	
	$x^{8 + x7 + x5}$	+	6x4	–	$x^3 + 0$

Hence, the perimeter of the triangle is $x^8 + x^7 + x^5 + 6x^4 + x^3 + 0$

2. Perimeter of a triangle = Sum of its sides

$= 3(3x^2 - y^2) + (4x^2 - 7xy + 4y^2) + (-3x^2 + 7xy + 8y^2)$

$3x^2 - y^2$

$4x^2$

3. Perimeter of the rectangle = 2(Length + Breadth)

$2((x^2 + 3y^2) + (x^3 - y^2))$

$= 2(x^2 + x^3 + 3y^2 - y^2) = 2(x^2 + x^3 + 2y^2)$

$= 2x^2 + 2x^3 + 4y^2$

Hence, the perimeter of the rectangle is $2x^2 + 2x^3 + 4y^2$.

4. (a)

–	3x	+	4z	
–	9x	–	7z	
+		+		
	6x	+	11z	

(b)

+	14r	–	30s	
+	16r	+	12s	
–		–		
–	2r	–	42s	

(c)

	m^2	–	9		
+	$3m^2$	+	3	+	6m
–		–		–	
–	$2m^2$	–	12	–	–6m

(d)

	9a	+	8b	–	9c
+	3a			–	4c
–				+	
	6a	+	8b	–	5c

5.

x^4	+	$3x^2$	–	4x	+	4
	+	$4x^2$	–	3x	–	7
	–		–		+	
x^4	–	x^2	–	7x	+	11

6.

$7x^2$	–	5x	+	70
$5x^2$	–	4x	+	30
–	+		–	
$2x^2$	–	x	–	40

7.

$8x^3$	+	$8x^2$	+	7x	–	3
x^3	+	$8x^2$	–	7x	+	7
–		–		–		–	
$7x^3$	+	0	+	0	–	10

8

		$5x^2$	+	3x	+	7
$2x^3$			–	2x	+	5
–			+		–	
–	$2x^3$	+	$5x^2$	+	5x	+	2

$2x^3 - 2x + 5$ is smaller than $7 + 5x^2 + 3x$ by $-2x^3 + 5x^2 + 5x + 2$

9.

$8x^2$	–	$9y^2$
$3x^2$	+	$2y^2$
–	+	
$5x^2$	–	$7y^2$

$8x^2 - 9y^2$ is larger than $3x^2 - 2y^2$ by $5x^2 - 7y^2$.

10.

$3x^2$	+	$4x$	+	1
$2x^2$	–	$4x$	–	35
+		+		–
x^2	+	$8x$	–	34

$x^2 + 8x + -34$ should be taken by $3x^2 + 4x + 1$ to get $-2x^2 - 4x + 35$.

11. Cost of shirt: ₹5 × 2

Cost of belt: ₹2x – 10

Total money spent: ₹(5x + 20) + (2x – 10)

= ₹7x + 10

Hence, total money spent by Deepa is ₹7x + 10

Exercise 9.3

1. (a) y^3

(b) $(-a)^2 = a^2$

(c) $b^{3+2} = b^5$

(d) $2 \times a \times b \times 2 \times b = 2 \times 2\ a \times a \times b \times b = 4a^2\ b^2$

(e) $4abc \times 5abc = 4 \times 5 \times a \times b \times c \times a \times b \times c = 2a\ a^2b^2c^2$

(f) $2a^2\ b^3 \times 4a^3\ b^2 = 2 \times a \times a \times b \times b \times b \times 4 \times a \times a \times a \times b \times b = 8a(2 + 3)\ b(3 + 2) = 8a^5\ b^5$

2. (a) $(4x^2y) \times 6x$

$4 \times x \times x \times y \times 6 \times x$

$24x^{2+1} \times y = 24x^3y$

(b) $(\sqrt{2x})\ (\sqrt{2x})$

$(\sqrt{2x})^2$

$= 2x$

(c) $6x^2y\ (-4xy)$

$= 6 \times x \times y\ x - 4 \times x \times y = 6x\text{-}4 \times x \times x \times x \times y \times y$

$= -24x(2 + 1)\ (1 + 1) = -24x^3y^2$

(d) $(ab)\ (4a^2\ b)\ (5ab^2)$

$a \times b \times 4 \times a \times a \times b + 5 \times a \times b \times b$

$= 4 \times 5 \times a \times a \times a + b \times b \times b \times b$

$= 20\ a^{(1+2+1)}\ b^{(1+1+2)} = 20a^4b^4$

(e) $(a + 2)\ (a + 2)$

$a \times a + 2 \times a + 2 \times a + 2 \times 2$

$= a^2 + 2a + 2a + 4$

$= a^2 + 4a + 4$

(f) $(6a - 9b)\ (6a - 9b)$

$6a \times 6a + 6a \times -9b + -9b \times 6a + -9b \times -9b$

$36a^2 - 54ab - 54ab + 81b^2$

$36a^2 + 81b^2 - 108ab$

3. (a) $a(a - b) = a \times a + a \times -b$

$= a^2 - ab$

(b) $2(x + 3) = 2 \times x + 2 \times 3 = 2x + 6$

(c) $5(x^2 - y^2) = 5 \times x^2 + 5x - y^2$

$= 5x^2 - 5y^2$

(d) $3x^2y\ (4x + 5y)$

$3x^2y \times 4x + 3x^2 \times 5y$

$12x^3y + 15x^2y^2$

(e) $3ab(a^2b - ab^2)$

$3ab\ (a^2b) + 3ab\ (-ab^2)$

$3a^3b^2 - 3a^2b^3$

(f) $5a^2\ b^3\ (4a^3b + 2ab^3)$

$= 5a^2b^3\ (4a^3b) + 5a^2b^3\ (2ab^3)$

$= 2a^5b^4 + 10a^3b^6$

4. (a) $(y + 2)\ (y - 4)$

$y \times y + y \times -4 + 2 \times y + 5x - 4$

$y^2 - 4y + 2y - 8$

$= y^2 - 2y - 8$

(b) $(x - 7)\ (x - 6)$

$x \times x + x \times -6 - 7 \times x - 7 \times -6$

$x^2 - 6x - 7x + 42$

$x^2 - 13x + 42$

(c) $(x^2 + 5)\ (x^2 + 10)$

$x^2 \times x^2 + x^2 \times 10 + 5 \times x^2 + 5 \times 10$

$(x)^{2+2} + 10x^2 + 5x^2 + 50$

$= x^4 + 10x^2 + 5x^2 + 50$

$= x^4 + 15x^2 + 50$

(d) $(7x + 3y)\ 2x - 5y)$

$7x \times 2x + 7x \times -5y + 3y \times 2x + 3y \times -5y$

$14x^2 - 35xy + 6xy - 15y^2$

$= 14x^2 - 15y^2 - 29xy$

(e) $(2x^2y - 3y)\ (3xy - x)$

$(2x^2y - 3y)\ 3xy) + (2x^2y - 3y)\ (-x)$

$6x^3y^2 - 9xy^2 - 2x^3y + 3xy$

$6x^3y^2 - 2x^3y - 9xy^2 + 3xy$

(f) $(x - y)\ (x - 2y)$

$(x \times x + x \times -2y) + (-y \times x - y \times -2y)$

$x^2 - 2xy - xy + 2y^2$

$x^2 + 2y^2 - 3xy$

5. (a) $(5 - 2d - d^2)\ (3 - 2d)$

$(5 - 2d - d2)\ (3) + (5 - 2d - d^2)\ (-2d)$

$15 - 6d - 3d^2 - 10d + 4d^2 + 2d^3$

$2d^3 + d^2 - 16d + 15$

(b) $(a^2 + ab + b^2)\ (a - b)$

$(a^2 + ab + b^2)\ (a) + (a^2 + ab + b^2)\ (-b)$

$a^3 + a^2 + b + ab^2$

$-a^2b - ab^2 + b^3$

$= a^3 + b^3$

(c) $(x^2 + x + 1)\ (1 - x)$

$(x^2 + x + 1)\ (1) + (x^2 + x + 1)\ (-x)$

$x^2 + x + 1 - x^3 - x^2 - x$

$-x^3 + 1$

(d) $(a^2\ b^2 - 2ab + 4)\ (a + 2)$

$(a^2\ b^2 - 2ab + 4)\ (a) + (a^2 + b^2 - 2ab + 4)\ (2)$

$a^3\ b^2 - 2a^2b + 4a + 2a^2b^2 - 4ab + 8$

$a^3\ b^2 + 2a^2b^2 - 2a^2b - 4ab + 4a + 8$

(e) $(x^2 - y^2)\ (4x^3 - y^3)$

$= x^2(4x^3 - y^3) - y^2(4x^3 - y^3)$

$= 4x^5 - x^2y^3 - 4x^3y^2 + y^5$

$= 4x^5 + y^5 - x^2y^3 - 4x^3y^2$

(f) $(x^2 + y^2)\ (x^2 + xy + y^2)$

$x^2\ (x^2 + xy + y^2 + (y^2)\ (x^2 + xy + y^2)$

$x^4 + x^3y + x^2y^2 + x^2y^2 + xy^3 + y^4$

$= x^4 + y^4 + 2x^2y^2 + x^3y + xy^3$

(g) $(3x + 4y + 5z)\ (4x + 3y + 4z)$

							$3x$	$+$	$4y$	$+$	$5z$	
$\times$							$4x$	$+$	$3y$	$+$	$4z$	
							$12xz$	$+$	$16yz$	$+$	$20z^2$	
			$9xy$	$+$	$12y^2$	$+$	$12y^z$	$+$	$15yz$		$\times$	
$+$	$12x^2$	$+$	$16xy$				$20x^z$		$\times$		$\times$	
	$12x^2$	$+$	$25xy$	$+$	$12y^2$	$+$	$32x^z$	$+$	$31y^z$	$+$	$20z^2$	

$12x^2 + 12y^2 + 20z^2 + 25xy + 32xz + 31y^z$

(h)

							$4x$	$-$	$2y$	$+$	z	
$\times$							$5x$	$-$	$5y$	$+$	z	
							$4xz$	$-$	$2yz$	$+$	z^2	
		$-$	$20xy$	$+$	$10y^2$	$+$		$-$	$5yz$		$\times$	
$+$	$20x^2$	$-$	$10xy$				$5xz$		$\times$		$\times$	
	$20x^2$	$-$	$30xy$	$+$	$10y^2$	$+$	$9xz$	$-$	$7yz$	$+$	z^2	

$= 20x^2 + 10y^2 + z^2 - 30xy + 9xz - 9yz$

(i)

			1	$+$	x	$+$	x^2	
$\times$					1	$-$	$4x$	
			$-4x$	$-$	$4x^2$	$-$	$4x^3$	
$+$	1	$+$	x	$+$	x^2	$+$	$\times$	
	1	$-$	$3x$	$-$	$3x^2$	$-$	$4x^3$	

$= -4x^3 - 3x^2 - 3x + 1$

Exercise 9.4

1. (a) $r^{100 - 2} = r^{98}$

(b) $s^{6 - 3} = s^3$

(c) $t^{20 - 4}\ y^{5 - 3} = t^{16}y^2$

(d) $8x^{9 - 2}\ y^{5 - 2} = 8x^7y^3$

(e) $3a^{4 - 4}\ b^{6 - 2}\ c^{88}$

$= 3b^4$

(f) $\dfrac{-6x - 6x - 6}{-6 \times -6 \times -6} = 1$

2. (a) $\dfrac{9x}{9} = X,\ \dfrac{9y}{9} = y$

$\dfrac{9x + 9y}{9} = x + y$

(b) $\dfrac{7a + 8b}{8} = \dfrac{7a}{8} - \dfrac{8b}{8} = \dfrac{7a}{8} - b$

(c) $\frac{100x - 60y}{-5} = \frac{100x}{-5} + \frac{-60y}{-5} = -20x + 15y$

(d) $\frac{-6y^2}{3} + \frac{24z^2}{3} = -2y^2 + 8z^2$

(e) $\frac{64y^4}{4y^3} + \frac{8y^3}{4y^3} = 16y^{4-3} + 2y^{3-3}$

$= 16y + 2$

(f) $\frac{-14x^{12}y^2 + 8x^2}{2x^2} = -7x^{12-2}y^2 + 4x^{2-2} =$

$-7x^{10}y^2 + 4z$

(g) $\frac{36q^5}{-12q^3} + \frac{48q^9}{-12q^3} = -3q^{5-3} + (-7q^{9-1})$

$= -3q^2 - 4q^6$

(h) $\frac{-14^{12}\,c + (8a^2c)}{2a^2c} = \frac{-14a^{12}c}{2a^2c} + \frac{8a^2c}{2a^2c}$

$= -7a12 - 3c + -1 + 4a^{2-2}c^{-c}$

$= -7a^{10} + 4$

(i) $\frac{-81a^9b^{14} + 27a^5b^3}{9a^3b^2} = -9a^{9-3}b14{-}2 + 3a^{5-}$

$^3b^{3-2}$

$= 9a^6\,b^{12} + 3a^2b$

(j) $\frac{-15x3}{3x} + \frac{12 \times 7}{3x} = -5\,x^3 - 1 + 4x^{7-1}$

$= -5x^2 + 4x^6$

(k) $\frac{100k^5}{4k^3} + \frac{8k^6}{4k^3} = 20k^{5-3} + 2k^{6-3}$

$= 25k^2 + 2k^3$

(l) $\frac{34y^3z^2}{17y^2z^2} + \frac{51y^5z^3}{17y^2z^2}$

$2y^{3-2}\,z^{2-2} + 3y^{5-2}\,z^{3-2} = 2y + 3y^3z$

3. Cost of 5x books = $(10x^2 + 20x)$

Cost of 1 book = $₹\left(\frac{10x^2 + 20x}{5}\right)$

$= ₹\left(\frac{10x^2}{5x} + \frac{20x}{5x}\right) = ₹2x + 4x$

Hence, Cost of 1 book is ₹2x + 4x

4. Let the missing side be breadth.

Area of reactangle = Length × Breadth

$21x^2 - 7x = 7x \times B$

$B = \frac{21x^2 - 7x}{7x} = \frac{21x^2}{7x} = \frac{-7x}{7x}$

Hence, the other side is 3x – 1

5. Speed = $\frac{\text{Distance}}{\text{Time}}$

Distance covered by train in 10 hours

$= 30a^2 + 15a^{-1} - 10$

Average speed of train = $\frac{30a^2 + 15a - 10}{10}$

$= 3a^2 + 1.5^{a-1}$

Hence, the average speed of train is $3a^2 + 1.5^{a-1}$

Review Exercise

1. **Monomials:** Algebraic expressions with only number one term with number negative exponent for any variable in the term.

(a) $a^2 + 7a + 12$

(b) $b^{2/3} + b^3$

(c) x^3

2. Monomials: Algebraic expressions with only number one term with number negative exponent for any variable in the term.

(a) 2 (b) 3

(c) 6 + 5 = 11 (d) 12

3.

x^4	+	$3x^2$	–	4x	+	4
	+	$4x^2$	+	3x	–	7
	–		–		+	
x^4	–	x^2	–	7x	+	11

$= x^4 - x^2 - 7x + 11$

4. (a) $a(a - b)$

$= a \times a + ax - b$

$= a^2 - ab$

(b) $2(x + 3)$

$2 \times x + 2 \times 3$

$= 2x + 6$

(c) $5(x^2 - y^2)$

$5 \times x^2 + 5x - y^2$

$= 5x^2 - 5y^2$

(d) $3x^2y\,(4x + 5y)$

$3x^2y \times 4x + 3x^2y \times 5y$

$12x^3y + 15x^2y^2$

5. $9x^2 + 24x + 16$, $x = 12$

$9 \times (12)^2 + 24 \times 12 + 16$

$9 \times 144 + 288 + 16$

$1296 + 304$

$= 1600$

6. $(36x^2 + 25y^2 - 60xy)$, $x = \frac{2}{3}$, $y = \frac{1}{5}$

$36 \times \frac{2}{3} \times \frac{2}{3} + 25 \times \frac{1}{5} \times \frac{1}{5}$

$-60 \times \frac{2}{3} \times \frac{1}{5}$

$= 16 + 1 - 8$

$= 9$

7. (a) $\left(x + \frac{1}{x}\right) = 4$

$\left(x + \frac{1}{x}\right)^2 = x^2 + \frac{1}{x^2} + 2 \times x \times \frac{1}{x}$

$\left(x + \frac{1}{x}\right)^2 = x^2 + \frac{1}{x^2} + 2$

$(4)^2 = x^2 + \frac{1}{x^2} + 2$

$16 - 2 = x2 + \frac{1}{x^2}$

$x^2 + \frac{1}{x^2} = 14$

(b) $2x + x^3 + \frac{1}{x^2}$

$= x^2 + \frac{1}{x^2} + 2$

$x + \frac{1}{x} = 4$

Squaring both the sides

$\left(x + \frac{1}{x}\right)^2 = (4)^2$

$= x^2 + \frac{1}{x^2} + 2 = 16$

$x^2 + \frac{1}{x^2} = 16 - 2$, $x^2 + \frac{1}{x^2} = 14$

Again, squaring both the sides

$\left(x^2 + \frac{1}{x^2}\right)^2 = (14)^2$

$x^4 + \frac{1}{x^4} + 2 = 196$

$x^4 + \frac{1}{x^4} = 194$

8. $x + y = 12$, $xy = 14$

Squaring both the sides

$(x + y)^2 + (12)^2$

$X^2 + y^2 + 2 \times x \times y = 144$

$x^2 + y^2 + 2 \times 14 = 144$

$x^2 + y^2 + 28 = 144$

$x^2 + y^2 = 166$

9.

$$x + 1 \overline{)2x^2 + 3x + 1} \quad (2x + 1)$$

$2x2 + 2x$

$- \quad -$

$x + 1$

$x + 1$

$- \quad -$

0

$= \frac{2x^2 + 3x + 1}{x + 1} = 2x + 1$

10. (a) $\left(\frac{1}{x} + \frac{1}{y}\right)\left(\frac{1}{x} - \frac{1}{y}\right) =$

$\frac{1}{x} \times \frac{1}{x} \times \frac{1}{x} \times \frac{1}{y} + \frac{1}{y} + \frac{1}{x} + \frac{1}{y} \times \frac{-1}{y}$

$= \frac{1}{x^2} - \frac{1}{xy} + \frac{1}{xy} - \frac{1}{y^2}$

$= \frac{1}{x^2} - \frac{1}{y^2}$

(b) $\left(2a + \frac{3}{b}\right)\left(2a - \frac{3}{b}\right)$

$= 2a \times 2a + 2a \times - \frac{3}{b} + \frac{3}{b} \times 2a + \frac{3}{b} \times \frac{-3}{b}$

$= 4a^2 - \frac{6a}{b} + \frac{6a}{b} + \frac{-9}{b^2}$

$= 4a^2 - \frac{9}{b^2}$

(c) $\left(5x^2 + \frac{3}{4}y^2\right)\left(5x^2 - \frac{3}{4}y^2\right)$

$5x^2 \times 5x^2 + 5x^2 \times \frac{3}{-4}y^2 + \frac{3}{4}y^2 \times 5x^2 + \frac{3}{4}$

$y^2 \times \frac{3}{4}\ y^2$

$= 25x^4 - \frac{15x^2y^2}{4} + \frac{15x^2y^2}{4} - \frac{9}{16}y^4$

$= 25x^4 - \frac{9}{16}y^4$

(d) $(8 + x)\ (8 - x) = 8 \times 8 + 8x - x + 8 \times x$

$= 64 - 8x + 8x - x^2 + x \times -x$

$= -x^2 + 64$

Multiple Choice Questions

1. (c) Monomial

2. (b) Trinomial

3. (b) 0

4. $(x + 5)\ (x - 3) = x \times x + x \times -3 + 5 \times x$

$= x^2 - 3x + 5x - 15 + 5 \times -3$

$= x^2 + 2x - 15$

Answer: (d) $x^2 + 2x - 15$

5. $(x - 6)\ (x - 6)$

$(x - 6)^2 = x^2 - 6^2 - 2x \times x - 6$

$= x^2 - 12x + 36$

Answer: (d) x2 − 12x + 36

6. $(a + 1)\ (a - 1)\ (a^2 + 1)$

$= (a^2 - a + a - 1)\ (a^2 + 1)$

$= (a^2 - 1)\ (a^2 + 1) = a^2 \times a^2 + a^2 \times 1a - a^2 - 1$

$= a^4 + a^2 - a^2 - 1$

$= a^4 - 1$

Answer: (c) $a^4 - 1$

7. $(82)^2 - (18)^2$

6724 − 324

= 6400

Answer: (c) 6400

8. $4x^2 + 20x + 25,\ x = 10$

$4 \times 10 \times 10 + 20 \times 10 + 25$

= 400 + 200 + 25

= 625

Answer: (c) 625

9. $(a + b) = 12,\ ab = 14$

Squaring, both the sides

$(a + b)^2 = (12)^2$

$a^2 + b^2 + 2 \times a \times b = 144$

$a^2 + b^2 + 2 \times 14 = 144$

$a^2 + b^2 = 144 - 28$

$a^2 + b^2 = 116$

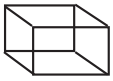
Answer: (c) 116

10 Visualizing Solid Shapes

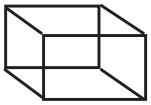
Exercise 10.1

1. (a) Cube (b) Sphere
(c) Cone (d) Cylinder

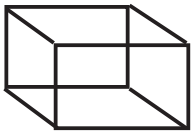
2. (a) each side 2cm

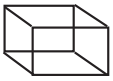


(b) each side 4cm

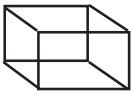


(c) each side 5cm

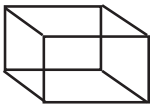


3. (a) 

Each side 3cm

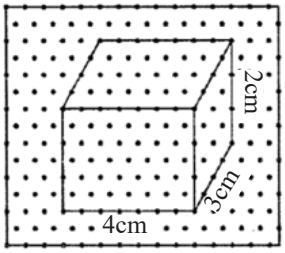
(b) 

Each side 4cm

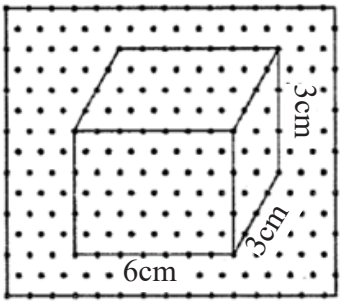
(c) 

Each side 4.5cm

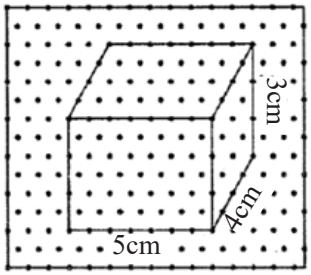
4. (a) 4cm × 3cm × 2cm



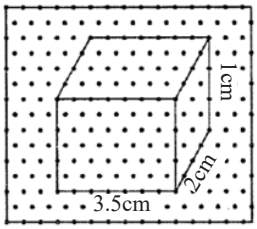
(b) 6cm × 3cm × 3cm



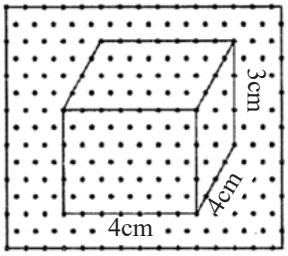
(c) 5cm × 4cm × 3cm



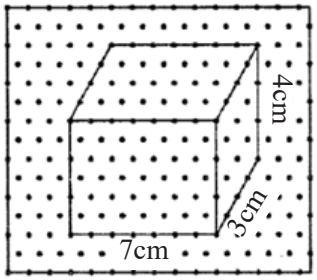
5. (a) 3.5cm × 2cm × 1cm



(b) 4cm × 4cm × 3cm



(c) 7cm × 3cm × 4cm



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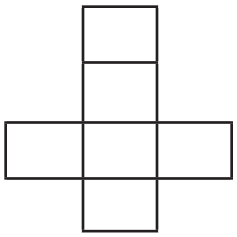
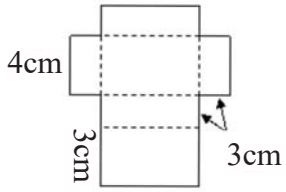


each side = 4cm

7.



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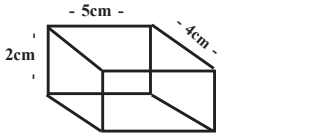

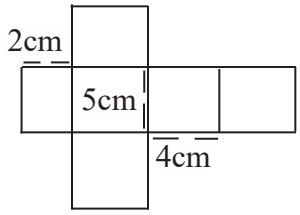

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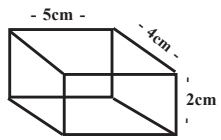
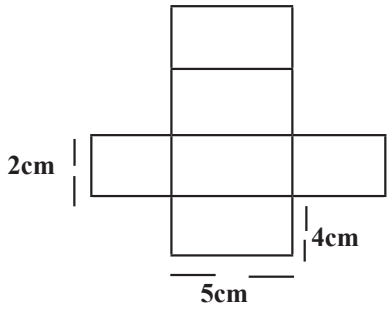




Exercise 10.2

1. Answer: (a) 6

(b) 6

(c) 6

(d) 9

(e) 12

(f) 4

2. Answer: (a) 12

(b) 18

(c) 12

(d) 6

(e) 8

(f) 12

3. Answer: (a) 1

(b) 5

(c) 2

(d) 9

(e) 8

(f) 12

4. (a) A prism whose base is polygon of "n" sides will have

1. n + 2 faces – n lateral faces(rectangles), one top and one bottom.

2. 3n edges – n on top, n on bottom, n on lateral surfaces.

3. 2n vertices – n on top and n on bottom.

(b) A pyramid whose base is polygon of "n" sides will have

1. n+1 faces – n lateral faces(triangles) and one bottom

2. 2n edges – n on bottom, n on lateral surfaces

3. n + 1 vertices – 1 on top and n on bottom surface

5. Euler's formula:

$V - E + F = 2$

$V = 4$

$F = 4$

$E = ?$

$4 - E + 4 = 2$

$8 - 2 = E$

$E = 6$

There will be 6 edges

6. As given in question that a polyhedron has 30 edges and 20 vertices.

We have to find the faces of polyhedron.

We know that,

By Euler's formula:

$F + V - E = 2$ Where, F is faces of polyhedron.

V is vertices of polyhedron.

E is the edges of polyhedron.

$F + 20 - 30 = 2$

$F - 10 = 2$

$F = 2 + 10$

$\therefore F = 12$

Thus the the faces of polyhedron will be 12.

7. $V = F + F = 2$

$= V - 30 + 20 = 2$

$V - 10 = 2$

$= V = 12$

8. No. of edges = 3n

No. of vertices = 2n

No. of faces = n + 2

given: $3n = 24 \quad n - \frac{24}{3} = 8$

No of faces = n+2=8+2=10

9.

s.No	Name of solid	Number of faces (F)	Number of Vertices (V)	Number of Edges (E)	(F+V–E) =2
1	Cube	6	8	12	6 + 8 – 12 = 2
2	Pentagonal Prism	7	10	15	7 + 15 – 15 = 2
3	Tringular Prism	5	6	9	5 + 6 – 9 = 2
4	square Pyramid	5	5	8	5 + 5 – 8 = 2
6	Triangular Pyramid	4	4	6	4 + 4 – 6 = 2

Multiple Choice Question

1. Answer: (a) rectangular prism

2. Answer: (c) 4

3. Answer: (b) 18

4. Answer: (d) 9

5. Answer: (b) square

6. Answer: (c) cone

7. Answer: (a) cuboid

8. Answer: (b) 5

9. Answer: (c) polyhedron

10. Answer: (a)regular octahedron

11 Mensuration

Exercise 11.1

1. **(a)** (i) Surfaces

1. WXYZ
2. PQRS
3. QPWX
4. SRYZ
5. QRYX
6. PSZW

(ii) Surfaces

1. ABOP
2. CDSR
3. BCRQ
4. ADSP
5. PQRS
6. ABCD

(b) (i) PQ, QX, WX, PW, PS, SZ, WZ, QR, RY, XY, YZ, RS

(ii) AB, BQ, QP, PA, RC, CD, DS, SR, PS, QR, AD, BC

(c) (i) P, Q, X, W, S, Z, R, Y

(ii) A, B, Q, P, C, D, S, R

Exercise 11.2

1. Total Surface area of cuboid = 2(lb + bh + hl)

(a) $2(6 \times 3 + 3 \times 2 + 2 \times 6)cm^2$

$= 2(18 + 6+ 12)cm^2$

$= 2(36)cm^2$

$= 72cm^2$

(b) $2(3 \times 1 + 1 \times 1 + 1 \times 3)m^2$

$= 2(3 + 1 + 3) = 2(7)m^2$

$= 14cm^2$

(c) $2(46 \times 46 + 46 \times 46 + 46 \times 46)$

$= 2(2116 + 2116 + 2116)$

$= 12696cm^2$

(d) $2(8 \times 4 + 4 \times 2 + 2 \times 8)m^2$

$2(32 + 8 + 16)m^2$

$= 2(56)m^2 = 112m^2$

2. Area of room = Area of cuboid

$= 2(5 \times 4 + 4 \times 3 + 3 \times 5)m^2$

$= 2(20 + 12 + 15)m^2 = 2(47)m^2 = 94m^2$

Cost of painting $1m^2$ = ₹7.50

Cost of painting $94m^2$ = ₹(7.50×94) = ₹705

Hence, the cost of painting room is ₹705.

3. Total surface area of cuboid = 2(lb + bh + hl)

$= 2(25 \times 20 + 20 \times 15 + 15 \times 25)cm^2$

$= 2(500 + 300 + 375)cm^2$

$= 2(1175)cm^2 = 2350cm^2$

4. Area of cubical box = Area of cube = $6a^2$

$= 6 \times (70)^2 = (6 \times 4900)m^2$

$= 29400m^2$

5. Volume of 5cm cube = $a^2 = (5)^3 = 125cm^3$

Volume of 20cm cube = $4a^3 = (20)^3 = 8000cm^2$

Number of 5cm cubes that can be obtained from cube with 20cm edge = $\frac{8000cm^3}{125cm^3}$ = 64

Hence, 64 cubes can be obtained from cube with 20cm edge.

6. The length, breadth, and height of a room are 5 m, 4 m, and 3 m respectively.

Since the four walls and ceiling are to be painted so, it has 5 faces only, excluding the base.

Hence, the area of the room to be painted can be obtained by adding the area of the ceiling to the lateral surface area of the cuboidal room.

Lateral surface area of cuboid = 2(l + b)h

The length, breadth and height of a room are 5 m, 4 m, and 3 m respectively. Find the cost of painting the walls of the room and ceiling at the rate of ₹7.50 per m^2.

The cost of painting the walls of the room and ceiling will be equal to the area of the room to be painted multiplied by the rate of the painted per m^2.

Length, l = 5 m

Breadth, b = 4 m

Height, h = 3 m

Surface area of 4 faces = Area of the 4 walls and ceiling = 2(l + b)h

2(l + b)h + 2 × (5 m + 4 m) × 3 m

= 2 × 9 m × 3 m

= 54 m^2

The cost of whitewashing the walls of the room and ceiling = Rate × Area

= ₹60/m^2 × 54 m^2

= ₹3240

Thus, the cost of whitewashing the walls of the room and the ceiling is ₹3240.

7. Length of swimming pool = 30m

Breadth of swimming pool = 20m

Height of swimming pool = 1.5m

The total surface area of pool= Lateral surface area + Area of base

= 2h(l + b) + (l × b)

= 2 × 1.5(30 + 20) + (30 × 20)

= 750m^2

Side of square tile a = 50cm = 0.5m

Area of 1 tile = a × a = 0.5 × 0.5 = 0.25m^2

$$\text{Number of tiles} = \frac{\text{Ara of pool}}{\text{Area of tile}}$$

$$= \frac{750}{0.25}$$

Number of tiles = 3000

Therefore 3000 tiles are required.

8. Length of the box = 20cm

Breadth of the box = 15cm

Height of the box = 10cm

Total Surface area = 2(lb+bh+lh)

=2(20 × 15 + 15 × 10 + 10 × 20)

=2(300 + 150 + 200) = 2 × 650 = 1300sq.cm

Area of the lid = length × breadth = 20 × 15 = 300sq.cm

Area of the box without lid = 1300 − 300 = 1000sq.cm

9. Total Surface of a cube without lid = $5a^2$

$a^2 = \frac{180}{5}$ = 36sq.cm

= side = 6cm

= Dimension of the box = 6 × 6 × 6

10. We know that the total surface are of the cube = $6a^2$

Given, the surface area of a cube is 150^2

So,

$150 = 6a^2$

$= a^2 = \frac{150}{6} = 25$

= a = 5

Hence, the side of the cube is 5cm.

Exercise 11.3

1. (a) 1*l* = 1000m*l* = 1000cm^3

(b) 5*l* = 5dm^3

(c) 10000cm^3 = 10m^3

(d) 5dm^3 = 5000cm^3

(e) 5k*l* = 5000*l*

(f) 1000*l* = 1m^3

Exercise 11.4

1. Volume of cuboid = length × Breadth × Height

(a) Volume = (5 × 2 × 3)m^3

= 30m^3

(b) Volume = (15 × 5 × 1)m^3

= 75m^3

(c) Volume = (46 × 46 × 46)cm^3

= 97336cm^3

(d) Volume = (31 × 21 × 10)m^3

= 6510m^3

(e) Volume = (62 × 52 × 42)cm^3

= 135408cm^3

2. (a) Volume of cuboid = length × Breadth × Height

$576cm^3 = 12 \times 8 \times h$

$576 = 96 \times h$

$h = \frac{576}{96}$

$h = 6cm$

(b) Volume of cuboid = length × Breadth × Height

$144m^3 = l \times 3.2 \times 4.5$

$l = \frac{144}{14.4}$

$l = 10m$

(c) Volume of cuboid = length × Breadth × Height

$V = 12 \times 30 \times 12$

$V = 4320cm^3$

(d) Volume of cuboid = length × Breadth × Height

$h = \frac{168}{56}$

$h = 3m$

(e) Volume = $54dm^3$

$1dm^3 = 1 \times 1000cm^3$

$54dm^3 = 54 \times 1000cm^3$

$= 54000cm^3$

Volume of cuboid = length × Breadth × Height

$54000cm^3 = 60 \times 45 \times h$

$h = \frac{54000}{2700}$

$h = 20cm$

3. $l = 2.4m$, $b = 1.6m$, $h = 1.2m$

Colume of water tank

$= (2.4 \times 1.6 \times 1.2)m^2$

$= 4.608m^3$

$1m^3 = 1000l$

$4.608m^3 = (4.60 \times 1000)l$

$= 4608l$

Hence, the water tank can hold $4608l$ of water.

4. Volume of Rectangle tank = $l \times b \times h$

$189kl = 7 \times b \times 4.5$

$1kl = 1m$, $189kl = (189m) = 189000l$

$189 = b \times 31.5$

$b = \frac{189}{31.5}$, $b = 6m$

Hence, the breadth of the rectangular tank is 6m.

5. Volume of cuboidal vessel = $l \times b \times h$

$960cm^3 = 10 \times 8 \times h$

$h = \frac{960}{80}$, $= 12cm$

Hence, the height required for cuboidal vessel is 12cm.

6. Total surface area of cube = $6a^2$

$54cm^2 = 6a^2$, $a^2 = 9$, $a = 3cm$

Volume of cube = $(a)^3 = (3)^3 = 27cm^3$

7. Volume of woodent plank = Length × Breadth × Height

$6.3cm^3 = l \times 3 \times 30$

$l = \frac{6.3}{90}cm = 0.07cm$

Hence, the length of wooden plank is 0.07cm.

8. Volume of cube = a^3

$1000cm^3 = a^3$

$a = 10cm$

T.S.A = $6a^2$

$= (6 \times 10 \times 10)cm^2$

$= 600cm^2$

Exercise 11.5

1. Diameter = 3.5m (so radius = 1.75) and height = 6m

Lateral surface = $2\pi rh = 2x \frac{22}{7} \times 1.75 \times 6 = 66m^2$

(If we use 3.14 then it goes like this 2x 3.14x 1.75x 6 = 65.94)

Volume = $\pi r^2 h = \frac{22}{7} \times 1.75 \times 1.75 \times 6 = 57.75m^2$

(If we use 3.14 well then again for money it goes like this $3.14 \times 1.75 \times 1.75 \times 6 = 57.69$)

2. TSA of cylinder = $2\pi r(h+r)$

$= 2 \times \frac{22}{7} \times \frac{7}{2} (9 + 3.5)$

$= 22 \times 12.5$

$= 275\ m^2$

Cost of 1 m^2 = rs35

Cost of 275 m^2: 275 × 35 = ₹9625.

3. Diameter = 3m

Radius = $\frac{3}{2}$m

Height = 7m

volume of cylinder or well = $\pi r^2 h$

$= \frac{22}{7} \times \frac{3}{2} \times \frac{3}{2} \times 7 = 49.5 m^3$

$(1m^3 = 1kl^3)$

So, $49.5m^3 = 49.5kl^3$

Hence, the quantity of water in the well is 49.5kl.

4. Circumference of base of right circular cylinder = 176cm

Height = 1m = 100cm

Let radius of the right circular cylinder be 'r'cm

so, circumference of its base = $2\pi r$

$= 176cm = 2 \times \frac{22}{7} \times r$

$88cm = \frac{22}{7} \times r$

$= r = 28cm.$

To calculate lateral surface are of the cylinder

$= 2\pi rh = 2 \times \frac{22}{7} \times 28 \times 100 = 17600 cm^2$

5. Let r be the radius of the cross-section of cylinder and h be the height of the cylinder.

According to question the rectangular sheet is rolled along its length

= Circumference of crossection of cylinder = Length of rectangular sheet

$= 2\pi r = 44cm = r = \frac{44cm}{2\pi}$

$r = \frac{(44cm \times 7)}{(2 \times 22)}$

$r = 7cm$

Also, Height of cylinder = breadth of rectangular sheet = 16cm

Thus,

Volume of cylinder = $\pi r^2 h$

$\frac{22}{7} \times 7 \times 7 \times 16$

$= 22 \times 7 \times 16$

Volume of cylinder = $2464 cm^3$

6. Pillar is in the form of a cylinder

CSA of pillar = $2\pi rh$

Where, r = 21cm

h = 3m = 300cm

C.S.A = $2\pi rh$

$= 2 \times \frac{22}{7} \times 21 \times 300 = 39600 cm^2$

7. The volume of a cylinder is $29571.2m^3$ and Lateral suface are of a cylinder is $4220.16m^2$.

Step-by-step explanation:

Formula

Where r is the radius of the cylinder .

As given

The base area of the cylinder is 616 square metre.

(As the base of the cylinder in the form of circle.)

r = 14 m (Approx)

Formula

Where r is the radius and h is the height .

As given

A tank is in the form of a right circular cylinder its height is 48 m .

h = 48 m

r = 14 m

Putting all the values in the formula

Volume of a cylinder = 29541.12 m^3 (Approx)

Formula

Lateral surface area of a cylinder = 2 × 3.14 × 14 × 48= 4220.16 m^2

Therefore the volume of a cylinder is 29541.2 m^3 and Lateral surface area of a cylinder is 4220.16 m^2.

Volume of cyclinder will $4224 cm^3$ if π will be taken as $\frac{22}{7}$.

Exercise 11.6

1. Length of parallel sides is 24cm and 20 cm

Height (h) = 15 cm

We know that area of trapezium is $\frac{1}{2}$ × (sum of parallel sides) × height

Therefore, Area of trapezium = $\frac{1}{2}$ × (24 +20) × 15 =330 cm^2.

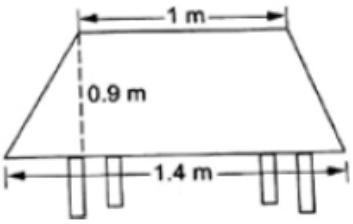
2. Length of parallel sides is 38.7cm and 22.3 cm

Height (h) = 16 cm

We know that area of trapezium is $\frac{1}{2}$× (sum of parallel sides) × height

Therefore Area of trapezium = $\frac{1}{2}$ × (38.7 + 22.3) × 16 = 488 cm^2.

3.



Length of parallel sides is 1m and 1.4m

Height (h) = 0.9m

We know that area of trapezium is $\frac{1}{2}$ × (sum of parallel sides) × height

Therefore Area of trapezium = $\frac{1}{2}$ × (1 +1.4) × 0.9

=1.08 m^2.

4. Length of parallel sides is 55cm and 35 cm

Area of trapezium= 1080 cm^2

Let Height (h) = y cm

We know that area of trapezium is $\frac{1}{2}$ × (sum of parallel sides) × height

Therefore Area of trapezium is $\frac{1}{2}$ × (55 + 35) × y =1080 cm2.

$\therefore \frac{1}{2} \times (90) \times y = 1080$

$= 45 \times y = 1080$

$= y = \frac{1080}{22} = 24$

∴ Distance between the parallel lines is 24 cm.

5. Let length of parallel sides be 84cm and y cm

Area of trapezium= 1586 cm^2

Let Height (h) =26 cm

We know that area of trapezium is $\frac{1}{2}$ × (sum of parallel sides) × height

Therefore Area of trapezium is $\frac{1}{2}$ × (84 +y) × 26 =1586 cm2.

$\therefore \frac{1}{2} \times (84 + y) \times 26 = 1586$

$= (84 + y) \times 13 = 1586$

$= 84 + y = \frac{1586}{13}$

$= y = 122 - 84 = 38$

∴ Length of the other parallel side is 38 cm.

6. Lengths of the parallel sides are in the ratio 4:5

Therefore let one of the side length be 4X and other side length be 5X

Area of trapezium= 405 cm^2

Let Height (h) = 18 cm

We know that area of trapezium is × (sum of parallel sides) × height

Therefore Area of trapezium is x (4X + 5X) × 18 = 405 cm^2.

$\therefore \frac{1}{2} \times (4X + 5X) \times 18 = 405$

$= (9X) \times 9 = 405$

$= 81X = 405$

$= X = \frac{405}{81} = 5$

∴ Length of the parallel sides is 4X = 4 × 5 = 20 cm and 5X = 5 × 5 = 25 cm.

Therefore lengths of the parallel sides are 20 cm, 25 cm.

7. Let length of first parallel side X

Length of other parallel side is X + 6

Area of trapezium= 180 cm^2

Let Height (h) = 9 cm

We know that area of trapezium is $\frac{1}{2}$ × (sum of parallel sides) × height

Therefore Area of trapezium is $\frac{1}{2}$ × (X + 6 +X) × 9 =180 cm^2.

$\therefore \frac{1}{2} \times (X + 6 + X) \times 9 = 180$

$= \frac{1}{2} \times (2X + 6) \times 9 = 180$

$= 2X + 6 = \frac{180}{9} \times 2$

$= 2X + 6 = 40$

$= 2X = 40 - 6 = 34$

$= X = 17$

$\therefore$ Length of the parallel sides is X=17 cm and $X + 6 = 17 + 6 = 23$ cm.

Therefore lengths of the parallel sides are 17 cm, 23 cm.

8. Let length of first parallel side X

Length of other parallel side is 2X

Area of trapezium= $9450 m^2$

Let Height (h) =84m

We know that area of trapezium is $\frac{1}{2}$ × (sum of parallel sides) × height

Therefore Area of trapezium is $\frac{1}{2} \times (X + 2X) \times 84 = 9450\ cm^2$.

$\therefore \frac{1}{2} \times (X + 2X) \times 84 = 9450$

$= (3X) \times 42 = 9450$

$= 126X = 9450$

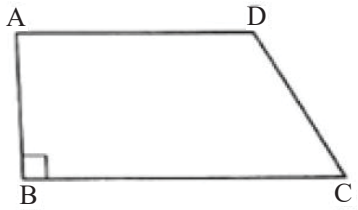
$= 2X + 6 = \frac{9450}{126} = 75$

$= X = 17$

$\therefore$ Length of the parallel sides is X=75 m and 2X = 150 m.

Therefore length of the longest is 150 m.

9.



Length of parallel sides

AD = 42 m

BC = 54 m

Given that total length of fence is 130 m

That is AB + BC + CD + DA = 130

AB + 54 + 19 + 42 = 130

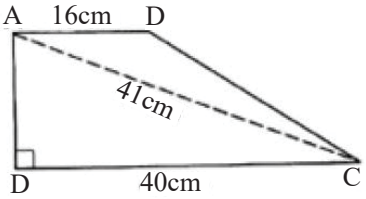
Therefore AB = 15

Height (AB) = 15 m

We know that area of trapezium is $\frac{1}{2}$ × (sum of parallel sides) × height

Therefore Area of trapezium = $\frac{1}{2} \times (42 + 54) \times 15 = 720\ m^2$

10.



AD = 16cm

BC = 40cm

AC = 41 cm

$\angle ABC = 90$

Height = AB =?

Here in ABC using Pythagoras theorem

$AC^2 = AB^2 + BC^2$

$41^2 = AB^2 + 40^2$

$AB^2 = 41^2 - 40^2$

$AB^2 = 1681 - 1600 = 81$

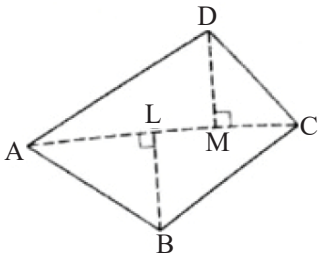
$\therefore AB = 9$

We know that area of trapezium is $\frac{1}{2}$ × (sum of parallel sides) × height

Therefore Area of trapezium = $\frac{1}{2} \times (16 + 40) \times 9 = 252\ cm^2$.

Exercise 11.7

1.



A quadrilateral ABCD

BL ⊥ AC and DM ⊥ AC

AC = 24 cm

BL = 8 cm

DM = 7 cm

Here,

Area (quad. ABCD) = area (ΔABC) + area (Δ ADC)

Area of triangle = $\frac{1}{2}$ × (base) × (height).

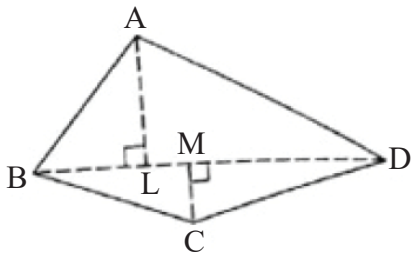
Therefore

Area of quad ABCD = $\frac{1}{2}$ × (AC) × (BL) + $\frac{1}{2}$ × (AC) × (DM)

= $\frac{1}{2}$ × (24) × (8) + $\frac{1}{2}$ × (24) × (7) = 96 + 84 = 180 cm^2

Therefore area of the quadrilateral ABCD is 180 cm^2

2.



Given: A quadrilateral ABCD

AL ⊥ BD and CM ⊥ BD

AL = 19 cm

BD = 36 cm

CM = 11 cm

Here,

Area (quad. ABCD) = area (ΔABD) + area (Δ ACD)

Area of triangle = $\frac{1}{2}$ × (base) × (height).

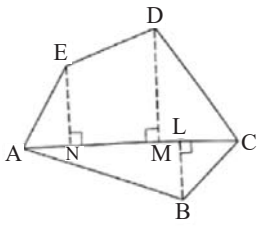
Therefore

Area of quad ABCD = $\frac{1}{2}$ × (BD) × (AL) + $\frac{1}{2}$× (BD) × (CM)

= $\frac{1}{2}$ × (36) × (19) + $\frac{1}{2}$ × (36) × (11) = 342 + 198 = 540 cm^2

Therefore area of the quadrilateral ABCD is 540 cm^2.

3.



Given: A pentagon ABCDE

BL ⊥ AC, DM and EN ⊥ AC

AC = 18 cm

AM = 14 cm

AN = 6cm

BL = 4cm

DM = 12cm

EN = 9cm

MC = AC – AM = 18 – 14 = 4 cm

MN = AM – AN = 14 – 6 = 8 cm

Here,

Area (Pent. ABCDE) = area (AEN) + area (DMC) + area (ABC) + area (Trap. DMNE)

Area of triangle = $\frac{1}{2}$ × (base) × (height).

Area of trapezium is $\frac{1}{2}$ × (sum of parallel sides) × height

Here,

Area (ΔAEN) = $\frac{1}{2}$ × (AN) × (EN) = $\frac{1}{2}$ × (6) × (9) = 27 cm^2.

Area (ΔDMC) = $\frac{1}{2}$ × (MC) × (DM) = $\frac{1}{2}$ × (4) × (12) = 24 cm^2.

Area (ΔABC) = $\frac{1}{2}$ × (AC) × (BL) = $\frac{1}{2}$ × (18) × (4) = 36 cm^2.

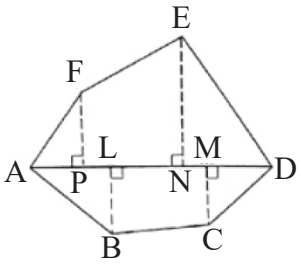
Area (Trap. DMNE) = $\frac{1}{2}$ × (DM + EN) × MN = $\frac{1}{2}$ × (12 + 9) × 8 = 84 cm^2.

Area (Pent. ABCDE) = area (ΔAEN) + area (ΔDMC) + area (ΔABC) + area (Trap. DMNE)

= 27 + 24 + 36 + 84 = 171 cm^2.

∴Area (Pent. ABCDE) = 171 cm^2.

4.



Given: A Hexagon ABCDE

BL ⊥ AD, CM and EN ⊥ AD and FP ⊥ ADcm

AP = 6cm

PL = 2cm

LN = 8cm

NM = 2cm

MD = 3cm

FP = 8cm

EN = 12cm

BL = 8cm

CM = 6cm

AL = AP + PL = 6 + 2 = 8 cm

PN = PL + LN = 2 + 8 = 10 cm

LM = LN + NM = 8 + 2 = 10 cm

ND = NM + MD =2 + 3 = 5 cm

Here,

Area (Hex. ABCDEF) = area (ΔAPF) + area (ΔDEN) + area (ΔABL) + area (ΔCMD) + area (Trap. PNEF) + area (Trap. LMCB)

Area of triangle = $\frac{1}{2}$ × (base) × (height).

Area of trapezium is $\frac{1}{2}$ × (sum of parallel sides) × height

Here,

Area (ΔAPF) = $\frac{1}{2}$ × (AP) × (FP) = $\frac{1}{2}$ × (6) × (8) = 24 cm^2.

Area (ΔDEN) = $\frac{1}{2}$ × (ND) × (EN) = $\frac{1}{2}$ × (5) × (12) = 30 cm^2.

Area (ΔABL) = $\frac{1}{2}$ × (AL) × (BL) = $\frac{1}{2}$ × (8) × (8) = 32 cm^2.

Area (ΔCMD) = $\frac{1}{2}$ × (MD) × (CM) = $\frac{1}{2}$ × (3) × (6) = 9 cm^2.

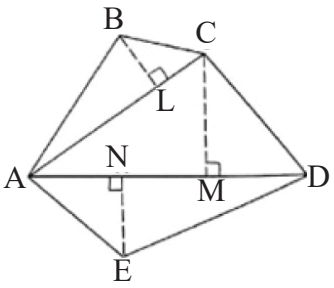
Area (Trap. PNEF) = $\frac{1}{2}$ × (FP + EN) $\frac{1}{2}$ × PN = × (8 + 12) × 10 = 100 cm^2.

Area (Trap. LMCB) = $\frac{1}{2}$ × (BL + CM) $\frac{1}{2}$ × LM = $\frac{1}{2}$ × (8 + 6) × 10 = 70 cm^2.

Area (Hex. ABCDEF) = area (ΔAPF) + area (ΔDEN) + area (ΔABL) + area (ΔCMD) + area (Trap. PNEF) + area (Trap. LMCB) = 24 + 30 + 32 + 9 + 100 + 70 = 265 cm^2.

Area (Hex. ABCDEF) = 265 cm^2.

5.



Given: A pentagon ABCDE

BL ⊥ AC, CM ⊥ AD and EN ⊥ AD

AC = 10cm

AD = 12cm

BL = 3cm

CM = 7cm

EN = 5cm

Here,

Area (Pent. ABCDE) = area (ΔABC) + area (ΔACD) + area (ΔADE)

Area of triangle = $\frac{1}{2}$ × (base) × (height).

Here,

Area (ΔABC) = $\frac{1}{2}$ × (AC) × (BL) = $\frac{1}{2}$ × (10) × (3) = 15 cm^2.

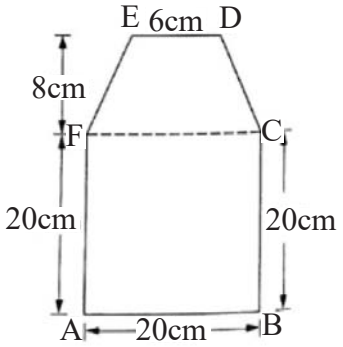
Area (ΔACD) = $\frac{1}{2}$ × (AD) × (CD) = $\frac{1}{2}$ × (12) × (7) = 42 cm^2.

Area (ΔADE) = $\frac{1}{2}$ × (AD) × (EN) = $\frac{1}{2}$ × (12) × (5) = 30 cm^2.

Area (Pent. ABCDE) = area (ΔABC) + area (ΔACD) + area (ΔADE) = 15 + 42 + 30 = 87 cm^2.

Area (Pent. ABCDE) = 87 cm^2.

6.



Given: A figure ABCDEF

AB = 20 cm

BC = 20 cm

ED = 6 cm

AF = 20 cm

AB = FC

FC = 20 cm

Let distance between FC and ED be h = 8 cm

FC = ED

Here,

From the figure we can see that ABCF forms a square and EFCD forms a trapezium.

Area of square = (side length)^2

Area of trapezium = $\frac{1}{2}$ × (sum of parallel sides) × height

Therefore,

Area of the figure ABCDEF = Area of square (ABCF) + Area of trapezium (EFCD)

Here,

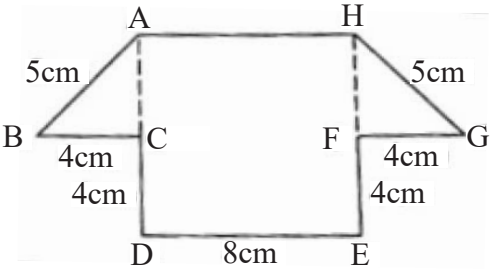
Area of square (ABCF) = $(AB)^2 = (20)^2$ = 400 cm^2

Area of trapezium (EFCD) = $\frac{1}{2}$ × (FC + ED) × h = $\frac{1}{2}$ × (6 + 20) × 8 = 104 cm 2

Area (ABCDEF) = Area of square (ABCF) + Area of trapezium (EFCD) = 400 + 104 = 504 cm^2.

Area (Fig. ABCDEF) = 504 cm^2.

7.



Given: A figure ABCDEFGH

BC = FG = 4 cm

AB = HG = 5 cm

CD = EF = 4 cm

ED = 8 cm

ED = AH

AH = 8 cm

Here

ΔABC and GHF are equal and right angled

AC = AH = ?

In ΔABC using Pythagoras theorem

$AB^2 = BC^2 + AC^2$

$52 = 42 + AC^2$

$25 = 16 + AC^2$

$AC^2 = 25 - 16 = 9$

AC = 3

AH = 3

Area(ABCDEFGH) = area(Rect. ADEH) + 2 X area (ΔABC)

Area of rectangle = (length × breadth)

Area of triangle = $\frac{1}{2}$ × (base) × (height).

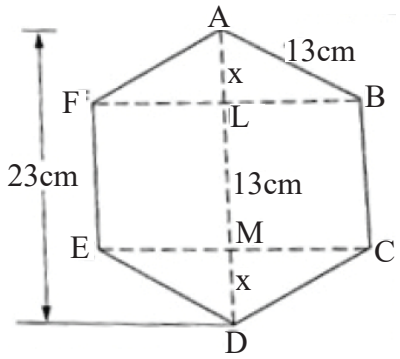
Area(Rect. ADEH) = (DE × AD) = (DE × (AC + AD)) = (8 × (3 + 4)) = 56 cm2

Area(ΔABC) = $\frac{1}{2}$ × (BC) × (AC) = $\frac{1}{2}$ × (4) × (3) = 6 cm^2

Area(ABCDEFGH) = area(Rect. ADEH) + 2 × area (ΔABC) = 56 + (2 × 6) = 68 cm^2

Area(ABCDEFGH) = 68 cm^2.

8.



Given: a regular hexagon ABCDEF

AB = BC = CD = DE = EF = FA = 13 cm

AD = 23 cm

Here AL = MD

Therefore Let AL = MD = x

Here

AD = AL + LM + MD

23 = 13 + 2x

2x = 23 – 13 = 10

x = 5

Now,

In ΔABL using Pythagoras theorem

$AB^2 = AL^2 + LB^2$

$13^2 = x^2 + LB^2$

$13^2 = 5^2 + LB^2$

$169 = 25 + LB^2$

$LB^2 = 169 - 25 = 144$

LB = 12

Here area (Trap. ABCD) = area (Trap. AFED)

Therefore,

Area (Hex. ABCDEF) = 2 × area (Trap. ABCD)

Area of trapezium = $\frac{1}{2}$ × (sum of parallel sides) × height

Area (Trap. ABCD) = $\frac{1}{2}$ × (BC + AD) × LB = $\frac{1}{2}$ × (13 + 23) × 12 = 216 cm^2.

∴ Area(ABCDEFGH) = 2 × area (Trap. ABCD) = 2 × 216 = 432 cm^2

∴ Area(ABCDEFGH) = 432 cm^2.

Multiple Choice Questions

1. Volume of cube = a^3

$(5a)^3 = 5a \times 5a \times 5a = 125a^3$

Answer: (d) $125a^3$

2. Volume of cuboid = Length × Bredth × Height

= 2a × 3b × 4c = 24abc

Answer: (b) 24abc

3. Surface area of cube = $6a^2$

a = 9cm, $6 \times (9)^2$

$= (6 \times 81)cm^2$

$= 486cm^2$

Answer: (b) $486cm^2$

4. Let the ratio be x.

Length = 3x

Breadth = 1x

Height = 2x

Volume of cuboid

= Length × Breadth × Height

$= 3x \times x \times 2x = 6x^3$

or 6 × $(breadth)^3$, (breadth = x)

Answer: (c) 6 × $Breadth^3$

5. **Answer:** (b) Surface area

6. $1m^3 = 1000l$

$3m^2 = (3 \times 1000)l$

$= 3000l$

Answer: (c) 3000

7. Volume of mg = $(a)^3$

$1l = a^3$

$1l = 1000cm = a^3$

$a^3 = 1000m$

a = 10cm

Answer: (b) 10cm

8. Total surface are of box – Area of lid of the box

$= 2(lb + bh + hl) - lb$

$= 2(bh + hl) + lh$

Answer: (c) $2(bh + hl) + lb$

9. Volume of cyclinder = $\pi r^2 h$

$D = H$

$R = \frac{D}{2} = \frac{h}{2}$

$\pi \times \frac{h}{2} \times \frac{h}{2} \times h = \frac{\pi h^3}{4}$

Answer: (b) $\frac{\pi h^3}{4}$

10. Diagonal of cube = $a\sqrt{3}$

$a\sqrt{3} = 4\sqrt{3}$, $a = 4$

Hence, Volume of cube = $a^3 = (4)^3 = 64cm^3$

Answer: (b) $64cm^3$

11. Surface of brick = Surface area fo cuboid

$= 2(lb + bh + hl) = 2(10 \times 4 + 4 \times 3 + 3 \times 10)cm^2$

$= 2(40 + 12 + 30) = 2(82)cm^2$

$= 164cm^2$

Answer: (d) $164cm^2$

12. T.S.A of cyclinder: $2\pi r\ (r + h)$

$= 2 \times \pi \times 20 \times (20 + h)$

$= 40\pi\ (20 + 60) = 40\pi\ (80)$

$= 3200\pi$

L.S.A of cyclinder: $2\pi r(r + h)$

$2 \times \pi \times 20 \times (20 + h)$

$= 40\ \pi(20 + 60) = 40\pi\ (80)$

$= 320\pi$

L.S.A of cyclinder = $2\pi rh$

$= 2 \times \pi \times 20 \times 60$

$= 2400\pi$

Ratio of TSA to LSA

$= \frac{3200\pi}{2400\pi} = \frac{4}{3}$

$= 4:3$

Answer: (a) 4:3

13. Volume of cylinder = $\pi r^2 h$

Diameter = 14m

Radius = $\frac{D}{2} = \frac{14m}{2} = 7m$

$1848m^3 = \frac{22}{7} \times 7 \times 7 \times h$

$1848 = 154 \times h$

$h = \frac{1848}{154} = 12m$

Answer: (c) 12m

12 Power and Exponents

Exercise 12.1

1. (a) $\left(\frac{1}{4}\right)^3 = \frac{1}{4} \times \frac{1}{4} \times \frac{1}{4} = \frac{1}{64}$

(b) $\left(\frac{5}{7}\right)^4 = \frac{5}{7} \times \frac{5}{7} \times \frac{5}{7} \times \frac{5}{7} = \frac{625}{2401}$

(c) $\left(-\frac{5}{2}\right)^3 = -\frac{5}{2} \times -\frac{5}{2} \times -\frac{5}{2} = \frac{-125}{8}$

(d) $\left(-\frac{1}{3}\right)^5 = -\frac{1}{3} \times -\frac{1}{3} \times -\frac{1}{3} \times -\frac{1}{3} = \frac{-1}{243}$

(e) $\left(\frac{7}{10}\right)^3 = \frac{7}{10} \times \frac{7}{10} \times \frac{7}{10} = \frac{343}{1000}$

(f) $\left(-\frac{6}{8}\right)^4 = \frac{-6}{8} \times \frac{-6}{8} \times \frac{-6}{8} \times \frac{-6}{8} = \frac{1296}{4096}$

(g) $\left(\frac{1}{2}\right)^3 = \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} = \frac{1}{8}$

(h) $(-6)3 = -6 \times -6 \times -6 = -216$

(i) $\left(\frac{-3}{5}\right)^4 = \frac{-3}{5} \times \frac{-3}{5} \times \frac{-3}{5} \times \frac{-3}{5} = \frac{81}{625}$

2. (a) $64 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 = (2)^6$

(b) $\frac{-27}{343} = \frac{-3 \times -3 \times -3}{7 \times 7 \times 7} = \left(\frac{-3}{7}\right)^3$

(c) $\frac{25}{49} = \frac{5 \times 5}{7 \times 7} = \left(\frac{5}{7}\right)^2$

(d) $\frac{81}{100} = \frac{9 \times 9}{10 \times 10} = \left(\frac{9}{10}\right)^2$

(e) $\frac{125}{216} = \frac{5 \times 5 \times 5}{6 \times 6 \times 6} = \left(\frac{5}{6}\right)^3$

(f) $\frac{512}{2197} = \frac{8 \times 8 \times 8}{13 \times 13 \times 13} = \left(\frac{8}{13}\right)^3$

3. (a) Reciprocal of $7^2 = \left(\frac{1}{7}\right)^2$

(b) Reciprocal of $\left(\frac{2}{5}\right)^4 = \left(\frac{5}{2}\right)^4$

(c) Reciprocal of $\left(-\frac{1}{8}\right)^4 = (-8)^4$

(d) Reciprocal of $\left(-\frac{8}{10}\right)^4 = \left(\frac{-10}{-8}\right)^4$

(e) Reciprocal of $\left(\frac{1}{8}\right)^{-3} = 8^{-3}$

(f) Reciprocal of $(9)^{-4} = \left(\frac{1}{9}\right)^{-4}$

(g) Reciprocal of $\left(-\frac{1}{3}\right)^{-3} = (-3)^{-3}$

(h) Reciprocal of $\left(\frac{1}{3}\right)^{-4} = (3)^{-4}$

(i) Reciprocal of $\left(\frac{3}{7}\right)^2 = \left(\frac{7}{3}\right)^2$

4. (a) Reciprocal of $\left(\frac{1}{4}\right)^3 = 4^3 = 64$

(b) Reciprocal of $\left(-\frac{2}{6}\right)^4 = \left(\frac{-6}{-2}\right)^4 = \frac{1296}{16} = 81$

(c) Reciprocal of $\left(\frac{3}{6}\right)^{-3} = \left(\frac{6}{3}\right)^{-3} = \left(\frac{3}{6}\right)^{-3} = \frac{27}{216} = \frac{1}{8}$

(d) Reciprocal of $\left(\frac{7}{3}\right)^{-3} = \left(\frac{3}{7}\right)^{-3} = \left(\frac{7}{3}\right)^3 \frac{343}{27}$

(e) Reciprocal of $\left(-\frac{2}{4}\right)^4 = \left(-\frac{4}{2}\right)^4 = \frac{256}{16} = 16$

(f) Reciprocal of $\left(-\frac{3}{5}\right)^{-3} = \left(-\frac{3}{5}\right)^3 = \frac{-27}{125}$

Exericse 12.2

1. (a) $\left(\frac{1}{5}\right)^5 \times \left(\frac{1}{5}\right)^4 = \left(\frac{1}{5}\right)^{5+4} = \left(\frac{1}{5}\right)^9$

(b) $\left(\frac{5}{4}\right)^6 \times \left(\frac{5}{4}\right)^4 = \left(\frac{5}{4}\right)^{6+4} = \left(\frac{5}{4}\right)^{10}$

(c) $\left(\frac{-4}{3}\right)^7 \times \left(\frac{-4}{3}\right)^{-4} = \left(\frac{-4}{3}\right)^{7+(-4)} = \left(\frac{-4}{3}\right)^3$

(d) $\left(\frac{6}{8}\right)^{-3} = \left(\frac{6}{8}\right)^{-4} = \left(\frac{6}{8}\right)^{-3+(-4)} = \left(\frac{6}{8}\right)^{-7}$

(e) $\left[\left(\frac{7}{10}\right)^2\right]^3 = \left(\frac{7}{10}\right)^{2 \times 3} = \left(\frac{7}{10}\right)^6$

(f) $\left(\frac{-7}{10}\right)^9 \div \left(\frac{-7}{10}\right)^7 = \left(\frac{-7}{10}\right)^{9-7} = \left(\frac{-7}{10}\right)^2$

(g) $\left(\frac{3}{7}\right)^6 \times \left(\frac{3}{7}\right)^5 = \left(\frac{3}{7}\right)^{6+5} = \left(\frac{3}{7}\right)^{11}$

(h) $\left(\frac{-3}{4}\right)^{-3} \div \left(\frac{-3}{4}\right)^{-3} = \left(\frac{-3}{4}\right)^{-3-(-3)} = \left(\frac{-3}{4}\right)^{-3+3} = \left(\frac{-3}{4}\right) = 1$

(i) $\left(\frac{8}{9}\right)^6 \times \left(\frac{8}{9}\right)^{-3} = \left(\frac{8}{9}\right)^{6+(-3)} = \left(\frac{8}{9}\right)^3$

(j) $\left[\left(\frac{3}{2}\right)^2\right]^7 = \left(-\frac{3}{2}\right)^{2 \times 7} = \left(\frac{3}{2}\right)^{14}$

(k) $\left[\left(\frac{5}{6}\right)^3\right]^{-4} = \left(\frac{5}{6}\right)^{3 \times (-4)} = \left(\frac{5}{6}\right)^{-12}$

(l) $\left[\left(\frac{4}{5}\right)^3\right]^{-4} = \left(\frac{4}{5}\right)^{3 \times (-4)} = \left(\frac{4}{5}\right)^{-12}$

2. (a) $\left(\frac{3}{8}\right)^3 \times \left(\frac{4}{9}\right)^3 = \left(\frac{3}{8} \times \frac{4}{9}\right)^3 = \left(\frac{1}{6}\right)^3 = \frac{1}{216}$

(b) $\left(\frac{20}{27}\right)^4 \times \left(\frac{9}{10}\right)^4 \times \left(\frac{2}{3}\right)^4 = \left(\frac{\cancel{20}^{2}}{\cancel{9}\cancel{27}} \times \frac{\cancel{9}}{\cancel{10}_{1}} \times \frac{\cancel{2}}{\cancel{3}\ 1}\right)^4 =$

$\left(\frac{2}{9} \times \frac{1}{1} \times \frac{2}{1}\right)^4 = \left(\frac{4}{9}\right)^4 = \frac{256}{6561}$

(c) $\left(\frac{6}{25}\right)^4 \times \left(\frac{5}{3}\right)^4 \div \left(\frac{2}{5}\right)^3 = \left(\frac{6}{25} \times \frac{5}{3}\right)^4 \div \left(\frac{2}{5}\right)^3 =$

$\left(\frac{2}{5}\right)^4 \div \left(\frac{2}{5}\right)^3 = \left(\frac{2}{5}\right)^{4-3} = \frac{2}{5}$

(d) $\left(\frac{2}{5}\right)^3 \times \left(\frac{2}{5}\right)^5 \div \left(\frac{2}{5}\right)^7 = \left(\frac{2}{5}\right)^{3+5-7} = \left(\frac{2}{5}\right)^1 = \frac{2}{5}$

(e) $\left(\frac{1}{3}\right)^5 \div \left(\frac{1}{3}\right) \times \left(\frac{1}{3}\right)^{-4} = \left(\frac{1}{3}\right)^{(5-1+(-4)} = \left(\frac{1}{3}\right) = \frac{1}{1}$

(f) $\left[\left(\frac{-3}{4}\right)^5 \times \left(\frac{-3}{4}\right)^3\right]^4 \div \left[\left(\frac{9}{16}\right)^3\right]^4 = \left[\left(\frac{-3}{4}\right)^{5+3}\right]^4$

$\div \left[\left(\frac{9}{16}\right)^3\right]^4$

$= \left[\left(\frac{-3}{4}\right)^8\right] \div \left[\left(\frac{9}{16}\right)^3\right]^4 = \left[\left(\frac{6561}{65536}\right) \div \left(\frac{729}{4096}\right)\right]^4$

$= \left(\frac{6561}{65536} \div \frac{729}{4096}\right)^4 = \left(\frac{9}{16}\right)^4 = \frac{6561}{65536}$

3. (a) $(2^{-1} \times 3^{-1}) = \left(\frac{3}{8}\right)^{-1} = \left(\frac{1}{2} \times \frac{1}{3}\right)^2 \times \left(\frac{8}{3}\right)^1$

$= \left(\frac{1}{6}\right)^2 \times \frac{8}{3} = \frac{1}{36} \times \frac{8}{3} = \frac{8}{108} = \frac{2}{27}$

(b) $(4^{-1} \times 3^{-1}) \div (12)^{-1} = (4 \times 3)^{-1} \div (12)^{-1} =$

$12^{-1} \div 12^{-1} = 1$

(c) $(2^5 \div 2^8) \div (2)^{-7} = (2^{5-8-(-7)}) = (2)^{5-8+7}$

$(2)^{12-8} = (2)^4 = 16$

4. (a) $\left(\frac{4}{5}\right)^3 \times \left(\frac{4}{5}\right)^{-6} = \left(\frac{4}{5}\right)^{2x-1} = \left(\frac{4}{5}\right)^{3+(-6)} = \left(\frac{4}{5}\right)^{2n-1}$

$= \left(\frac{4}{5}\right)^{-3} = \left(\frac{4}{5}\right)^{2n-1}$

$-3 = 2^{-1}$, $2n = -2$, $n = -1$

(b) $n(3^{-5}) = 3$

$n = \frac{3}{3^{-5}}$, $n = (3)^{1-(-5)}$

$n = (3)\ (1 + 5)$

$n = 3^6$

(c) $n(-5)4 \div x^2 = 5$

$n \div n^2 = \frac{5}{(-5)^5}$, $(n)\ 1 - 2 = \frac{5}{625}$

$n - 1 = \frac{1}{125}$, $n = 125$

5. (a) $\left(\frac{1}{7}\right)^{-2} \div \left(\frac{2}{7}\right)^{-3}$

$(7)^2 \div \left(\frac{7}{2}\right)^3 = 49 \div \frac{343}{8}$

$= 49 \times \frac{8}{343} = 1 \times \frac{8}{7} = \frac{8}{7}$

(b) $\left(\frac{2}{3}\right)^3 \div \left(\frac{5}{6}\right)^2 = \frac{8}{27} \times \left(\frac{6}{5}\right)^2$

$= \frac{8}{27} \times \frac{36}{25} = \frac{32}{75}$

6. (a) $(2^{-3})^2 = (2)^{-3 \times 2} = (2)^{-6}$

(b) $5^2 \times 5^3 = (5)^{2+3} = (5)^5 = \left(\frac{1}{5}\right)^{-5}$

(c) $\left[\left(-\frac{2}{5}\right)^{-1}\right]^{-2} = \left(-\frac{5}{2}\right)^{-2}$

7. (a) $\left(\frac{-4}{5}\right)^4 \div \left(\frac{-4}{5}\right)^3 = \left(\frac{-4}{5}\right)^n$

$\left(\frac{-4}{5}\right)^{4-3} = \left(\frac{-4}{5}\right)^n$

$\left(\frac{-4}{5}\right)^1 = \left(\frac{-4}{5}\right)^n$

$n = 1$

(b) $(-5)^4 \div (-5)^2 = 5^n$

$(-5)^{4-2} = 5^x$

$(-5)^2 = 5^n$

$n = 2$

(c) $\left(\frac{5}{11}\right)^{-3} \times \left(\frac{5}{11}\right)^5 = \left(\frac{5}{11}\right)^x$

$\left(\frac{5}{11}\right)^{-3+5} = \left(\frac{5}{11}\right)^x$

$\left(\frac{5}{11}\right)^2 = \left(\frac{5}{11}\right)^x$

$x = 2$

Exercise 12.3

1. (a) 149600000km = 1.496×10^8

2. 2500,000 = 2.5×10^6km

3. 100,000 light years = 1×10^5 light years

4. 2028,000,000km = 228×10^8km

5. 3.84400km = 3844×10^5km

6. 695000 = 6.95×10^5

7. 1276000m = 1.2756×10^7m

8. 142, 984,000 = 1.42984×10^8m

9. 5913000000km = 5.913×10^9km

10. 58,000,000km = 5.8×10^7km

11. 250,000,000 bytes = 2.5×10^8 bytes

12. 0.005cm to 0.001cm = 5×10^{-3}cm to 1×10^{-3}cm

13. $0.0000067 = 6.7 \times 10^{-6}$

14. $0.000172 = 1.72 \times 10^{-4}$

15. 0.000000963
$= 9.63 \times 10^{-7}$

Review Exercise

1. (a) $(1)^6 = 1 \times 1 \times 1 \times 1 \times 1 \times 1 = 1$

(b) $3^6 = 3 \times 3 \times 3 \times 3 \times 3 \times 3 = 729$

(c) $4^5 = 4 \times 4 \times 4 \times 4 \times 4 = 1024$

(d) $(-6)^5 = -6 \times -6 \times -6 \times -6 \times -6 = -7776$

(e) $\left(-\frac{16}{4}\right)^4 = -\frac{16}{4} \times \frac{16}{4} \times \frac{16}{4} \times \frac{16}{4} = \frac{65536}{256} = 256$

(f) $\left(\frac{-4}{8}\right)^2 = \left(\frac{-1}{2}\right)^2 = \frac{-1}{2} \times \frac{-1}{2} = \frac{1}{4}$

(g) $\left(\frac{-2}{8}\right)^3 = \frac{-2}{8} \times \frac{-2}{8} \times \frac{-2}{8} = \frac{-8}{512}$

(h) $\left(\frac{-1}{2}\right)^5 = \frac{-1}{2} \times \frac{-1}{2} \times \frac{-1}{2} \times \frac{-1}{2} \times \frac{-1}{2} = \frac{-1}{32}$

2. (a) $\frac{-125}{64} = \frac{-5 \times -5 \times -5}{4 \times 4 \times 4} = \left(\frac{-5}{4}\right)^3$

(b) $\frac{27}{8} = \frac{3 \times 3 \times 3}{2 \times 2 \times 2} = \left(\frac{3}{2}\right)^3$

(c) $\frac{729}{1000} = \frac{9 \times 9 \times 9}{10 \times 10 \times 10} = \left(\frac{9}{10}\right)^3$

(d) $\left(-\frac{6}{5}\right)^4 = \left(-\frac{5}{6}\right)^4$

(e) $8 - 1 = \left(\frac{1}{8}\right)^{-1}$

(f) $\left(\frac{8}{8}\right)^{-2} = (1)^{-2} = (1)^{-2} = 1$

4. (a) $\left(\frac{4}{7}\right)^5 \times \left(\frac{4}{7}\right)^3 \div \left(\frac{4}{7}\right)^6 = \left(\frac{4}{7}\right)^{5+3-6} = \left(\frac{4}{7}\right)^{8-6}$
$= \left(\frac{4}{7}\right)^2 = \frac{16}{49}$

(b) $\left(\frac{3}{7}\right)^5 \times \left(\frac{3}{7}\right)^4 \div \left(\frac{3}{7}\right)^9 = \left(\frac{3}{7}\right)^{5+4-6} = \left(\frac{3}{7}\right)^{9-9}$
$= \left(\frac{3}{7}\right)^0 = 1$

(c) $(7^0)10 = (7)^{0 \times 10} = 7^0 = 1$

(d) $(2^{100})^0 = (2)^{100 \times 0} = 2^0 = 1$

(e) $\left(\frac{7}{4}\right)^0 \times 3 = 1 \times 3 = 3$

(f) $\left(\frac{2}{3}\right)^{-3} = \left(\frac{3}{2}\right)^3 = \frac{3}{2} \times \frac{3}{2} \times \frac{3}{2} \times \frac{3}{2} = \frac{27}{8}$

(g) $\left[\left(\frac{2}{3}\right)^2\right]^{-5} = \left[\frac{4}{5}\right]^{-5} = \left[\frac{9}{4}\right]^5 = \frac{9 \times 9 \times 9 \times 9 \times 9}{4 \times 4 \times 4 \times 4 \times 4}$
$= \frac{59049}{1024}$

(h) $\left(\frac{3}{4}\right)^4 = \frac{3}{4} \times \frac{3}{4} \times \frac{3}{4} \times \frac{3}{4} \times \frac{3}{4} = \frac{81}{256}$

(i) $\left(\frac{1}{8}\right)^3 \div \left(\frac{1}{8}\right)^6 = 8x$

$\left(\frac{1}{8}\right)^{3-6} = 8x$

$\left(\frac{1}{8}\right)^{-3} = 8x$

$83 = 8x$

$x = 3$

(j) $\left(\frac{1}{4}\right)^{-3} = 43 = 4 \times 4 \times 4 \times 4 = 64$

(k) $\left(\frac{-4}{7}\right)^{-3} = \left(\frac{-7}{4}\right)^3 = \frac{-7}{4} \times \frac{-7}{4} \times \frac{-7}{4}$
$= \frac{-343}{256}$

5. (a) $7260000 = 7.26 \times 10^6$

(b) $36000 = 3.6 \times 10^4$

(c) $0.000671 = 6.71 \times 10^{-4}$

(d) $0.0000000416 = 4.16 \times 10^{-8}$

6. (a) $(12)^x = 144$

$12^x = 12^2$

$x = 2$

(b) $\left(\frac{1}{8}\right)^3 \div \left(\frac{1}{8}\right)^6 = 8^x$

$\left(\frac{1}{8}\right)^{3-6} = 8^x$

$\left(\frac{1}{8}\right)^{-3} = 8^x$

$8^3 = 8^x$

$x = 3$

(c) $\left(\frac{2}{8}\right)^{2x} \times \left(\frac{2}{8}\right)^x = \left(\frac{2}{8}\right)^6$

$\left(\frac{2}{8}\right)^{2x+x} = \left(\frac{2}{8}\right)^6$

$3x = 6$

$x = 2$

Multiple Choice Question

1. $\frac{-8}{27} = \frac{-2 \times -2 \times -2}{3 \times 3 \times 3} = \left(\frac{-2}{3}\right)^3$

Answer: (a) $\left(\frac{-2}{3}\right)^3$

2. $\left(\frac{2}{3}\right)^{-3} = \left(\frac{3}{2}\right)^3$

Answer: (b) $\left(\frac{3}{2}\right)^3$

3. $\left(\frac{-2}{3}\right)^{-1} = \left(\frac{-3}{2}\right)^1$

Answer: (b) $\frac{-3}{2}$

4. $\left(-\frac{1}{5}\right)^3 \div \left(-\frac{1}{5}\right)^8 = \left(-\frac{1}{5}\right)^{3-8} = \left(-\frac{1}{5}\right)^{-8} (-5)^5$

Answer: (c) $(-5)^5$

5. $a^7 \div a^{12} =$ (a) $12^{7-12} = a^{-5}$

Answer: (c) a^{-5}

6. $\left(\frac{4}{3}\right)^{-6} \div \left(\frac{4}{3}\right)^{-6} = \left(\frac{4}{3}\right)^{-6-(-6)} = \left(\frac{4}{3}\right)^0 = 1$

Answer: (b) 1

7. $(a^3)^{-2} = (a)^{3 \times -2} = a^{-6}$

Answer: (b) a^{-6}

8. $(7^{-1} - 8^{-1})^{-1} - (3^{-1} - 4^{-1})^{-1}$

$= \left(\frac{1}{7} - \frac{1}{8}\right)^{-1} - \left(\frac{1}{3} - \frac{1}{4}\right)^{-1}$

$= \left(\frac{8-7}{56}\right)^{-1} - \left(\frac{4-3}{12}\right)^{-1}$

$= \left(\frac{1}{56}\right)^{-1} = -\left(\frac{1}{12}\right)^{-1}$

$= 56 - 12 = 44$

Answer: (d) 44

9. $\left(\frac{5}{9}\right)^{-2} \div \left(\frac{81}{25}\right)^{-2} = x^{-2}$

$\left(\frac{5}{9} \div \frac{81}{25}\right)^{-2} = x^{-2}$

$\left(\frac{5}{9} \times \frac{25}{81}\right)^{-2} = x^{-2} = \left(\frac{125}{729}\right)^{-2} = x^{-2}$

$x = \frac{125}{729}$

Answer: (d) $\frac{125}{729}$

10. $\frac{x}{y} = \left(\frac{2}{5}\right)^{-3} \times \left(\frac{15}{8}\right)^{-3}$

$\frac{x}{y} = \left(\frac{2}{5} \times \frac{15}{8}\right)^{-3}$

$\frac{x}{y} = \left(\frac{3}{4}\right)^{-3}, \frac{x}{y} = \left(\frac{4}{3}\right)^3$

$\frac{x}{y} = \frac{64}{27}$

Answer: (a) $\frac{64}{27}$

11. $(-3)^{-3} = \left(\frac{-1}{3}\right)^3 = -\frac{1}{27}$

Answer: (c) $-\frac{1}{27}$

12. $\left(\frac{3^{-6}}{3^4}\right) = 3^{-6-4} = 3^{-10}$

Answer: (c) 3^{-10}

13. $\left(\frac{5}{12}\right)^{-4} \times \left(\frac{5}{12}\right)^{3x} = \left(\frac{5}{12}\right)^5$

$\left(\frac{5}{12}\right)^{-4+3x} = \left(\frac{5}{12}\right)^5 = -4 + 3x = 5$

$3x = 5 + 4, 3x = 9$

$x = 3$

Answer: (d) 3

14. $\left(\frac{3}{5}\right)^0 = 1$

Answer: (c) 1

15. $\left(\frac{-1}{3}\right)^3 = \frac{-1}{3} \times \frac{-1}{3} \times \frac{-1}{3} = \frac{-1}{27}$

Answer: (c) $\frac{-1}{27}$

Check Your Progress

1. $3^{-2} = \left(\frac{1}{3}\right)^2 = \frac{1}{3} \times \frac{1}{3} = \frac{1}{9}$

2. $\left[\left(\frac{3}{4}\right)^2\right]^{-4} = \left(\frac{3}{4}\right)^{2 \times -4} \left(\frac{3}{4}\right)^{-8} = \left(\frac{4}{3}\right)^8$

3. $\left(\frac{-11}{15}\right)^{-6} \times \left(\frac{-11}{15}\right)^4 \times \left(\frac{-11}{15}\right)^2 = \left(\frac{-11}{15}\right)^{-6+4+2} = \left(\frac{-11}{15}\right)^0 = 1$

4. $(5^{-1})^{-1} = 5^{-1 \times -1} = 5^1 = 5$

5. $(3^0 - 2^0) \times 5^2$

$= (1 - 1) \times 25$

$= 0 \times 25 = 0$

6. $\left(\frac{1}{4}\right)^{-1} + \left(\frac{1}{2}\right)^{-1} + \left(\frac{1}{3}\right)^{-1} = 4 + 2 + 3 = 9$

7. Let the missing number be x.

$\left(\frac{13}{14}\right)^{-1} \div (x)^n = \left(\frac{13}{14}\right)^4$

$x = \left(\frac{13}{14}\right)^{-1-n} = \left(\frac{13}{14}\right)^4$

$x = \left(\frac{13}{14}\right)^{-1-n} = \left(\frac{13}{14}\right)^4$

$-1 - n = 4$

$-n = 4 + 1$

$n = -5$

$n = \left(\frac{13}{14}\right)^{-5}$

8. $(4^{-1} + 8^{-1}) = \frac{1}{4} = \frac{1}{8} = \frac{2+1}{8} = \frac{3}{8}$

9. $\left(\frac{1}{4}\right)^{-3} = (4)^3$

10. $[(-3)^{-2}]^{-1} = [-3]^{-2 \times -1} = (-3)^2 = -3 \times -3 = 9$

13 Direct and Indirect Proporations

Exercise 13.1

1. (a) $6, 9 = \frac{6}{9} = \frac{2}{3}$

Dividing both by their HCF 3.

(b) $18, 16 = \frac{18}{16}$

$= \frac{9}{8}$

Dividing both by their HCF 2.

(c) $16, 48 = \frac{16}{48}$

$= \frac{1}{3}$

Dividing both by their HCF 16.

(d) $88, 28 = \frac{88}{28}$

$= \frac{22}{7}$

Dividing both by their HCF 4.

(e) $10, 49 = \frac{10}{49}$

$= \frac{2}{3}$

It has no factors hence, it is in its simples from.

(f) $108, 64 = \frac{108}{64} = \frac{27}{16}$

Dividing both by their HCF 4.

2. (a) $\frac{5}{7}$

(b) $\frac{3}{8}$

(c) 1 hour = 60 minutes

4 hours = (60 × 4) minutes

= 240 minutes

$= \frac{240}{80}$ [HCF = 80]

$= \frac{3}{1}$

(d) 1m = 100cm

$= \frac{100}{20}$cm (HCF = 20)

$= \frac{5}{1}$

(e) $\frac{18}{20}$ (HCF = 2)

$= \frac{9}{10}$

(f) $\frac{27}{36}$ (HCF = 9)

$= \frac{3}{4}$

(g) $\frac{5}{20}$ (HCF = 5)

$= \frac{1}{4}$

3. Cost of 35 pencils = ₹35

Cost of 1 pencil = $\frac{\text{Cost of 35 pencils}}{\text{35 pencils}}$

$= ₹\frac{35}{35} = ₹1$

Cost of 91 pencils = Cost of 1 pencils × 91

= ₹91

Hence, 91 pencils costs ₹91.

4. Quantity of rice bougth in ₹117.20 = 8kg

Quantity of rice bougth in ₹1 = $\frac{8}{117.20}$

5. Cost of 37m of cloth = ₹2090.50

Cost of 37m of cloth = ₹2090.50/37

Cost of cloth for 2373 rupees = $\frac{37 \div 2373}{2090.50}$ = 42

Hence 42m of cloth can be purchased for ₹2090.50

6. Number of paper sheets that weight 162g = 6

Number of paper sheets that weight 1g = $\frac{6}{162}$ [Less than, Less sheets]

∴ Number of paper sheets that weight 13.5kg = $\frac{6}{162}$ × 13.5 × 1000 = 500 [More weight, More Sheet]

7. Given that number of kilometer a car can cover by using 36 litres of petrol = 522km

Number of kilometer a car can cover by using 1 litre of petrol = $\frac{522}{36}$

Hence, the number of kilometer a car can cover by using 14 litres = $\frac{522}{36}$ × 14

= 203km

8. Number of cartoons needed to pack 1152 soap bars = 8

Number of crtoons needed to pack 1 soap bar = $\frac{8}{1152}$

Number of cartoons needed to pack 3888 soap bar = $\frac{8}{1152}$ × 3888 = 27

9. The cost of travelling 900km rail is Rs 140

The cost of travelling 1km rail = ₹$\frac{140}{900}$ = ₹0.1556

The cost of travelling 139.5km = Cost of travelling 1km × 139.5

= 0.1556 × 139.5 = ₹21.70

Hence, it will cost ₹21.70 to travel 139.5km

10. Number of men employed to bulit the 16.25m long wall = 15

Number of men required to built a 1m long wall = $\frac{15}{16.25}$ × 26 = 24

∴ 24 men should be employed to build a well of length 26m in a day.

Exercise 13.2

1.

x	3	x_1	x_2	10
y	36	60	96	y_1

According to the question, they are in direct proportion Hence, $\frac{3}{6} = \frac{x_1}{60}$ = 60 × 3 = 6x × 1

Similaly, $\frac{x_1}{60} = \frac{30}{60} = \frac{x_2}{60}$ = 96 × 30 = x_2 × 60 x^2 = 48

Similarly, $\frac{x_2}{96} = \frac{48}{96} = \frac{10}{41}$ = 48 × y_1 = 10 × 96

$y_1 = \frac{10 \times 96}{48}$ y = 20

2. (a) $\frac{1}{3} = \frac{2}{\boxed{x}} = \frac{2}{\boxed{7}} = \frac{\boxed{2}}{12} = \frac{1}{3} = \frac{2}{x}$ = x = 6

$\frac{2}{6} = \frac{3}{y}$ = y = 9, $\frac{3}{9} = \frac{z}{12}$ = z = 4

(b) $\frac{3}{5} = \frac{6}{\boxed{x}} = \frac{9}{\boxed{y}} = \frac{\boxed{z}}{20}$

$\frac{3}{5} = \frac{6}{x}$, x = 10

$\frac{6}{10} = \frac{a}{y}$, y = 15

$\frac{9}{15} = \frac{z}{20}$, z = 12

(c) $\frac{3}{2} = \frac{\boxed{x}}{6} = \frac{\boxed{y}}{8} = \frac{15}{\boxed{z}}$

$\frac{3}{2} = \frac{x}{6}$, x = 9

$\frac{9}{6} = \frac{4}{8}$, y = 12

$\frac{12}{8} = \frac{15}{z}$, z = 10

(d) $\frac{11}{20} = \frac{\boxed{x}}{20}$

11 × 80 = 20 × x

x = $\frac{880}{20}$

x = 44

(e) $\frac{13}{40} = \frac{39}{\boxed{x}}$

13 × x = 39 × 40

x = $\frac{3\ \cancel{39} \times 40}{1\ \cancel{13}}$

x = 120

(f) $\frac{5}{6} = \frac{\boxed{x}}{24}$

5 × 24 = 6 × x

x = $\frac{120}{6}$

x = 20

(g) $\frac{6}{7} = \frac{\boxed{x}}{14} = \frac{18}{\boxed{4}} = \frac{\boxed{z}}{28}$

$\frac{6}{7} = \frac{x}{14}$, 6 × 14 = x × 7

x = 12

$\frac{12}{14} = \frac{18}{y}$

12 × y = 18 × 14

y = $\frac{18 \times 14}{12} = \frac{252}{12}$ = 21

$\frac{18}{21} = \frac{z}{38}$

18 × 38 = z × 21

z = $\frac{18 \times 38}{21}$

z = 24

(h) $\frac{1}{8} = \frac{7}{x}$

x × 1 = 8 × 7

x = 56

3. Time taken to cover 51km = 45mins

Time taken to cover 1 km = $\frac{45}{51}$

Time taken to cover 221 kms = $\frac{45}{51}$ × 221 = 195 min

4. Length of the iron rod that weight 88.5kg = 22.5

Length of the rod that weight 1kg = $\frac{22.5}{85.5}$

Length of the rod weight 22.8kg = $\frac{22.5}{85.5}$ × 22.8 = 6*m*

5. It length of the shelf increases, the number of boxes will also increase.

$\frac{68}{x} = \frac{13.6}{20.4}$

$= 68 \times 20.4 = x \times 13.6$

$= x = \frac{68 \times 20.4}{13.6}$

$= \frac{1387.2}{13.6}$

$= 102$

Thus, 102 boxes will occupy a shelf - Length of 20.4m.

6. 102 people need 1530kg of cereals in a month.

So, quantity of cereals consumed by each people $= \frac{1530}{102}$kg = 15kg

So, quantity fo cereals required for 135 member $= 135 \times 15\text{kg} = 2025\text{kg}$

7. A labourer is paid Rs 806 for 13 days of work

In 1 day he got $= \frac{806}{13}$

= ₹62

He worked $\frac{1798}{62} = 29$ days

∴ He worked 29 days to get ₹1798

8. Let x be the numbers of men required to dig a trench of 225 meters

Number of men	13	x
Length (in m)	117	225

Since, the length of the trench and the number of men are in the direct variation we have,

$= \frac{13}{x} = \frac{117}{225}$

$= 13 \times 225 = 117 \times x$

$= 2925 = 117x$

$x = \frac{2925}{117} = 25$

Hence, 25 men should be employed to dig 225m long trench in one day.

9. The Length of the shadow of Qutab Minar = 80m

The height of Qutub minar = 72

The length of the shadow of the Pole = 1000cm = 10m

Height of pole = x = ?

The length of the shadow of an object will be denpendent on the height of the object and hence it is dicectly proportional to each others.

Height of the Pole = $x = 72 \times (10/80) = 9$m

10. Number of patients who can consume 1350*l* of milk = 60

Number of patients who can consume 1*l* of milk $= \frac{60}{1350}$

Number of patients who can consume 1710*l* of milk $= \frac{60}{1350} \times 1710 = 76$

Exercise 13.3

1. (a) Direct proportion as in all areas $\frac{x_1}{x_2} = \frac{y_1}{y_2}$

$\frac{3}{9} = \frac{4}{12} = 3:9 :: 4:12$

(b) Direct proportion as in all areas $\frac{x_1}{x_2} = \frac{y_1}{y_2}$

$= \frac{9}{12} = \frac{30}{40}$

(c) In all cars $x_1y_1 = x_2y_2$

but $\frac{x_1}{x_2} \neq \frac{y_1}{y_2}$

$\frac{10}{5} = \frac{24}{12}$

Thus, 10:5 :: 2y : 12 is the required inverse proporation

(d) In all cars $x_1y_1 = x_2y_2$

but $\frac{x_1}{x_2} \neq \frac{y_1}{y_2}$

$\frac{10}{2} = \frac{75}{15}$

Thus, 10:2 :: 75 : 15 is the required inverse proportion

2. (a) **Inverse:** More people will tead to less consumption of time

(b) **Inverse:** More people will tead to less number of days in consumption of food.

(c) **Inverse:** Less time if speed is increasing

(d) **Direct:** More people requires more food.

(e) **Direct:** When distance increase the time will increase too.

(f) **Inverse:**: Increase in cost will lead in reduction of number of articles

(g) **Direct**: As the total cost will increase with the increase in articles the number of articles.

3. Let x be the number of machines he can buy if a discount of Rs. 50 is offered on each machines.

Number of machines	75	x
Price of each machines (in Rs)	200	150

Since, Raju is getting a discount of ₹50 on each machine, the cost of each machines will get decreased by ₹50

If the price of a machine is less, he can buy more number of machines.

It is a case of inverse variation.

$\therefore 75 \times 200 = x \times 150$

$= x = \frac{75 \times 200}{150}$

$= x = \frac{15000}{150}$

$= x = 100$

$\therefore$ The number of machines he can buy is 100.

4. Given: Average speed of A = 54 km/hr

Average speed of B = 60km/hr

Bus A takes 10 hours to complete the journey

To find: House long will Bus B take

Solution: As we know distance = Speed × Time

$\therefore$ Distance = Speed × Time

$\therefore$ 540 = 60x Time

$\therefore$ Time $= \frac{540}{60} = 9$ hours

Answer: Bus B will take 9 hours to complete.

5. Let number of pumps required be x.

As number of hours decreased then the number of pumps has to increase so, its inverse varation.

Thus, $\frac{x}{8} = \frac{4}{16/3} = x = 2\cancel{4} \times \frac{3}{\cancel{16}\,\cancel{2}_{1}} \times \cancel{8}^{1} = 6$

$\therefore$ 6 pumps are required to fill the water in swimming pool.

Execise 13.4

1. It is given that Rakesh can do a piece of work in 20 days.

$\therefore$ Rakesh's 1 day's work = $\frac{1}{20}$

$\therefore$ Ralesh's workfor 4 days = $\frac{4}{20} = \frac{1}{5}$

Thus, he can do $\frac{1}{5}$ the of the work in 4 days.

2. Time taken by Anil to do the work = 5 days

Time taken by Ankur to do the work = 4 days

$\therefore$ Work done by Anil in 1 day = $\frac{1}{5}$

Work done by Ankur in 1 day = $\frac{1}{4}$

$\therefore$ Work done by Anil and Ankur in one day = $\frac{1}{5} + \frac{1}{4}$

$= \frac{4+5}{20} = \frac{9}{20}$

Thus, Anil an Ankur can do the work in $\frac{20}{9}$ days i.e $2\frac{2}{9}$ days.

3. Time taken by Mohan to do to work = 9 hours

Time taken by Mohan and Sohan to do the work = 4 hours

$\therefore$ Work done by Mohan $= \frac{1}{9}$

Work done by Mohan and Sohan = $\frac{1}{4}$

$\therefore$ Work done by Mohan = $\frac{1}{4} - \frac{1}{9}$

$= \frac{9-4}{36} = \frac{5}{36}$

Thus, Sohan Can do the work in $\frac{5}{36}$ hours i.e. $7\frac{1}{5}$ hours.

4. Time taken by reena to do the work = 9 hours

Time taken by rita to do the work = 6 hours

Time taken by meena to do the work = 12 hours

Now,

Work done by reena = $\frac{1}{9}$

Work done by rita = $\frac{1}{6}$

Work done by meena = $\frac{1}{12}$

$\therefore$ Work done by them together = $\frac{1}{9} + \frac{1}{6} + \frac{1}{12}$

$= \frac{4+6+3}{36} = \frac{13}{36}$

Thus, together they can do the work in $\frac{13}{36}$ hours.

5. A, B, C Working together complete a work in 8 hour.

$\therefore$ In one hour they can complete $\frac{1}{8}$th of work.

A can alone do the work in 20hr

$\therefore$ In one hour A can complete $\frac{1}{20}$th of work

B can alone do the work in 24hr.

$\therefore$ In one hour B can do $\frac{1}{24}$th of work.

Let in one hour C can do $\frac{1}{x}$th of work.

$\therefore \frac{1}{20} + \frac{1}{24} + \frac{1}{x} = \frac{1}{8}$

$= \frac{1}{x} = \frac{1}{8} - (\frac{1}{20} + \frac{1}{24})$

$= \frac{1}{8} - \frac{44}{20 \times 24}$

$= \frac{1}{8} - \frac{11}{120}$

$= \frac{15 - 11}{120} = \frac{4}{120}$

$= \frac{1}{30}$

$\therefore$ C can do the same work in 30 hours.

6. A and B's one day work = $\frac{1}{20}$

B's one day work = $\frac{1}{15}$

A and B's 2 days works = $\frac{1}{20} \times 2 = \frac{1}{10}$

Remaining work = $1 - \frac{1}{10} = \frac{10 - 1}{10} = \frac{9}{10}$

Now B's can do $\frac{1}{15}$ work in = 1 day

$\therefore$ B will do $\frac{9}{10}$ work in = $\frac{1 \times 15}{1} \times \frac{9}{10}$

$= \frac{27}{2} = 13\frac{1}{2}$ days

7. A's 1 day work = $\frac{1}{6}$

B's day work = $\frac{1}{4}$

A and B day work = $\frac{1}{6} + \frac{1}{4} = 6$

$\frac{2 + 3}{12} = \frac{5}{12}$

As 2 day work = $\frac{1}{6} \times 2 = \frac{1}{3}$

Remaining work = $1 - \frac{1}{3} = \frac{2}{3}$ [$\therefore$ Whole work = 1]

Now A and B can do $\frac{5}{12}$th work in 1 day

They will do 1 work (whole work) in $1 \times \frac{12}{5}$ day's B's and they will do $\frac{2}{3}$th 1 work = $\frac{12}{5} \times \frac{2}{3}$

$= \frac{8}{5} = 1\frac{3}{5}$ days

$\therefore$ Total work was finished in $1\frac{3}{5} + 2$

$= 3\frac{3}{5}$ days [$\because a\frac{b}{c} + d = (a + d)\frac{b}{c}$]

8. Reema can weave 35 baskets in = 25 days

She will weave 1 basket in = $\frac{25}{35}$ days

(More work, more days)

$= \frac{275}{7} = 39\frac{2}{7}$days

Exercise 13.5

1. (a) 20m/s into 1 m/sec

$\frac{18}{5}$ km/hr

20m/s = $20 \times \frac{18}{5}$km/hr

= 75km/hr

(b) 18km/hr into m/sec

1km/hr = $\frac{5}{18}$m/sec

18km/hr = $18 \times \frac{5}{18}$m/sec = 5m/sec

(c) 65m/s into km/h

1km/hr = $\frac{18}{5}$m/sec

65m/s = $65 \times \frac{18}{5}$km/hr

= 234km/hr

(d) 162km/hr into m/s

1km/hr = $\frac{5}{18}$m/sec

162km/h = $162 \times \frac{5}{18}$m/sec

= 45m/sec

2. Distance = 280m

Speed = 48 km/h = $42 \times \frac{5}{18} = \frac{210}{18} = \frac{70}{6}$ m/s

[$\because$1km/hr = $\frac{5}{18}$m/s]

time = $\frac{\text{Distance}}{\text{Speed}}$

$= \frac{280}{70}$

$= 280 \times \frac{6}{70}$

$= \frac{167}{7}$

= 24s

3. Length of train: 180m

Length of platform: 570m

Total distance to be covered by train While crossing: 180m + 570m = 750m

Speed = 50km/jr = 13.88m/s

Time = $\frac{\text{Distance}}{\text{Speed}} = \frac{750}{13.88}$ seconds = 54 seconds

Hence, train will pass the platform in 54 second.

4. Length of train: 160m

Length of platform: 200m

Total distance to be covered by train while crossing = 160m + 200m = 360m

Time taken = 18 second

Speed of train = $\frac{\text{Distance}}{\text{Speed}} = \frac{360}{18}$ = m/sec = 20m/sec = 72 km/hr

Hence, the speed of train is 72km/hr

5. Speed in m/s = 54 × 5/18=15 m/s

It takes 11 seconds to cross an electric pole hence length of the train is 15 × 11=165 m

Now it has to cross a platform of 240 m hence total displacement = 240 + 165 = 405 m

With a speed of 15 m/a

Hence it will take 405/15=28 seconds

6. Length of two trains = 150m and 180m

If they are running opposite directions the total distance = 150 + 180 = 330m

The speed of the first train = 30km/hr

$= \cancel{5}\,\cancel{30} \times \frac{5}{\cancel{15}\,3}$ m/sec

$= \frac{25}{3}$ m/sec

The speed of the second train = 24km/hr

$= \cancel{4}\,\cancel{24} \times \frac{5}{\cancel{18}\,3}$

$= \frac{20}{3}$ m/sec

Their reletively speed $= \frac{25}{3} + \frac{20}{3} = \frac{25 + 20}{3}$

$= \frac{\cancel{45}\,15}{\cancel{3}}$

= 15 m/sec

∴ They will cars each other at the train a time

$= \frac{\text{Distance}}{\text{Speed}}$

$= \frac{\cancel{330}\,22}{\cancel{15}}$

= 22sec

8. Distance = Speed × Time

Speed = 72km/hr = 1.25 km/min

(a) Distance travelled in 24min = Speed per min × 24 minutes

= (1.25 × 24)km

= 30km

(b) Time taken to cover 175km = $\frac{\text{Distance}}{\text{Speed}} = \frac{175}{75} \times 60$

= 140 minutes = 2 hours 20 minutes

9. Money 5 men earn a day = 875Rs

∴ 5 men = 875Rs

1 men = $\frac{875}{5}$ = 175/day

∴ 1 men earn 175Rs a day

Amount of money 7 women earns = 875Rs

7 women = $\frac{875}{5}$ = 125 Rs/day

1 women earns 125 Rs/day

Now,

10 men earn = 175 × 10 = 1750 per day

5 women earn = 125 × 5 = 652 per day

∴ 10 men and 5 women earn per day = 1750 + 625

10 men and women = ₹2375

Multiple Choice Question

1. (a) $\frac{x}{y}$ remains contant

2. (b) x × y remains contant

3. x and y are directly proportional x × y

if x = 8, y = 12

then, 8 × 12 or 2 × 3

Now if we compare

(a) 10 × 15 = 2 × 3

(b) 2 × 3 = 2 × 3

(c) 6 × 9 = 2 × 3

(d) 5 × 20 = 1 × 4

Answer: (d) 5 × 20

4. Since, X and Y varies in inverse proporation, therefore,

= XY = K where k is a contant.

Now, if X = 12 and Y = 3, then

= K = 12 × 3 = 36

Answer: (a) (5 and 6)

= 4 × 9 = 36 = k

(b) 10, 36

= 10 × 3.6 = 36 = k

(c) 72, 0.5

= 72 × 0.5 = 36 = k

(d) 5, 6

= 5 × 6 = 30 ≠ k

5. Cost of 12 note books = 450

Cost of 1 note book = $\frac{450}{12}$

Cost of 16 note books = $\frac{450}{12} \times 16$

= 600

Answer: (d) 600

6. Let the number of pen to be bought in ₹52.50 be x

Number of Pens	5	x
Cost of Pens	37.50	52.5

Since, they re in direct proportion

$\frac{5}{37.50} = \frac{x}{52.50}$, $x = \frac{5 \times 52.50}{37.50} = 7$

Answer: (c) 7

7. Let the time to cover a distance of 546km be x.

Distance (in km)	210	546
Time taken	5	x

Since, they are in direct proportion

$\frac{210}{5} = \frac{546}{x}$, $\frac{546 \times 5}{210} = x = 13$ hours

(a) 13 hours

8. Given, Speed = 54/hr

Time = 2.5 hours

Speed × Time = Distance

Distance = 54 × 2.5 = 135km

In nex Case, Distance = 135km

Speed = 45km/h

Now time = Distance/Speed = 135/45 = 3 hours

It can cover the same distance at a speed of 45km/h in 3 hours.

Answer: (c)

9. Number of pages composed by 1 computer operator in hours = 120/(10 ÷ 2)

= 6 pages

Number of pages composed by 1 computer operator in 30 minutes = $\frac{6}{2} = 3$

Number of computer operator to work to compose 120 pages in 30 minutes = $\frac{120}{3}$ = 40

Thus 40 computer operator have to work to compose 120 pages in 30 minutes

Answer: (b) 40

10. If more amount of pulses, the cost will be more. thererfore it's directly proportional

Let us consider the cost be x, then

$\frac{882}{14} = \frac{x}{22}$

14 × x = 882 × 22

x = 19404/14

x = 1386

∴ 1386 is the cost

Answer: (d) ₹1386

11.

Distance covered (in km)	8	x
Time (in min)	56	100

Let numberof Apples in ₹180 be x.

Since, it is in direct proportion.

$\frac{8}{56} = \frac{x}{180}$, 180 × 8 = x × 56

$x = \frac{180 \times 8}{56} = \frac{1440}{56}$

= ₹25.70 (Approx)

Answer: (c) 25

12. We use the formula Speed = $\frac{\text{Distance}}{\text{Time}}$

Let us consider the distance be x km

Then time = $\frac{20}{60}$hr = $\frac{1}{3}$hr

= S = $\frac{D}{T}$

= 75 = $\frac{x}{1/3}$

x = 75 × $\frac{1}{3}$

= x = 25

∴ the car will cover 25km.

Answer: (a) 25km

Check Your Progress

1. Cost of 18 dolls = ₹630

Cost of 1 doll = $\frac{630}{18}$ = 35rupees.

According to the problem

(Cost of 1 doll)(Number of dolls) = Total cost

= 35x = 455

= x = $\frac{455}{35}$ = 13

so, 13 dolls can be bougth.

2. If more amount of sugar is bought the cost will also be more. Therefore, it's directly proportional

Let the amount of sugar be x kg, $\frac{238.50}{9}$ = $\frac{371}{x}$

238.50 × x = 9 × 371

238.50x = 3339

x = $\frac{3339}{238.50}$

x = 14

∴ 14kg Sugar can be bought for ₹371.

3. 1 hour = 60minutes

1 hour, 12 minutes = 60 + 12 = 72min

Let the required distance be x

Distance covered (in km)	50	x
Time (in min)	60	72

Clearly, more distance will be covered in more time. So, this is a case of direct proporation.

$\frac{50}{60}$ = $\frac{x}{72}$

= 50 × 72 = x × 60

= x = $\frac{50 \times 72}{60}$

x = 60

Therefore, the distance travelled by the car 1h 12min is 60km.

4. Let x be the height of the tree

Height of object	14	x
Length of shadow	10	7

The more the length of the shadow, the more will be the height of the tree

Now, $\frac{14}{10}$ = $\frac{x}{7}$

= x = $\frac{14 \times 7}{10}$

= x = 9.8

Therefore, a 9.8m tall tree will cast a shadow of length 7m.

14 Factoriation

Exercise 14.1

1. $7x + 7y$

$= 7 \times x + 7 \times y$

$7(x + y)$

2. $\frac{1}{3}x + \frac{1}{3}$

$\frac{1}{3} \times x + \frac{1}{3} \times 1$

$\frac{1}{3}(x + 1)$

3. $186a + 186b$

$186 \times a + 186 \times b$

$186\ (a + b)$

4. $am + an$

$a \times b + a \times n$

$a(m + n)$

5. $ap + bp$

$a \times p + b \times p$

$p(a + b)$

6. $pqm + pqt$

$p \times q \times m + p \times q \times t$

$pq(m + t)$

7. $100a + 100b + 100c$

$100 \times a + 100 \times b + 100 \times c$

$100\ (a + b + c)$

8. $42x - 7y$

$7 \times 6 \times x - 7 \times y$

$7(6x - y)$

HCF = 7

9. $89xy + 89y$

$89 \times x \times y + 89 \times y$

HCF = 89

$89y\ (x + 1)$

10. $4x^2 - 16a^2$

$4 \times x \times x - 4 \times 4 \times a \times a$

HCF = 4

$4(x^2 - 4a^2)$

11. $16a^2b^3 - 8a^3b^2$

$16 \times a \times a \times b \times b \times b - 8 \times a \times a \times a \times b \times b$

$HCF = 8a^2b^2$

$= 8a^2b^2(2b - a)$

12. $rx - ry$

$r \times x - x \times y$

$r\ (x - y)$

13. $9xy^2 + 9xy$

HCF = 9xy

$9 \times y\ (y + 1)$

14. $16x^2 + 2x$

= HCF = 2x

$2x(8x + 1)$

15. $125m^2n^3 - 25mn$

HCF = 25mn

$25mn(5mn^2 - 1)$

16. $12y^3 + 6a^3$

HCF = 6

$6(2y^3 + a^3)$

17. $7x + 14y$

$7 \times x + 14 \times y$

HCF = 7

$7(x + 2y)$

18. $12x^3y - 4xy^2$

$12 \times x \times x \times x \times y - 4 \times x \times y \times y$

HCF = 4xy

$4xy(3x^2 - y)$

19. $abc + aby + ab^2$

$a \times b \times c + a \times b \times y + a \times b \times z$

HCF = ab

$ab(c + y + z)$

20. $5x + 5y - 5z$

$5 \times x + 5 \times y - 5 \times z$

$5(x + y - z)$

21. $4x - 4y - 4z$

$4 \times x - 4 \times y - 4 \times z$

$4(x - y - z)$

22. $3ay + 3az$

$3 \times a \times y + 3 \times a \times z$

$3a(y + z)$

Exercise 14.2

1. (a) $9a^2$ and $15b^2$

HCF of 9 and 15 is 3

Number of a^2 and b^2

Thus, HCF of 90^2 and $15b^2$ is 3.

(b) $15a^2b^2$ and $-24ab$

HCF of 15 and -24 is 3

HCF of a^2 and a is a

HCF of b^2 and b is b

Thus, HCF of $15a^2b^2$ and $-24ab$ is 3ab

(c) $18x^3y$ and $27x^2y^2z$

HCF of 18 and 27 is 9

HCF of x^3 and x^2 is x^2

HCF of y and y^2 is y

Thus, HCF is $18x^3y$ and $27x^2y^2z$ is $9x^2y$

(d) 72abc and 27abc

HCF of 72 and 27 is 9

HCF of abc and abc is abc

Thus, HCF of 72abc and 27abc is 9abc.

(e) $90a^2xy$ and 81xy

HCF of 90 and 81 is 9

HCF of xy and xy is xy

Thus, HCF of $90a^2xy$ and 81xy is 9xy

(f) 3xyz and 27

HCF of 3 and 27 is 3

Thus, HCF of 3xyz ad 27 is 3.

(g) 3xyz and 15

HCF of 3 and 15 is 3

Thus, HCF is 3xyz and 15 is 3.

(h) $39a^3b^3c^3$ and $26a^2b^2c^2$

HCF of 39 and 26 is 13

HCF of a^3 and a^2 is a^2

HCF of b^3 and b^2 is b^2

HCF of c^3 and c^2 is c^2

Thus, HCF of $39a^3b^3c^3$ and $26a^2b^2c^2$ is $13a^2b^2c^2$

(i) 2ab, 7ac and 9bc

No common factors of 2, 7 and 9

No common factors of a, b and c

Thus, 2ab, 7ac and 9bc has no common factors.

(j) $36a^2b^2c^2$, $27a^2b^2c^2$, 72abc

HCf of 36, 27 and 72 is 9

HCF of a^2, a^2 and a is a

HCF of b^2, b^2 and b is b

HCF of c^2, c^2 and c is c

Thus, HCF of $36a^2b^2c^2$, $27a^2b^2c^2$, 72abc is 9abc

2. (a) $4x + 12y$

HCF of 4x and 12y is 4

$4(x + 3y)$

(b) $15x - 20$

HCF of 15 and 20 is 5

$5(3x - 4)$

(c) $4x^2 - 12x^3 + 24x^4$

HCF of 4, 12 and 24 is 4.

HCF of x^2, x^3 and x^4 is x^2

Thus, HCF of $4x^2$, $-12x^3$ and $24x^4$ is $4x^2$

$4x^2(1 - 3x + 6x^2)$

(d) $10x - 25x^2$

HCF of 10 and 25 is 5

HCF of x and x^2 is x

Thus, HCF of 10x and $25x^2$ is 5x.

5x(2–5x)

(e) $3x^2y + xy$

HCF of x^2y and xy is xy

xy(3x + 1)

(f) $3x^2y^2 - 12xy + 27x^3y^3$

HCF of 3, 12 and 27 is 3

HCF of x^2, x and x^3 is x

HCF of y^2, y and y^3 is y

Thus, HCF of $3x^2y^2$, $-12xy$ and $27x^3y^3$ is 3xy

$3xy(xy - 4 + 9x^2y^2)$

Exercise 14.3

1. (a) x2 – 15x + 56

$x^2 - 8x - 7x + 56$

$x(x-8) -7 (x - 8)$

$(x - 7) (x - 8)$

(b) $x^2 - 33x + 90$

$x^2 - 30x - 3x + 90$

$x(x - 30)^3 -3(x - 30)$

$(x - 3) (x^2 - 30)$

(c) $x^2 + 8x + 15$

$x^2 + 3x + 5x + 15$

$x(x + 3) 5(x + 3)$

$(x + 5) (x + 3)$

(d) x2 – 9x + 14

$x^2 - 2x - 7x + 14$

$x(x - 2) - 7(x - 2)$

$(x - 7) (x - 2)$

(e) $x^2 - 15x + 36$

$x^2 - 12x - 3x + 36$

$x(x - 12) -3(x - 12)$

$(x - 3) (x - 12)$

(f) $x^2 + 17x + 60$

$x^2 + 12x + 5x + 60$

$x(x + 12) 5(x + 12)$

$(x + 5) (x + 12)$

(g) $x^2 - 20x + 36$

$x^2 - 18x - 2x + 36$

$x(x - 18) -2 (x - 18)$

$(x - 2) (x - 18)$

(h) $x^2 - 36x + 99$

$x^2 - 33x - 3x + 99$

$x^2(x - 33)-3 (x - 33)$

$(x - 3) (x - 33)$

(i) $x^2 + 4x - 45$

$x^2 + 9x - 5x - 45$

$x(x + 9) - 5(x + 9)$

$(x - 5) (x + 9)$

(j) $x^2 + 14x + 45$

$x^2 + 9x + 5x + 45$

$x(x + 9) 5(x + 9)$

$(x + 5) (x + 9)$

(k) $x^2 - 4x - 21$

$x^2 - 7x + 3x - 21$

$x(x - 7) + 3(x - 7)$

$(x + 3) (x - 7)$

(l) $x^2 + 4x - 77$

$x^2 + 11x - 7x - 77$

$x(x + 11) - 7(x + 11)$

$(x - 7) (x + 11)$

2.

		M.T	Prod.	Nos.	Factors
(a)	$x^2 - 5x + 6$	–5	6	–2, –3	(x – 3) (x – 2)
(b)	$x^2 - 11x + 14$	–11	24	–3, –8	(x – 3) (x – 8)
(c)	$x^2 - 9x + 24$	–9	14	–7, –2	(x – 7) (x – 2)
(d)	$x^2 - x - 6$	–1	–6	–3, 2	(x – 3) (x + 2)
(e)	$y^2 + 12y + 36$	12	36	6, 6	(y + 6) (y + 6)
(f)	$x^2 + 5x - 84$	5	–84	12, –7	(x + 12) (x + 7)
(g)	$a^2 + 13a - 14$	13	–14	14, –1	(a + 14) (a – 1)
(h)	$p^2 + p - 72$	1	–72	9, –8	(p + 9) (p – 8)
(i)	$x^2 - 16xy + 39y^2$	–16	39	–3, –13	(x – 13y) (x – 3y)
(j)	$m^2 + 14m + 45$	14	45	9, 5	(m + 9) (m + 5)
(k)	$y^2 + 13y - 14$	13	-14	14, –1	(y + 14) (y – 1)
(l)	$h^2 - 13h + 30$	–13	30	–10, –3	(h – 10) (h – 3)
(m)	$y^2 - 3y - 54$	–3	–54	–9, 3	(y – 9) (y + 6)
(n)	$b^2 - 5b - 24$	–5	–24	–8, 3	(b – 8) (b + 3)
(o)	$x^2 - 8xy - 48y^2$	–8	–48	–12, 4	(x – 12y) (x + 4y)

(c) $x^2 - 9x + 14$

$x^2 - 2x - 7x + 14$

$x(x - 2) - 7(x - 2)$

$(x - 7) (x - 2)$

(d) $x^2 - x - 6$

$x^2 - 3x + 2x - 6$

$x(x - 3)\ 2(x - 3)$

$(x + 2)\ (x - 3)$

(e) $y^2 + 12y + 36$

$y^2 + 6y + 6y + 36$

$y(y + 6)\ 6(y + 6)$

$(y + 6)\ (y + 6)$

(f) $x^2 + 5x - 84$

$x^2 + -7x + 12x - 84$

$x(x - 7)\ 12(x - 7)$

$(x + 12)\ (x - 7)$

(g) $a^2 + 13a - 14$

$a^2 + 14a - a - 14$

$a(a + 14) -1(a + 14)$

$(a - 1)\ (a + 14)$

(h) $p^3 + p - 72$

$p^2 + 9p - 8p - 72$

$p(p + 9) -8(p + 9)$

$(p - 8)\ (p + 9)$

(i) $x^2 - 16xy + 39y^2$

$x^2 - 3xy - 13xy + 39y^2$

$x(x - 3y) -13y\ (x - 3y)$

$(x - 13y)\ (x - 3y)$

(j) $m^2 + 14m + 45$

$m^2 + 5m + 9m + 45$

$m(m + 5)\ 9(m + 5)$

$(m + 9)\ (m + 5)$

(k) $y^2 + 13y - 14$

$y^2 + 14y - y - 14$

$y(y + 14) -1(y + 14)$

$(y - 1)\ (y + 14)$

(l) $h^2 - 13h + 30$

$h^2 - 10h - 3h + 30$

$h(h - 10) -3(h - 10)$

$(h - 3)\ (h - 10)$

(m) $y^2 - 3y - 54$

$y^2 - 9y + 6y - 5y$

$y(y - 9)\ 6(y - 9)$

$(y + 6)\ (y - 9)$

(n) $b^2 - 5b - 24$

$b^2 + 3b - 8b - 24$

$b(b + 3) -8(b + 3)$

$(b - 8)\ (b + 3)$

(o) $x^2 - 8xy - 48y^2$

$x^2 + 4xy - 12xy - 48y^2$

$x(x + 4y - 12y\ (x + 4y)$

$(x - 12y)\ (x + 4y)$

3. (a) $4x^2 + 17x + 15$

$4x^2 + 12x + 5x + 15$

$4x(x + 3)\ 5(x + 3)$

$(4x + 5)\ (x + 3)$

(b) $2x^2 - 15x + 22$

$2x^2 - 4x - 11x + 22$

$2x(x - 2) -11(x - 2)$

$(2x - 11)\ (x - 2)$

(c) $8x^2 - 22 + 15$

$8x^2 - 10x - 12x + 15$

$2x(4x - 5) -3(4x - 5)$

$(2x - 3)\ (4x - 5)$

(d) $4x^2 - 16x - 9$

$4x^2 - 2x - 18x - 9$

$2x\ (2x + 1) -9(2x + 1)$

$(2x - 9)\ (2x + 1)$

(e) $3x^2 + 11xy + 6y^2$

$3x^2 + 9xy + 2xy + 6y^2$

$3x(x + 3y)\ 2y(x + 3y)$

$(3x + 2y)\ (x + 3y)$

(f) $6x^2 - 11xy - 10y^2$

$6x^2 - 15xy + 4xy - 10y^2$

$3x(2x - 5) + 2y(2x - 5y)$

$(3x + 2y)\ (2x - 5)$

(g) $4x^2 - 4x + 1$

$4x^2 - 2x - 2x + 1$

$2x(2x - 1) - 1(2x - 1)$

$(2x - 1)(2x - 1)$

(h) $8x^2 - 21x + 10$

$8x^2 - 16x - 5x + 10$

$8x(x - 2) - 5(x - 2)$

$(8x - 5)(x - 2)$

4. (a) $a^2 + 6a + 9$

First term is square of a

Last term is square of 3

Middle term is $2 \times 3 \times a = 6a$

Hence, $a^2 + 6a + 9$

$= (a + 3)^2$

(b) $4x^2 + 4xy + y^2$

First term is square of 2x

Last term is square of y

Middle term is square of $2x \times 2x \times y = 4xy$

Hence, $4x^2 + 4xy + y^2$

$= (2x + y)^2$

(c) $4a^2 + 20ab + 25b^2$

First term is square of 2a

Last term is square of 5b

Middle term is square of $2 \times 2a \times 5b$

Hence, $4a^2 + 20ab + 25b^2$

$= (2a + 5b)^2$

(d) $25x^2 - 20xy + 4y^2$

First term is square of 5x

Last term is square of 2y

Middle term is square $-2 \times 5x \times 2y = -20xy$

Hence, $25x^2 - 20xy + 4y^2$

$= (5x - 2y)^2$

(e) $4x^2 - 12x + 9$

First term is square of 2x

Last term is square of 3

Middle term is square $= -2x \times 2 \times 3 = -24x$

Hence, $4x^2 - 12x + 9$

$= (2x - 3)^2$

(f) $121 + 22x + x2$

First term is square is 11

Last term is square of x

Middle term is square $2 \times 11 \times x = 22x$

Hence, $121 + 22x + x^2$

$= (11 + x)^2$

(g) $x^2 - y^2$

Expresion is the difference of 2 squares x and y

Thus, $x^2 - y^2$

$= (x + y)(x - y)$

(h) $4p^2 - 16q^2$

Expresion is the difference of 2 squares 2p and 4q

Thus, $4p^2 - 16q^2$

$= (2p - 4q)(2p + 4q)$

(i) $25x^2 - 49y^2$

Expresion is the difference of 2 squares 5x and 7y

5x and 7y

Thus, $25x^2 - 49y^2$

$= (5x - 7y)(5x + 7y)$

(j) $x^4 - 81$

Expresion is the difference of 2 squares $x^2 - 9$

$x^2 - 9^2$

Thus, $x^4 - 81$

$= (x^2 - 9)(x^2 + 9)$

(k) $m^6 - 25$

Expresion is the difference of 2 squares m^3 and 5

Thus, $m^6 - 25$

$= (m^3 - 5)(m^3 + 5)$

(l) $25a^2b^2 - 9p^2q^2$

Expresion is the difference of 2 squares 5ab and 3pq

Thus, $25a^2b^2 - 9p^2q^2$

$= (5ab - 3pq)(5ab + 3pq)$

(m) $\frac{d^2}{100} - e^2$

Expresion is the difference of 2 squares $\frac{d}{10}$ and $\frac{e}{3}$

Thus, $\frac{d^2}{100} - \frac{e^2}{9}$

$= \left(\frac{d}{10} - \frac{e}{3}\right)\left(\frac{d}{10} + \frac{e}{3}\right)$

Review Exercise

1. (a) $5x^2 + 20x - 15$

Common factor of 5, 20 and 15 is 5

$5(x^2 + 4x - 3)$

(b) $x^2yz - xy^2z + xyz^2$

Common factor x^2, y and x is x

Common factor of y, y^2 and y is y

Common factro z, z and z^2 is z

So, $x^2yz - xy^2z + xyz^2$

$= xyz(x - y + z)$

(c) $7ab^2c + 21a^2bc^2 - 35abc$

Common factors of 7, 21 abd 35 is 7

Factor of a, a^2 and a is a

Factor of b^2, b and b is b

Factor of c, c^2 and c is c

So, $7ab^2c + 21a^2bc^2 - 35abc$

$= 7abc(b + 3ac - 5)$

2. (a) $5x^2 - 20x - 8y + 2xy$

$= 5x(x - 4) + 2y(-4 + x)$

$(5x + 2y)\ (x - 4)$

(b) $(x - 2y)2 + (8y - 4x)$

Common factor = x – 2y

x – 2y (x – 2y – 4)

(c) $7p^2 + 7q^2 + ap^2 + aq^2$

$= 7p^2 + ap^2 + 7q^2 + aq^2$

$p^2(7 + a)\ q^2(7 + a)$

$(p^2 + q)\ (7 + a)$

3. (a) $36m^2 - 81x^2$

Expresion is the different of square as 6m – 9x

Thus, $36m^3 - 81n^2$

$= (6m - 9n)\ (6m + 9n)$

(b) $50x^2 - 98y^2$

$2 \times 5 \times 5 \times x \times x - 2 \times 7 \times 7xyxy$

$= 2((5x)^2 - (7y)^2)$

$a^2 - b1\ (a + b)\ (a\text{-}b)$

$= x(5x + 7y)\ (5x - 7y)$

$= (10x + 14y)\ (10 - 14y)$

(c) $16z^2 - 4x^2 - 12xy - 9y^2$

$16z^2 - (4x^2 + 12xy + 9y^2)$

$(4z)^2 - (2x + 3y)^2$

$(a + b)^2 = a^2 + b1 + 2ab$

$(4z + (2x + 3y)\ (4z - (2x + 3y)$

$= (4z + 2x + 3y)\ (4z - 2x - 3y)$ $a^2 - b^2 = (a + b)\ (a - b)$

4. (a) $25x^2 - 90xy + 81y^2$

First term is square is 5x

Second term is square of 9y

Middle term is square $2 \times 5x \times 9y = 90xy$

Hence, $25x^2 - 90xy + 81y^2$

$= (5x - 9y)^2$

(b) $121x^2 - 88xy + 16y^2$

First term is square is 11x

Last term is square of 4y

Middle term is square $2 \times 11x \times 4y = 88xy$

Hence, $121x^2 - 88xy + 16y^2$

$= (11x - 4y)^2$

(c) $49a^4 - 112a^2b^2 + 64b^4$

First term is square is $7a^2$

Last term is square of $8b^2$

Middle term is square $2 \times 7a^2 \times 8b^2 = 112a^2b^2$

Hence, $49a^4 - 112a^2b^2 + 64b^4$

$= (7a^2 - 8b^2)$

5. (a) $(a^2 - b^2)^2 + 4a^2b^2$

$(a^2 - b2)^2 + (2ab)^2$

$a^2 + b^2 - 2ab + (2ab)^2$

$a^2 + b^2 - 2ab\ (-1 + 0)$

$(a^2 - b^2)^2 + 4a^2b^2$

$((a - b)\ (a + b)\ a^2b^2$

$(a^2\ b)^2\ (a + b)^2 + 4a^2b^2$

$(a^2 + b^2 - 2ab)\ (a^2 + b^2 + 2ab) + 4a^2b^2$

$a^4 - 2a^2b^2 + b^4 + 4a^2b^2$

$a^4 + b^4 + a^2b^2\ (a^2 + b^2 + 2ab)$

$= (a^2 + b^2)^2 = (a + b)^2$

(b) $x^4 - (y + z)^4$

$x^4 - (y + z)^4 = (x^2)^2 - [(y + z)^2]^2$

Using the identities $a^2 - b^2 = (a + b)\ (a - b)$

$(x^2)^2 - [(y + z)^2]^2 = [x^2 - (y + z)^2]\ [x^2 - (y + z)^2]\ [x^2 - (y + z)^2]\ [x^2 - (y + z)^2] = [(x - (y + z)\ (x + (y + z)][x^2 + (y + z)^2]\ [x^2 - (y + z)^2][x^2 + (y + z)^2] = (x - y - z)(x + y + z)\ [x^2 + (y + z)^2]$

$= x^4 - (y + z)^4 = (x + y + z)\ [x^2 + (y + z)^2]$

Using the identities $a^2 - b^2 = (a + b)\ (a - b)$

$(x^2)^2 - [(y + z)^2]$

(c) $(x - z)^4 - x^4$

$((x - z)^2)^2 - (x^2)^2$

$(x(-z)^2 - x^2)\ (x - x)^2 + x^2)$

$= (2x^2 - 2xz + z^2) - z(2x - z)\ (a^2 - b^2)\ (a + b\ (a - b)$

6. (a)

$$
\begin{array}{r|l}
p - 4 & 5p - 5p \\
\hline
 & 5p^2 - 25p + 20 \\
 & 5p^2 - 20p \\
 & - \quad + \\
\hline
 & -5p + 20 \\
 & -5p + 20 \\
 & + \quad - \\
\hline
 & 0
\end{array}
$$

(b) $44(y^4 - 5y^3 - 24y^2) \div 22y^2(y - 8)$

$(44y^4 - 220y^3 - 1056y^2) \div 22y^3 - 176y^2$

$$
\begin{array}{r|l}
22y^3 - 176y^2 & 2y + 6 \\
\hline
 & 44y^4 - 220y^3 - 1056y^2 \\
 & 44y^4 - 352y^3 \\
 & - \quad + \\
\hline
 & 132y^3 - 1056y^2 \\
 & 132y^3 - 1056y^2 \\
 & - \quad + \\
\hline
 & 0
\end{array}
$$

(c) $x(5x^2 - 80)$ by $5x(x + 4)$

$(5x^3 - 80x) \div (5x^2 + 20x)$

$$
\begin{array}{r|l}
5x^3 + 20x & x - 4 \\
\hline
 & 5x^3 + 0 - 80x \\
 & 5x^3 + 20x^2 \\
 & - \quad - \\
\hline
 & -20x^3 - 80x \\
 & -20x^3 - 80x \\
 & + \quad - \\
\hline
 & 0
\end{array}
$$

(d) $48(2y^4 - 36y^2 + 162) \div 4(y - 3)^2$

$96y^4 - 1728y^2 + 7776 \div 4(y^2 + (3)^2 - 2 \times y \times 3)$

$(6y^4 - 1728y^2 + 7776) \div (4y^2 + 36 - 24y)$

$$
\begin{array}{r|l}
4y^2 - 24y + 36 & 24y^2 + 144y + 216 \\
\hline
 & 96y^4 + 0 - 1728y^2 + 0 + 7776 \\
 & 96y^4 - 576y^3 + 836y^2 \\
 & - \quad + \quad - \\
\hline
 & 576y^3 - 2592y^2 + 0 + 7776 \\
 & 576y^3 - 3456y^2 + 0 + 5184y \\
 & - \quad + \quad - \\
\hline
 & 0
\end{array}
$$

Multiple Choice Questions

1. Highest Common factor of $-10x^3y^4$ and $15xy^3$

Highest Common factor of 10 and 5 is 5

Highest Common factor of x^3 and x is x

Highest Common factor of y^4 and y^3 is y^3

So, Highest Common factor of $-10x^3y^4$ and $15xy^3$ is $5xy^3$.

Answer: (c) $5xy^3$

2. $a^2 + bc + ab + ac$

$= a^2 + ab + ac + bc$

$a(a + b) (a + b)$

Answer: (a) $(a + b) (a + c)$

3. $x^2 + 6x + 9$

$x^2 + 3x + 3x + 9$

$x(x + 3) + 3(x + 3)$

$(x + 3) (x + 3)$

Answer: (a) $(x + 3)$ and $(x + 3)$

4. $12x^2 - x - 1$

$12x^2 - 4x + 3x - 1$

$4x(3x - 1)\ 1(3x - 1)$

$(4x + 1) (3x - 1)$

Answer: (b) $(4x + 1) (3x - 1)$

5. $2x^2 + 7x + 5$

$2x^2 + 2x + 5x + 5$

$2x(x + 1)\ 5(x + 1)$

$(2x + 5) (x + 1)$

Answer: (c) $(x + 1)$ and $(2x + 5)$

6. $(7a^2 - 21b^2)$

$a2 - b^2 = (a + b) (a - b)$

$(7a + 21b) (7a - 21b)$

$7(a + 3b) (a - 3b)$

Answer: (d) $7(a - 3b) (a + 3b)$

7. x3 – 144x

$x(x^2 - 12^2)$

$x(x + 12) (x - 12)$

Answer: (c) $x(x - 12) (x + 12)$

8. $a^2 + bc + ab + ac$

$a^2 + ab + bc + ac$

$a(a + b) + c(b + a)$

$(a + c) (a + b)$

Answer: (a) $(a + b) (a + c)$

9. $ab - mn - an - bm$

$ab + an - bm - an$

$a(b + h) - m (b + n)$

$(a - m) (b + n)$

Answer: (b) (a - m) (b + n)

10. $x^2 + 6x + 8$

$x^2 + 2x + 4x + 8$

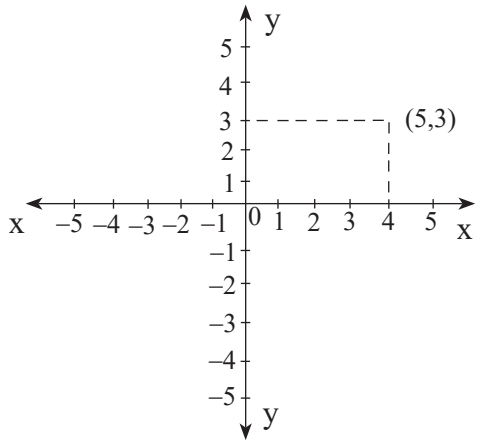
$x(x + 2)\ 4(x + 2)$

Answer: (c) $(x + 2) (x + 4)$

15 Graphs

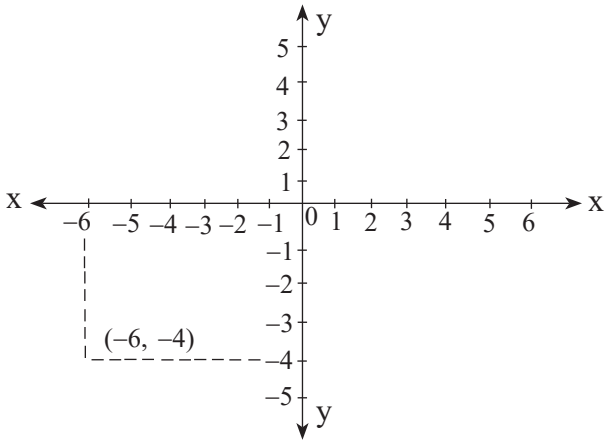
Exercise 15.1

1. (a)



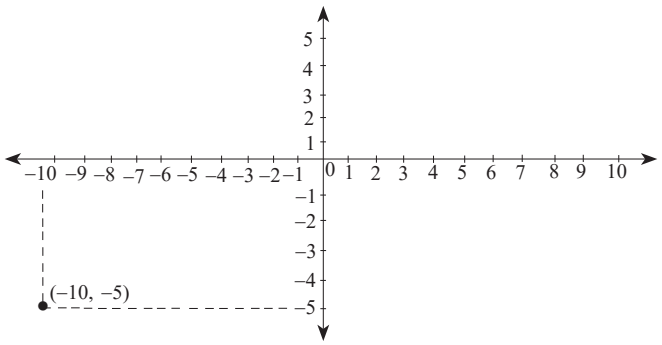
1st

(b)



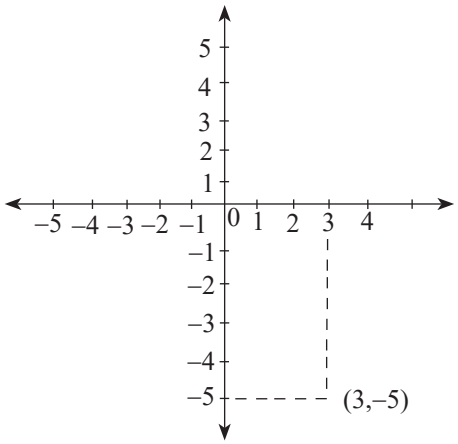
3rd

(c)



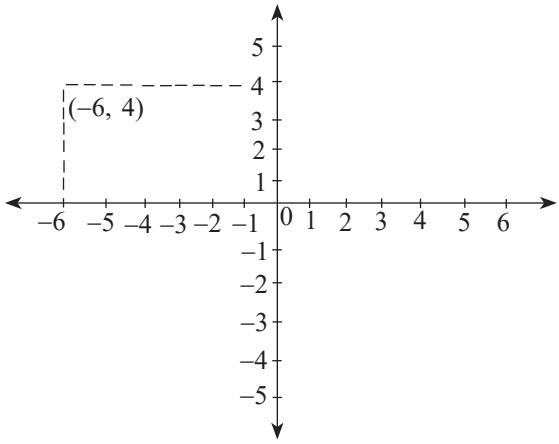
3rd

(d)



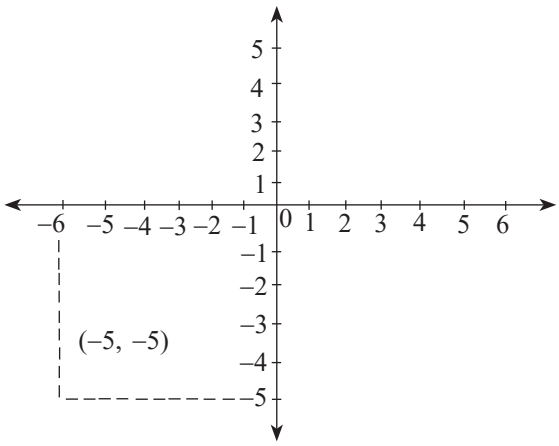
4th

(e)



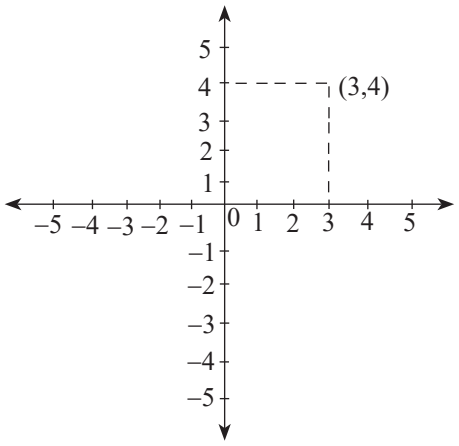
2nd

(f)



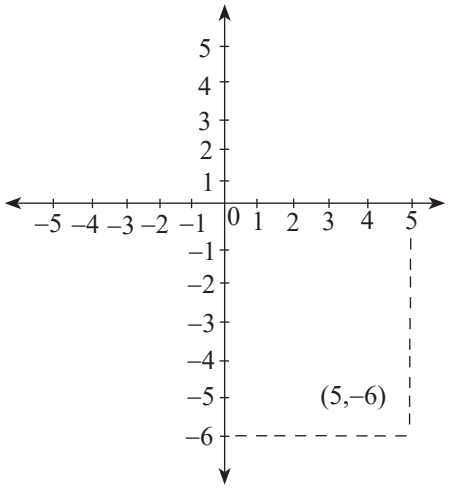
3rd

(g)



1st

(h)

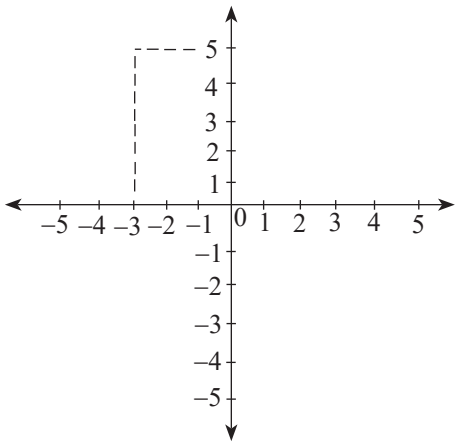


4st

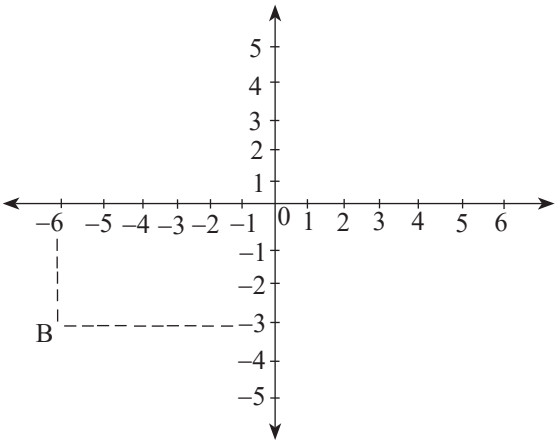
2. (a) X-axis
(b) 4-axis
(c) y-axis
(d) X-axis
(e) 4-axis
(f) X-axis
(g) 4-axis
(h) X-axis

3.

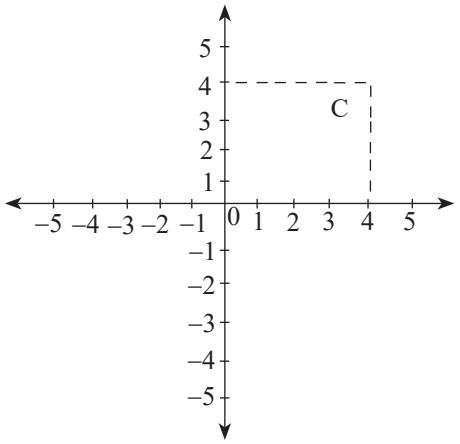
(a)



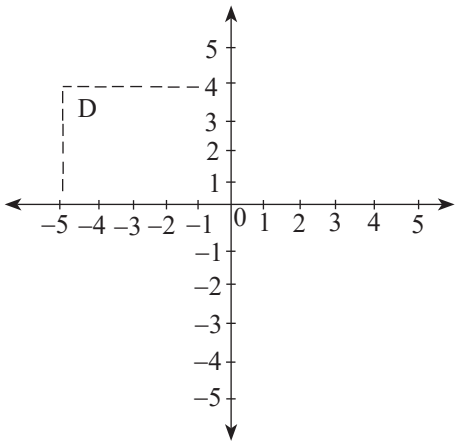
(b)



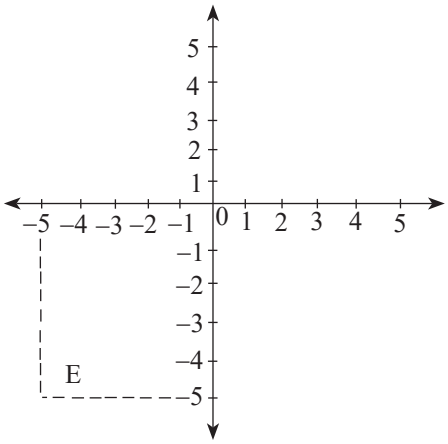
(c)



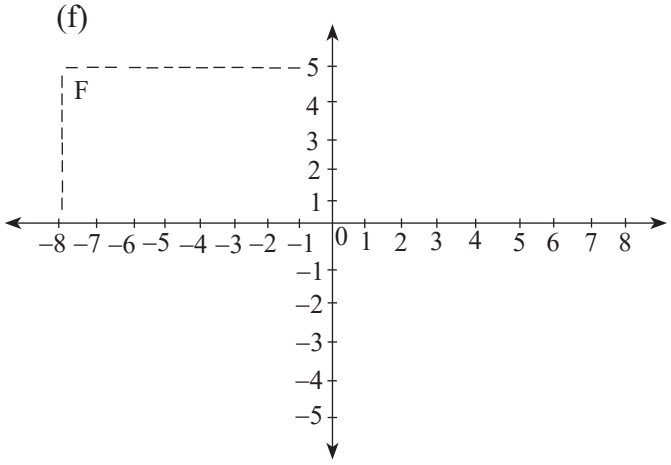
(d)



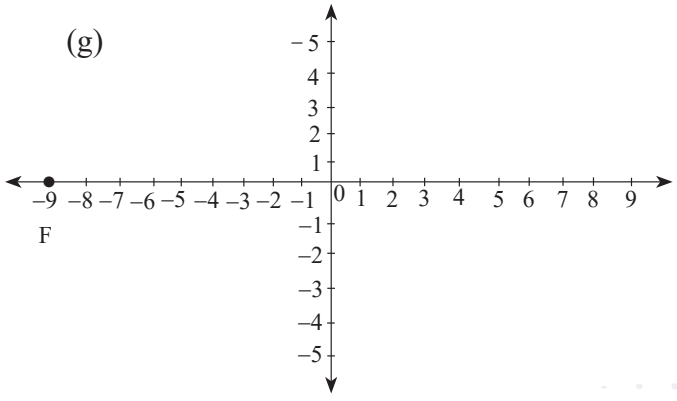
(e)



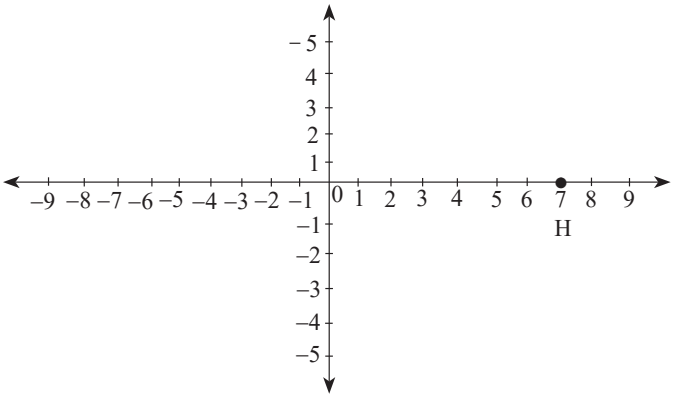
(f)



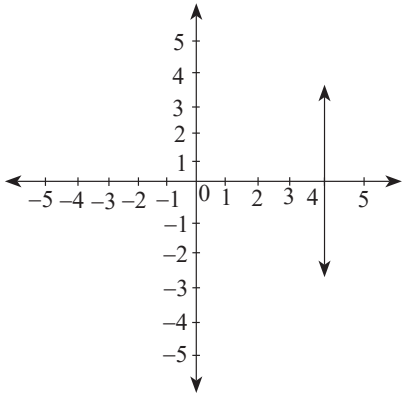
(g)



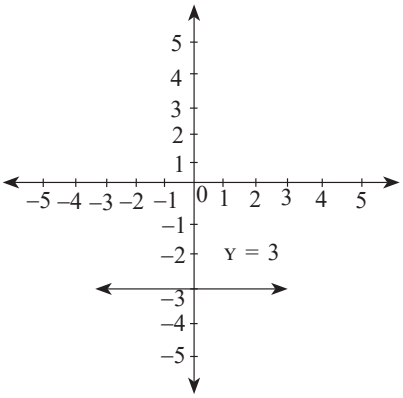
(h)



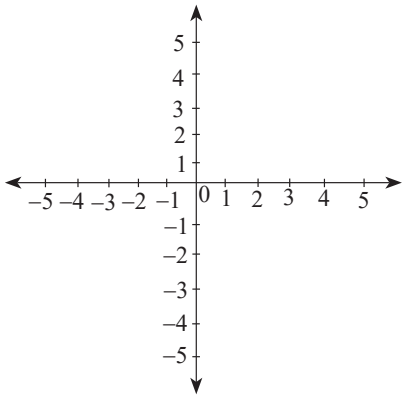
4. (a)



(b)



(c)



5. Abcissa is x-coordinate of a point

(a) (0,5) = 0

(b) (–2, 4) = –2

(c) (6, –3) = 6

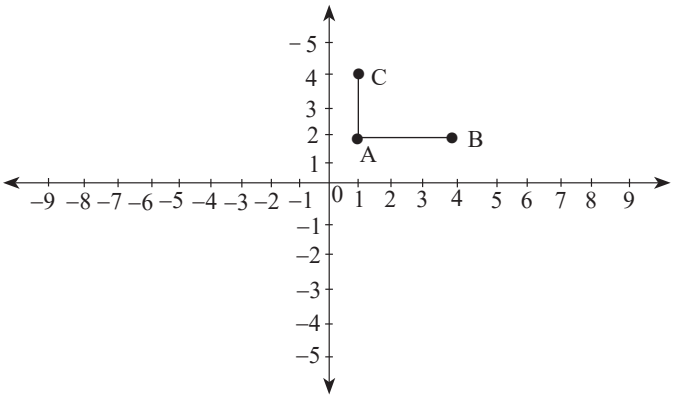
(d) (3, 7) = 3

6. Given points are : A (1,2), B (4,2) and C(1,4)

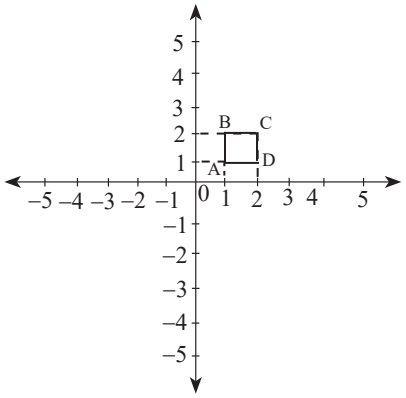
The graph of these points is as shown.

These given points represent an incomplete rectangle.

The coordinates of the fourth point D to complete the rectangle ABCD is D(4,4)



7.



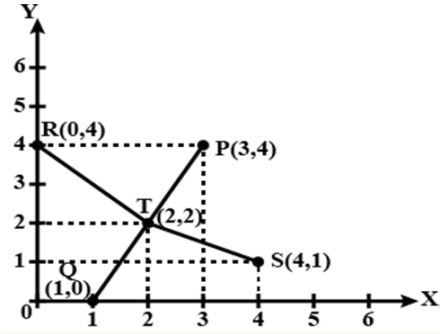
ACDB is a square as all its 4 sides are equal

8. A(1, 4), B(3, 4), C(3, 8), D(1, 8)

9. The given points P,Q,R and S are plotted on the graph sheet as shown.

After observing the graph, We get,

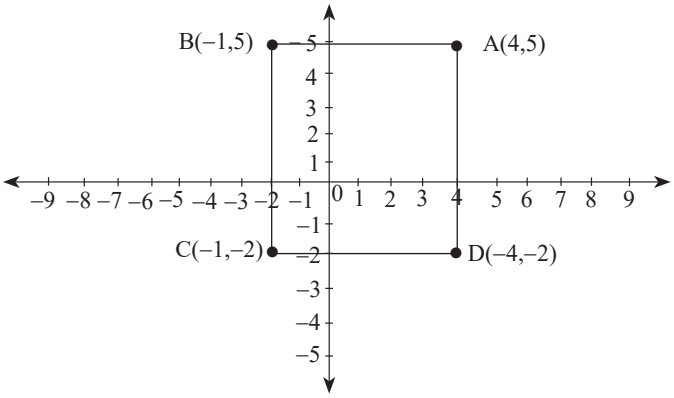
The intersecting point of RS and PQ is T(2,2).



10. Since opposite sides are equal in length and sides are perpendicular to each other, the quadrilateral ABCD is a rectangle.

Also length of rectangle is AB = CD = 5units and breadth of rectangle is AD = BC = 7units

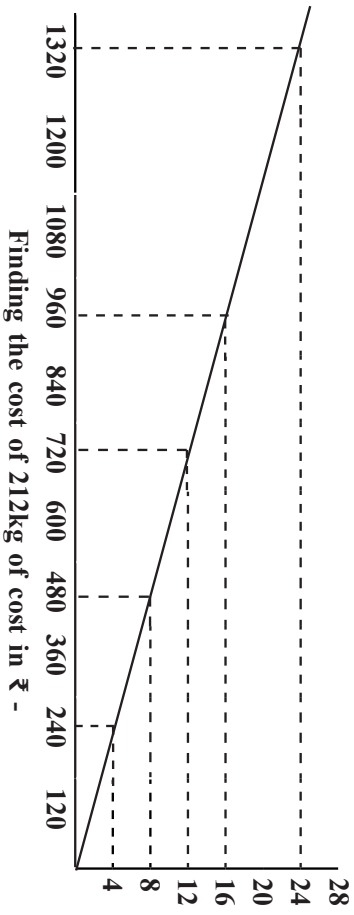
So Area of the rectangle = length × breadth = 5 × 7 = 35squnits



Exercise 15.2

1.

Quantity of mangoes (in kg)	4	8	12	16
Cost (in ₹)	240	480	720	960



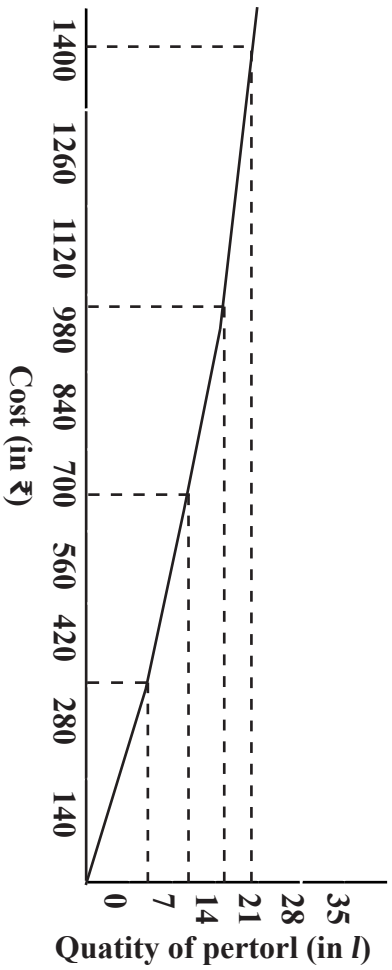
Mangoes, we draw a perpendicular line form x-axis to line graph, from that point we draw a perpendicular line of y-axis. It meet at 1320. Hence, the cost of 22kg of Mangoes is ₹1320.

2.

Quantity of petrol (in litres)	5	10	15	20
Cost (in ₹)	350	700	1050	1400

Scale of x-axis = 1unit = 7 litres of pertrol

Scale of y-axis = 1 unit = ₹140



For finding the amount of petrol, we draw a perpendicular line from x-axis to line graph, form that point, we draw a perpendicular line on y-asix. It meets at 28. Hence, 28 litres of petrol on be purchased for ₹ 1960.

3. Let us find the simple interest on various sum deposited in the bank for one year.

Given: r = 8%

y = 1 yr

(i) Sum = ₹800

(ii) Sum = ₹1500

To find: Interest

Solution: Graph between sum deposited and simple interest earned

P = 100

Simple interest = $\frac{100 \times 8 \times 1}{100} = 8$

P = 200

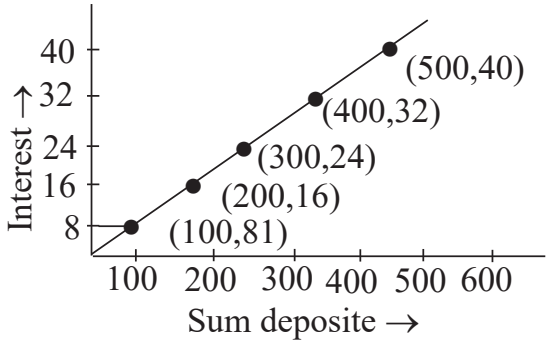
Simple interest = $\frac{200 \times 8 \times 1}{100}$ = 16

P = 300

Simple interest = $\frac{300 \times 8 \times 1}{100}$ = 24

P = 400

Simple interest = $\frac{400 \times 8 \times 1}{100}$ = 32



r = 8% t = 1 yr

(i) P = ₹800

Simple interest = $\frac{800 \times 8 \times 1}{100}$ = ₹64

(ii) P = ₹1500

Simple interest = $\frac{1500 \times 8 \times 1}{100}$ = ₹120

(a) For finding the interest on ₹800, draw a perpendicular line on the line graph and from that point draw a line on y-axis, we get ₹64 as interest.

(b) Similarly, on ₹1200, SI is ₹120.

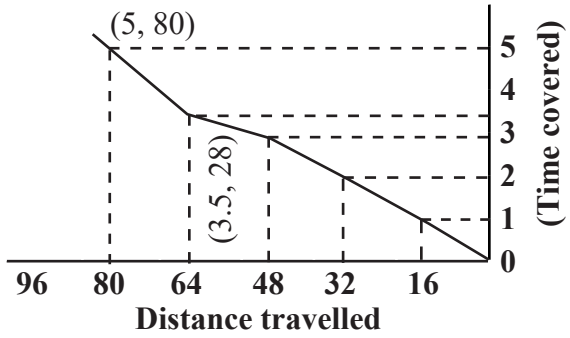
4. speed of bicycle = 16km/hr we need to make a time-distance graph so, finding different values of distance at different values of time.

Time (in hour)	1	2	3	4
Distance (in km)	8	16	24	32

Time	**Distance = Speed × Time**
1 hours	16 × 1 = 16km
2 hours	16 × 2 = 32km
3 hours	16 × 3 = 48km
4 hours	16 × 4 = 64km

Scale of x-axis: 1 unit = 1hour

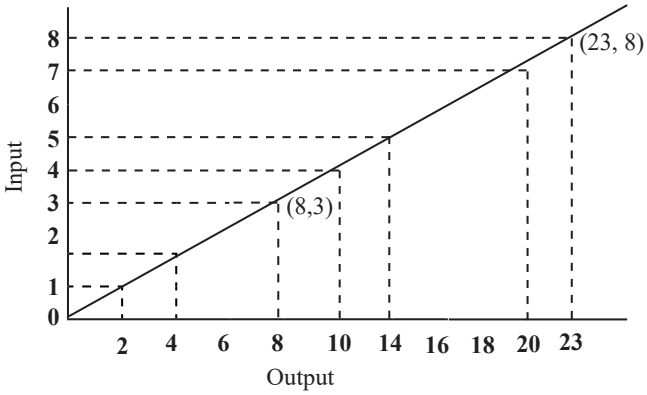
Scale of y-axis: 1 unit = 16km



(a) So, distance travelled in 3.5hours = 56km

(b) Time taken to cover 80km = 5 hours.

5.



Scale of x-axis 1 unit = 2

Scale of y-axis 1 unit = 1

Output for 3 = 8

Output for 8 = 23

6. (1) (i) 2013 – 7cr

(ii) 2015 – 10cr

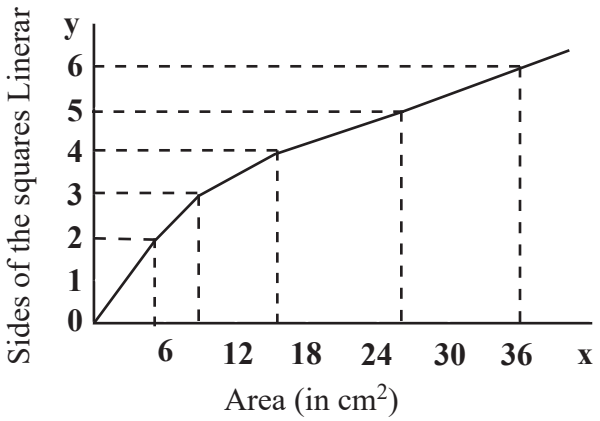
(iii) 2016 – 8cr

7. (a) 180km

(b) 5 hous

(c) 2 hours

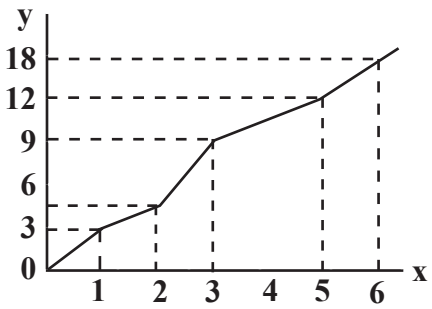
8.



Scale of x-asix 1 unit = $6cm^2$

Scale of y-axis 1 unit = 1cm

9.



$y = 2x + 1$

Let $x = 1$

$y = 2 \times 1 + 1$

$y = 2 + 1$

$y = 3$

Let $x = 2$

$y = 2 \times 2 + 1$

$y = 4 + 1$

$y = 5$

Let $x = 3$

$y = 2 \times 3 + 1$

$= 6 + 1$

$= 7$

(a) $y = 13$

When $x = 5$

$x = 6$

when $y = 13$

10.

Time (hrs)	1	2	3	4
Distance (km)	30	60	90	120

(a) Given speed = 30 km/hr, distance = 75km

using formula we have $30 = \frac{7}{\text{time taken}}$

time taken = 2.5hr

Hence, the time taken by Sajal to ride 75km is 2.5hr.

(b) Given speed = 30 km/hr, time = $3\frac{1}{2}$hr

using formula we have,

$30 = \frac{\text{Distance}}{7/2}$

Distance = 105km

Hence, the distance covered by sajal in $3\frac{1}{2}$ hours is 105km.

Review Exercise

1. (a) 3rd Quadrant

(b) 1st Quadrant

(c) IInd Quadrant

(d) IV Quadrant

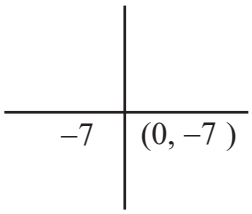
2. (a) y-asix

(b) x-asix

(c) y-asix

(d) x-asix

3. (a) $y = -7$



(b) $y = -5x$

Let $x = 1$

$Y = -5 \times 1$

$y = -5$,

Let $x = 2$

$y = -5 \times 2$

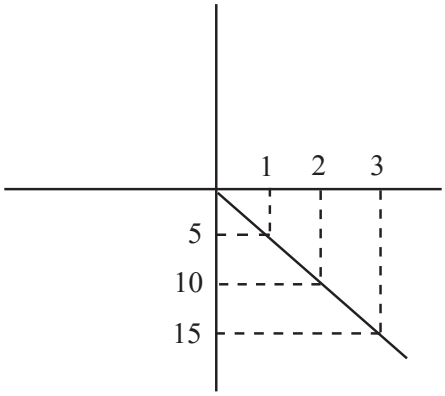
$y = -10$,

Let $x = 3$

$y = -5 \times 3$

$= -15$

x	1	2	3
y	–5	–10	–15



(c) x – y = 4

Let x = 1

y = 1 – 4

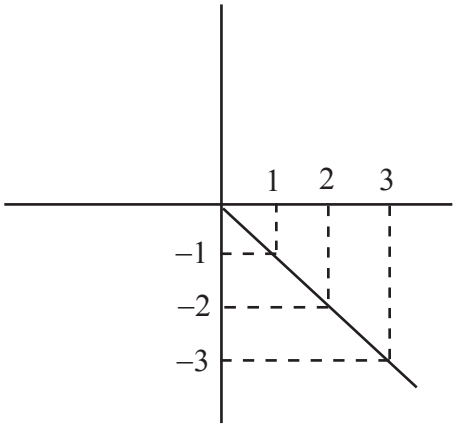
y = –3

Let x = 2

y = 2 – 4

y = –2

x	1	2	3
y	–3	–2	–1



(d) x – 2y = 0

x = –2y

Let x = 1

Let x = 1

1 = –2y

$y = \frac{-1}{2} = -0.5$

Let x = 2

2 = –2y

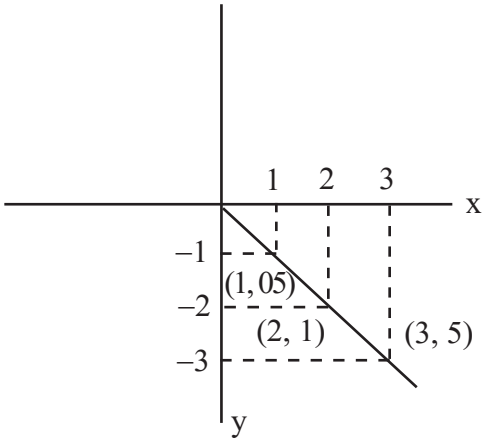
y = –1

Let x = 3

3 = –2y

$y = \frac{-3}{2} = -15$

x	1	2	3
y	–0.5	–1	–1.5



4. Let side be a and perimeter be P

P = 4a

Let a be 1

P = 4 × 1

= 4

Let a be 2

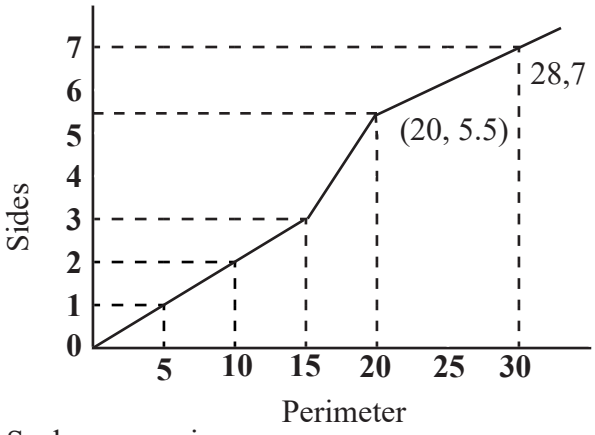
P = 4 × 2

= 8

Let a be 3

P = 4 × 3

= 12



Scale on x axis

1 unit = 5 units

Scale on yaxis

1 unit = 1 unit

(a) Perimeter of square when side is 5.5cm = 22cm

5. $S.T = \frac{P \times R \times T}{100}$

S.I for 1 year of sum deposit

$S.I = \frac{P \times R \times T}{100} = \frac{100 \times 10 \times 1}{100} = 10$

$P = 200 = \frac{200 \times 10 \times 1}{100} = 20$

$P = 300,\ SI = \frac{300 \times 10 \times 1}{100} = 30$

$P = 400,\ SI = \frac{400 \times 10 \times 1}{100} = 40$

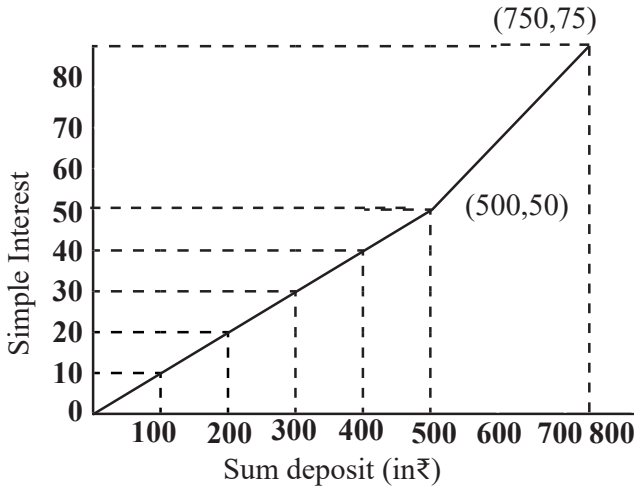
Sum deposit	100	200	300	400
Anuud SI	10	20	30	40

Scale x-axis

1 unit = ₹100

Scale on y-asix

1 unit = 10%



6. (a) 5:30am and 6pm

(b) 5:30am to 6pm

= 13 hours

(c) Forward joerney

(d) 6am to 9 am = 3 hours

(e) 3pm to 5:30pm

7. (i) Amit make least progress from 25min to 40min, as indicated by the line in the graph . (Distance travelled in this time peroid is 1.50 – 1.25 = 0.25km)

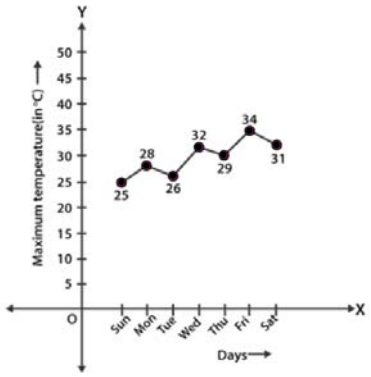
(ii) Total distance covered = 2km

Total time = 55min = $\frac{55}{60}$hr

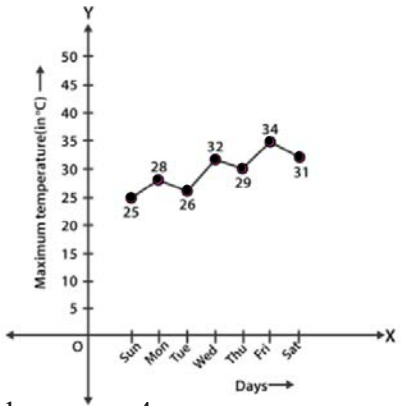
Average speed = $\frac{\text{Total distance covered}}{\text{Total time}}$

$= \frac{2}{55} = \frac{2 \times 60}{55} = 2.18$km/hr

8. Taking the days on the X – axis and maximum temperature on the Y – axis, the line graph is obtained as in the figure above.



9. Consider the percentage of students who dropped out of school on the X – axis and year on the Y– axis. The line graph is represented in figure.



10. We have p = 4q

(i) When q = 6

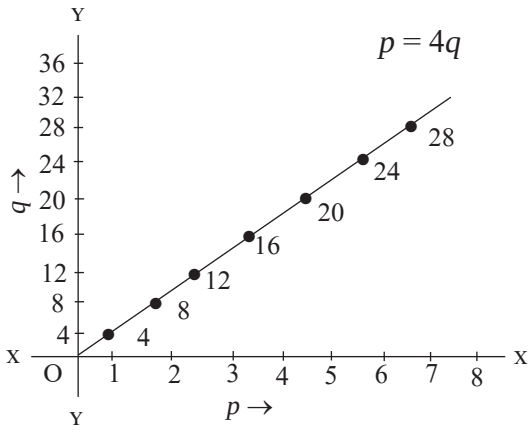
then p = 4 × 4 = 16

(ii) when p = 20

then, 20 = 4q

5 = q

And the graph of p = 4q is given by



Multiple Choice Questions

1. Answer: (d) IVth quadrant

2. Answer: (a) 1st quadrant

3. Answer: (c) (-, +)

4. Answer: (c) (6, 0)

5. Answer: (a) x - x is

6. Answer: (c) 0 Absiscass is the x-coordinate of a point

7. Answer: (c) (0,2,-4) ordinate is y-coordinate of the point.

8. Answer: (a) x = 0

9. Answer: (d) a line 11 to x - axis

10. Answer: (c) y-axis

16 Playing with Numbers

Exercise 16.1

1. (a)

		7	3	2
×			2	1
		7	3	2
1	4	6	4	×
1	5	3	7	2

$2 \times 1 = 2$

$2 \times 2 = 4$

(Now we have got both the numbers to be multiplies, we can do the what multiplication easily)

(b)

		9	2	5
×			3	6
	5	5	5	0
2	7	7	5	×
3	3	3	0	0

(Now we have got both the numbers to be multiplies, we can do the what multiplication easily)

2. (a)

			①	
	4	1	8	5
+	6	3	2	9
1	0	5	1	4

(b)

		⑯	
	⑦	~~6~~	⑮
	~~8~~	~~7~~	~~5~~
−	3	9	8
	4	7	7

3. (a). Now, we have got both the numbers to be multiplied we can do the what multiplication easily

		①	①	
	3	8	5	2
×				9
3	4	6	6	8

(b) Now, we have got both the numbers to be multiplied we can do the what multiplication easily

			①	
	4	1	8	5
×	6	3	2	9
1	0	5	1	4

(c) Now, we have got both the numbers to be multiplied we can do the what multiplication easily

	①	①	
	8	0	9
×			7
5	6	6	3

4. (a) 2, 6, 10, **<u>14</u>**, **<u>18</u>**, **<u>22</u>**, (Addition of 4)

(b) 9, 7.5, 6, **<u>4</u>**, **<u>5</u>**, **<u>3</u>**, **<u>15</u>** (Subraction of 1.5)

(c) 1, 8, 27, **<u>64</u>**, **<u>125</u>**, **<u>216</u>** (Cube of continouse numbers)

(d) 9, 17, 25, **<u>33</u>**, **<u>41</u>**, **<u>49</u>** (Addition of 8)

5.

3	**–14**	**11**
8	**0**	**–8**
–11	**14**	**–3**

$11 + 3 + (-14)$

$8 + 0 + (-8) = 0$

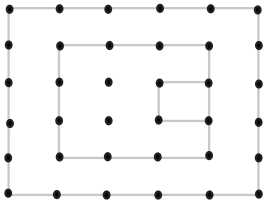
$-11 + 14 + (-3) = 0$

$3 + 8 + (-11) = 0$

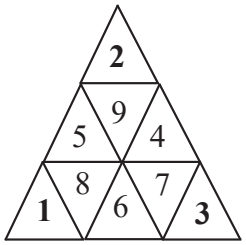
$14 + 0 + (-14)0,\ 11 - 8 - 3 = 0$

$-11 + 11 = 0 \quad 3 + (-3) = 0$

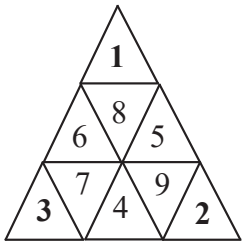
6.



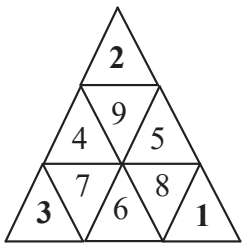
7.



= 2 + 9 + 5 + 8 + 1 = 25, 2 + 9 + 4 + 7 + 3 = 25, 1 + 8 + 6 + 17 + 3 = 25

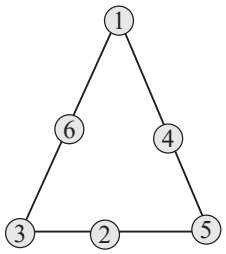


= 1 + 8 + 6 + 7 + 3 + 1 = 25, 1 + 8 + 5 + 9 + 2 = 25, 3 + 7 + 4 + 9 + 2 = 25

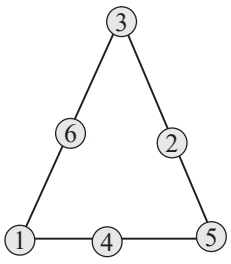


= 2 + 9 + 4 + 7 + 3 = 25, 3 + 7 + 6 + 8 + 1 = 25, 2 + 9 + 5 + 8 + 1 = 25

8.

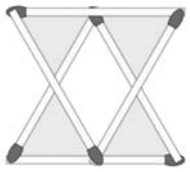


= 1 + 6 + 3 = 10, 1 + 4 + 5 = 10, 3 + 2 + 5 = 10



= 3 + 6 + 1 = 10, 1 + 4 + 5 = 10, 3 + 2 + 5 = 10

9.



10. let x = father's age

x – 24 = son's age

x – 24 – 25 = x – 49 = grandson's age

x + x – 49 = 73

2x = 122

x = 61

how old am i?=61

1 × 239 × 4649 = 1111111

2 × 239 × 4649 = 2222222

The result is a 7-digit number, having identical digits.

So, x × 29 × 4449 x × 1111111 = xxxxxxx

11. 2,3,5,8,4,7: Largest digit = 875 (8>7>5>4>3>2)

Second Largest digit = 432 (Now, we have got both the numbers to be multiplied we can do the what multiplication easily)

875 + 432 = 1307

12. The result is a 7-digit number, having identical digits.

238 × 4649 = 111111.

So, x × 239 4649 = x × 111111 = xxxxxx

13. **Answer:** 5 hours

14. (a) 35 × 35 = 1225

3 × (3 + 1), 5 × 5

= 3 × 4 = 12 = 25

= 1225

(b) 47 × 43

4 × (4 + 1) = 4 × 5, 7 × 3

= 20 = 21

= 2021

(c) 56 × 54 = 3024

5 × (5 + 1), 6 × 4

= 30 = 24

= 3024

(d) $62 \times 68 = 4216$

$6 \times (6 + 1) = 2 \times 8$

$= 42 \qquad = 16$

$= 4216$

(e) 86×84

$= 8 \times (8 + 1), (6 \times 4)$

$= 72 \qquad = 24$

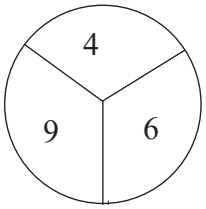
$= 7224$

(f) $93 \times 97 = 9027$

$9 \times (9 + 1), 3 \times 7$

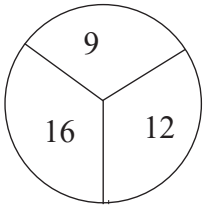
$= 90 \qquad = 21$

15.



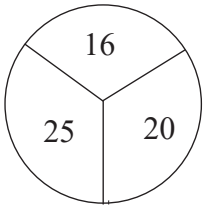
$4 + 2 = 6$

$6 + 3 = 9$



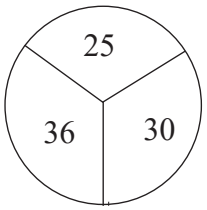
$9 + 3 = 12$

$12 + 4 = 16$



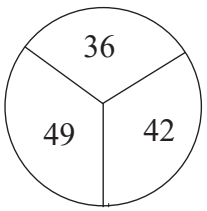
$16 + 4 = 20$

$20 + 5 = 25$



$25 + 5 = 30$

$30 + 6 = 36$



$36 + 6 = 42$

$42 + 7 = 49$

16. . Here a = 8 and b = 13 The numbers in the Fibonacci sequence are arranged in the following manner: 1^{st}, 2^{nd}, (1^{st} + 2^{nd}), (2^{nd} + 3^{th}), (3^{th} + 4^{th}), (4^{th} + 5^{th}), (5^{th} + 6^{th}), (6^{th} + 7^{th}), (7^{th} + 8^{th}), (8^{th} + 9^{th}), (9^{th} + 10^{th})

The numbers are 8, 13, 21, 34, 55, 89, 144, 233, 377 and 610. Sum of the numbers = 8 + 13 + 21 + 34 + 55 + 89 + 144 + 233 + 377 + 610 = 1584 11 × 7^{th} number = 11 × 144 = 1584

Exercise 16.2

1.

Number	Is the ones digit even	Divisble by 2
890	Yes	Yes
2711	No	No
369	No	No
2452	Yes	Yes
1306	Yes	Yes
1834	Yes	Yes

2.

Numbers	Is the ones digit 500	Divisible by 5	Is the ones digit 0	Divisible by 10
3605	Yes	Yes	No	No
9000	Yes	Yes	Yes	Yes
6139	No	No	No	No
8710	Yes	Yes	Yes	Yes
2025	Yes	Yes	No	No

3.

Numbers	Sum of digits	Is sum of digit divisble by 3	Divisible by 3	Divisible by 9	Divisible by 8
781	7 + 8 + 7 = 16	No	No	No	No
1002	1 + 0 + 0 + 2 = 3	Yes	Yes	No	No
5634	5 + 6 + 3 + 4 = 18	Yes	Yes	Yes	Yes
60174	6 + 0 + 1 + 7 + 4 = 16	Yes	Yes	Yes	Yes

4.

Numbers	Difference between of ones digit and rest of the numbers	Is the subtraction divisible by 7	Divisible by 7
343	34 – 6 = 28	Yes	Yes
9863	986 – 6 = 980	Yes	Yes
1050	105 – 0 = 105	Yes	Yes
638	63 – 16 = 47	No	No

5.

Numbers	Last 2 digits divisible by 4	Divisible by 4	Last 3 digits divisble by 8	Divisble by 8
1628	Yes	Yes	No	No
32168	Yes	Yes	Yes	Yes
9530	No	No	No	No
1008	Yes	Yes	Yes	Yes

6.

Number	Is ones digit even	Divisble by 2	Is sum of the digits	Is sum of the digit divisble by 3	Divisble by 3	Divisible by both 2 & 3	Divisible by 6
9132	Yes	Yes	9 + 1 + 3 + 2 = 15	Yes	Yes	Yes	Yes
838	Yes	Yes	8 + 3 + 8 = 19	No	No	No	No
63210	Yes	Yes	6 + 3 + 2 + 1 + 0 = 12	Yes	Yes	Yes	Yes
1005	No	No	1 + 0 + 0 + 5 = 6	Yes	Yes	No	No

7.

Number	Sum of digits	Is sum of the digit divisible by 3	divisible by 3	Is sum of the digit 9	Is sum of the digit 9
702	7 + 2 = 9	Yes	Yes	Yes	Yes
501	5 + 0 + 1 = 6	Yes	Yes	No	No
213	2 + 1 + 3 = 6	Yes	Yes	No	No
102	1 + 0 + 2 = 3	Yes	Yes	No	No
675	6 + 7 + 5 = 18	Yes	Yes	Yes	Yes
426	4 + 2 + 6 = 12	Yes	Yes	No	No
721	7 + 2 + 1 = 10	No	No	No	No
601	6 + 0 + 1 = 7	No	No	No	No
275	2 + 7 + 5 = 14	No	No	No	No

Number divisible by 3 but not by 9

= 501, 213, 102 & 426

8.

	Number	Divisibilty by 11 Sum of digits at odd places	Sum of digits at even place	Difference	Is difference Divisible by 11 or 0	Divisible by 11
(a)	**0000001**	1 + 0 + 0 + 0 = 1	0 + 0 + 0 + 1 = 1	1 – 1 = 0	Yes	Yes
(b)	**9083625**	1 + 0 + 3 + 2 = 6	9 + 8 + 6 + 5 = 28	28 – 6 = 22	Yes	Yes

(c) Divisibilty by 9

Digit = 2134563

Sum of digits = 2 + 1 + 3 + 4 + 5 + 6 + 3 = 24

Is Sum divisible by 9: No

Hence, it is not divisible by 9.

9. (a) 342 = 3 + 4 + 2 = 9

(b) 252 = 2 + 5 + 2 = 9

(c) 162 = 1 + 6 + 2 = 9

(e) 504 = 5 + 0 + 4 = 9

(f) 666 = 6 + 6 + 6 = 18

10. (b), (c) and (f)

5x6 = 5 + x + 6 = 11

Most nearby number divisible by 3 from 11 = 12

So, x = 1 as 5 + 1 + 6 = 12

Which is divisible by 12.

11. x^7y^5 is exactly divisible by 3

Sum of its digits must be divisible by 3

x + 7 + y + 5 = 12 + (x + y) is divisible by 3

Least value of x + y = 0 as

12 + 0 = 12 is divisible by 3

12. We know that if sum of digits of a number is divisible by 9, then the number is divisible by 9.

Here,

x + 4 + y + 5 + z = multiple of 9

x + y + z + 9 = 0, 9, 18, ….

Hence,

x + y + z + 18 = 18

But x + y + z cannot be 0 because then x, y and z will have to be 0.

Since x is the first digit, it cannot be 0.

x + y + z + 18 = 27

x + y + z = 9

∴ the least value of (x + y) is 9

13. For the divisibility by 3, sum of digits must be divisible by 3

So, sum of 7 + 5 + 4 + x must be divisible by 3

=16 + x must be divisible by 3, x can be any number from 0 − 9

When x = 2, the sum = 18 which is divisible by 3.

When x =5, the sum = 21 which is divisible by 3.

When x =8, the sum = 24 which is divisible by 3.

So the value of x can be 2,5,8 and the numbers are 7542, 7545, 7548 respectively.

14. We know that,

A number is divisible by 4 if the number formed by the tens digit and ones digit is divisible by 4 but a number is divisible by 8, if the number formed by hundreds digit, tens digit and ones digit is divisible by 8.

Therefore,

Numbers which are divisible by 4 but not by 8 are 124, 244, 324, etc.

Let the digits at tens place and ones place be x and 9 – x

Therefore, original number = 10x + (9 – x) = 9x + 9

On interchanging the digits, the digits at ones place and tens place will be x and 9 – x respectively.

Therefore, the new number after interchanging the digits = 10(9 – x) + x = 90 – 9x

New number = Original number -45

90 – 9x = 9x + 9 – 45

90 – 9x = 9x – 36

Transposing –9x to RHS and –36 to LHS, we obtain 90 +36 = 18x

126 = 18x

Dividing both sides by 18, we obtain x =7

Hence, 9 – 7 = 2

Hence, the digits at tens place and one's place of the number are 7 and 2 respectively. The number is 72.

Review Exercise

1. (a) 10 × 8 + 6

(b) 10 × 5 + 3

(c) 100 × 6 + 10 × 8 + 9

(d) 100 × 7 + 10 + 4 + 3

2.

Numbers	Is one digit even	Divisible by 2
89	No	No
64	Yes	Yes
128	Yes	Yes
562	Yes	Yes

3.

Numbers	Sum of digit	Is sum divisble by 3	Divisible by 3	Is sum divisible by 9	Divisible by 9
819	8 + 1 + 9 = 18	Yes	Yes	Yes	Yes
635	6 + 3 + 5 = 14	No	No	No	No
519	5 + 1 + 9 = 15	Yes	Yes	No	No
8901	8 + 9 + 0 + 1 = 18	Yes	Yes	Yes	Yes

4.

Numbers	Is the ones digit 5 or 0	Divisible by 5	Is the ones digit 0	Divisible by 10
586	No	No	No	No
915	Yes	Yes	No	No
420	Yes	Yes	Yes	Yes
6840	Yes	Yes	Yes	Yes

5. 314x = 3 + 1 + 4 + x = 8 + x

When sum of the digit is divisible by 9 then is divisible by 9.

So, 8 + x = 9

6. 9132 - Yes it is divisible by 6; 838 - No it is not divisible by 6; 63210 - Yes it is divisible by 6; 1005 - No it is not divisible by 6.

7. (a) 4, 6, 8, 9, 10, 12, 14 (Adding 2 twice and then 1 twice)

(b) 2, 6, 12, 20, 30, 42 (4, 4, + 2, 4 + 2 + 2, 4 + 2 + 2 + 2)

8. From the given pattern we see that the square of the given number has the same number of zeros before and after digit 2 as it is present in the original number.

$11^2 = 121$

$101^2 = 10201$

$1001^2 = 1002001$

$100001^2 = 10000200001$

9.

Number	Sum of digit at odd place	Sum of digit at even place	Difference	Is different divisible by 11 or 0	Divisible by 11
444444	4 + 4 + 4 = 12	4 + 4 + 4 = 12	12 + 2 = 0	Yes	Yes
900163	9 + 0 + 6 = 15	0 + 1 + 3 = 4	15 – 4 = 11	Yes	Yes
818532	8 + 8 + 3 = 19	1 + 5 + 2 = 8	19 – 8 = 11	Yes	Yes
22222	2 + 2 + 2 = 6	2 + 2 = 4	6 – 4 = 2	No	No
6132	6 + 3 = 9	1 + 2 = 3	9 – 3 = 6	No	No
59312	5 + 3 + 2 = 10	9 + 1 = 10	10 – 10 = 0	Yes	Yes

10. We know that if number is divisible by 3 only when sum of digits of given number is divisible by 3.

Hence, if 7x3 is divisible by 3, then,

$7 + x + 3 = 0, 3, 6, 9,12,\ldots$

$\therefore$ $10 + x$ = multiple of 3.

Hence, x = (multiple of 3) – 10

Here, possible values for multiples of 3 are 12, 15 and 18

Hence, $x = 2, 5$ or 8

Hence, possible numbers are 723, 753 and 783

11. Examples of numbers, such that each one of which is divisible by 3 but not divisible by 9, are 21, 24, 30, 33 and 39.

12. Here, $x + 2 + 7 + y$ = multiple of 9 $x + y + 9 = 0, 9, 18, \ldots$

Hence, $x + y + 9 = 9 \quad \therefore x + y = 0$

But $x + y$ cannot be 0 because then x and y both will have to be 0.Since x is the first digit, it cannot be 0. $\therefore$ $x + y + 9 = 18$ $x + y = 9$

$\therefore$ the least value of $(x + y)$ is 9.

Multiple Choice Question

1. (a) 638 as its digit is even

2. (c) 816 as $8 + 1 + 6 = 15$ which is divisible by 3

3. (d) all of the above as either their unit digit is 0 or 5.

4. (a) 10 (Addition of 2)

5. (b) 20

6. $5 + x + 6 = 11 + x$ (If sum of the digits is divisible by 3 then the number is divisible by 3)

Let $x = 1$

$11 + 1 = 12$

(c) 1

7. We know that if sum of digits of a number is divisible by 9, then the number is divisible by 9.

Here, for the given number to be divisible by 9

$4 + 8 + 6 + \times + 7$ = multiple of 9

$x + 25 = 0, 9, 18, \ldots$.(multiple of 9)

Hence, $x + 25 = 27$ [lowest multiple then]$x = 2$ $\therefore$ $x = 2$ $\therefore$ the least value of x is 2

Answer: (c) 2

8. (c) 154326 as its last 2 digits are not divisible by 4.

9. $3 + 7 + y + 4$ = multiple of 9

$14 + y = 0, 9, 18, 27\ldots$.

$14 + y = 18$ $\therefore$ $y=18 - 14 = 4$

The least value of y is 4

(b) 4

10. 3(60, 72 and 84)

Check your progress

1. 1 run for number ball + sixon no ball + six on extra ball

$= 1 + 6 + 6 = 13$ runs

2. Total number of marbles $= 39 + (2 \times 3)$ (Cosing 3 marbles by 2 Children each)

$= 39 + 6 = 45$

$$\text{Number of children} = \frac{\text{Total number of marbles}}{\text{Number of marbles with each child}}$$

$$= \frac{45}{9} = 5 \text{ marbles}$$

3. 8

4. $(2637 \times 10) + 2637$

$= 26370 + 2637$

$= 29007$

5. $2 \times 6 \div 3 + 4 = 12 \div 3 + 4 = 4 + 4 = 8$

6. Yes, as 9 is divisible since 3 is a factor 9.