1 Integers

Exercise 1.1

1. The opposite of :
   (a) 5 m above the ground in 5 m below the ground.
   (b) 7 km North is 7 km South.
   (c) 9°C below the freezing point is 9°C above the freezing point.
   (d) loss of ₹45 is profit of ₹45.
2. (a) –5°C is lower than 5°C.
   (b) –4°C is lower than 0°C.
   (c) –6°C is lower than 6°C.
   (d) –7°C is lower than 7°C.
3. (a) The absolute value of $|7 + 5| = 7 + 5 = 12$.
   (b) The absolute value of $-|-3 + 9| = -|6| = -6$.
   (c) The absolute value of $|-6 - 8| = |-14| = 14$.
   (d) The absolute value of $-|-8 + 2| = -|-6| = -6$.
4. The additive inverse of :
   (a) 7 is –7 (b) –11 is 11 (c) 0 is 0 (d) 272 is –272
5. (a) $7 - 8 = -1$ and $-5 - 0 = -5$
   $\therefore 7 - 8 > -5 - 0$
   (b) $11 - (-9) = 11 + 9 = 20$ and $9 + 11 = 20$
   $\therefore 11 - (-9) = 9 + 11$
   (c) $6 - 15 = -9$ and $6 - 10 = -4$
   $\therefore 6 - 15 < 6 - 10$
   (d) $-2 + 7 = 5$ and $7 - 2 = 5$
   $\therefore -2 + 7 = 7 - 2$
6. (a) $15 + (-6) + 7 - 6 = 15 - 6 + 7 - 6 = 15 + 7 - 12 = 22 - 12 = 10$.
   (b) $1162 + (-285) - 763 = 1162 - 285 - 763 = 1162 - 1048 = 114$.
   (c) $68 + (-60) + 70 = 68 - 60 + 70 = 8 + 70 = 78$.
   (d) $8 - (-15) + 7 - (-15) = 8 + 15 + 7 + 15 = 45$.
7. The pair of integers with :
   (a) sum as 0 is –2, 2 (b) difference –15 is –15, 0
   (c) sum as –27 is –14, –13 (d) difference 9 is 9, 0
8. (a) $-15 + (-85 + 148) = -15 + (63) = -15 + 63 = 48$.
   (b) $769 + [985 + (-669)] = 769 + 985 - 669 = 1754 - 669 = 1085$.
   (c) $-42 + 270 - 158 = -42 - 158 + 270 = -200 + 270 = 70$.
9. To get the required number, we subtract the given integer –487 from the sum –364.
   $\therefore -364 - (-487) = -364 + 487 = 123$.
   Thus, the required number to be added is 123.
10. (a) $-487 + 0 = -487$, because 0 added to any number gives the same number.
    (b) $0 + (-284) = -284$ or $0 - 284 = -284$.
    (c) $-15 + (-368) = -368 + (-15)$ [Using the closure property]
    (d) $-787 - (-787) = 0$ or $-787 + 787 = 0$
11. (a) The pair of negative integers having sum –11 is –5, –6.

(b) A pair of a positive and a negative integers with difference –13 is 2, –15.

(c) The required pair of integers is –10, –5.

(d) The required pair of integers is 20, –8.

(e) The required pair of integers is –7, –5.

(f) The required pair of integers is 20, –3.

12. The maximum temperature of Shimla recorded = 16°C
The maximum temperature of Shimla recorded = –2°C
Difference in temperatures = 16°C – (–2°C) = 16°C + 2°C = 18°C.
Thus, the fall in temperature = 18°C.

13. Sum of two integers = –85
One integer = 50
Other integer = –85 – 50 = –135
Thus, the other integer is –135.

14. Height of flying plane above the sea level = 7500 m
Depth of floating submarine below the sea level = 800 m
Vertical distance between them = 7500 m + 800 m = 8300 m
Thus, the vertical height between the plane and submarine is 8300 m.

Exercise 1.2

1. (a) We have _____ × (–5) = 5
As the product of two negative integers is positive
∴ (–1) × (–5) = 5.
Thus, (–1) × (–5) = 5.

(b) We have _____ ÷ (–12) = –12
Let the other integer be x.
Then x ÷ (–12) = –12
or x = (–12) × (–12) = 144.
Thus, 144 ÷ (–12) = –12.

(c) We have _____ ÷ (–15) = 1
Let the other integer be x.
Then x ÷ (–15) = 1
or x = × (–15) = –15.
Thus, (–15) ÷ (–15) = 1.

(d) We have _____ ÷ (–85) = 0
We know that zero (0) divided by any number gives 0 as the quotient.
Thus, 0 ÷ (–85) = 0.

(e) We have 7816 × _____ = –7816.
Let the other integer be x.
Then 7816 × x = –7816
or 7816 × (–1) = 7816 [Using the multiplicative identity]
Thus, 7816 × (–1) = –7816.

(f) We have 497 × _____ = 0
We know that the product of a number and zero is always zero.
Thus, 497 × 0 = 0.

2. (a) –6 × 5 × (–2) = –6 × (–10) = 60. [Product of two integers with opposite signs is negative]

(b) $-783 \times 245 \times 0 = 0$, because the product of any number of integers and zero is always zero.

(c) $16 \times (-2) \times (-1) \times (-5)$

$= -32 \times (-1) \times (-5)$ [Product of integers with opposite signs is negative.]

$= -32 \times 5 = -160$. [Product of two negative integers is negative.]

(d) $9 \times (-2) \times (-8) \times (-10) = (-18) \times 80 = -1440$

(e) $-5 \times [(-2) + 7] = -5 \times [-2 + 7] = -5 \times 5 = -25$

(f) $7 \times [(-6) - (-4)] = 7 \times [-6 + 4] = 7 \times (-2) = -14$.

3. (a) $7 \times (-4) = -28$ and $4 \times 7 = 28$

As -28 is less than 18, to the given statement is incorrect.

(b) $(-10) \times (-1) = 10 \quad 0$

Thus, the given statement is incorrect.

(c) $6 \times (-2) = -12$, which is equal to RHS, i.e., -12.

Thus, the given statement is incorrect.

(d) $-7 \div 0 \quad 0$ because division only integers by 0 is not defined.

Thus, the given statement is incorrect.

(e) $(-20) \div (-5) = 4$, which is not equal to -4.

Thus, the given statement is incorrect.

(f) $-10 \div 2 = -5$ which is equal to RHS, i.e., -5.

Thus, the given statement is correct.

4. (a) $-8 \times 178 \times 25 = -8 \times 25 \times 178$ [Arranging the numbers]

$= -200 \times 178 = 2 \times -100 \times 178 = 2 \times (-17800) = -35600$.

(b) $4 \times (-361) \times 150$

$= 4 \times 150 \times (-361)$ [Arranging the numbers]

$= 600 \times (-361) = 6 \times (-361) \times 100 = -2166 \times 100 = -216600$.

(c) $2 \times (-367) \times 250 = 2 \times 250 \times (-367)$ [Arranging the numbers]

$= 500 \times (-367) = 5 \times 100 \times (-367) = 5 \times (-36700) = -183500$.

(d) $-8 \times 4 \times (-5)$

$= -8 \times 4 \times (-5) \times (-9)$ [Arranging the numbers]

$= -32 \times (-5) \times (-9) = 160 \times (-9) = 1440$.

(e) $-4 \times 75 \times 25 \times (-2) = -4 \times 25 \times 75) \times (-2) = -100 \times 75 \times (-2) = -7500 \times (-2) = 25000$.

(f) $-4 \times 7 \times 50 = -4 \times 50 \times 7 = -200 \times 7 \times -1400$

5. (a) $(-5) \times 65 + (-5) \times 7 = (-5) \times (65 + 7) = (-5) \times 72 = -360$.

(b) $-19 \times 102 = -19 \times (100 + 2) = (-19) \times 100 + (-19) \times 2 = -1900 - 38 = -1938$.

(c) $-21 \times 15 + 15 \times (-45) = 15 \times 15 + (-21 - 45) = 15 \times (-66) = -990$.

(d) $-42 \times (40 + 5) = -42 \times 40 + (-42) \times 5 = -1680 - 210 = -1890$.

(e) $32 \times (-42) + 32 \times (-6) = 32 \times (-42 - 6) = 32 \times (-48) = -1536$.

(f) $-15 \times 96 = -15 \times (100 - 4) = (-15) \times 100 - (-15) \times 4 = -1500 + 60 = -1440$.

6. (a) $-76 \div (-4) = \dfrac{-76}{-4} = 19$.

(b) $0 \div 43\text{ p} = 0$, because zero divided by any integer gives 0.

(c) $2575 \div (-25) = \dfrac{2575}{-25} = -103$.

(d) $-600 \div 30 = \dfrac{-600}{30} = -20$.

(e) $-4968 \div (-9) = \frac{-4968}{-9} = 552.$

(f) $-1221 \div 11 = \frac{-1221}{11} = -111.$

7. Here, divisor = – 11 and quotient = 8.
   ∴ Dividend = Division × quotient = $-11 \times 8 = -88$
   Thus, the required integer is –88.

8. Recruited integer = $\frac{\text{Product}}{\text{One integer}} = \frac{-11}{-2} = 50.$

9. (a) Correct questions attempted = 22
   Marks obtained for correct questions = 22 × 2 = 44.
   Number of incorrect questions = 30 – 22=8
   Marks for incorrect questions = 8 × = 8
   ∴ Shiva's total score = 44 – 8 = 36.
   (b) Number of correct questions = 17
   Marks obtained for correct questions = 17 × 2 = 34
   Marks obtained for not attempted questions = 6 × 0 = 0
   ∴ Neha's total score = 34 Marks.

10. Number of negative numbers multiplied is odd.
    Thus, the sign of the product will be negative.

Revision

1. (a) Other integer = Sum of integers – One integer = – 15 – 56 = –71
   (b) Required integer = –13 + 16 = 3.
   (c) Required integer = $\frac{\text{Product}}{\text{Given number}} = \frac{-608}{76} = -8.$
   (d) Required number = $\frac{-540}{-9} = 60.$

2. (a) $0 \times (-47) = 0$ (b) $-76 \times 1 = -76$
   (c) $(-11) \times 10 = -110$ (d) $-52 \times 8 = -416$

3. (a) $58 \div 0$ = not defined (b) $0 \div 7 = 0$
   (c) $0 \div (-24) = 0$ (d) $(-80) - (-10) = 8$

4. $(-9) \times 70 + (-9) \times 56 = -9\,(70 + 56) = -9 \times 126 = -1134$; Distributive Property

5. (a) $-26 \times (-2) = 56$ (b) $14 \times (-8) = -112$
   (c) $-36 \times 3 = -108$ (d)

6. (a) $49 \div (-49) = -1$ (b) $150 \div (-5) = \frac{150}{-5} = -30.$
   (c) $-72 \div (-8) = \frac{-72}{-8} = 9.$ (d) $100 \div (-10) = \frac{100}{-10} = -10.$

5. (a) $8 - 25 \div 5 = 8 - 5 = 3$
   (b) $[(-8) \times (-2)] \div [(-3) - 5] = [16] \div [-8] = \frac{16}{-8} = -2.$
   (c) $[36 \div (-6)] \times [1 - (-5)] = -6 \times (1 + 5) = -6 \times 6 = -36.$

(d) $-25 + (-5) \div 5 + (13 \times 2) = -25 - 1 + 26 = -26 + 26 = 0$.

8. (a) $-4 \times 85 \times (-25) = -25 \times (-4) \times 85 = 100 \times 85 = 8{,}500$. [Using associative property]
   (b) $4 \times [7 + (-5)] = 4 \times 7 + 4 \times (-5) = 28 - 20 = 8$. [Using distributive property]
   (c) $-276 \times (-1) = 276$. [Using identity property]
   (d) $6 \times (-26) + 6 \times 16 = 6[-26 + 16] = 6[-10] = -60$. [Using distributive property]
   (e) $68 \times 101 = 68 \times (100 + 1) = 68 \times 100 + 68 \times 1 = 6800 + 68 = 6868$. [Using distributive property]
   (f) $369 \times 99 - 369 \times (-1) = 369(99 + 1) = 369 \times 100 = 36900$. [Using distributive property]

9. Additive inverse of :
   (a) -1 is 1 (b) 7 is -7 (c) 0 is 0 (d) -3 is 3

10. Multiplicative inverse of :
   (a) $\frac{5}{2}$ is $\frac{2}{5}$. (b) 1 is 1 (c) $\frac{-3}{7}$ is $\frac{7}{-3}$ (d) -15 is $\frac{1}{-15}$

11. We have to verify $p \times (q + r) = p \times q + p \times r$
   (a) We have $p = 2$, $q = -3$ and $r = 4$.
   LHS $= p \times (q + r) = 2 \times (-3 + 4) = 2 \times 1 = 2$.
   RHS $= p \times q + p \times r = 2 \times (-3) + 2 \times 4 = -6 + 8 = 2$.
   $\therefore$ LHS = RHS.
   Hence, verified.
   (b) We have p = -4, q = -3 and r = 5.
   LHS $= p \times (q + r) = (-4) \times (-3 + 5) = -4 \times 2 = -8$.
   RHS $= p \times q + p \times r = (-4) \times (-3) + (-4) \times 5 = 12 - 20 = -8$.
   $\therefore$ LHS = RHS.
   Hence, verified.

12. (a) $\frac{-81}{9} = \frac{-81 \div 9}{9 \div 9} = -9$.
   (b) $\frac{78}{-39} = \frac{78 \div 39}{-39 \div 39} = \frac{2}{-1} = \frac{2 \times (-1)}{-1 \times (-1)} = -2$. [HCF of 78 and 39 is 39.]
   (c) $\frac{-45}{-40} = \frac{-45 \div 5}{-40 \div 5} = \frac{-9}{-8} = \frac{9}{8}$. [HCF of 45 and 40 is 5.]
   (d) $\frac{60}{-75} = \frac{60 \div 15}{-75 \div 15} = \frac{4}{-5} = \frac{-4}{5}$

13. We know the product of the odd number of negative numbers is negative and even number of negative numbers is positive.
   As 54 and 36 are even numbers, the sign of the required product will be positive.

14. The required room temperature $= [30 - (5 \times 10)]°C = (30 - 50)°C = -20°C$.

15. Let P be that point. Then the positions of Vinay and Radhika can be represented as shown alongside.
   $\therefore$ Distance between Vinay and Radhika = 200 m + 450 m = 650 m.

Multiple Choice Questions

1. Integers are not closed under division. So the correct option is (d).
2. The division of a negative number by itself gives 1. So the correct option is (b).
3. The sum of an integer and its additive inverse is zero (0). So the correct option is (c).
4. The greatest negative integer is -1. So the correct option is (c).

5. As the sum of –3 and 5 = –3 + 5 = 2, so the correct option is (b).
6. On dividing zero by a non-negative number, we get the quotient zero. So the correct option is (c).
7. On dividing a positive integer by a negative number, we get a negative integer. So the correct option is (d).
8. The product of an integer and zero is zero. So the correct option is (c).
9. $-17p - 4 = -72$

   $\Rightarrow -17p = -72 + 4 = -68$

   $\Rightarrow p = \frac{-68}{-17} = 4.$

   Thus, the value of p is 4 and the correct option is (c).
10. The sum of a positive integer and a negative integer can be positive or negative. So the correct option is (c).

Mental Maths

A. See answers given in the book.

B. See answer given in the book.

C. $p \times (-4) = -72$

   $\therefore p = \frac{-72}{-4} = 18.$

   Thus, the value of p is 18.

Higher Order Thinking Skills (HOTS)

1. $-4 + 6 = 2; -8 \div 2 = -4; 2 \times (-3) = -6; |-2|; (-1) \times (-2) = 2.$

   Here, –6 is the smallest result.

   Thus, $2 \times (-3)$ is the smallest.
2. The sum of any non-zero integer and its additive inverse is always zero. So there are many such pairs as 7, –7, 15, –15.
3. $\{7 - 9 + 2 \times (-3) - 8 \div 8\} = \{7 - 9 + 2 \times (-3) - 1\}$

   $= \{7 - 9 + (-6) - 1\} = \{7 - 9 - 6 - 1\} = = 7 - 16 = -9.$

   Additive inverse of –9 = 9.

   Now, product of –3 and 5 = $-3 \times 5 = -15$

   $\therefore$ Required sum = $9 + (-15) = 9 - 15 = -6.$
4. Three pairs of integers with product –20 are : 2, –10, –4, 5 and 1, –20.
5. Let the consecutive integers be x, $x + 1$ and $x + 2$.

   Then according to the question,

   $x + x + 1 + x + 2 = 705$

   $\Rightarrow 3x + 3 = 705$

   $\Rightarrow 3x = 705 - 3 = 702$

   $\Rightarrow x = 702 \div 3 = 234$

   $\therefore x + 1 = 234 + 1 = 235$

   and $x + 2 = 234 + 2 = 236$.

   Thus, the greatest of these consecutive integers is 236.
6. A fraction can be written in the form of $\frac{p}{q}$. Thus, a fraction is a rational number.

   Examples : $\frac{3}{7}, \frac{8}{9}, \frac{1}{18}, \ldots$.

2 Fractions

Exercise 2.1

1. (a) proper fraction (b) mixed fraction
   (c) improper fraction (d) unit fraction (e) proper fraction

6. (a) $\frac{25}{7} = 3\frac{4}{7}$ (b) $\frac{9}{4} = 2\frac{1}{9}$ (c) $\frac{17}{16} = 1\frac{1}{16}$ (d) $\frac{250}{12} = 20\frac{10}{12}$

3. (a) $2\frac{4}{5} = \frac{2 \times 5 + 4}{5} = \frac{14}{5}$.
   (b) $9\frac{1}{2} = \frac{9 \times 2 + 1}{2} = \frac{19}{2}$.
   (c) $15\frac{1}{3} = \frac{15 \times 3 + 1}{3} = \frac{46}{3}$.
   (d) $11\frac{1}{4} = \frac{11 \times 4 + 1}{4} = \frac{45}{4}$.

4. See the answers given in the book.

5. We know that like fractions have same denominators. Thus :
   (a) $\frac{2}{15}$ and $\frac{1}{15}$ are like fractions.
   (b) $\frac{7}{9}$ and $\frac{2}{5}$ are unlike fractions.
   (c) $\frac{11}{45}$ and $\frac{13}{45}$ are like fractions.
   (d) $\frac{21}{44}$ and $\frac{21}{41}$ are unlike fractions.

6. (a) We have $\frac{2}{7}, \frac{3}{5}, \frac{1}{2}$ and $\frac{4}{5}$.

2	7	5	2	5
5	7	5	1	5
7	7	1	1	1
	1	1	1	1

$\therefore$ LCM = $2 \times 5 \times 7 \times = 70$

LCM of denominators 70.
Converting the given fractions into like fractions with denominator 70, we get

$\frac{2}{7} = \frac{2 \times 10}{7 \times 10} = \frac{20}{70}, \frac{3}{5} = \frac{3 \times 14}{5 \times 14} = \frac{42}{70}$,

$\frac{1}{2} = \frac{1 \times 35}{2 \times 35} = \frac{35}{70}, \frac{4}{5} = \frac{4 \times 14}{5 \times 14} = \frac{56}{70}$

Comparing the numerators, we find that: $20 < 35 < 42 < 56$.

$\therefore \frac{20}{70} < \frac{35}{70} < \frac{42}{70} < \frac{56}{70}$

$\frac{2}{7} < \frac{1}{2} < \frac{3}{5} < \frac{4}{5}$

(b) We have $\frac{9}{11}, \frac{2}{5}, \frac{7}{11}, \frac{3}{10}$

2	11	5	11	10
5	7	5	1	5
7	7	1	1	1
	1	1	1	1

$\therefore$ LCM = $2 \times 5 \times 11 = 110$.

LCM of denominators 110.
Converting the given fractions into like fractions with denominator 110, we get

(c) We have $\frac{2}{3}, \frac{6}{4}, \frac{3}{9}$ and $\frac{7}{10}$.

LCM of denominators is 180.
Converting the given fractions into like fractions with denominator 180, we get

$\frac{2}{3} = \frac{2 \times 60}{3 \times 60} = \frac{120}{180}$, $\frac{6}{4} = \frac{6 \times 45}{4 \times 45} = \frac{270}{180}$,

$\frac{3}{9} = \frac{3 \times 20}{9 \times 20} = \frac{60}{180}$

$\frac{7}{10} = \frac{7 \times 18}{10 \times 18} = \frac{126}{180}$

2	3	4	9	10
2	3	1	9	5
3	3	1	3	5
3	1	1	1	5
5	1	1	1	1

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

Now, we have : $\frac{120}{180}, \frac{270}{180}, \frac{60}{180}, \frac{126}{180}$

$\frac{60}{180} < \frac{120}{180} < \frac{126}{180} < \frac{270}{180}$

$\frac{3}{9} < \frac{2}{3} < \frac{6}{4} < \frac{7}{10}$, which is ascending order of the given fractions.

(d) Similar work to be done.

7. (a) We have $\frac{5}{16}, \frac{7}{8}, \frac{1}{4}$ and $\frac{9}{4}$.

LCM of denominators is 16.

Converting the given fractions into like fractions with denominator 16, we get

$\frac{5}{16} = \frac{5 \times 1}{16 \times 1} = \frac{5}{16}, \frac{7}{8} = \frac{7 \times 2}{8 \times 2} = \frac{14}{16}$

$\frac{1}{4} = \frac{1 \times 4}{4 \times 4} = \frac{4}{16}, \frac{9}{4} = \frac{9 \times 4}{4 \times 4} = \frac{36}{16}$

2	16	8	4	4
2	8	4	2	2
2	4	2	1	1
2	2	1	1	1
2	1	1	1	1

$\therefore$ LCM = $2 \times 2 \times 2 \times 2 = 16$

Now, we have : $\frac{5}{16}, \frac{14}{16}, \frac{4}{16}, \frac{36}{16}$ $\therefore \frac{36}{16} > \frac{14}{16} > \frac{5}{16} > \frac{4}{16}$

$\frac{9}{4} > \frac{7}{8} > \frac{5}{16} > \frac{1}{4}$, which is descending order of the given fractions.

(b) We have $\frac{7}{24}, \frac{3}{8}, \frac{5}{12}$ and $\frac{11}{24}$.

LCM of denominators 24.

Converting the given fractions into like fractions with denominator 24, we get

$\frac{7}{24} = \frac{7 \times 1}{24 \times 1} = \frac{7}{24}, \frac{3}{8} = \frac{3 \times 3}{8 \times 3} = \frac{9}{24}$,

$\frac{5}{12} = \frac{5 \times 2}{12 \times 2} = \frac{10}{24}, \frac{11}{24} = \frac{11 \times 1}{24 \times 1} = \frac{11}{24}$

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

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

Now, we have $\frac{7}{24}, \frac{9}{24}, \frac{10}{24}, \frac{11}{24}$

$\therefore \frac{11}{24} > \frac{10}{24} > \frac{9}{24} > \frac{7}{24}$

$\frac{11}{24} > \frac{5}{12} > \frac{3}{8} > \frac{7}{24}$, which is descending order of the given fractions.

$\frac{221}{8}$

$27\frac{5}{8}$

(c) Similar work to be done.

(d) Similar work to be done.

8. (a) $\frac{3}{7} + \frac{2}{5} = \frac{3 \times 5 + 2 \times 7}{35} = \frac{15 + 14}{35} = \frac{29}{35}$.

(b) $3\frac{1}{4} + 2\frac{3}{5} = \frac{13}{4} + \frac{13}{5}$ [Converting into improper fraction]

$= \frac{13 \times 5 + 13 \times 4}{20} = \frac{65 + 52}{20} = \frac{117}{20} = 5\frac{17}{20}$. [LCM of 4 and 5 is 20.]

(c) $\frac{8}{1} + \frac{2}{3} = \frac{8 \times 3 + 2 \times 1}{3} = \frac{24 + 2}{3} = \frac{26}{3} = 8\frac{2}{3}$.

(d) $\frac{11}{12} + 2\frac{1}{2} = \frac{11}{12} + \frac{5}{2} = \frac{11 + 5 \times 6}{12} = \frac{11 + 30}{12} = \frac{41}{12} = 3\frac{5}{12}$.

9. (a) $2\frac{1}{10} - 3\frac{1}{5} = \frac{21}{10} - \frac{16}{5}$ [Converting into improper fractions]

$= \frac{21 - 16 \times 2}{10} = \frac{21 - 32}{10} = \frac{-11}{10} = -1\frac{1}{10}$.

(b) $\frac{24}{45} - \frac{3}{5} = \frac{24 - 3 \times 9}{45} = \frac{24 - 27}{45} = \frac{-3}{45} = \frac{-1}{15}$. [LCM of 45 and 5 is 45.]

(c) $\frac{7}{18} - \frac{2}{9} = \frac{7 - 2 \times 2}{18} = \frac{7 - 4}{18} = \frac{3}{18} = \frac{1}{6}$.

(d) $\frac{15}{1} - 7\frac{1}{2} = \frac{15}{1} - \frac{15}{2} = \frac{15 \times 2 - 15}{2} = \frac{30 - 15}{2} = \frac{15}{2} = 7\frac{1}{2}$.

10. Here, the sum is 8.

∴ Required number $= 8 - 9\frac{1}{2} = \frac{8}{1} - \frac{15}{2} = \frac{8 \times 2 - 15}{2} = \frac{16 - 15}{2} = \frac{1}{2}$.

11. Here, the sum is $12\frac{1}{4}$ and one added is $9\frac{2}{3}$.

∴ Required number $= 12\frac{1}{4} - 9\frac{2}{3} = \frac{49}{4} - \frac{29}{3} = \frac{49 \times 3 - 29 \times 4}{12}$ [LCM of 3 and 4 is 12.]

$= \frac{147 - 116}{12} = \frac{31}{12} = 2\frac{7}{12}$.

$\frac{5}{8}$.

12. Given : Sum of two fractions $= 7\frac{1}{5}$ and one fraction $= \frac{3}{15}$.

∴ Other fraction = Sum of fractions – One fraction

$= 7\frac{1}{5} - \frac{3}{15} = \frac{36}{5} - \frac{3}{15} = \frac{36 \times 3 - 3}{15}$ [LCM of 5 and 15 is 15.]

$= \frac{108 - 3}{15} = \frac{105}{15} = 7$.

Exercise 2.2

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

   (b) $7\frac{1}{4} \times 9 = \frac{29}{4} \times 9 = \frac{29 \times 9}{4} = \frac{261}{4} = 65\frac{1}{4}$.

   (c) $12\frac{2}{3} \times 8 \times 0 = 0$, because multiplication of any number with 0 gives 0.

   (d) $5\frac{2}{3} \times 12 = \frac{17}{\cancel{3}_1} \times \cancel{12}^{4} = 68$.

   (e) $8\frac{1}{9} \times 81 = \frac{73}{\cancel{9}_1} \times \cancel{81}^{9} = 73 \times 9 = 657$.

   (f) $15 \times 10\frac{2}{3} = \cancel{15}^{5} \times \frac{32}{\cancel{3}_1} = 5 \times 32 = 160$.

   (g) $5 \times 2\frac{3}{5} = \cancel{5} \times \frac{13}{\cancel{5}} = 13$.

   (h) $\cancel{6}^{1} \times \frac{2}{\cancel{18}_3} = \frac{2}{3}$.

2. (a) $5\frac{1}{2} \times \frac{3}{7} = \frac{11}{2} \times \frac{3}{7} = \frac{11 \times 3}{2 \times 7} = \frac{33}{14} = 2\frac{5}{14}$.

   (b) $\frac{8}{15} \times 2\frac{1}{4} = \frac{\cancel{8}^{2}}{15} \times \frac{9}{\cancel{4}_1} = \frac{2}{\cancel{15}_5} \times \frac{\cancel{9}^{3}}{1} = \frac{2 \times 3}{5} = \frac{6}{5} = 1\frac{1}{5}$.

   (c) $10\frac{2}{3} \times 3\frac{1}{4} = \frac{\cancel{32}^{8}}{3} \times \frac{13}{\cancel{4}_1} = \frac{8 \times 13}{3} = \frac{104}{3} = 34\frac{2}{3}$.

   (d) $\frac{18}{25} \times 12\frac{1}{2} = \frac{\cancel{18}^{9}}{\cancel{25}} \times \frac{\cancel{25}}{\cancel{2}_1} = 9$.

   (e) $10\frac{3}{7} \times 5\frac{2}{5} = \frac{73}{7} \times \frac{27}{5} = \frac{73 \times 27}{35} = \frac{1971}{35} = 56\frac{11}{35}$.

   (f) $\frac{36}{49} \times 8\frac{1}{6} = \frac{\cancel{36}^{6}}{\cancel{49}} \times \frac{\cancel{49}}{\cancel{6}_1} = 6$.

   (g) $12\frac{1}{4} \times \frac{2}{9} \times \frac{3}{5} = \frac{49}{\cancel{4}_2} \times \frac{\cancel{2}^{1}}{\cancel{9}_3} \times \frac{\cancel{3}^{1}}{5} = \frac{49}{2} \times \frac{1}{3} \times \frac{1}{5} = \frac{49}{30} = 1\frac{19}{30}$.

   (h) $9\frac{2}{7} \times \frac{49}{108} \times 5\frac{3}{7} = \frac{65}{7} \times \frac{\cancel{49}^{7}}{108} \times \frac{38}{\cancel{7}_1} = \frac{65}{\cancel{7}_1} \times \frac{\cancel{7}^{1}}{\cancel{108}_{54}} \times \frac{\cancel{38}^{19}}{1} = \frac{65 \times 19}{54} = \frac{1235}{54} = 22\frac{47}{54}$.

3. (a) $\frac{3}{1} \times \frac{4}{5} \times \frac{1}{7} = \frac{3 \times 4 \times 1}{1 \times 5 \times 7} = \frac{12}{35}$.

   (b) $4\frac{3}{7} \times 2\frac{1}{4} \times 8 = \frac{31}{7} \times \frac{9}{\cancel{4}_1} \times \frac{\cancel{8}^{2}}{1} = \frac{31 \times 9 \times 2}{7} = \frac{558}{7} = 79\frac{5}{7}$.

   (c) $11\frac{2}{3} \times 9\frac{1}{5} \times 3\frac{2}{23} = \frac{\cancel{35}^{7}}{3} \times \frac{\cancel{46}^{2}}{\cancel{5}_1} \times \frac{71}{\cancel{23}_1} = \frac{7 \times 2 \times 71}{3 \times 1 \times 1} = \frac{924}{3} = 331\frac{1}{3}$.

   (d) $\frac{5}{11} \times \frac{3}{\cancel{8}_4} \times \frac{\cancel{6}^{3}}{7} = \frac{5 \times 3 \times 3}{11 \times 4 \times 7} = \frac{45}{308}$.

4. (a) $\frac{5}{8}$ of $200 = \frac{5}{\cancel{8}_1} \times \cancel{200}^{25} = 5 \times 25 = 125$.

(b) $\frac{4}{5}$ of 1 km = $\frac{4}{\cancel{5}_1} \times \cancel{1000}^{200}$ m = 800 m.

(c) $\frac{3}{25}$ of ₹ 2 = $\frac{3}{\cancel{25}_1} \times \cancel{200}^{8}$ p = 3 × 8p = 24p.

(d) $\frac{1}{2}$ of 1 day = $\frac{1}{2} \times 24$ hours. = $\frac{1}{\cancel{2}} \times \cancel{24}^{12}$ = 12 hours.

(e) $\frac{2}{3}$ of 1 year = $\frac{2}{\cancel{3}_1} \times \cancel{12}^{4}$ months = 8 months.

(f) $\frac{9}{10}$ of 4 kg = $\frac{9}{10} \times 4000$ g = 9 × 400 g = 3600 g. [1 kg = 1000 g]

(g) $\frac{4}{3}$ of a dozen = $\frac{4}{\cancel{3}_1} \times \cancel{12}^{4}$ = 4 × 4 = 16.

(h) $\frac{4}{5}$ of a score = $\frac{4}{\cancel{5}_1} \times \cancel{20}^{4}$ = 4 × 4 = 16.

5. (a) $\frac{3}{4} \times \left(1\frac{1}{2} - \frac{1}{2}\right) = \frac{3}{4} \times \left(\frac{3}{2} - \frac{1}{2}\right) = \frac{3}{4} \times \frac{\cancel{2}}{\cancel{2}} = \frac{3}{4}$.

(b) $\frac{1}{2}$ of $\left(1\frac{3}{4} + \frac{1}{4}\right) = \frac{1}{2} \times \left(\frac{7}{4} + \frac{1}{4}\right) = \frac{1}{2} \times \frac{8}{4} = \frac{\cancel{8}}{\cancel{8}} = 1$.

(c) $2\frac{1}{4} \times \frac{1}{2} - \frac{4}{5} = \frac{9}{4} \times \frac{1}{2} - \frac{4}{5} = \frac{9}{8} - \frac{4}{5} = \frac{45 - 32}{40} = \frac{13}{40}$.

(d) $3\frac{1}{4} \times \left(1\frac{1}{5} - 2\frac{1}{4}\right) = \frac{13}{4} \times \left(\frac{6}{5} - \frac{9}{4}\right) = \frac{13}{4} \times \left(\frac{24 - 45}{20}\right) = \frac{13}{4} \times \frac{-21}{20} = \frac{-273}{80}$

(e) $8\frac{4}{5} - \left(\frac{2}{5} + 1\frac{1}{2}\right) = \frac{44}{5} - \left(\frac{2}{5} + \frac{3}{2}\right) = \frac{44}{5} - \frac{19}{10} = \frac{88 - 19}{10} = \frac{69}{10} = 6\frac{9}{10}$.

(f) $3\frac{1}{4} \times \left(8\frac{1}{2} - 4\frac{1}{4}\right) = \frac{13}{4} \times \left(\frac{17}{2} - \frac{17}{4}\right)$

$= \frac{13}{4} \times \left(\frac{17 \times 2 - 17}{4}\right) = \frac{13}{4} \times \left(\frac{34 - 17}{4}\right) = \frac{13}{4} \times \frac{17}{4} = \frac{221}{8} = 27\frac{5}{8}$.

(g) $5 \times \left(\frac{3}{5} - \frac{7}{10}\right) = 5 \times \left(\frac{3 \times 2 - 7}{10}\right) = 5 \times \left(\frac{6 - 7}{10}\right) = \cancel{5}^{1} \times \frac{-1}{\cancel{10}_2} = \frac{-1}{2}$.

(h) $\frac{8}{9} \times \left(\frac{7}{32} - \frac{9}{64}\right) = \frac{8}{9} \times \left(\frac{7 \times 2 - 9}{64}\right) = \frac{8}{9} \times \left(\frac{14 - 9}{64}\right) = \frac{\cancel{8}^{1}}{9} \times \frac{5}{\cancel{64}_8} = \frac{5}{72}$.

6. Distance walked in 1 hour = $\frac{3}{8}$ km

Distance walked in $4\frac{1}{2}$ hours = $\frac{3}{8} \times 4\frac{1}{2} = \frac{3}{8} \times \frac{9}{2} = \frac{27}{16}$ km = $1\frac{11}{16}$ km

Thus, Shweta covers $1\frac{11}{16}$ km in $4\frac{1}{2}$ hours.

7. Total number of apples in the box = 75.

Number of rotten apples = $\frac{1}{5}$ of 75 = $\frac{1}{\cancel{5}_1} \times \cancel{75}^{15}$ = 15 apples.

$\therefore$ Number of good apples = 75 – 15 = 60 apples.

Thus, there are 60 good apples.

8. Distance covered by a car in 1 L petrol = 24 km.

Distance covered by the car in $9\frac{1}{2}$ L petrol = $24 \times 9\frac{1}{2}$ km = $\cancel{24}^{12} \times \frac{19}{\cancel{2}_1}$ km = 12 × 19 km = 228 km.

Thus, the required distance covered by the car in 228 km.

9. $\frac{1}{4}$ of 8 km = $\frac{1}{\cancel{4}_1} \times \cancel{8}^{2}$ km = 2 km.

Now, $\frac{1}{2}$ of 2 km = $\frac{1}{\cancel{2}_1} \times \cancel{2}^{1}$ km = 1 km.

Thus, half of $\frac{1}{4}$th of 8 km is 1 km.

10. Perimeter of the rectangle = 2 (Length + Breadth)

$$= 2 \times \left(8\frac{1}{2} + 6\frac{3}{4}\right)\text{cm} = 2 \times \left(\frac{17}{2} + \frac{27}{4}\right)\text{cm}$$

$$= 2 \times \left(\frac{34 + 27}{4}\right)\text{cm} = \cancel{2}^{1} \times \frac{61}{\cancel{4}_2}\text{cm} = \frac{61}{2}\text{cm} = 30\frac{1}{2}\text{cm}.$$

Exercise 2.3

1. (a) $\frac{75}{106} \div 1 = \frac{75}{106}$ (b) $1 \div \frac{23}{45} = 1 \times \frac{45}{23} = \frac{45}{23}$.

(c) $0 \div \frac{1}{9} = 0 \times \frac{9}{1} = 0$ (d) $3\frac{1}{2} \div 0$ is not defined.

(e) $16 \times \frac{1}{16} = 1$ (f) $\frac{5}{2} \times \frac{2}{5} = 1$

(g) $4\frac{1}{3} \times$ _____ $= 1 \quad \Rightarrow \frac{13}{3} \times$ _____ $= 1 \quad \Rightarrow \frac{13}{3} \times \frac{3}{13} = 1$

(h) $\frac{1}{9} \times 9 = 1$

2. The reciprocal of :

(a) 0 is 0 (b) $\frac{9}{17}$ is $\frac{17}{9}$ (c) 25 is $\frac{1}{25}$ (d) $2\frac{4}{5} = \frac{14}{5}$ is $\frac{5}{14}$

(e) 1 is 1 (f) $15\frac{1}{2} = \frac{31}{2}$ is $\frac{2}{31}$ (g) $\frac{3}{4}$ of $\frac{1}{2} = \frac{3}{4} \times \frac{1}{2} = \frac{3}{8}$ is $\frac{8}{3}$ (h) –1 is –1

3. (a) $\frac{3}{7} \div 3 = \frac{\cancel{3}}{7} \times \frac{1}{\cancel{3}} = \frac{1}{7}$. (b) $\frac{9}{11} \div 15 = \frac{\cancel{9}^{3}}{11} \times \frac{1}{\cancel{15}_5} = \frac{3}{55}$.

(c) $2\frac{1}{2} \div 8 = \frac{5}{2} \times \frac{1}{8} = \frac{5}{16}$. (d) $18 \div \frac{1}{2} = 18 \times \frac{2}{1} = 36$.

(e) $12\frac{3}{5} \div \frac{63}{10} = \frac{\cancel{63}}{5} \times \frac{10}{\cancel{63}} = \frac{\cancel{10}^{2}}{\cancel{5}_{1}} = 2.$

(f) $9\frac{3}{5} \div 4\frac{1}{8} = \frac{48}{5} \div \frac{33}{8} = \frac{\cancel{48}^{16}}{5} \times \frac{8}{\cancel{33}_{11}}$

(g) $7\frac{2}{9} \div \frac{8}{9} = \frac{65}{\cancel{9}} \times \frac{\cancel{9}^{1}}{8} = \frac{65}{8} = 8\frac{1}{8}.$

(h) $\frac{9}{18} \div \frac{108}{36} = \frac{\cancel{9}^{1}}{18} \times \frac{36}{\cancel{108}_{12}} = \frac{\cancel{36}^{3}}{18 \times \cancel{12}_{1}} = \frac{\cancel{3}^{1}}{\cancel{16}_{6}} = \frac{1}{6}.$

4. (a) $36 \div 4\frac{2}{3} = 36 \div \frac{14}{3} = \cancel{36}^{18} \times \frac{3}{\cancel{14}_{7}} = \frac{54}{7} = 7\frac{5}{7}.$

(b) $25\frac{1}{2} \div 10\frac{1}{5} = \frac{51}{2} \div \frac{51}{35} = \frac{\cancel{51}}{2} \times \frac{5}{\cancel{51}} = \frac{5}{2} = 2\frac{1}{2}.$

(c) $19\frac{2}{3} \div 59 = \frac{59}{3} \div 59 = \frac{\cancel{59}}{3} \times \frac{1}{\cancel{59}} = \frac{1}{3}.$

(d) $9\frac{3}{4} \div 36 = \frac{39}{4} \div 36 = \frac{\cancel{39}^{13}}{4} \times \frac{1}{\cancel{36}_{12}} = \frac{13}{48}.$

(e) $45\frac{1}{2} \div 1\frac{6}{7} = \frac{91}{2} \div \frac{13}{7} = \frac{\cancel{91}^{7}}{2} \times \frac{7}{\cancel{13}_{1}} = \frac{49}{2} = 24\frac{1}{2}.$

(f) $20\frac{1}{4} \div \frac{1}{100} = \frac{81}{\cancel{4}} \times \frac{\cancel{100}^{25}}{1} = 2025.$

(g) $5\frac{1}{4} \div 2\frac{3}{8} = \frac{21}{4} \div \frac{19}{8} = \frac{21}{\cancel{4}_{1}} \times \frac{\cancel{8}^{2}}{19} = \frac{42}{19} = 2\frac{4}{19}.$

(h) $7\frac{1}{17} \div \frac{1}{85} = \frac{120}{17} \div \frac{1}{85} = \frac{120}{\cancel{17}_{1}} \times \frac{\cancel{85}^{5}}{1} = 600.$

5. (a) $\frac{7}{\cancel{8}_{4}} \times \frac{\cancel{2}^{1}}{5} \div \frac{11}{15} = \frac{7}{\cancel{20}_{4}} \times \frac{\cancel{15}^{3}}{11} = \frac{21}{44}.$

(b) $\frac{9}{17} \times \frac{1}{2} \div \frac{3}{38} = \frac{9}{34} \div \frac{3}{38} = \frac{\cancel{9}^{3}}{\cancel{34}_{17}} \times \frac{\cancel{38}^{19}}{\cancel{3}_{1}} = \frac{57}{17} = 3\frac{6}{17}.$

(c) $\left(2\frac{1}{3} \div 1\frac{1}{2}\right) \div \left(5\frac{1}{3} \div 2\frac{1}{2}\right) = \left(\frac{7}{3} \div \frac{3}{2}\right) \div \left(\frac{16}{3} \div \frac{5}{2}\right)$

$= \left(\frac{7}{3} \times \frac{2}{3}\right) \div \left(\frac{16}{3} \times \frac{2}{5}\right) = \frac{14}{9} \surd \frac{32}{15} = \frac{\cancel{14}^{7}}{\cancel{9}_{3}} \times \frac{\cancel{15}^{5}}{\cancel{32}_{16}} = \frac{35}{48}.$

(d) $2\frac{3}{5} \div \frac{3}{5}$ of $\frac{1}{5} + \frac{3}{4} + \frac{1}{4} = \frac{13}{5} \times \frac{\cancel{5}}{3} \times \frac{1}{\cancel{5}} + \frac{1}{1} = \frac{13}{15} + 1 = \frac{13 + 15}{15} = \frac{28}{15} = 1\frac{13}{15}.$

6. Quantity of rice bought for ₹ $34\frac{1}{4} = 1$ kg

Quantity of rice bought for ₹ $680\frac{1}{2} = 1 \times 680\frac{1}{2} \div 34\frac{1}{4}$ kg

$$= \frac{1361}{2} \div \frac{137}{4} = \frac{1361}{\cancel{2}_1} \times \frac{\cancel{4}^2}{137} = \frac{2722}{137}\text{kg} = 19\frac{119}{137}\text{kg}.$$

Thus, $19\frac{119}{137}$kg rice can be bought.

7. We have $12\frac{3}{5} = \frac{63}{5}$ and $9\frac{9}{10} = \frac{99}{10}$.

$\therefore$ Sum of these fractions $= \frac{63}{5} + \frac{99}{10} = \frac{126 + 99}{10} = \frac{225}{10}$.

Their difference $= \frac{126}{10} - \frac{99}{10} = \frac{27}{10}$.

Now, $\frac{225}{10} \div \frac{27}{10} = \frac{225}{\cancel{10}} \times \frac{\cancel{10}}{27} = \frac{\cancel{225}^{25}}{\cancel{27}_3} = \frac{25}{3} = 8\frac{1}{3}$.

8. Given : Number of students in the school = 4500

$\therefore$ Number of girls $= \frac{3}{5}$ of $4500 = \frac{3}{\cancel{5}_1} \times \cancel{4500}^{900} = 3 \times 900 = 2700$.

Number of boys = 4500 – 2700 = 1800.

Thus, there are 1800 boys and 2700 girls in the school.

9. Required number $= \frac{7}{18} \sqrt{3\frac{1}{15}} = \frac{7}{18} \sqrt{\frac{46}{15}} = \frac{7}{\cancel{18}_6} \times \frac{\cancel{15}^5}{46} = \frac{35}{276}$.

10. Let the required number by x.

Then according to the question:

$\frac{2}{5}$ of $x = \frac{17}{20} \quad \Rightarrow \frac{2x}{5} = \frac{17}{20} \quad \Rightarrow x = \frac{\cancel{85}^{17}}{\cancel{40}_8} = \frac{17}{8} = 2\frac{1}{8}$.

Thus, the required number is $2\frac{1}{8}$.

11. Weight of 15 boxes of sweets $= 13\frac{2}{5}\text{kg} = \frac{67}{5}\text{kg}$

Weight of 1 box of sweets $= \frac{67}{5} \div 15$ kg $= \frac{67}{5} \times \frac{1}{15} = \frac{67}{75}$kg.

Thus, the weight of 1 box of sweets is $\frac{67}{75}$kg.

12. Other number = Product ÷ one number

$$= 18\frac{2}{3} \div \frac{8}{100} = \frac{56}{3} \div \frac{8}{100} = \frac{\cancel{56}^7}{3} \times \frac{100}{\cancel{8}_1} = \frac{700}{3} = 233\frac{1}{3}.$$

Revision Exercise

1. Refer to the **Answers** given in the book.

2. (a) $3\frac{5}{6} - \frac{3}{4} + 2\frac{1}{2} = \frac{23}{6} - \frac{3}{4} + \frac{5}{2}$

$= \frac{23\times 2 - 3\times 3 + 5\times 6}{12} = \frac{46 - 9 + 30}{12} = \frac{46 + 30 - 9}{12} = \frac{76 - 9}{12} = \frac{67}{12} = 5\frac{7}{12}.$

(b) $9 - 5\frac{2}{3} + 1\frac{1}{4} = \frac{9}{1} - \frac{17}{3} + \frac{5}{4} = \frac{9\times 12 - 17\times 4 + 5\times 3}{12}$

$= \frac{108 - 68 + 15}{12} = \frac{123 - 68}{12} = \frac{55}{12} = 4\frac{7}{12}.$

3. Reciprocal of :

(a) 9 is $\frac{1}{9}$. (b) $5\frac{2}{3} = \frac{17}{3}$ is $\frac{3}{17}$. (c) 1 is 1 (d) $\frac{5}{2}$ is $\frac{2}{5}$.

4. (a) $8\times\frac{2}{3} = \frac{16}{3} = 5\frac{1}{3}.$ (b) $12\times 5\frac{1}{2} = \frac{\cancel{12}^{6}}{} \times \frac{11}{\cancel{2}_{1}} = 66.$

(c) $\frac{\cancel{2}^{1}}{\cancel{9}_{3}}\times\frac{1}{\cancel{4}_{2}}\times\frac{\cancel{3}^{1}}{8} = \frac{1}{48}.$ (d) $\frac{6}{23}\times 11\frac{1}{2} = \frac{6}{\cancel{23}}\times\frac{\cancel{23}}{2} = \frac{6}{2} = 3.$

(e) $8\frac{2}{3}\times 9\frac{2}{4} = \frac{\cancel{26}^{13}}{3}\times\frac{38}{\cancel{4}_{2}} = \frac{13\times 38}{6} = \frac{494}{6} = 82\frac{2}{6} = 82\frac{1}{3}.$

(f) $7\frac{2}{3}\times\frac{8}{15}\times 4\frac{1}{5} = \frac{23}{\cancel{3}_{1}}\times\frac{8}{15}\times\frac{\cancel{21}^{7}}{5} = \frac{1288}{75} = 17\frac{13}{75}.$

(g) $9\frac{2}{3}\times\frac{15}{29} = \frac{\cancel{29}}{\cancel{3}_{1}}\times\frac{\cancel{15}^{5}}{\cancel{29}} = 5.$ (h) $\frac{17}{35}\times 3\frac{2}{11} = \frac{17}{\cancel{35}}\times\frac{\cancel{35}}{11} = \frac{17}{11} = 1\frac{6}{11}.$

5. (a) $15 \div \frac{1}{2} = 15\times\frac{2}{1} = 30.$

(b) $30 \div 2\frac{3}{4} = 30 \div \frac{11}{4} = 30\times\frac{4}{11} = \frac{120}{11} = 10\frac{10}{11}.$

(c) $\frac{17}{45} \div \frac{2}{5} = \frac{17}{\cancel{45}_{9}}\times\frac{\cancel{5}^{1}}{2} = \frac{17}{18}.$

(d) $12\frac{3}{4} \div 2\frac{1}{2} = \frac{51}{4} \div \frac{5}{2} = \frac{51}{\cancel{4}_{2}}\times\frac{\cancel{2}^{1}}{5} = \frac{51}{10} = 5\frac{1}{10}.$

(e) $9\frac{1}{3} \div 14 = \frac{28}{3} \div 14 = \frac{\cancel{28}^{2}}{3}\times\frac{1}{\cancel{14}_{1}} = \frac{2}{3}.$

(f) $\frac{8}{27}$ of $\left(\frac{3}{4} \div 9\right) = \frac{\cancel{7}^{1}}{29}\times\frac{1}{\cancel{42}_{6}} = \frac{1}{174}.$

(g) $\frac{9}{17} \div 2\frac{5}{17} = \frac{9}{17} \div \frac{39}{17} = \frac{9}{\cancel{17}}\times\frac{\cancel{17}}{39} = \frac{\cancel{9}^{3}}{\cancel{39}_{13}} = \frac{3}{13}.$

(h) $16\frac{3}{5} \div \frac{166}{35} = \frac{83}{5} \div \frac{166}{35} = \frac{\cancel{83}^{1}}{\cancel{5}_{1}}\times\frac{\cancel{35}^{7}}{\cancel{166}_{2}} = \frac{7}{2} = 3\frac{1}{2}.$

6. (a) $\frac{2}{9} \div \left(\frac{1}{\cancel{4}_{2}} \times \frac{\cancel{2}^{1}}{3}\right) = \frac{2}{9} \div \left(\frac{1}{6}\right) = \frac{2}{\cancel{9}_{3}} \times \frac{\cancel{6}^{2}}{1} = \frac{4}{3} = 1\frac{1}{3}.$

(b) $6 \div \left(\frac{3}{7} \times \frac{1}{4}\right) = 6 \sqrt{\frac{3}{28}} = \cancel{6}^{2} \times \frac{28}{\cancel{3}_{1}} = 56.$

(c) $8 \div \left(25 \div \frac{5}{8}\right) = 8 \div \left(\cancel{25}^{5} \times \frac{8}{\cancel{5}_{1}}\right) = 8 \times 40 = 320.$

(d) $\frac{3}{14} + \left(\frac{1}{2} \text{ of } \frac{4}{7}\right) = \frac{3}{14} + \left(\frac{1}{2} \times \frac{4}{7}\right) = \frac{3}{14} + \frac{4}{14} = \frac{7}{14} = \frac{1}{2}.$

(e) $\frac{8}{15} \div 1\frac{2}{3} + \left(\frac{4}{9} \div \frac{2}{3}\right) = \frac{8}{15} \div \frac{5}{3} + \left(\frac{\cancel{4}^{2}}{\cancel{9}_{3}} + \frac{\cancel{3}^{1}}{\cancel{2}_{1}}\right)$

$= \frac{8}{\cancel{15}_{5}} \times \frac{\cancel{3}^{1}}{5} + \frac{2}{3} = \frac{8}{25} + \frac{2}{3} = \frac{24 + 50}{75} = \frac{74}{75}.$

(f) $\frac{8}{27} \text{ of } \left(\frac{3}{4} \div 9\right) = \frac{8}{27} \times \left(\frac{\cancel{3}^{1}}{4} \times \frac{1}{\cancel{9}_{3}}\right) = \frac{\cancel{8}^{2}}{27} \times \frac{1}{\cancel{12}_{3}} = \frac{2}{81}.$

(g) $\frac{2}{3} \text{ of } \left(\frac{5}{12} \div 24 \times 5\right) = \frac{\cancel{2}^{1}}{3} \times \frac{5}{\cancel{12}_{6}} \times \frac{1}{24} \times 5 = \frac{5 \times 5}{18 \times 24} = \frac{25}{432}.$

(h) $\frac{2}{3} \times \left(4\frac{2}{3} + 5\frac{5}{6}\right) = \frac{2}{3} \times \left(\frac{14}{3} + \frac{35}{6}\right) = \frac{2}{3} \times \left(\frac{28 + 35}{6}\right) = \frac{\cancel{2}^{1}}{\cancel{3}_{1}} \times \frac{\cancel{63}^{21}}{\cancel{6}_{3}} = \frac{21}{3} = 7.$

7. (a) $\frac{14}{15} \text{ of } 1\frac{1}{2}\text{kg} = \frac{\cancel{14}^{7}}{\cancel{15}_{5}} \times \frac{\cancel{3}^{1}}{\cancel{2}_{1}}\text{kg} = \frac{7}{5}\text{kg}$

(b) $\frac{3}{8}$ of 1 year $= \frac{3}{\cancel{8}_{2}} \times \cancel{12}^{3}$ months $= \frac{9}{2}$ months $= 4\frac{1}{2}$ months.

(c) $\frac{1}{6}$ of 1 day $= \frac{1}{\cancel{6}_{1}} \times \cancel{24}^{4}$ hours = 4 hours

(d) $\frac{1}{2}$ of a score $= \frac{1}{\cancel{2}_{1}} \times \cancel{20}^{10} = 10.$

8. Quantity of oil that a tank can hold $= 8\frac{1}{2}\text{L} = \frac{17}{2}\text{L}.$

$\therefore$ Quantity of oil that 24 tanks can hold $= \frac{17}{\cancel{2}_{1}} \times \cancel{24}^{12}\text{L} = 17 \times 12\text{L} = 204\text{ L}$

Thus, 24 tanks can hold 204 litres of oil.

9. Length of a side of the square plot $= 12\frac{3}{4}\text{m} = \frac{51}{4}\text{m}.$

$\therefore$ Area of the square plot = side × side

$= \frac{51}{4} \times \frac{51}{4}\text{m}^2 = \frac{2601}{16}\text{m}^2 = 162\frac{9}{16}\text{m}^2.$

10. Cost of $\frac{2}{5}$ litres of oil = ₹ 35.

$\therefore$ Cost of 1litre of oil = ₹ $35 \div \frac{2}{5}$ = ₹ $\frac{35 \times 5}{2}$

$\therefore$ Cost of $9\frac{1}{2}$ litres of oil = ₹ $\frac{175}{2} \times 9\frac{1}{2}$ = ₹ $\frac{175}{2} \times \frac{19}{2}$ = ₹ $\frac{3325}{4}$ = ₹ $831\frac{1}{4}$.

11. We have $3\frac{1}{9} = \frac{28}{9}$ and $4\frac{2}{3} = \frac{14}{3}$.

Product of these fractions = $\frac{28}{9} \times \frac{14}{3} = \frac{392}{27}$.

Now, dividing product by 36, we get

$\frac{392}{27} \div 36 = \frac{\cancel{392}^{98}}{27} \times \frac{1}{\cancel{36}_{9}} = \frac{98}{243}$.

12. Number of students who got grade A = $\frac{1}{5}$ of 600 = 120 students.

Number of students who got grade B = $\frac{3}{5}$ of 600 = 3 × 120 = 360 students.

Number of students who got grade C = 600 – (120 + 360) = 600 – 480 = 120 students.

Thus, the number of students who passed with B and C grades are 360 and 120 respectively.

13. Distance travelled by train = $80\frac{1}{2}$ km = $\frac{161}{2}$ km.

Distance travelled by bus = $25\frac{3}{4}$ km = $\frac{123}{4}$ km.

Distance travelled by these modes = $\frac{161}{2} + \frac{123}{4} = \frac{322 + 123}{4} = \frac{455}{4}$ km, which is half of the journey.

$\therefore$ Total distance travelled = $\left(\frac{455}{\cancel{4}_{2}} \times \cancel{2}^{1}\right)$ km = $\frac{455}{2}$ km = $227\frac{1}{2}$ km.

Thus, Navin travelled $227\frac{1}{2}$ km.

Multiple Choice Questions

1. In simplification 'of' represents multiplication. So, the correct option is (c).
2. $1\frac{1}{2}$ of $2 = \frac{3}{\cancel{2}} \times \cancel{2} = 3$. So the correct option is (d).
3. $\frac{2}{3}$ of an hour = $\frac{2}{\cancel{3}_{1}} \times \cancel{60}^{20}$ min = 40 m. So, the correct option is (b).
4. $8\frac{3}{4} = \frac{35}{4}$. Reciprocal of $\frac{35}{4}$ is $\frac{4}{35}$. So, the correct option is (b).
5. See the **Answers** given in the book.
6. $\frac{2}{5} \div (-1) = \frac{2}{5} \times \frac{1}{-1} = \frac{2}{-5} = \frac{-2}{5}$. So, the correct option is (b)
7. $\frac{-24}{36} = \frac{-24 \div 12}{36 \div 12} = \frac{-2}{3}$. So, the correct option is (a).

8. See the **Answers** given in the book.

9. The product of a fraction and its reciprocal is 1. So, the correct option is (c).

10. $\frac{\cancel{2}^{1}}{\cancel{5}} \times \frac{\cancel{5}}{\cancel{4}_{2}} = \frac{1}{2}$, which his between 0 and 1. So the correct option is (a).

Mental Maths.

Refer to the **Answers** given in the book for A and B.

C. Time Sunita stayed in her school = $5\frac{2}{3}\text{h} = \frac{17}{3}\text{h}$.

Time the spent in activities and games = $1\frac{1}{3}\text{h} = \frac{4}{3}\text{h}$

$\therefore$ Time she spent in studies = $\frac{17}{3} - \frac{4}{3} = \frac{13}{3} = 4\frac{1}{3}\text{h}$.

Thus, Sunita spent $4\frac{1}{3}$ hours in studies.

D. Cost of 1 book = ₹ $85\frac{1}{2}$ = ₹ $\frac{171}{2}$

$\therefore$ Cost of 50 books = $\frac{171}{\cancel{2}_{1}} \times \cancel{50}^{25}$ × Rs. 171 × 25 = Rs. 4275.

E. 1 dozen = 12, so half of 12 = $\frac{12}{2} = 6$

One third of 6 = $\frac{\cancel{6}^{2}}{\cancel{3}_{1}} = 2$.

Thus, one third of half of dozen is 2.

Higher order Thinking Skills (HOTS)

1. Reciprocal of $\frac{250}{1000} = \frac{1000}{250} = 4$. It is an integer or whole number.
2. 1 is the only natural number which has the same multiplicative inverse.
3. Whole number 0 does not have its reciprocal.
4. We know that the product of a number and its reciprocal is 1. Thus, x represents $\frac{34}{-25}$.
5. Distance travelled in 1 litre petrol = $16\frac{3}{4}\text{km} = \frac{67}{4}\text{km}$.

   Distance travelled in $28\frac{1}{4}$ litres petrol = $\frac{67}{4} \times 28\frac{1}{4}\text{km}$.

   = $\frac{67}{4} \times \frac{113}{4} = \frac{7571}{16} = 473\frac{3}{16}\text{km}$.
6. $4\frac{1}{6} \div 4\frac{2}{3} = \frac{25}{6} \div \frac{14}{3} = \frac{25}{\cancel{6}_{2}} \times \frac{\cancel{3}^{1}}{14} = \frac{25}{28}$, which is less than 1.

3 Decimals

Exercise 3.1

1. In words :
   (a) 7.56 is seven point five six.
   (b) 0.189 is zero point one eight nine.
   (c) 15.006 is fifteen point zero zero six.
   (d) 4.9003 is four point nine zero zero three.

2. The decimal part in :
   (a) 17.5 is 5 (b) 2.967 is 967 (c) 0.18 is 18 (d) 4.695 is 695

3. (a) 8.5 [=] 8.50 (b) 15.3 [>] 1.53 (c) 0.896 [<] 2.00 (d) 9.3 [>] 9.257

4. (a) $\frac{2}{5} = \frac{2\times 2}{5\times 2} = \frac{4}{10} = 0.4.$

   (b) $9\frac{1}{4} = \frac{37}{4} = \frac{37\times 25}{4\times 25} = \frac{925}{100} = 9.25.$

   (c) $15\frac{3}{4} = \frac{63}{4} = \frac{63\times 25}{4\times 25} = \frac{1575}{100} = 15.75.$

   (d) $\frac{60}{100} = 0.60.$

5. (a) We have 1.75. Number of decimal places in 1.75 is two.

   $\therefore 1.75 = \frac{175}{100} = \frac{7}{4} = 1\frac{3}{4}.$ [HCF of 175 and 100 is 25.]

   (b) We have 0.24. Number of decimal places in it is two.

   $\therefore 0.24 = \frac{24}{100} = \frac{24\sqrt{4}}{100\sqrt{4}} = \frac{6}{25}.$ [HCF of 24 and 100 is 4.]

   (c) We have 10.325 which has three decimal places.

   $\therefore 10.325 = \frac{10325}{1000} = \frac{10325\sqrt{25}}{1000\sqrt{25}} = \frac{413}{40}.$ [HCF of 10325 and 1000 is 25.]

   (d) We have 0.125. Number of decimal places is three.

   $\therefore 0.125 = \frac{125}{1000} = \frac{125\sqrt{125}}{1000\sqrt{125}} = \frac{1}{8}.$ [HCF of 125 and 1000 is 125.]

6. See the **Answers** given in the book.

7. (a)
   $$\begin{array}{r} 15.900 \\ 0.286 \\ 7.900 \\ +\ 4.000 \\ \hline 28.086 \end{array}$$
   (b)
   $$\begin{array}{r} 2.670 \\ 18.400 \\ 0.994 \\ +\ 10.080 \\ \hline 32.144 \end{array}$$
   (c)
   $$\begin{array}{r} 91.000 \\ 7.008 \\ 18.500 \\ +\ 0.920 \\ \hline 27.428 \end{array}$$
   (d)
   $$\begin{array}{r} 6.008 \\ 156.320 \\ +\ 4.985 \\ \hline 167.313 \end{array}$$

8. (a) 151.90 –17.28 = 134.62 (b) 2.168 –0.480 = 1.688
   (c) 10.000 – 9.175 = 0.825 (d) 1592.68 – 285.70 = 1306.98

9. Required number = 150.00 – 48.90 = 101.10.

10. Required number = 86.92 – 6.92 = 80.

Exercise 3.2

1. We know that 10 multiply any decimal by 10, 100, 1000 or powers of 10, the decimal points shifts to the right as the number of zeros in the multiplier after 1. Thus, following this rule, we get :

   (a) $45.25 \times 10 = 452.5$ (b) $27.6 \times 10 = 276.0$ (c) $3.5 \times 100 = 350$

   (d) $0.009 \times 100 = 0.9$ (e) $0.0007 \times 1000 = 0.7$ (f) $0.05 \times 1000 = 50$

   (g) $2.684 \times 1000 = 2684$ (h) $6.396 \times 100 = 639.6$ (i) $2.598 \times 10 = 25.98$

   (j) $0.4 \times 10 = 4.0$ (k) $5.4 \times 1000 = 5400$ (l) $5.92 \times 100 = 592.0$

2. (a) $\begin{array}{r} 2.7 \\ \times\ 6 \\ \hline 16.2 \end{array}$ (b) $\begin{array}{r} 9.15 \\ \times\ 42 \\ \hline 18.30 \end{array}$ (c) $\begin{array}{r} 0.14 \\ \times\ 5 \\ \hline 0.70 \end{array}$ (d) $\begin{array}{r} 3.58 \\ \times\ 20 \\ \hline 71.6 \end{array}$

   (e) $25.3 \times 2.1 = 53.13$ (f) $17.2 \times 4 = 68.8$ (g) $0.008 \times 19 = 0.152$

   (h) $0.003 \times 2 = 0.006$

3. (a) We have 4.2×3.6. Multiplying decimals without decimal point, we get :

$$\begin{array}{r} 42 \\ \times\ 36 \\ \hline 252 \\ 1260 \\ \hline 1512 \end{array}$$

   Now we have $42 \times 36 = 1512$.

   Sum of the number of decimal places in the given decimals $= 1 + 1 = 2$

   $\therefore\ 4.2 \times 3.6 = 15.12$

   (b) We have 0.002×0.4. Multiplying the decimals without decimal point, we get $2 \times 4 = 8$

   Sum of the number of decimal places in the given decimals $= 3 + 1 = 4$

   $\therefore\ 0.002 \times 0.4 = 0.0008$.

   (c) Similar work to be done as (a).

   (d) Similar work to be done as (a).

   (e) We have 3.2×0.004. Multiplying the decimals without decimal point, we get $32 \times 4 = 128$.

   Sum of the number of decimal places in the given decimals $= 1 + 3 = 4$.

   $\therefore\ 3.2 \times 0.004 = 0.0128$.

   (f) Similar work to be done.

   (g) Similar work to be done.

   (h) We have 4.2×100.1. Multiplying decimals without decimal point, we get

$$\begin{array}{r} 1001 \\ \times 42 \\ \hline 2002 \\ 40040 \\ \hline 42042 \end{array}$$

   Now we have $42 \times 1001 = 42042$.

   Sum of the number of decimal places in the given decimals $= 1 + 1 = 2$.

   $\therefore\ 4.2 \times 100.1 = 420.42$.

   (i) We have $7.2 \times 0.2 \times 0.1$. Multiplying decimals without decimal point, we get

   $72 \times 2 \times 1 = 144$.

Sum of the number of decimal places in the given decimals = 1 + 1 + 1 = 3.
$\therefore$ 7.2 × 0.2 × 0.1 = 0.144.

(j) We have 0.004 × 7.1 × 0.2. Multiplying the decimals without decimal point, we get 4 × 71 × 2 = 71 × 8 = 568.
Sum of the number of decimal places in the given decimals = 3 + 1 + 1 = 5.
$\therefore$ 0.004 × 7.1 × 0.2 = 0.00568.

(k) We have 10.1 × 1.1 × 0.1. Multiplying the decimals without decimal point, we get 101 × 11 × 1 = 1111.
Sum of the number of decimal places in the given decimals = 1 + 1 + 1 = 3.
$\therefore$ 10.1 × 7.1 × 0.1 = 1.111.

(l) We have 2.5 × 1.2 × 0.01. Multiplying the decimals without decimal point, we get 25 × 12 × 1 = 300.
Sum of the number of decimal places in the given decimals = 1 + 1 + 2 = 4.
$\therefore$ 2.5 × 1.2 × 0.01 = 0.0300.

Exercise 3.3

1. We know that on dividing any decimal by 10, 100, 1000 or any power of 10, the decimal point shifts to its left as many places as the number of zeros in the divisor after 1. Thus, following this rule, we get :

(a) 4.32 ÷ 10 = 0.432
(b) 7.16 ÷ 100 = 0.0716
(c) 19.36 ÷ 1000 = 0.01936
(d) 47.9 ÷ 10 = 4.79
(e) 0.01 ÷ 100 = 0.0001
(f) 8.9 ÷ 10 = 0.89
(g) 982.5 ÷ 1000 = 0.9825
(h) 7586.2 ÷ 1000 = 7.5862

2. (a) $22.4 \div 5.6 = \dfrac{22.4 \times 10}{5.6 \times 10} = \dfrac{\cancel{224}^{4}}{\cancel{56}_{1}} = 4.$ [Making the denominator a whole number.]

Thus, 22.4 ÷ 5.6 = 4.

(b) $650.16 \div 6.3 = \dfrac{650.16 \times 10}{6.3 \times 10}$

$= \dfrac{6501.6}{63} = 103.2.$

Thus, 650.16 ÷ 6.3 = 103.2.

```
      103.2
  63 | 6501.6
     -63
     ----
      201
     -189
     ----
      126
     -126
     ----
        0
```

(c) $22.5 \div 0.09 = \dfrac{22.5 \times 100}{0.09 \times 100} = \dfrac{2250}{9} = 250.$ [Making the denominator a whole number.]

(d) Similar work to be done.

(e) $1.48 \div 0.074 = \dfrac{1.48 \times 1000}{0.074 \times 1000} = \dfrac{1480}{74} = 20.$

Thus, 1.48 ÷ 0.074 = 20.

```
      20
  74 | 1480
     -148
     ----
        0
```

(f) Similar work to be done as (c).

(g) $21.976 \div 16.4 = \dfrac{21.976 \times 10}{16.4 \times 10} = \dfrac{219.76}{164} = 1.34$

Thus, 21.976 ÷ 16.4 = 1.34

(h) Similar work to be done.

```
      1.34
 164 | 219.76
     -164
     -----
      557
     -492
     -----
      656
     -656
     -----
        0
```

3. (a) $0.08 \div 20 = \frac{0.08}{2 \times 10} = \frac{0.04}{10} = 0.004$.

(b) $3.15 \div 500 = \frac{3.15}{500} = \frac{3.15}{5 \times 100} = \frac{0.63}{100} = 0.0063$.

(c) $197.6 \div 40 = \frac{197.6}{40} = \frac{197.6}{4 \times 10} = \frac{49.4}{10} = 4.94$.

(d) $59.2 \div 800 = \frac{59.2}{800} = \frac{59.2}{8 \times 100} = \frac{7.4}{100} = 0.074$.

Similar work to be done for (e) to (h).

Exercise 3.4

1. Price of notebook = ₹ 95.25

∴ Price of 15 notebook = ₹ 95.25 × 15 = ₹ 1428.75

$$\begin{array}{r} 95.25 \\ \times\ 15 \\ \hline 476\ 25 \\ 952\ 50 \\ \hline 1428.75 \end{array}$$

Thus, the price of 15 notebooks is ₹ 1428.75.

2. Area of the rectangle = length × breadth = 8.5 cm × 6.5 cm = 55.25 cm^2.

Thus, the area of the rectangle is 55.25 cm^2.

$$\begin{array}{r} 8.5 \\ \times\ 6.5 \\ \hline 425 \\ 5100 \\ \hline 55.25 \end{array}$$

3. Weight of 35 bags of rice = 1758.75 kg

∴ Weight of 1 bag of rice = 1758.75 ÷ 35 kg = 50.25 kg.

Thus, the weight of 1 bag of rice is 50.25 kg.

$$\begin{array}{r|l} & 50.25 \\ \hline 35 & 1758.75 \\ & -175 \\ \hline & 87 \\ & -70 \\ \hline & 175 \\ & -175 \\ \hline & 0 \end{array}$$

4. Other decimal = Product ÷ One decimal

$= 3.875 \div 0.25 = \frac{3.875}{0.25} = \frac{3.875 \times 100}{0.25 \times 100} = \frac{387.5}{25} = 15.5$

$$\begin{array}{r|l} & 15.5 \\ \hline 25 & 38750 \\ & -25 \\ \hline & 137 \\ & -125 \\ \hline & 125 \\ & -125 \\ \hline & 0 \end{array}$$

Thus, the other decimal is 15.5.

5. Cost of 1 kg sugar = ₹ 42.60

Cost of 8.75 kg sugar = ₹ 42.60 × 8.75

$$\begin{array}{r} 42.60 \\ \times\ 8.75 \\ \hline 21300 \\ 298200 \\ 3408000 \\ \hline 372.7500 \end{array}$$

Thus, the cost of 8.75 kg sugar is ₹ 372.75.

6. Part of the girls in school = 1 – 0.6 = 0.4.

If 0.4 is 180, so 0.6 = $\frac{180 \times 0.6}{0.4} = \frac{\cancel{180}^{45} \times 6}{\cancel{4}_{1}} = 270.$

Thus, there are 270 boys in the school.

7. Number of tins required to hold 1.5 litres milk = 1.
∴ Number of tine required to hold 22.5 litres milk = 22.5 × 1.5 = 15 tins.
Thus, 15 tins are required to hold 22.5 litres of milk.

8. Cost of 15.5 kg of rice = ₹ 1122.20
∴ Cost of 1 kg of rice = ₹ 1122.20 ÷ 15.5 = ₹ 72.40
Thus, the cost of 1 kg of rice is ₹ 72.40.

9. 1 dozen = 12
Cost of 1 banana = ₹ 4.15
Cost of 12 bananas = ₹ 4.15 × 12 = ₹ 49.80.
Thus the price of 1 dozen bananas is ₹ 49.80.

10. Cost of 10.5 kg sugar = ₹ 446.25.
Cost of 1 kg sugar = ₹ 446.25 ÷ 10.5 = 42.50
Cost of 8.5 kg sugar = ₹ 42.50 × 8.5 = ₹ 361.25.
Thus, Neha paid ₹ 361.25 to the shopkeeper.

11. Total quantity of rice = 15 kg
Weight of 1 packet = 1.25 kg
Number of packets formed = 15 kg ÷ 1.25 kg = 12 packets.
Thus, 12 packets can be formed.

12. $125\frac{3}{4} = 125.75.$

So, Aditya's answer is not correct.
∴ Required difference = 125.75 – 125.25 = 0.50.

Revision Exercise

1. Similar work to be done as Q.1 of Exercise 3.2.

2. (a) $52.8 \times 8 = 422.4.$

(b) $1.5 \times 0.03 = \frac{15 \times 3}{10 \times 100} = \frac{45}{1000} = 0.045.$

(c) $6.9 \times 2.4 = \frac{69 \times 24}{10 \times 10} = \frac{1656}{100} = 16.56.$

(d) $2.5 \times 8 \times 0.3 = \dfrac{25 \times 8 \times 3}{10 \times 10 \times 10} = \dfrac{600}{100} = 6.0.$

(e) $5.001 \times 0.01 = \dfrac{5001 \times 1}{1000 \times 100} = 0.05001.$

(f) $0.403 \times 0.2 = \dfrac{403 \times 2}{1000 \times 10} = \dfrac{806}{10000} = 0.0806.$

(g) Similar work to be done as (c).

(h) Similar work to be done as (d).

3. Given that $23.4 \times 7 = 163.8$. Therefore :

(a) $2.34 \times 7 = 16.38$ (b) $234 \times 7 = 1638$

(c) $0.234 \times 7 = 1.638$ (d) $0.0234 \times 7 = 0.1638$

4. Similar work to be done as Q.1 of Exercise 3.3.

5. (a) $3.24 \div 3 = \dfrac{3.24}{3} = \dfrac{324}{3} \times \dfrac{1}{100} = \dfrac{108}{100} = 1.08.$

(b) $33.92 \div 16 = \dfrac{3392}{16} \times \dfrac{1}{100} = \dfrac{212}{100} = 2.12.$

(c) $2.28 \div 3.8 = \dfrac{2.28}{3.8} = \dfrac{2.28 \times 10}{3.8 \times 10} = \dfrac{22.8}{38} = 0.6.$

(d) $0.8433 \div 0.9 = \dfrac{0.8433}{0.9} = \dfrac{8.433}{9}.$

$\therefore 0.8433 \div 0.9 = 0.937$

$$\begin{array}{r|l} & 0.937 \\ \hline 9 & 8.433 \\ & -81 \\ \hline & 33 \\ & -27 \\ \hline & 63 \\ & -63 \\ \hline & 0 \end{array}$$

(e) $784 \div 0.008 = \dfrac{784}{0.008} = \dfrac{\cancel{784}^{98} \times 1000}{\cancel{8}_{1}} = 98 \times 1000 = 98000.$

(f) $765 \div 51 = \dfrac{7.65}{51} = \dfrac{\cancel{765}^{15}}{\cancel{51}_{1} \times 100} = \dfrac{15}{100} = 0.15.$

(g) $1.020 \div 0.17 = \dfrac{1.020}{0.17} = \dfrac{1.020 \times 100}{0.17 \times 100} = \dfrac{102.0}{17} = 6.0.$

(h) $1.92 \div 0.25 = \dfrac{1.92}{0.25} = \dfrac{1.92 \times 100}{0.25 \times 100} = \dfrac{192}{25} = 7.68.$

6. We have $6.25 \div 5 = 1.25$. Therefore :

(a) $62.5 \div 5 = 12.5.$ (b) $0.625 \div 5 = 0.125.$

(c) $625 \div 5 = 125.$ (d) $0.0625 \div 5 = 0.0125.$

7. Thickness of 75 sheets of paper = 7.5 mm.

$\therefore$ Thickness of 1 sheet of paper = $(7.5 \div 75)$ mm.

8. Cost of 9 books = ₹ 1129.50

$\therefore$ Cost of 1 book = ₹ $1129.50 \div 9$

$\therefore$ Cost of 5 books = ₹ $\dfrac{1129.5 \times 5}{9}$ = ₹ (125.50×5) = ₹ 627.50.

9. Quantity of sugar required to make 11 cakes = 2.750 kg

$\therefore$ Quantity of sugar required to make 1 cake = $2.750 \div 11$ kg

$\therefore$ Quantity of sugar required to make 5 cakes $= \frac{2.750 \times 5}{11}$ kg

$= \frac{\cancel{2750}^{250} \times 5}{\cancel{11}_{1} \times 1000}$ kg $= \frac{250 \times 5}{1000}$ kg $= \frac{1250}{1000}$ kg $= 1.250$ kg

10. Distance covered in 3.6 litres of petrol = 234 km

$\therefore$ Distance covered in 1 litre of petrol $= \frac{234}{3.6}$ km

$\therefore$ Distance covered in 4 litres of petrol $= \frac{234 \times 4}{3.6} = \frac{\cancel{234}^{26} \times \cancel{4}^{1} \times 10}{\cancel{36}_{9_1}} = 26 \times 10 = 260$ km

This, the bike will cover 260 km in 4 litres of petrol.

Multiple Choice Questions

1. See the Answers given in the book.
2. $3 \times 100 + 4 + \frac{6}{10} = 304.6$. So, the correct option is (b).
3. Required number = 4.5 – 4.03 = 0.47. So, the correct option is (a).
4. Required number = 0.1 – 0.04 = 0.06. So, the correct answer is (d).
5. $0.017 \times 0.05 = 0.00085$. So, the correct option is (d).
6. $1503.7 \times 100 = 15.037$. So, the correct option is (b).
7. 0.463 lies between 0.46 and 0.47. So, the correct answer is (c).
8. See the Answers given in the book.
9. The place value of 6 in 2.065 is 6 hundredths. So, the correct option is (c).
10. 70.082 has three decimal places. Therefore, $70.082 \times 1000 = 700892$. So, the correct option is (c).

Metal Maths

A. See the **Answers** given in the book.

B. See the **Answers** given in the book.

Higher Order Thinking Skills (HOTS)

1. $0.55 \div 0.5 = \frac{0.55}{0.5} = \frac{5.5}{5} = 1.1$.

$0.55 \times 0.5 = \frac{55}{100} \times \frac{5}{10} = \frac{275}{1000} = 0.275$.

As 1.1 greater than 0.275, so $0.55 \div 0.5$ is greater.

2. We have 25.25 and 24.75.

25.25 + 24.75 = 50.0 and 25.25 – 24.75 = 0.5

Dividing the sum by the difference of given decimals, we get

$50 \div 0.5 = \frac{50}{0.5} = \frac{50 \times 10}{0.5 \times 10} = \frac{500}{5} = 100$.

3. $0.1 \times 0.1 \times 0.1 \times 0.1 = \frac{1}{10} \times \frac{1}{10} \times \frac{1}{10} \times \frac{1}{10} = \frac{1}{10000} = 0.0001$.

4. See the **Answers** given in the book.

5. We have _____ ÷ 1.05 = 2.346
Let the required number be x.
Then x ÷ 1.05 = 2.346
$\frac{x}{1.05} = 2.346$
x = 2.346 × 1.05 = 2.4633.
Thus, 2.4633 ÷ 1.05 = 2.346

6. Weight of empty water bottle = 78.36 g
Weight of the water bottle when full of water = 1608.36 g
Weight of water in the bottle = 1608.36 – 78.36 = 1530g
(i) Weight of the bottle when it is 0.3 times full of water = (78.36 + 1530 × 0.3) g = (78.36 + 459)g = 537.36 g.
(ii) Weight of the bottle when it is half full of water = (78.36 + 1530 ÷ 2) g = (78.36 + 765)g = 843.36g.

4 Rational Numbers

Exercise 4.1

1. (a) $\frac{3}{-5}$ is a rational number. (b) $\frac{2}{7}$ is a rational number.
(c) $\frac{0}{8}$ is a rational number. (d) $\frac{0}{0}$ is not rational number.
(e) $\frac{-5}{1}$ is a rational number. (f) $\frac{-2}{-8}$ is a rational number.
(g) $\frac{9}{0}$ is not a rational number. (h) $\frac{7}{-8}$ is a rational number.

2. See the Answers given in the book.

3. The first three rational numbers of :
(a) $-\frac{3}{4}$ are : $-\frac{3\times2}{4\times2}, -\frac{3\times3}{4\times3}, -\frac{3\times4}{4\times4} = -\frac{6}{8}, -\frac{9}{12}$ and $-\frac{12}{16}$.
(b) $\frac{8}{11}$ are : $\frac{8\times2}{11\times2}, \frac{8\times3}{11\times3}, \frac{8\times4}{11\times4} = \frac{16}{22}, \frac{24}{33}$ and $\frac{32}{44}$.
(c) $\frac{4}{7}$ are : $\frac{4\times2}{7\times2}, \frac{4\times3}{7\times3}, \frac{4\times4}{7\times4} = \frac{8}{14}, \frac{12}{21}$ and $\frac{16}{28}$.
(d) $\frac{-1}{5}$ are : $\frac{-1\times2}{5\times2}, \frac{-1\times3}{5\times3}, \frac{-1\times4}{5\times4} = \frac{-2}{10}, \frac{-3}{15}$ and $\frac{-4}{20}$.

4. (a) $\frac{15}{-22} = \frac{15\times(-1)}{-22\times(-1)} = \frac{-15}{22}$ (b) $\frac{6}{-7} = \frac{6\times(-1)}{-7\times(-1)} = \frac{-6}{7}$
(c) Similar work to be done. (d) Similar work to be done.

5. (a) To represent $\frac{4}{7}$ on the number line, follow these steps :
- Draw a number line.
- As the denominator is 7, so divide the unit length between 0 and 1 into 7 equal parts.
- The fourth part to the right of zero represent $\frac{4}{7}$ as shown below.

(b) We have $\frac{3}{-4} = \frac{-3}{4}$ which is a negative rational number. To represent it on the number line, follow these steps :
- Draw a number line.
- As the denominator is 4, so divide the unit length between 0 and –1 into four equal parts.
- The third part to the left of zero represents $\frac{-3}{4}$ as shown below.

(c) We have $\frac{-5}{3}$ and $\frac{4}{3}$.

To represent $\frac{-5}{3}$, divide the unit length into three equal parts. Count and mark the fifth part to the left of zero as A which represents $\frac{-5}{3}$.

To represent $\frac{4}{3}$, count and mark the fourth part to the right of zero as B which represent $\frac{4}{3}$.

(d) We have $\frac{3}{5}, \frac{1}{5}$ and $\frac{-2}{5}$.
- Draw a number line.
- Divide each unit length into five equal parts.
- To the right of zero, mark the first part as A and third part as B. Thus, A and B represent $\frac{1}{5}$ and $\frac{3}{5}$ respectively.
- To the left of zero, mark the second point as C which represents $\frac{-2}{5}$.

6. (a) As $21 \div 7 = 3$, so $\frac{7 \times 3}{8 \times 3} = \frac{21}{24}$.

(b) As $-35 \div 7 = -5$, so $\frac{7 \times (-5)}{8 \times (-5)} = \frac{-35}{-40}$.

(c) Similar work to be done.

(d) Similar work to be done.

7. (a) As $-30 \div 10 = -3$, so $\frac{-8}{10} = \frac{-8 \times (-3)}{10 \times (-3)} = \frac{24}{-30}$.

(b) As $20 \div 10 = 2$, so $\frac{-8}{10} = \frac{-8 \times 2}{10 \times 2} = \frac{-16}{20}$.

(c) Similar work to be done.

(d) Similar work to be done.

8. (a) We have $\frac{-24}{36}$.

HCF of 24 and 36 is 12.

$\therefore \frac{-24}{36} = \frac{-24 \div 12}{36 \div 12} = \frac{-2}{3}$.

(b) We have $\frac{-72}{144}$.

$\therefore \frac{-72}{144} = \frac{-72 \div 72}{144 \div 72} = \frac{-1}{2}$. HCF of 72 and 144 is 72.

(c) We have $\frac{-525}{-575}$.

$\therefore \frac{-525}{-575} = \frac{525}{575}$.

$\therefore \frac{525}{575} = \frac{525 \surd 25}{575 \surd 25} = \frac{21}{23}$. [HCF of 525 and 575 is 25.]

(d) We have $\frac{-21}{49}$.

$\therefore \frac{-21}{49} = \frac{-21 \div 7}{49 \div 7} = \frac{-3}{7}$. [HCF of 21 and 49 is 7.]

9. (a) We have $\frac{6}{-11} = \frac{\square}{33}$.

As $33 \div 11 = 3$

$\therefore \frac{6}{-11} = \frac{6 \times 3}{-11 \times 3} = \frac{18}{-33} = \frac{18 \times (-1)}{-33 \times (-1)} = \frac{\boxed{-18}}{33}$.

(b) We have $\frac{-25}{50} = \frac{\square}{10}$.

As $50 \div 10 = 5$

$\therefore \frac{-25}{50} = \frac{-25 \div 5}{50 \div 5} = \frac{\boxed{-5}}{10}$.

(c) We have $\frac{-5}{8} = \frac{-25}{\square}$.

As $-25 \div -5 = 5$

$\therefore \frac{-5}{8} = \frac{-5 \times 5}{8 \times 5} = \frac{-25}{\boxed{40}}$.

(d) We have $\frac{30}{42} = \frac{-5}{\square}$.

As $30 \div -5 = -6$,

$\therefore \frac{30}{42} = \frac{30 \div (-6)}{42 \div (-6)} = \frac{-5}{\boxed{-7}}$.

10. (a) We have $\frac{-3}{4}, \frac{-7}{12}, \frac{-5}{16}$ and $\frac{8}{24}$.

LCM of denominators is 48. Converting the given rational numbers in equivalent rational numbers with denominator 48, we get :

$\frac{-3}{4} = \frac{-3 \times 12}{4 \times 12} = \frac{-36}{48}$.

$\frac{-7}{12} = \frac{-7 \times 4}{12 \times 4} = \frac{-28}{48}$, $\frac{-5}{16} = \frac{-5 \times 3}{16 \times 3} = \frac{-15}{48}$ and $\frac{8}{24} = \frac{8 \times 2}{24 \times 2} = \frac{16}{48}$

Now, we have $\frac{-36}{48}, \frac{-28}{48}, \frac{-15}{48}, \frac{-16}{48}$.

Comparing the numerators, we get $-36 < -28 < -15 < 16$.

$\therefore \frac{-36}{48} < \frac{-28}{48}, \frac{-15}{48}, \frac{-16}{48}$

$\frac{-3}{4} < \frac{-7}{12} < \frac{-5}{16} < \frac{8}{24}$, which is the required ascending order.

(b) We have $\frac{3}{-5}, \frac{2}{8}, \frac{7}{10}, \frac{-11}{20}$.

Writing the given rational numbers denominator 40, we get

$\frac{3}{-5} = \frac{3 \times 8}{-5 \times 8} = \frac{-24}{40}$, $\frac{2}{8} = \frac{2 \times 5}{8 \times 5} = \frac{10}{40}$,

$\frac{7}{10} = \frac{7 \times 4}{10 \times 4} = \frac{28}{40}$, $\frac{-11}{20} = \frac{-11 \times 2}{20 \times 2} = \frac{-22}{40}$.

Now we have $\frac{-24}{40}, \frac{10}{40}, \frac{28}{40}, \frac{-22}{40}$.

Comparing the numerators, we get $-24 < -22 < 10 < 28$

$\therefore \frac{-24}{40} < \frac{-22}{40} < \frac{10}{40} < \frac{28}{40}$

$\frac{3}{-5} < \frac{-11}{20} < \frac{2}{8} < \frac{7}{10}$, which is the required ascending order.

11. (a) We have $\frac{2}{-7}, \frac{3}{14}, \frac{-8}{7}, \frac{11}{21}$.

LCM of denominators is 42.

Writing the given rational numbers with denominator 42, we get

$\frac{2}{-7} = \frac{2 \times 6}{-7 \times 6} = \frac{-12}{42}$, $\frac{3}{14} = \frac{3 \times 3}{14 \times 3} = \frac{9}{42}$,

$\frac{-8}{7} = \frac{-8 \times 6}{7 \times 6} = \frac{-48}{42}$, $\frac{11}{21} = \frac{11 \times 2}{21 \times 2} = \frac{22}{42}$.

Now we have $\frac{-12}{42}, \frac{9}{42}, \frac{-48}{42}, \frac{22}{42}$.

Comparing the numerators, we get

$22 > 9 > -12 > -48$

$\therefore \frac{22}{42} > \frac{9}{42} > \frac{-12}{42} > \frac{-48}{42}$

$\frac{11}{21} > \frac{3}{14} > \frac{2}{-7} > \frac{-8}{7}$, which is descending order of the given rational number.

(b) We have $\frac{-4}{9}, \frac{7}{-12}, \frac{-6}{18}, \frac{1}{3}$.

LCM of denominators is 36.

Writing the given rational numbers with denominator 36, we get

$\frac{-4 \times 4}{9 \times 4} = \frac{-16}{36}, \frac{7}{-12} = \frac{7 \times 3}{-12 \times 3} = \frac{21}{-36}$,

$\frac{-6}{18} = \frac{-6 \times 2}{18 \times 2} = \frac{-12}{36}, \frac{1}{3} = \frac{1 \times 12}{3 \times 12} = \frac{12}{36}$.

Now, we have $\frac{-16}{36}, \frac{21}{-36}, \frac{-12}{36}, \frac{12}{36}$.

Comparing the numerators, we get $12 > -12 > -16 > -21$

$\therefore \frac{12}{36} > \frac{-12}{36} > \frac{-16}{36} > \frac{21}{-36}$

$\frac{1}{3} > \frac{-6}{18} > \frac{-4}{9} > \frac{7}{-12}$, which is descending order of the given rational number.

12. We know that a negative rational number is greater than every positive rational number.

(a) $\frac{-4}{5}$ [<] $\frac{11}{7}$

(b) $\frac{2}{-11}$ [=] $\frac{-6}{33}$, as $\frac{-6}{33} = \frac{-2}{11}$

(c) $\frac{-4}{9}$ [<] $\frac{2}{5}$

(d) $\frac{6}{10}$ [>] $\frac{3}{-5}$

13. (a) Numbers –3 and 5 are –2, –1, 0, 1, 2, 3, 4.

Thus, four rational numbers between 3 and 5 are –2, –1, 1 and 2.

(b) We have $\frac{-5}{12}$ and $\frac{2}{3}$

LCM of the denominators 3 and 12 is 12. Converting the given rational numbers into like rational numbers with denominators 12, we get

$\frac{-5}{12} = \frac{-5 \times 1}{12 \times 1} = \frac{-5}{12}$ and $\frac{2}{3} = \frac{2 \times 4}{3 \times 4} = \frac{8}{12}$.

Clearly, $\frac{-5}{12} < \frac{-4}{12} < \frac{-3}{12} < \frac{-2}{12} < \frac{-1}{12} < \frac{1}{12} < \frac{2}{12} < ... < \frac{8}{12}$.

Thus, four rational numbers between $\frac{-5}{12}$ and $\frac{2}{3}$ are : $\frac{-4}{12}, \frac{-3}{12}, \frac{-2}{12}$ and $\frac{-1}{12}$.

(c) We have –1 and $\frac{1}{4}$.

LCM of the denominators 1 and 4 is 4.

$\therefore \frac{-1}{1} = \frac{-1 \times 4}{1 \times 4} = \frac{-4}{4}$ and $\frac{1}{4} = \frac{1 \times 1}{4 \times 1} = \frac{1}{4}$.

Clearly, $\frac{-4}{4} < \frac{-3}{4} < \frac{-2}{4} < \frac{-1}{4} < 0 < \frac{1}{4}$

Thus, four rational numbers between –1 and $\frac{1}{4}$ are : $\frac{-3}{4}, \frac{-2}{4}, \frac{-1}{4}$ and 0.

(d) We have $\frac{2}{3}$ and $\frac{5}{6}$.

LCM of the denominators 3 and 6 is 6.

$\therefore \frac{2}{3} = \frac{2 \times 2}{3 \times 2} = \frac{4}{6}$ and $\frac{5}{6} = \frac{5 \times 1}{6 \times 1} = \frac{5}{6}$.

Clearly, there is not any number between 4 and 5. Now we write the like rational numbers with denominator 30.

$\frac{2}{3} = \frac{2 \times 10}{3 \times 10} = \frac{20}{30}$ and $\frac{5}{6} = \frac{5 \times 5}{6 \times 5} = \frac{25}{30}$.

Clearly, $\frac{20}{30} < \frac{21}{30} < \frac{22}{30} < \frac{23}{30} < \frac{24}{30} < \frac{25}{30}$

Thus, four rational numbers between $\frac{2}{3}$ and $\frac{5}{6}$ are: $\frac{21}{30}, \frac{22}{30}, \frac{23}{30}$ and $\frac{24}{30}$.

14. The value of :

(a) $\left|\frac{3}{-17}\right| = \frac{3}{17}$ (b) $\left|\frac{-25}{41}\right| = \frac{25}{41}$ (c) $-\left|\frac{2}{7}\right| = -\frac{2}{7}$ (d) $-\left|\frac{-5}{11}\right| = -\frac{-5}{11}$

Exercise 4.2

1. The additive inverse of :

(a) $\frac{3}{7}$ is $\frac{-3}{7}$ (b) $\frac{-4}{5}$ is $\frac{4}{5}$ (c) $\frac{-4}{9}$ is $\frac{4}{9}$

(d) $\frac{-5}{-11}$ is $\frac{-5}{11}$ as $\frac{-5}{-11} = \frac{5}{11}$

2. (a) We have $\frac{5}{14} + \frac{[\ ]}{5} = \frac{8}{14}$.

$\therefore \frac{5}{14} + \frac{[3]}{5} = \frac{8}{14}$, as $5 + 3 = 8$.

(b) We have $\frac{9}{20} - \frac{[\ ]}{20} = \frac{7}{20}$.

$\therefore \frac{9}{20} - \frac{[\ ]}{20} = \frac{7}{20}$.

$\frac{9}{20} - \frac{7}{20} = \frac{[\ ]}{20} = \frac{[2]}{20}$.

Thus, $\frac{9}{20} - \frac{[2]}{20} = \frac{7}{20}$.

(c) We have $\frac{13}{15} + \frac{1}{15} = \frac{[\ ]}{15}$.

$\therefore \frac{13}{15} + \frac{1}{15} = \frac{[14]}{15}$.

(d) We have $\frac{2}{7} + \frac{[\ ]}{7} = 1$.

$\therefore \frac{[\ ]}{7} = \frac{1}{1} - \frac{2}{7} = \frac{7-2}{7} = \frac{5}{7}$.

Thus, $\frac{2}{7} + \frac{[5]}{7} = 1$.

3. (a) $\frac{-3}{5} + \frac{4}{7} = \frac{-3\times7 + 4\times5}{35} = \frac{-21+20}{35} = \frac{-1}{35}$. [LCM of 5 and 7 = 35]

(b) $\frac{-5}{9} + \frac{3}{4} = \frac{-5\times4 + 3\times9}{36} = \frac{-20+27}{36} = \frac{7}{36}$. [LCM of 9 and 4 = 36]

(c) $-6 + \frac{2}{-5} = \frac{-6}{1} + \frac{-2}{5} = \frac{-6\times5-2}{5} = \frac{-30-2}{5} = \frac{-32}{5} = -6\frac{2}{5}$. [LCM of 1 and 5 = 5]

(d) $\frac{-6}{7} + \frac{5}{14} = \frac{-6\times2+5}{14} = \frac{-12+5}{14} = \frac{-7}{14} = \frac{-1}{2}$. [LCM of 7 and 14 = 14]

(e) $\frac{-4}{35} + \frac{2}{5} = \frac{-4+2\times7}{35} = \frac{-4+14}{35} = \frac{10}{35}$. [LCM of 5 and 35 = 35]

Similar work to be done for (f) to (h)

4. (a) $\frac{1}{3} - \frac{3}{5} = \frac{1\times5-3\times3}{15} = \frac{5-9}{15} = \frac{-4}{15}$. [LCM of 3 and 5 = 15]

(b) $\frac{2}{5} - \frac{9}{10} = \frac{2\times2-9}{10} = \frac{4-9}{10} = \frac{-5}{10} = \frac{-1}{2}$. [LCM of 5 and 10 = 10]

(c) $\frac{16}{25} - \frac{8}{25} = \frac{16-8}{25} = \frac{8}{25}$.

(d) $\frac{2}{-5} - \frac{9}{25} = \frac{-2\times5-9}{25} = \frac{-10-9}{25} = \frac{-19}{25}$. [LCM of 5 and 25 = 25]

(e) $\frac{-3}{5} - \frac{12}{15} = \frac{-3\times3-12}{15}$ [LCM of 5 and 15 = 15]

$= \frac{-9-12}{15} = \frac{-21}{15} = \frac{-21\div3}{15\div3} = \frac{-7}{5} = 1\frac{-2}{5}$.

Similar work to be done for (f) to (h)

5. (a) $\frac{-5}{9} + \frac{2}{3} = \frac{-5}{9} + \frac{2\times3}{3\times3} = \frac{-5+6}{9} = \frac{1}{9}$. [LCM of 3 and 9 = 9]

(b) $\frac{6}{7} + \frac{-3}{5} = \frac{6}{7} - \frac{3}{5} = \frac{6\times5}{7\times5} - \frac{3\times7}{5\times7}$ [LCM of 5 and 7 = 35]

$= \frac{30}{35} - \frac{21}{35} = \frac{30-21}{35} = \frac{9}{35}$.

(c) $\frac{-12}{19} + \frac{2}{3} = \frac{-12 \times 3 + 2 \times 19}{57} = \frac{-36 + 38}{57} = \frac{2}{57}$. [LCM of 19 and 3 = 57]

(d) $\frac{1}{2} + \frac{2}{5} + \frac{-3}{4} = \frac{1 \times 10 + 2 \times 4 - 3 \times 5}{20}$ [LCM of 2, 5 and 4 = 20]

$= \frac{10 + 8 - 15}{20} = \frac{18 - 15}{20} = \frac{3}{20}$.

(e) $\frac{-6}{7} + \frac{2}{-3} + \frac{-1}{2} = \frac{-6}{7} - \frac{2}{3} - \frac{1}{2}$ [LCM of 2, 3 and 7 = 42]

$= \frac{-6 \times 6 - 2 \times 14 - 1 \times 21}{42} = \frac{-36 - 28 - 21}{42} = \frac{-85}{42} = -2\frac{1}{42}$.

(f) $\frac{9}{2} + \frac{-2}{5} + \frac{-1}{2} = \frac{9}{2} - \frac{2}{5} - \frac{1}{2} = \frac{9 \times 5 - 2 \times 2 - 1 \times 5}{10}$ [LCM of 2 and 5 = 10]

$= \frac{45 - 4 - 5}{10} = \frac{45 - 9}{10} = \frac{\cancel{36}^{18}}{\cancel{10}_{5}} = \frac{18}{5} = 3\frac{3}{5}$.

(g) $\frac{-7}{2} + \frac{14}{3} + \frac{43}{6} = \frac{-7 \times 3 + 14 \times 2 + 43}{6}$ [LCM of 2, 3 and 6 = 6]

$= \frac{-21 + 28 + 43}{6} = \frac{-21 + 71}{6} = \frac{\cancel{50}^{25}}{\cancel{6}_{3}} = \frac{25}{3} = 8\frac{1}{3}$.

(h) $\frac{-1}{2} + \frac{-5}{-4} + \frac{17}{8} = \frac{-1}{2} + \frac{5}{4} + \frac{17}{8} = \frac{-1 \times 4 + 5 \times 2 + 17}{8}$ [LCM of 2, 4 and 8 = 8]

$= \frac{-4 + 27}{8} = \frac{23}{8} = 2\frac{7}{8}$.

6. (a) $\frac{3}{4} - \frac{2}{5} = \frac{3 \times 5 - 2 \times 4}{20} = \frac{15 - 8}{20} = \frac{7}{20}$. [LCM of 4 and 5 = 20]

(b) $-6 - \frac{3}{5} = \frac{-6}{1} - \frac{3}{5} = \frac{-6 \times 5 - 3}{5} = \frac{-30 - 3}{5} = \frac{-33}{5} = -6\frac{3}{5}$. [LCM of 1 and 5 = 5]

(c) $\frac{-7}{15} - \frac{-3}{5} = \frac{-7}{15} + \frac{3}{5} = \frac{-7 + 3 \times 3}{15} = \frac{-7 + 9}{15} = \frac{2}{15}$. [LCM of 5 and 15 = 15]

(d) $\frac{-11}{-18} - \frac{-2}{3} = \frac{11}{18} + \frac{2}{3} = \frac{11 + 2 \times 6}{18} = \frac{11 + 12}{18} = \frac{23}{18} = 1\frac{5}{18}$. [LCM of 3 and 18 = 18]

(e) $\frac{9}{2} - \frac{-3}{4} = \frac{9}{2} + \frac{3}{4} = \frac{9 \times 2 + 3}{4} = \frac{18 + 3}{4} = \frac{21}{4} = 5\frac{1}{4}$.

(f) $\frac{5}{-12} - \frac{13}{4} = \frac{-5}{12} - \frac{13}{4} = \frac{-5 - 13 \times 3}{12}$ [LCM of 4 and 2 = 12]

$= \frac{-5 - 39}{12} = \frac{\cancel{-44}^{11}}{\cancel{12}_{3}} = \frac{-11}{3} = -3\frac{2}{3}$.

(g) $\frac{-7}{-8} - \frac{-2}{-3} = \frac{7}{8} - \frac{2}{3} = \frac{7 \times 3 - 2 \times 8}{24} = \frac{21 - 16}{24} = \frac{5}{24}$. [LCM of 8 and 3 = 24]

(h) Similar work to be done.

7. (a) $\frac{-8}{15} + \frac{1}{-3} = \frac{-8}{15} - \frac{1}{3} = \frac{-8 - 1\times 5}{15} = \frac{-8-5}{15} = \frac{-13}{15}$. [LCM of 3 and 15 = 15]

(b) $\frac{-3}{5} + \frac{-8}{15} - \frac{-2}{5} = \frac{-3}{5} - \frac{8}{15} + \frac{2}{5} = \frac{-3\times 3 - 8 + 2\times 3}{15}$ [LCM of 5 and 15 = 15]

$= \frac{-9 - 8 + 6}{15} = \frac{-17 + 6}{15} = \frac{-11}{15}$.

(c) $-2 + \frac{1}{4} - \frac{1}{3} = \frac{-2}{1} + \frac{1}{4} - \frac{1}{3} = \frac{-2\times 12 + 1\times 3 - 1\times 4}{12}$ [LCM of 1, 3 and 4 = 12]

$= \frac{-24 + 3 - 4}{12} = \frac{-28 + 3}{12} = \frac{-25}{12} = 2\frac{1}{12}$.

(d) $\frac{3}{4} - \frac{-2}{9} + \frac{-1}{3} = \frac{3}{4} + \frac{2}{9} - \frac{1}{3} = \frac{3\times 9 + 2\times 4 - 1\times 12}{36}$ [LCM of 3, 4 and 9 = 36]

$= \frac{27 + 8 - 12}{36} = \frac{35 - 12}{36} = \frac{23}{36}$.

(e) $7 - \frac{1}{4} + \frac{5}{2} = \frac{7}{1} - \frac{1}{4} + \frac{5}{2} = \frac{7\times 4 - 1 + 5\times 2}{4}$ [LCM of 2 and 4 = 4]

$= \frac{28 - 1 + 10}{4} = \frac{38 - 1}{4} = \frac{37}{4} = 9\frac{1}{4}$.

(f) $\frac{-9}{11} + \frac{2}{3} - \frac{-1}{6} = \frac{-9}{11} + \frac{2}{3} + \frac{1}{6} = \frac{-9\times 6 + 2\times 22 + 1\times 11}{66}$ [LCM of 3, 6 and 11 = 66]

$= \frac{-54 + 44 + 11}{66} = \frac{-54 + 55}{66} = \frac{1}{66}$.

Exercise 4.3

1. The multiplicative inverse of :

(a) $\frac{2}{3}$ is $\frac{3}{2}$ (b) $\frac{1}{8}$ is 8 (c) -15 is $\frac{1}{-15}$

(d) $\frac{13}{-15}$ is $\frac{-15}{13}$ (e) -1 is -1

2. (a) $\frac{2}{3}\times\frac{1}{7} = \frac{2}{21}$ Multiplicative inverse of $\frac{2}{21}$ is $\frac{21}{2}$.

(b) $-1\times\frac{4}{5} = \frac{-4}{5}$ Multiplicative inverse of $\frac{-4}{5}$ is $\frac{5}{-4}$.

(c) $\frac{\cancel{14}}{\cancel{3}}\times\frac{\cancel{3}}{\cancel{14}} = \frac{7}{3}$ Multiplicative inverse of $\frac{7}{3}$ is $\frac{3}{7}$.

(d) $\frac{-\cancel{8}^{-4}}{}\times\frac{1}{\cancel{2}_{1}} = \frac{-4}{1}$ Multiplicative inverse of $\frac{-4}{1}$ is $\frac{1}{-4}$.

3. (a) $\frac{9}{\cancel{7}_{1}}\times\frac{\cancel{14}^{2}}{} = 9\times 2 = 18$. (b) $\frac{11}{25}\times\frac{3}{22} = \frac{\cancel{11}^{1}}{25}\times\frac{3}{\cancel{22}_{2}} = \frac{3}{50}$.

(c) $\frac{8}{45} \times \frac{5}{8} = \frac{\cancel{5}^{1}}{\cancel{45}_{9}} = \frac{1}{9}$.

(d) $\frac{-26}{25} \times \frac{25}{26} = \frac{\cancel{-26}^{-1}}{\cancel{26}} = -1$.

(e) $\frac{8}{11} \times 1\frac{3}{8} = \frac{\cancel{8}}{\cancel{11}} \times \frac{\cancel{11}}{\cancel{8}} = 1$.

(f) $\frac{-6}{17} \times \frac{-5}{-24} = \frac{\cancel{-6}^{-1}}{17} \times \frac{5}{\cancel{24}_{4}} = \frac{-1 \times 5}{17 \times 4} = \frac{-5}{68}$.

4. (a) $-5 \div \frac{1}{5} = -5 \times \frac{5}{1} = -25$.

(b) $\frac{17}{5} \div \frac{-17}{5} = \frac{17}{\cancel{5}} \times \frac{\cancel{5}}{-17} = \frac{\cancel{17}^{1}}{\cancel{-17}_{-1}} = -1$.

(c) $\frac{14}{3} \sqrt{} \frac{14}{3} = \frac{\cancel{14}}{\cancel{3}} \times \frac{\cancel{3}}{\cancel{14}} = 1$.

(d) $\frac{1}{9} \sqrt{} 9 = \frac{1}{9} \times \frac{1}{9} = \frac{1}{81}$.

(e) $\frac{-45}{49} \div \frac{9}{7} = \frac{-45}{\cancel{49}_{7}} \times \frac{\cancel{7}^{1}}{9} = \frac{\cancel{-45}^{-5}}{7 \times \cancel{9}_{1}} = \frac{-5}{7}$.

(f) $16 \div \frac{4}{-5} = \frac{\cancel{16}^{4}}{1} \times \frac{-5}{\cancel{4}_{1}} = 4 \times -5 = -20$.

5. (a) We have $\frac{12}{35} \div [\quad] = -1$.

Let the required number is $\frac{p}{q}$.

Then $\frac{12}{35} \sqrt{} \frac{p}{q} = -1$.

$\Rightarrow \frac{12}{35} \times \frac{q}{p} = -1$. $\Rightarrow \frac{q}{p} = -1 \times \frac{35}{12} = \frac{-35}{12} = \frac{-12}{35}$.

Hence, the required number is $\frac{-12}{35}$.

(b) We have $\frac{6}{12} \sqrt{} 2 = [\quad]$

$\therefore \frac{6}{12} \sqrt{} 2 = \frac{\cancel{6}^{3}}{12} \times \frac{1}{\cancel{2}_{1}} = \frac{1}{4}$.

Hence, the required number is $\frac{1}{4}$.

(c) We have $\frac{-13}{20} \div \frac{13}{20} = -1$.

$\therefore \frac{-13}{20} \div \frac{13}{20} = \frac{\cancel{-13}^{-1}}{\cancel{20}} \times \frac{\cancel{20}}{\cancel{13}_{1}} = -1$.

Hence, the required number is -1.

(d) Similar work to be done as (a).

6. (a) $\frac{\cancel{7}^{1}}{\cancel{12}_{4}} \times \frac{\cancel{3}^{1}}{4} \times \frac{-1}{\cancel{14}_{2}} = \frac{-1}{32}$.

(b) $\frac{\cancel{7}^{1}}{45} \times \frac{-3}{\cancel{28}_{4}} = \frac{\cancel{-3}^{-1}}{\cancel{45}_{15} \times 4} = \frac{-1}{60}$.

(c) $\frac{6}{-11} \times \frac{\cancel{8}^{2}}{\cancel{-12}_{3}} = \frac{\cancel{6}^{2}}{-11} \times \frac{2}{\cancel{3}_{1}} = \frac{2 \times 2}{-11 \times 1} = \frac{4}{11}$.

(d) $1 \times \frac{-3}{4} \times \frac{5}{2} = \frac{-15}{8} = -1\frac{7}{8}$.

(e) $\frac{-22}{\cancel{77}_{11}} \times \frac{4}{5} \times \frac{\cancel{-7}^{-1}}{1} = \frac{-22}{11} \times \frac{4}{5} \times \frac{-1}{1} = \frac{\cancel{22}^{2}}{\cancel{11}_{1}} \times \frac{4}{5} = \frac{8}{5} = 1\frac{3}{5}$.

(f) $\frac{9}{22} \times (-8) \times \frac{4}{11} \times \frac{0}{7} = 0$,because the product of any number and zero is zero.

7. (a) $-15 \div \frac{2}{3} = \frac{-15}{1} \times \frac{3}{2} = \frac{-45}{2} = -22\frac{1}{2}$.

(b) $-45 \div \frac{-5}{9} = \frac{\cancel{-45}^{9}}{1} \times \frac{9}{\cancel{-5}_{1}} = 9 \times 9 = 81$.

(c) $\frac{21}{30} \div \frac{-7}{15} = \frac{21}{\cancel{30}_{2}} \times \frac{\cancel{15}^{1}}{-7} = \frac{21}{2 \times -7} = \frac{\cancel{21}^{3}}{\cancel{-14}_{-2}} = \frac{3}{2} = 1\frac{1}{2}$.

(d) $\frac{15}{7} \div \frac{3}{-14} = \frac{\cancel{15}^{5}}{7} \times \frac{-14}{\cancel{3}_{1}} = \frac{5}{\cancel{7}_{1}} \times \frac{\cancel{-14}^{-2}}{1} = 5 \times (-2) = -10$.

(e) $\frac{35}{4} \div \frac{3}{-5} = \frac{35}{4} \times \frac{-5}{3} = \frac{-175}{12} = 14\frac{7}{12}$.

(f) $\frac{21}{5} \div (-9) = \frac{\cancel{21}^{7}}{5} \times \frac{1}{\cancel{-9}_{-3}} = \frac{7}{-15} = \frac{-7}{15}$.

Exercise 4.4

1. Here, the product of two rational number = -49.
∴ Required rational number = Product ÷ One number

$$= -49 \div \frac{-7}{15} = \cancel{-49}^{7} \times \frac{15}{\cancel{-7}_{1}} = 7 \times 15 = 105.$$

2. Other number = Product ÷ One number = $\frac{-8}{17} \div \frac{-3}{17} = \frac{-8}{\cancel{17}} \times \frac{\cancel{17}}{-3} = \frac{8}{3} = 2\frac{2}{3}$.

3. Cost of 9 books = ₹ $\frac{271}{2}$

∴ Cost of 1 book = ₹ $\frac{271}{2} \sqrt{9}$ = ₹ $\frac{271}{2} \times \frac{1}{9}$

∴ Cost of 18 books = ₹ $\frac{271}{\cancel{2}_{1}} \times \frac{1}{\cancel{9}} \times \cancel{18}^{9}$ = ₹ 271.

Hence, the cost of 18 books is ₹ 271.

4. Let the required number be x.
Then according to the question,

$\frac{-22}{7} \div x = \frac{-11}{5}$

$\Rightarrow \frac{-22}{7} \times \frac{1}{x} = \frac{-11}{5}$

$\Rightarrow \frac{1}{x} = \frac{-11}{5} \div \frac{-22}{7} = \frac{\cancel{-11}^{1}}{5} \times \frac{7}{\cancel{-22}_{2}} = \frac{7}{10}$

$\Rightarrow x = \frac{7}{10}$.

Hence, the required number is $\frac{10}{7}$ or $1\frac{3}{7}$.

5. Product of –9 and $\frac{1}{2} = -9 \times \frac{1}{2} = \frac{-9}{2}$.

Now, $\frac{-9}{2} \div \frac{-11}{20} = \frac{-9}{\cancel{2}_1} \times \frac{\cancel{20}^{10}}{-11} = \frac{90}{11} = 8\frac{2}{11}$.

6. Cost of $\frac{17}{4}$m of cloth = ₹ $\frac{151}{2}$

$\therefore$ Cost of 1 m of cloth = ₹ $\frac{151}{2} \sqrt{\frac{17}{4}} = \frac{151}{\cancel{2}_1} \times \frac{\cancel{4}^{2}}{17}$ = ₹ $\frac{302}{17}$

$\therefore$ Cost of 17m of cloth = ₹ $\frac{302}{\cancel{17}} \times \cancel{17}$ = ₹ 302.

Hence, the cost of 17m of cloth is Rs. 302.

7. Distance between the sea level and the bottom of the ship = $\frac{91}{4}$m – $\frac{29}{2}$m

$= \frac{91}{4} - \frac{29 \times 2}{2 \times 2}$m $= \frac{91 - 58}{4} = \frac{33}{4} = 8\frac{1}{4}$m.

8. Required number = $\frac{19}{2} - \frac{-7}{8} = \frac{19}{2} + \frac{7}{8}$

$= \frac{19 \times 4 + 7}{8} = \frac{76 + 7}{8} = \frac{83}{8} = 10\frac{3}{8}$.

9. Sum of $\frac{-3}{7}$ and $\frac{11}{5} = \frac{-3}{7} + \frac{11}{5} = \frac{-3 \times 5 + 11 \times 7}{35} = \frac{-15 + 77}{35} = \frac{62}{35}$ [LCM of 7 and 5 = 35]

Now, dividing the sum by $\frac{-17}{20}$, we get

$= \frac{62}{35} \div \frac{-17}{20} = \frac{62}{\cancel{35}_7} \times \frac{\cancel{20}^{4}}{-17} = \frac{248}{-119} = -2\frac{10}{119}$.

10. Twice of $\frac{-5}{8} = \frac{-5}{\cancel{8}_4} \times \cancel{2}^{1} = \frac{-5}{4}$.

Now, the required sum = $\frac{-2}{5} + \frac{13}{4} + \frac{-5}{4}$

$= \frac{-2}{5} + \frac{13 - 5}{4} = \frac{-2}{5} + \frac{\cancel{8}^{2}}{\cancel{4}_1} = \frac{-2}{5} + \frac{2}{1} = \frac{-2 + 2 \times 5}{5} = \frac{-2 + 10}{5} = \frac{8}{5} = 1\frac{3}{5}$.

Revision Exercise

1. Similar work to be done as Q. 3 of Exercise 4.1.
2. Similar work to be done as Q. 8 of Exercise 4.1.
3. Similar work to be done as Q. 5 of Exercise 4.1.

4. (a) We have $\frac{-5}{11}$ and $\frac{-3}{-4} = \frac{3}{4}$.

As a negative number is smaller than every positive number, so the given rational numbers are not equivalent.

(b) We have $\frac{-7}{9}$ and $\frac{-21}{27}$

$\frac{-21}{27} = \frac{-21 \div 3}{27 \div 3} = \frac{-7}{9}$, which is equal to the other rational number.

Thus, $\frac{-7}{9}$ and $\frac{-21}{27}$ are equivalent.

(c) We have $\frac{-18}{-20}$ and $\frac{54}{60}$

$\frac{-18}{-20} = \frac{18}{20} = \frac{18 \sqrt{2}}{20 \sqrt{2}} = \frac{9}{10}$ [HCF of 18 and 20 = 2]

and $\frac{54}{60} = \frac{54 \sqrt{6}}{60 \sqrt{6}} = \frac{9}{10}$.

Thus, $\frac{-18}{-20}$ and $\frac{54}{60}$ are equivalent.

(d) We have $\frac{-2}{9}$ and $\frac{-18}{81}$

$\frac{-18}{81} = \frac{-18 \div 9}{81 \div 9} = \frac{-2}{9}$. [HCF of 18 and 81 = 9]

Thus, $\frac{-2}{9}$ and $\frac{-18}{81}$ are equivalent.

5. Reciprocal of :

(a) $-\frac{1}{\cancel{2}} \times \frac{\cancel{2}}{5} = \frac{-1}{5}$ is $\frac{5}{-1}$ (b) 1 is 1 (c) $\frac{-4}{5}$ is $\frac{5}{-4}$

(d) $\frac{7}{3}$ is $\frac{3}{7}$ (e) $\frac{4}{-9}$ is $\frac{-9}{4}$

6. The absolute value of :

(a) $\left|\frac{-5}{11}\right| = \frac{-5}{11}$ (b) $\left|-\frac{2}{3} - \frac{1}{2}\right| = \left|-\left(-\frac{4}{5} \times 3\right)\right| = \left|-\frac{7}{6}\right| = \frac{7}{6}$.

(c) $\left|-\left(-\frac{4}{5} \times 3\right)\right| = \left|-\left(-\frac{12}{5}\right)\right| = \left|\frac{12}{5}\right| = \frac{12}{5}$.

(d) $\left|\frac{2}{9} + \frac{-3}{4}\right| = \left|\frac{2}{9} - \frac{3}{4}\right| = \left|\frac{8 - 27}{36}\right| = \left|\frac{-19}{36}\right| = \frac{19}{36}$.

7. (a) $\frac{-36}{45} = \frac{-36 \div (-9)}{45 \div (-9)} = \frac{4}{-5}$. (b) $\frac{-36}{45} = \frac{-36 \times 2}{45 \times 2} = \frac{-72}{90}$.

(c) Similar as (a) above. (d) $\frac{-36}{45} = \frac{-36 \div (-3)}{45 \div (-3)} = \frac{12}{-15}$.

8. (a) $\frac{9}{-21}$ to $= \frac{9}{-21}$ (b) $\frac{7}{15} + \frac{-2}{5} = \frac{7 - 2 \times 3}{15} = \frac{7 - 6}{15} = \frac{1}{15}$.

(c) $\frac{4}{11} + \frac{2}{3} + \frac{5}{-6} = \frac{4}{11} + \frac{2}{3} - \frac{5}{6} = \frac{4}{11} + \left(\frac{4 - 5}{6}\right) = \frac{4}{11} + \frac{-1}{6} = \frac{4 \times 6 - 1 \times 11}{66} = \frac{24 - 11}{66} = \frac{13}{66}$.

(d) $\frac{2}{7} + \frac{3}{21} - \frac{6}{18} = \frac{2}{7} + \frac{1}{7} - \frac{1}{3} = \frac{2 + 1}{7} - \frac{1}{3} = \frac{3}{7} - \frac{1}{3} = \frac{3 \times 3 - 1 \times 7}{21} = \frac{9 - 7}{21} = \frac{2}{21}$.

9. (a) $\frac{6}{72} - \frac{2}{9} = \frac{6 - 2 \times 8}{72} = \frac{6 - 16}{72} = \frac{-10}{72} = \frac{-5}{36}$. [LCM of 9 and 72 = 72]

(b) $\frac{7}{45} - \frac{-4}{5} = \frac{7}{45} + \frac{4}{5} = \frac{7 + 4 \times 9}{45} = \frac{7 + 36}{45} = \frac{43}{45}$. [LCM of 5 and 45 = 45]

(c) $\frac{-25}{144} - 0 = \frac{-25}{144}$.

(d) $\frac{8}{75} - \frac{2}{15} = \frac{8}{75} - \frac{2 \times 5}{15 \times 5} = \frac{8}{75} - \frac{10}{75} = \frac{8 - 10}{75} = \frac{-2}{75}$. [LCM of 75 and 15 = 75]

10. (a) $\frac{\cancel{9}^{3}}{\cancel{-3}_{-1}} \times \frac{2}{} = \frac{6}{-1} = -6$. (b) $\frac{7}{15} \times \frac{-1}{4} \times 0 = 0$.

(c) $\frac{2}{17} \times \frac{\cancel{-3}^{-1}}{\cancel{45}_{9}} \times \frac{\cancel{25}^{5}}{\cancel{3}} = \frac{2 \times (-1) \times 5}{17 \times 9} = \frac{-10}{153}$.

(d) $\frac{\cancel{12}^{6}}{\cancel{50}_{25}} \times 9 \times \frac{1}{-2} = \frac{6 \times 9 \times 1}{25 \times (-2)} = \frac{\cancel{54}^{27}}{\cancel{-50}_{25}} = -\frac{27}{25} = -1\frac{2}{25}$.

11. (a) $3 \div \left(-\frac{1}{4}\right) = 3 \times \frac{-4}{1} = -12$. (b) $\frac{8}{17} \div \frac{4}{-9} = \frac{\cancel{8}^{2}}{17} \times \frac{-9}{\cancel{4}_{1}} = \frac{-18}{17} = -1\frac{1}{17}$.

(c) $\frac{9}{-19} \div \frac{-3}{38} = \frac{\cancel{9}^{3}}{\cancel{-19}_{-1}} \times \frac{\cancel{38}^{2}}{\cancel{-3}_{-1}} = \frac{6}{1} = 6$. (d) $\frac{33}{4} \div \frac{3}{-8} = \frac{\cancel{33}^{11}}{\cancel{4}_{1}} \div \frac{\cancel{-8}^{-2}}{\cancel{3}_{1}} = 11 \times (-2) = 22$

12. (a) $\left(\frac{5}{3} \times \frac{8}{3}\right) \div \frac{16}{3} = \frac{40}{9} \sqrt{\frac{16}{3}} = \frac{\cancel{40}^{5}}{\cancel{9}_{3}} \times \frac{\cancel{3}^{1}}{\cancel{16}_{2}} = \frac{5}{6}$.

(b) $\frac{8}{15} \div \frac{5}{8} \times \frac{-7}{16} + \frac{2}{9} - \frac{1}{4} = \frac{\cancel{8}^{4}}{15} \times \frac{8}{5} \times \frac{-7}{\cancel{16}_{2}} + \frac{2}{9} - \frac{1}{4} = \frac{-28}{75} + \frac{2}{9} - \frac{1}{4}$

$= \frac{-28 \times 12}{75 \times 12} + \frac{2 \times 100}{9 \times 100} - \frac{1 \times 225}{4 \times 225} = \frac{-336}{900} + \frac{200}{900} - \frac{225}{900}$ [LCM of 4, 9 and 75 = 900]

$= \frac{-336 + 200 - 225}{900} = \frac{-336 - 225 + 200}{900} = \frac{-561 + 200}{900} = \frac{-361}{900}$.

(c) $\frac{16}{35} + \frac{3}{8} \div \frac{6}{7} \times \frac{1}{2} - \frac{3}{4} = \frac{16}{35} + \frac{\cancel{3}^{1}}{8} \times \frac{7}{\cancel{6}_{2}} \times \frac{1}{2} - \frac{3}{4} = \frac{16}{35} + \frac{7}{32} - \frac{3}{4}$

$$= \frac{16 \times 32 + 7 \times 35 - 3 \times 280}{1120} = \frac{512 + 245 - 840}{1120} = \frac{757 - 840}{1120} = \frac{-83}{1120}.$$

(d) $5\left\{9 - \frac{3}{2}\left(\frac{-4}{7} - \frac{1}{2}\right)\right\} \div \frac{1}{15} = 5\left\{9 - \frac{3}{2}\left(\frac{-8-7}{14}\right)\right\} \div \frac{1}{15}$

$= 5\left\{9 - \frac{3}{2} \times \frac{-15}{14}\right\} \div \frac{1}{15} = 5\left\{9 - \frac{45}{28}\right\} \div \frac{1}{15}$

$= 5\left\{\frac{9 \times 28 - 45}{28}\right\} \div \frac{1}{15} = 5 \times \frac{207}{28} \times \frac{15}{1} = \frac{15525}{28} = 554\frac{13}{28}.$

13. Required number $= 1 - \frac{-3}{25} = 1 + \frac{3}{25} = \frac{25+3}{25} = \frac{28}{25} = 1\frac{3}{25}.$

14. Required number $= \frac{22}{7} \div \frac{-8}{7} = \frac{\cancel{22}^{11}}{\cancel{7}} \times \frac{\cancel{7}}{\cancel{-8}_{-4}} = \frac{11}{-4} = -2\frac{3}{4}.$

15. January of Rajeev can be represented as shown alongside.
Distance between the starting point and the last point
$= \frac{50}{6}\text{km} - \frac{10}{3}\text{km} = \frac{50-20}{6}\text{km} = \frac{\cancel{30}^{5}}{\cancel{6}_{1}}\text{km} = 5\text{ km}.$

16. Share of each child $= \frac{\text{Total Apple}}{3} = \frac{39}{4} \div 3 = \frac{\cancel{39}^{13}}{4} \times \frac{1}{\cancel{3}_{1}} = \frac{13}{4} = 3\frac{1}{4}\text{kg}.$

Multiple Choice Questions

1. Zero does not have a reciprocal. So, the correct option is (c).
2. All integers, fractions and natural numbers are rational numbers. So, the correct option is (d).
3. See the **Answers** given in the book.
4. $\frac{-60}{-120} = \frac{\cancel{60}^{1}}{\cancel{120}_{2}} = \frac{1}{2}$. So, the correct option is (c).
5. The multiplicative inverse of $\frac{13}{4}$ is $\frac{4}{13}$. So, the correct option is (c).
6. The absolute value of $= -\left|\frac{-5}{\cancel{4}_{2}} \times \frac{\cancel{2}^{1}}{3}\right| = -\left|\frac{-5}{6}\right| = \frac{-5}{6}$. So, the correct option is (a).
7. See the **Answers** given in the book.
8. See the **Answers** given in the book.
9. The reciprocal of $\frac{-1}{6}$ is –6. So, the correct option is (c).
10. The additive inverse of $\frac{-15}{17}$ is $\frac{17}{-15}$. So, the correct option is (c).

Mental Maths.

A. See the **Answers** given in the book.

B. See the **Answers** given in the book.

C. 1. $= \frac{-7}{15} = \frac{-7 \times 3}{15 \times 3} = \frac{-7 \times -4}{15 \times -4} = \frac{-21}{45} = \frac{28}{-60}$.

2. Required rational number $= \left(\frac{3}{4} + \frac{1}{2}\right) \div 2 = \frac{3+2}{4} \div 2 = \frac{5}{4} \times \frac{1}{2} = \frac{5}{8}$.

3. In the given pattern, the numerator and denominator both are multiplied by z to get the next number.
Thus, the complete pattern is

4. Let the missing number be $\frac{p}{q}$.

Then $\frac{-27}{20} \div \frac{p}{q} = \frac{-9}{2}$

$\Rightarrow \frac{-27}{20} \times \frac{q}{p} = \frac{-9}{2}$

$\Rightarrow \frac{q}{p} = \frac{-9}{2} \div \frac{-27}{20} = \frac{\cancel{-9}^{1}}{\cancel{2}_{1}} \times \frac{\cancel{20}^{10}}{\cancel{-27}_{3}} = \frac{10}{3}$.

$\Rightarrow \frac{p}{q} = \frac{3}{10}$

Thus, the missing number is $\frac{3}{10}$.

Higher Order Thinking Skills (HOTS)

1. Let us consider the rational numbers as $\frac{1}{3}$ and $\frac{-2}{3}$.

$\therefore \frac{1}{3} - \frac{-2}{3} = \frac{1}{3} + \frac{2}{3} = \frac{3}{3} = 1$.

2. Let the required rational number be $\frac{p}{q}$.

Then its reciprocal will be $\frac{q}{p}$.

According to the question,

$\frac{q}{p} \times \frac{-2}{5} = 2$

$\Rightarrow \frac{q}{p} = 2 \div \frac{-2}{5} = \frac{\cancel{2}^{1}}{1} \times \frac{5}{\cancel{-2}_{-1}} = \frac{-5}{1}$.

$\Rightarrow \frac{p}{q} = \frac{1}{-5}$.

Hence, the required rational number is $\frac{1}{-5}$.

3. Let the rational number be $\frac{2}{5}$.

Then its additive inverse $= \frac{-2}{5}$

Their product $= \frac{2}{5} \times \frac{-2}{5} = \frac{-4}{25}$.

Thus, the product of a rational number and its additive inverse is a negative number.

4. See the **Answers** given in the book.

5. See the **Answers** given in the book.

6. Yes, because the absolute value of a number either positive or negative is always positive.

5 Exponents

Exercise 5.1

1. (a) The base of 4^2 is 4 and its exponent is 2.

   (b) The base of $(-6)^5$ is -6 and its exponent is 5.

   (c) The base of $\left(\frac{10}{17}\right)^{-2}$ is $\frac{10}{17}$ and its exponent is 2.

   (d) The base of $\left(\frac{-6}{7}\right)^5$ is $\frac{-6}{7}$ and its exponent is 5.

   (e) The base of $(6)^{-3}$ is 6 and its exponent is -3.

2. (a) $9 \times 9 \times 9 \times 9 = 9^4$

   (b) $(-3) \times (-3) \times (-3) \times (-3) \times (-3) \times (-3) = (-3)^5$

   (c) $x \times x \times y = x^2y^1 = x^2y$.

   (d) $\frac{(-2) \times (-2)}{7} = \frac{(-2)^2}{7^1}$

   (e) $\frac{-5}{6} \times \frac{-5}{6} \times \frac{-5}{6} = \left(\frac{-5}{6}\right)^3$

   (f) $(-8) \times (-8) \times a \times b \times b \times b = (-8)^2 a^1 b^3$.

3. (a) By prime factorisation,

2	256
2	128
2	64
2	32
2	16
2	8
2	4
2	2
	1

   $\therefore 256 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 2^8$.

   (b) As 10 0000 has five zeroes followed by 1.

   $\therefore 100000 = 10 \times 10 \times 10 \times 10 \times 10 = 10^5$.

   (c) We have $\frac{-243}{-3125} = \frac{243}{3125}$.

   By prime factorisation,

3	243
3	81
3	27
3	9
3	3
	1

$\therefore 243 = 3 \times 3 \times 3 \times 3 \times 3 = 3^5$.

5	3125
5	625
5	125
5	25
5	5
	1

$\therefore 3125 = 5 \times 5 \times 5 \times 5 \times 5 = 5^5$.

Now, $\frac{243}{3125} = \frac{3^5}{5^5} = \left(\frac{3}{5}\right)^5$.

(d) We have $\frac{1}{343}$.

$\therefore \frac{1}{343} = \frac{1 \times 1 \times 1}{7 \times 7 \times 7} = \frac{1^3}{7^3} = \left(\frac{1}{7}\right)^3$.

7	343
7	49
7	7
	1

(e) We have $\frac{-1}{512}$.

$\frac{-1}{512} = \frac{(-1) \times (-1) \times (-1)}{8 \times 8 \times 8} = \frac{(-1)^3}{(8)^3} = \left(\frac{-1}{8}\right)^3$.

4. (a) By prime factorisation,

5	625
5	125
5	25
5	5
	1

$\therefore 625 = 5 \times 5 \times 5 \times 5 = 5^4$.

(b) By prime factorisation,

2	1792
2	896
2	448
2	224
2	112
2	56
2	28
2	14
7	7
	1

$\therefore 1792$
$= 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 7$
$= 2^8 \times 7^1$.

(c) By prime factorisation,

2	192
2	96
2	48
2	24
2	12
2	6
3	3
	1

$\therefore 192 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 3 = 2^6 \times 3^1$.

(d) By prime factorisation,

2	500
2	250
5	125
5	25
5	5
	1

$\therefore 500 = 2 \times 2 \times 5 \times 5 \times 5 = 2^2 \times 5^3$.

(e) By prime factorisation,

2	900
2	450
3	225
3	75
5	25
5	5
	1

$\therefore 900 = 2 \times 2 \times 3 \times 3 \times 5 \times 5$

5. (a) The reciprocal of $-15 = \frac{1}{-15}$.

(b) The reciprocal of $(13)^3 = \frac{1}{(13)^3}$.

(c) The reciprocal of $\left(\frac{5}{9}\right)^8 = \left(\frac{9}{5}\right)^8$

(d) The reciprocal of $\left(\frac{-2}{11}\right)^5 = \left(\frac{11}{-2}\right)^5$

(e) The reciprocal of $\left(\frac{6}{13}\right)^{-4} = \left(\frac{13}{6}\right)^{-4}$

6. (a) We have 3^5 and 5^3.
$3^5 = 3 \times 3 \times 3 \times 3 \times 3 = 243$
$5^3 = 5 \times 5 \times 5 = 125$
$\therefore 3^5$ is greater than 5^3

(b) We have $(-7)^3$ and $(-3)^7$.
$(-7)^3 = (-7) \times (-7) \times (-7) = -343$
$(-3)^7 = (-3) \times (-3) \times (-3) \times (-3) \times (-3) \times (-3) \times (-3) = -2187$
$\therefore (-7)^3$ is greater than $(-3)^7$.

(c) We have 4^2 and $(-5)^3$.
$4^2 = 4 \times 4 = 16$
$(-5)^3 = (-5) \times (-5) \times (-5) = -125$.
$\therefore 4^2$ is greater than $(-5)^3$.

(d) We have $(-3)^2$ and 4^2.
$(-3)^2 = (-3) \times (-3) = 9$.
$4^2 = 4 \times 4 = 16$
$\therefore 4^2$ is greater than $(-3)^2$.

(e) We have 6^2 and 2^6.
$6^2 = 6 \times 6 = 36$
$2^6 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 64$
$\therefore 2^6$ is greater than 62.

7. (a) $(-5)^x = (-125)$
$(-5)^x = (-5)3$
$\therefore x = 3$ [Bases are some.]
Thus, the value of x is 3.

(b) $1331 = 11^x$
$(11)^3 = 11^x$ [Bases are some.]
$\therefore 3 = x$ or $x = 3$.
Thus, the value of x is 3.

(c) $49 = 7^x$

$(7)^2 = 7^x$ [Bases are some.]

$\therefore 2 = x$ or $x = 2$.

Thus, the value of x is 2.

(d) $(-8)^x = -512$

$(-8)^x = (-8) \times (-8) \times (-8)$

$(-8)^x = (-8)^3$

$x = 3$ [Bases are some.]

Thus, the value of x is 3.

(e) $7^x = 343$

$7^x = 7 \times 7 \times 7$

$7^x = 7^3$

$x = 3$ [Bases are some.]

8. (a) $3^6 \times 2 = 3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 2 = 9 \times 9 \times 9 \times 2 = 729 \times 2 = 1458.$

(b) $(-7)^3 \times 10 = (-7) \times (-7) \times (-7) \times 10 = -343 \times 10 = -3430.$

(c) $(-5)^2 \times 2^3 = (-5) \times (-5) \times 2 \times 2 \times 2 = 25 \times 8 = 200.$

(d) $6^2 \times (-1)^5 \times 2^2 = 6 \times 6 \times -1 \times 2 \times 2 = 36 \times 4 \times -1 = -144.$ $[(-1)^5 = -1]$

(e) $4^2 \times (-2)^2 \times 3 = 4 \times 4 \times (-2) \times (-2) \times 3 = 16 \times 4 \times 3 = 64 \times 3 = 192.$

Exercise 5.2

1. (a) $7^6 \times 7^2 = 7^{6+2} = 7^8$

(b) $9^6 \times 3^{-3} = \dfrac{9^6}{3^3} = \dfrac{\left(3^2\right)^6}{3^3} = \dfrac{3^{2\times6}}{3^3} = \dfrac{3^{12}}{3^3} = 12^{12-3} = 3^9.$

(c) $\left(\dfrac{2}{5}\right)^7 \times \left(\dfrac{2}{5}\right)^{-4} = \left(\dfrac{2}{5}\right)^{7-4} = \left(\dfrac{2}{5}\right)^3.$

(d) $\left(\dfrac{3}{5}\right)^3 \times \left(\dfrac{3}{5}\right)^4 = \left(\dfrac{3}{5}\right)^{3+4} = \left(\dfrac{3}{5}\right)^7.$

(e) $(-3)^7 \div (-3)^4 = (-3)^{7-4} = (-3)^3$

(f) $4^{-2} \times 3 \times 2^2 = \dfrac{3 \times 2^2}{4^2} = \dfrac{3 \times 2^2}{\left(2^2\right)^2} = \dfrac{3 \times 2^2}{2^4} = \dfrac{3}{2^{4-2}} = \dfrac{3^1}{2^2}.$

(g) $\left[\left(\dfrac{-5}{9}\right)^2\right]^2 = \left(\dfrac{-5}{9}\right)^{2\times2} = \left(\dfrac{-5}{9}\right)^4.$

(h) $\left(\dfrac{-3}{10}\right)^2 \times \left(\dfrac{10}{11}\right)^2 = \dfrac{-3}{\cancel{10}} \times \dfrac{-3}{\cancel{10}} \times \dfrac{\cancel{10}}{11} \times \dfrac{\cancel{10}}{11} = \dfrac{(-3)^2}{11^2} = \left(\dfrac{-3}{11}\right)^2.$

(i) $\left(\dfrac{-5}{6}\right)^8 \times \left(\dfrac{-5}{6}\right)^{-6} = \left(\dfrac{-5}{6}\right)^{8-6} = \left(\dfrac{-5}{6}\right)^2.$

(j) $8^2 \div 8^3 = 8^{2-3} = 8^{-1}$

(k) $\left(\dfrac{4}{9}\right)^3 \times \left(\dfrac{4}{3}\right)^{-3} = \left(\dfrac{4}{9}\right)^3 \times \left(\dfrac{3}{4}\right)^3 = \dfrac{\cancel{4}}{9} \times \dfrac{\cancel{4}}{9} \times \dfrac{\cancel{4}}{9} \times \dfrac{3}{\cancel{4}} \times \dfrac{3}{\cancel{4}} \times \dfrac{3}{\cancel{4}} = \dfrac{3}{9 \times 9} = \dfrac{3}{3^4} = \dfrac{1}{3^3} = \left(\dfrac{1}{3}\right)^3$

(l) $4^2 \times 4^0 \times 4^{-2} = \frac{4^2 \times 1}{4^2} = 4^{2-2} = 4^0 = 1.$

2. (a) $3^5 \times 9 = 3^5 \times 3^2 = 3^{5+2} = 3^7.$

(b) $125 \times 5^2 = 5 \times 5 \times 5 \times 5^2 = 5^3 \times 5^2 = 5^{3+2} = 5^5.$

(c) $16 \times 4 \times 2^3 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2^3 = 2^6 \times 2^3 = 2^{6+3} = 2^9.$

(d) $27 \times 3^2 = 3 \times 3 \times 3 \times 3^2 = 3^3 \times 3^2 = 3^{3+2} = 3^5.$

3. (a) $\left(\frac{15}{8}\right)^7 \div \left[\left(\frac{15}{8}\right)^2 \times \left(\frac{15}{8}\right)^3\right] = \left(\frac{15}{8}\right)^7 \div \left[\left(\frac{15}{8}\right)^{2+3}\right] = \left(\frac{15}{8}\right)^7 \div \left(\frac{15}{8}\right)^5 = \left(\frac{15}{8}\right)^{7-5} = \left(\frac{15}{8}\right)^2.$

(b) $\left(\frac{2}{5}\right)^2 \times \left(\frac{2}{5}\right)^3 \div \left[\frac{3}{5} \times \frac{9}{25}\right] = \left(\frac{2}{5}\right)^{2+3} \div \left[\frac{3}{5} \times \frac{3\times3}{5\times5}\right]$

$= \left(\frac{2}{5}\right)^5 \div \left(\frac{3^3}{5^3}\right) = \left(\frac{2}{5}\right)^5 \div \left(\frac{3}{5}\right)^3 = \left(\frac{2}{5}\right)^5 \times \left(\frac{5}{3}\right)^3$

$= \frac{2^5}{5^5} \times \frac{5^3}{3^3} = \frac{2^5}{5^{5-3} \times 3^3} = \frac{2^5}{5^2 \times 3^3} = \frac{2\times2\times2\times2\times2}{5\times5\times3\times3\times3} = \frac{32}{675}.$

(c) $\left[\left(\frac{-2}{3}\right)^2\right]^4 \times \left(\frac{-9}{8}\right)^8 = \left(\frac{-2}{3}\right)^{2\times4} \times \frac{(-9)^8}{8^8} = \left(\frac{-2}{3}\right)^8 \times \frac{(-9)^8}{8^8}$

$= \frac{(-2)^8}{3^8} \times \frac{\left[(-3)^2\right]^8}{\left(2^3\right)^8} = \frac{(-2)^8}{3^8} \times \frac{(-3)^{2\times8}}{2^{3\times8}}$

$= \frac{(-1)^8 \times 2^8}{3^8} \times \frac{(-1)^{16} \times 3^{16}}{2^{24}} = \frac{1\times2^8}{3^8} \times \frac{1\times3^{16}}{2^{24}} = \frac{3^{16}-8}{2^{24}-8} = \frac{3^8}{2^{16}} = \frac{6561}{65536}.$

(d) $\left(\frac{2}{3}\right)^4 \times \left(\frac{2}{3}\right)^2 \div \left(\frac{3}{2}\right)^{-4} = \left(\frac{2}{3}\right)^{4+2} \div \left(\frac{2}{3}\right)^4 = \left(\frac{2}{3}\right)^6 \div \left(\frac{2}{3}\right)^4 = \left(\frac{2}{3}\right)^{6-4} = \left(\frac{2}{3}\right)^2 = \frac{4}{9}.$

4. (a) $6^x = 216$

$6^x = 6 \times 6 \times 6$

$6^x = 63$

$x = 3$ [Bases are same.]

Thus, the value of x is 3.

(b) $2^{2x+1} = 512$

$2^{2x+1} = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2$

$2^{2x+1} = 2^9$

$2x + 1 = 9$ [Bases are same.]

$2x = 9 - 1 = 8$

$x = 8 \div 2 = 4$

Thus, the value of x is 4.

2	512
2	256
2	128
2	64
2	32
2	16
2	8
2	4
2	2
	1

$\therefore 512 = 2^9.$

(c) $(-8)^x = 4096$

$(-8)^x = (-8) \times (-8) \times (-8) \times (-8)$

$(-8)^x = (-8)^4$

$x = 4$ [Bases are same.]

Thus, the value of x is 4.

(c) $32x + 3 = 243$

$32x + 3 = 3 \times 3 \times 3 \times 3 \times 3$

$32x + 3 = 35$

$2x + 3 = 5$ [Bases are same.]

$2x + 3 = 5 - 3 = 2$

$x = \frac{2}{2} = 1.$

Thus, the value of x is 1.

3	243
3	81
3	27
3	9
3	3
	1

$\therefore 243 = 3^5.$

5. (a) $(4^\circ + 7) \div 4^2 = 1 + 7 \div 16 = \frac{\cancel{8}^{1}}{\cancel{16}_{2}} = \frac{1}{2}.$

(b) $12^2 + 6^{-2} + 7^\circ \div (5^2 \div 5)$

$= 144 + \frac{1}{36} + 1 \div (25 \div 5) = 144 + \frac{1}{36} + 1 \div 5 = \frac{144 \times 180 + 1 \times 5 + 36}{180} = \frac{25961}{180}.$

(c) $\frac{7^0 \times 4^0 \times \cancel{3}^{1}}{3^{-5} \times \cancel{6}_{2}} = \frac{1 \times 1 \times 1}{3^{-5} \times 2} = \frac{1 \times 3^5}{2} = \frac{3 \times 3 \times 3 \times 3 \times 3}{2} = \frac{243}{2}.$

6. (a) $5^4 \div 125 = 5^4 \div 5^3 = 5^{4-3} = 5^1.$ [$125 = 5 \times 5 \times 5$]

(b) $16^6 \div 8^4 = \frac{16^6}{8^4} = \frac{2^6 \times 8^6}{8^4} = 2^6 \times 8^{6-4}$

$2^6 \times 8^2 = 2^6 \times (2^3)^2 = 2^6 \times 2^6 = 2^{6+6} = 2^{12}.$

(c) $\left[(-3)^3\right]^2 = (-3)^{3\times 2} = (-3)^6.$

(d) $\left[\left(\frac{7}{5}\right)^2\right]^{-3} = \left(\frac{7}{5}\right)^{2\times(-3)} = \left(\frac{7}{5}\right)^{-6}$

Exercise 5.3

1. (a) $4782 = 4 \times 1000 + 7 \times 100 + 8 \times 10 + 2$

$= 4 \times 10^3 + 7 \times 10^2 + 8 \times 10^1 + 2 \times 10^0.$

(b) $978046 = 9 \times 100000 + 7 \times 10000 + 8 \times 1000 + 4 \times 10 + 6$

$= 9 \times 10^5 + 7 \times 10^4 + 8 \times 10^3 + 4 \times 10^1 + 6 \times 10^0.$

(c) $210960 = 2 \times 100000 + 1 \times 10000 + 9 \times 100 + 6 \times 10 + 0$

$= 2 \times 10^5 + 1 \times 10^4 + 9 \times 10^2 + 6 \times 10^1$

(d) $4022 = 4 \times 1000 + 2 \times 10 + 2 = 2 \times 10^3 + 2 \times 10^1 + 2 \times 10^0.$

2. In the standard form :

(a) 2707 is written as 2.707×10^3.

(b) 498560 is written as 4.98560×10^5.

(c) 290000 is written as 2.9×10^5.

(d) 3058600 is written as 3.058600×10^6.

(e) 4000 is written as 4.0×10^3.

(f) Similar work to be done as (c).

(g) Similar work to be done as (c).

(h) 4876.72 is written as 4.87672×10^3.

3. In usual form :

(a) $2.9 \times 10^5 = 2.9 \times 100000 = 290000.$

(b) $6.287 \times 10^3 = 6.287 \times 1000 = 6287.$

(c) $4.98 \times 10^7 = 4.98 \times 10000000 = 49800000.$

(d) $1.2 \times 10^4 = 1.2 \times 10000 = 12000.$

(e) $7.036 \times 10^8 = 7.036 \times 100000000 = 703600000.$

(f) $2.37 \times 10^5 = 2.37 \times 100000 = 237000.$

(g) $3.14 \times 10^9 = 3.14 \times 1000000000 = 3140000000.$

(h) $4.232 \times 10^3 = 4.232 \times 1000 = 4232.$

4. (a) The population of India = 1,26,00,00,000 = 1.26×10^9.

(b) The diameter of Saturn = 480000 km = 4.8×10^5 km.

(c) Distance of the earth from the moon = 384400000m = 3.844×10^6.

(d) The number of stars in our galaxy = 100000000000 = 1.0×10^{11}.

Revision Exercise

1. Similar work to be done as Q. 2 of Exercise 5.1.

2. (a) $(-2)^7 = (-2) \times (-2) \times (-2) \times (-2) \times (-2) \times (-2) \times (-2)$

(b) $\left(\frac{4}{9}\right)^3 = \frac{4}{9} \times \frac{4}{9} \times \frac{4}{9}$

(c) $\left(-\frac{1}{4} \times \frac{-2}{3}\right)^2 = \left(\frac{1}{6}\right)^2 = \frac{1}{6} \times \frac{1}{6}$

(d) $\left(-4 \times (3) \times \frac{-2}{9}\right)^2 = (-4) \times (-4) \times (-3) \times (-3) \times \frac{-2}{9} \times \frac{-2}{9}$

3. (a) $\frac{25}{81} = \frac{5 \times 5}{9 \times 9} = \frac{5^2}{9^2} = \left(\frac{5}{9}\right)^2$

(b) $\frac{-1}{1000} = \frac{(-1) \times (-1) \times (-1)}{10 \times 10 \times 10} = \left(\frac{-1}{10}\right)^3$

(c) $\frac{64}{729} = \frac{4 \times 4 \times 4}{9 \times 9 \times 9} = \frac{4^3}{9^3} = \left(\frac{4}{9}\right)^3$

(d) $\frac{32}{-3125} = \frac{2 \times 2 \times 2 \times 2 \times 2}{(-5) \times (-5) \times (-5) \times (-5) \times (-5)} = \frac{2^5}{(-5)^5} = \left(\frac{2}{-5}\right)^5.$

4. (a) Given : $a = \frac{-2}{3}$.

$\therefore 2a^2 = 2 \times \left(\frac{-2}{3}\right) \times \left(\frac{-2}{3}\right) = \frac{2 \times (-2) \times (-2)}{3 \times 3} = \frac{8}{9}.$

(b) Given : $x = 2$ and $y = 5$

$\therefore x^y - y^x = 2^5 - 5^2 = 32 - 25 = 7.$

and $x^y \times y^x = 2^5 \times 5^2 = 3^2 \times 2^5 = 800.$

5. Similar work to be done as Q. 5 of Exercise 5.1.

6. Given : $\left(2^{2m}\right)^3 \div \left(2^{3m}\right)^4 = 2^{4m-12}$

LHS = $2^{2m \times 3} \div 2^{3m \times 4} = 2^{6m} \div 2^{12m} = 2^{6m - 12m} = 2^{-6m}$.

Now, $2^{-6m} = 2^{4m - 12m}$

$\Rightarrow -6m = 4m - 12$ [Bases are same.]

$\Rightarrow -6m - 4m = -12$

$\Rightarrow -10m = -12$

$\Rightarrow m = \frac{-12}{-10} = \frac{12}{10} = \frac{6}{5}$.

Thus, the value of m is $\frac{6}{5}$.

7. (a) $\left(\frac{4}{3}\right)^5 \times \left(\frac{4}{3}\right)^{-2} = \left(\frac{4}{3}\right)^{5-2} = \left(\frac{4}{3}\right)^3$.

(b) $\left(\frac{-3}{5}\right)^5 \times \left(\frac{-3}{5}\right)^{-7} = \left(\frac{-3}{5}\right)^{5-7} = \left(\frac{-3}{5}\right)^{-2} = \left(\frac{5}{-3}\right)^2$.

(c) $\left(\frac{3}{8}\right)^{-2} \times \left(\frac{3}{8}\right)^4 \times \left(\frac{3}{8}\right)^{-6} = \left(\frac{3}{8}\right)^{-2+4-6} = \left(\frac{3}{8}\right)^{4-8} = \left(\frac{3}{8}\right)^{-4} = \left(\frac{8}{3}\right)^4$.

(d) $\left(\frac{4}{11}\right)^{-2} \times \left(\frac{4}{11}\right)^5 \times \left(\frac{4}{11}\right)^0 = \left(\frac{4}{11}\right)^{-2+5} \times 1 = \left(\frac{4}{11}\right)^3$

8. (a) $\frac{4}{5} \div \left(\frac{4}{5}\right)^4 = \left(\frac{4}{5}\right)^{1-4} = \left(\frac{4}{5}\right)^{-3} = \left(\frac{4}{5}\right)^3$.

(b) $\left(\frac{-3}{4}\right)^7 \div \left(\frac{3}{-4}\right)^2 = \left(\frac{-3}{4}\right)^7 \div \left(\frac{-3}{4}\right)^{-2} = \left(\frac{-3}{4}\right)^{7+2} = \left(\frac{-3}{4}\right)^9$.

(c) $\frac{6^2 \times 6^4}{6^8} = \frac{6^{2+4}}{6^8} = \frac{6^6}{6^8} = 6^{6-8} = 6^{-2} = \left(\frac{1}{6}\right)^2$.

(d) $\left[\left(\frac{-5}{9}\right)^2\right]^{-3} = \left(\frac{-5}{9}\right)^{2 \times (-3)} = \left(\frac{-5}{9}\right)^{-6} = \left(\frac{9}{-5}\right)^6$.

9. (a) $3^4 = 81$ and $(-3)^3 = -27$

As 81 is greater then –27, so 3^4 is greater.

(b) $7^1 = 7$ and $1^7 = 1$

As 7 is greater than 1, so 7^1 is greater.

(c) $(-9)^2 = 81$ and $2^6 = 64$

As 81 is greater than 64, so $(-9)^2$ is greater.

(d) $4^{-2} = \left(\frac{1}{4}\right)^2 = \frac{1}{16}$ and $4^{-3} = \left(\frac{1}{4}\right)^3 = \frac{1}{64}$.

As $\frac{1}{16}$ is greater than $\frac{1}{64}$, so 4^{-2} is greater.

10. Given : $\frac{p}{q} = \left(\frac{1}{10}\right)^3 \times \frac{1}{10} = \left(\frac{1}{10}\right)^4$

$$\therefore \left(\frac{p}{q}\right)^{-2} = \left(\frac{p}{q}\right)^{2} = \left[\left(\frac{10}{1}\right)^{4}\right]^{2} = 10^{4\times2} = 10^{8} = 100000000.$$

11. In the standard form :
    (a) 780000 is written as 7.8×10^5.
    (b) 68725.37 is written as 6.872537×10^4.
    (c) 4 crore = 40000000 is written as 4.0×10^7.
    (d) 2 bition = 2,000,000,000 is written as 2.0×10^9.

Multiple Choice Questions

1. The value of $\left(\frac{1}{2}\right)^{0}$ is 1. Thus, the correct option is (a).
2. $(3^2)^4 = 3^{2\times4} = 3^8$. Thus, the correct option is (d).
3. 753000 in standard form is 7.53×10^5. Thus, the correct option is (d).
4. The exponential form having base –3 and exponent 2 is $(-3)^2$. Thus, the correct option is (b).
5. $(-2)^3 \times (-10)^3 = -8 \times (-1000) = 8000$. Thus, the correct option is (c).
6. See the Answer given in the book.
7. $3^4 \times 6^4 = (3 \times 6)^4 = 18^4$. Thus, the correct option is (c).
8. $\frac{3^5 \times a^6}{9 \times a} = \frac{3^5 \times a^6}{3^2 \times a} = 3^{5-2} \times a^{6-1} = 3^3 a^5$. Thus, the correct option is (d).
9. $(3° + 5°)(3° - 5°) = (1 + 1)(1 - 1) = 2 \times 0 = 0$. Thus, the correct option is (b).
10. $(6° + 5°)(6° - 5°) = (1 + 1)(1 + 1) = 2$ y 2 x 4. Thus, the correct option is (b).

Higher Order Thinking Skills (HOTS)

1. $81 \times 81^2 \times 81^3 \times 81^4 = 9^2 \times (9^2)^2 \times (9^2)^3 \times (9^2)^4 = 9^2 \times 9^4 \times 9^6 \times 9^8 = 9^{2+4+6+8} = 9^{20}$.
2. 5^5 kg $= 5^5 \times 1000 = 3125 \times 1000 = 3125000 = 3.125 \times 10^6$kg.
3. Square of $3^2 = (3^2)^2 = 3^{2\times2} = 3^4 = 81$
   Square of $2^3 = (2^3)^2 = 2^{3\times2} = 2^6 = 64$
   Difference between two results = 81 – 64 = 17.
4. $(794^4 \div 729^2) \div 3^8 = 729^{4-2} \div 3^8 = 729^2 \div 3^8 = (3^6)^2 \div 3^8 = 3^{6\times2} \div 3^8 = 3^{12} \div 3^8 = 3^{12-8} \div 3^4 = 81$.
5. See Answers given in the book.

6 Algebraic Expressions

Exercise 2.1

1. (a) p + 2q (b) $y - \frac{3x}{4}$ (c) $\frac{a+b}{4}$ (d) 2x – 5y
2. (a) The sum of 6 and two times b.
   (b) One fourth of y subtracted from nine times of x.

(c) Subtracted b from a.

(d) Three times a number y.

3. See the **Answers** given in the book.

4. (a) $2p - q + 3$ (b) $-2a + 2b - 8$ (c) $5 - 2x + \frac{3}{5}x$ (d) $-8a + b + 7$

5. (a) $3x - y$ is a binomial as it has two terms.

(b) $5a$ is a monomial as it has one term.

(c) $2x - 3 + 4x^2$ is a trinomial as it has three terms.

(d) $-3a$ is a monomial as it has one term.

(e) $\frac{-5}{7}x$ is a monomial as it has one term.

(f) $7 - 2x^2 - 4xy$ is a trinomial as it has three terms.

(g) $9a^2 - 2ab + ab^2 - 8$ is a quadrinomial as it has four terms.

(h) $2x + 10y$ is a binomial as it has two terms.

6. (a) We have $4x - 2x + 3 = 2\mathbf{x} + 3$.

Coefficient of x is 2.

(b) We have $-\frac{3}{4}x^2 - x$.

Coefficient of in it is -1.

(c) We have xy.

Coefficient of x in it is y.

(d) We have $x^2y - xy^2 - 3$.

Coefficient of x in it is $-y^2$.

7. (a) The constant term in $-4x + 9$ is 9.

(b) The constant term in $2x^2 - 3x$ is 0.

(c) The constant term in $2xy$ is 0.

(d) The constant term in $5x - \frac{2}{3}$ is $-\frac{2}{3}$.

8. (a) We have $x^2 - 7x + 4x^2$.

Like terms in it are : x^2 and $4x^2$.

(b) We have $p^2 - 2p + g^2$.

It has no like term.

(c) We have $4x - 3 - 5x - 3$.

Like terms are : $4x$ and $-5x$.

(d) We have $4x - 2y + 6x$.

Like terms are : 4x and $6x$.

(e) We have $2ab - b - 4ba + 3$.

Like terms are : $2ab$ and $-4ba$.

(f) We have $-\frac{3}{5}xy - xy + y$.

Like terms are : $-\frac{3}{5}xy$ and $-xy$.

(g) We have $4x^2y + 8yx^2 + 6x$.

Like terms are : $4x^2y$ and $8yx^2$.

(h) We have $9xy + 3y^2x + 4x^2y$.

It has no like term.

9. We know that in a non-zero polynomial, the highest power of the variable is called its degree. Thus :

(a) $4x^2 - 3x^3 + 8$ is a polynomial of degree 3.

(b) $9 - 2a^4 - 7a$ is a polynomial of degree 4.

(c) $\frac{2}{3}x^3 + 5 - 2x$ is a polynomial of degree 3.

(d) $p^5 - 8$ is a polynomial of degree 5.

Exercise 6.2

1. (a) $x + y + 4x + z = 5x + y + z$

(b) $x^2 + y^2 - 5y^2 + 2x^2 = x^2 + 2x^2 + y^2 - 5y^2 = 3x^2 - 4y^2$.

(c) $p^2q + pq^2 + p^2q + p = p^2q + p^2q + pq^2 + p = 2p^2q + pq^2 + p$

(d) $2ab^2 + b^2 + ab^2 + a - ab^2 = 2ab^2 + b^2 + a = 2ab^2 + b^2 + a$

(e) $6abc - 2abc + bc^2 - 3bc^2 = 4abc + bc^2 - 3bc^2$

(f) $4x^2y + 3xy^2 - 2yx^2 - 4xy^2 = 4x^2y - 2x^2y + 3xy^2 - 4xy^2 = 2x^2y - 2xy^2$

2. (a) $3a - b + 2a + b = 3a + 2a - b + b = 5a$.

(b) $xy^2 - x + 2x^2 + xy = 2x^2 + xy^2 + xy - x$

(c) $x^2y^2 - xy + xy + x^2 = x^2y^2 + x^2$

(d) $6a - 5b + c + a + b + c + a - 2b + 3c = 6a + a + a - 5b + b - 2b + c + c + 3c = 8a - 6b + 5c$

(e) $2a - 3b - c + 5a + 2b = 2a + 5a - 3b + 2b - c = 7a - b - c$

3. (a) $9b + 3b = 12b$ (b) $3a^2b + 5a^2b = 8a^2b$

(c) $6a - 2a + 7a = 13a - 2a = 11a$

(d) $2pq - pq - 7pq = 2pq - 8pq = -6pq$

(e) $3m + n - 2m + n = 3m - 2m + n + n = m + 2n$

(f) $4x - x - y + 2x - 2y = 4x - x + 2x - y - 2y = 5x - 3y$.

4. (a)
$$\begin{array}{r} 5a - 5b + 3 \\ a + b \\ +\ 4a - b - 3 \\ \hline 10a - 5b \end{array}$$

(b)
$$\begin{array}{r} x^3 - x^2 + 8 \\ -x^3 + 2x^2 - 7 \\ \hline x^2 + 1 \end{array}$$

(c)
$$\begin{array}{r} 8m^2n + 3mn - 2n^2 \\ 2m^2n - mn + n^2 \\ -9m^2n + 2mn - 3n^2 \\ \hline m^2n + 4mn - 4n^2 \end{array}$$

(d)
$$\begin{array}{r} 3x^2 + 8x - 3 \\ 5x^2 - 4x - 6 \\ +\ 2x^2 - 6x - 5 \\ \hline 10x^2 - 2x - 14 \end{array}$$

(e)
$$\begin{array}{r} 4a^2b - 2ab + b \\ -3a^2b + 4ab \\ \hline a^2b + 2ab + b \end{array}$$

(f)
$$\begin{array}{r} a^3 + 3abc + b^2 \\ a^2 + 0 - b^2 - 3ab \\ a^2 + 0 + b^2 + 0 \\ \hline a^3 + 2a^2 + 3abc - 3ab + b^2 \end{array}$$

5. Given : $A = 6p^2 - 2p + 3$ and $B = -6p^2 - 4p + 8$

$\therefore A + 2B = (6p^2 - 2p + 3) + 2(-6p^2 - 4p + 8)$

$= 6p^2 - 2p + 3 - 12p^2 - 8p + 16$

$= 6p^2 - 12p^2 - 2p - 8p + 13 + 16 = 6p^2 - 10p + 19$.

6. Given : $P = 3a^2 - 2ab + 8$, $QB = 2b - a^2 + 7$ and $R = a^2 - 2b + 3$

$\therefore$ P + 2Q + 3R = $3a^2 - 2b + 8 + 2(2b - a^2 + 7) + 3(a^2 - 2b + 3)$

$= 3a^2 - 2b + 8 + 4b - 2a^2 + 14 + 3a^2 - 6b + 9$

$= 3a^2 - 2a^2 + 3a^2 - 2b + 4b - 6b + 8 + 14 + 9 = 4a^2 - 4b + 31$

Exercise 6.3

1 (a) $9x - 4x = 5x$ (b) $2x^2 - 7x^2 = -5x^2$

(c) $(-2ab)^2 - (ab)^2 = -4a^2b^2 - a^2b^2 = -3a^2b^2$

(d) $-2x^2y - 6x^2y = -8x^2y$

(e) $-8abc - (-2abc) = -8abc + 2abc = -6abc$

(f) $8a^2b - (-3a^2b) = 8a^2b + 3a^2b = 11a^2b$

2. (a) $4a^2 - b^2 - (a^2 - b^2) = 4a^2 - b^2 - a^2 + b^2 = 4a^2 - a^2 - b^2 - b^2 = 3a^2$

(b) $9x^2 - 6x - (15x^2 - 2x) = 9x^2 - 6x - 15x^2 + 2x$

$= 9x^2 - 15x^2 - 6x + 2x = -6x^2 - 4x$

(c) $2p - 3q - (6p + 3q) = 2p - 3q - 6p - 3q = 2p - 6q - 3p - 3q = 4p - 6q$

(d) $-8x^2y^2 - 2x^2y^2 = 10x^2y^2$

3. (a) $3p^2 + q - (2p^2 + 3q + 4) = 3p^2 + q - 2p^2 - 3q - 4$

$= 3p^2 - 2p^2 + q - 3q - 4 = p^2 - 2p - 4$

(b) $7a - 2b + c - (2a - 8b) = 7a - 2b + c - 2a + 8b = 7a - 2b + 2a + 8b + c = 5a + 6b + c$

(c) $2x^2 - y^2 + 3xy - (x^2 + 2xy - y^2) = 2x^2 - y^2 - 3xy - x^2 - 2xy + y^2$

$= 2x^2 - x^2 - y^2 + y^2 - 3xy - 2xy = x^2 - 5xy$

(d) $2x^2 - 4x^3 - (-8x^3 - 2x^2 + 5) = -4x^3 + 2x^2 + 8x^3 + 2x^2 - 5$

$= -4x^3 + 8x^3 + 2x^2 + 2x^2 - 5 = 4x^3 + 4x^2 - 5$

(e) $8a + 6b - 3c - (-2a + 5b + 8c) = 8a + 6b - 3c + 2a - 5b - 8c$

$= 8a + 2a + 6b - 5b - 3c - 8c = 10a + b - 11c$

(f) $9m^2 - 3m + 4 - (2m + 8) = 9m^2 - 3m + 4 - 2m - 8$

$= 9m^2 - 3m - 2m - 8 + 4 = 9m^2 - 5m - 4.$

(g) $2a^2 - b^2 - c^2 - (a^2 - b^2 - c^2) = 2a^2 - b^2 - c^2 - a^2 + b^2 + c^2$

$= 2a^2 - a^2 - \cancel{b^2} + \cancel{b^2} - \cancel{c^2} + \cancel{c^2} = a^2$

(h) $7x - 8y + 6z - (8x - 6y - 7z) = 7x - 8y + 6z - 8x + 6y + 7z$

$= 7x - 8x - 8y + 6y + 6z + 7z = -x - 2y + 13z$

4. (a) $(-5x^3y + 7x^2y^2 - xy) - (8x^3y - x^2y^2 - xy) = -5x^3y + 7x^2y^2 - xy - 8x^3y + x^2y^2 + xy$

$= -5x^3y - 8x^3y + 7x^2y^2 + x^2y^2 - xy + xy = -13x^3y + 8x^2y^2$

(b) $(5a^2 - 2b^2 + 3ab) - (6ab + 4b^2 - a^2) = 5a^2 - 2b^2 + 3ab - 6ab - 4b^2 + a^2$

$= 5a^2 + a^2 - 2b^2 - 4b^2 + 3ab - 6ab = 6a^2\,6b^2 - 3ab$

(c) $(2ab^2 - 6ab + c^2) - (3ab^2 - 4ab + c^2) = 2ab^2 - 6ab + c^2 - 3ab^2 + 4ab - c^2$

$= 2ab^2 - 3ab^2 - 6ab + 4ab + c^2 - c^2 = -ab^2 - 2ab$

5. Given : $A = 3x^2 + 9x - 4$ and $B = 2x^2 + 9x - 2$

$\therefore$ $2A - B = 2(3x^2 + 9x - 4) - (2x^2 + 9x - 2)$

$= 6x^2 + 18x - 8 - 2x^2 - 9x + 2$

$= 6x^2 - 2x^2 + 18x - 9x - 8 + 2 = 4x^2 + 9x - 6$

6. $\{(4x^2 - 2xy + 3xy^2) + 2 \times (3x^2 - xy + xy^2) - (8x^2 - xy + xy^2)\}$

$= 4x^2 - 2xy + 3xy^2 + 6x^2 - 2xy + 2xy^2 - 8x^2 + xy - xy^2$

$= 4x^2 + 6x^2 - 8x^2 - 2xy - 2xy + 2xy + 3xy^2 + 2xy^2 - xy^2$

$= 2x^2 + 3xy + 4xy^2$

7. To get the answer, we will subtract $4x - xy^2 + 2y$ from $2x - xy^2 + y$.

$\therefore 2x - xy^2 + y - (4x - xy^2 + 2y)$

$= 2x - xy^2 + y - 4x + xy^2 - 2y$

$= 2x - 4x - xy^2 - xy^2 + y - 2y = -2x - y$

Thus, the required answer is $-2x - y$.

8. To get the answer, we will subtract $x^2y - 4x + 2y$ from $9x^2y - 3x - 4y$.

$\therefore 9x^2y - 3x - 4y - (x^2y - 4x + 2y)$

$= 9x^2y - 3x - 4y - x^2y + 4x - 2y$

$= 9x^2y - x^2y - 3x + 4x - 4y - 2y = 8x^2y + x - 6y$

Exercise 6.4

1. Given: $x = 2$, $y = -1$ and $z = 4$

(a) $x^2 - y^2 + z = (2)^2 - (-1)^2 + 4 = 4 - 1 + 4 = 7.$

(b) $2x - 5y + z = 2(2) - 5 \times (-1) + 4 = 4 + 5 + 4 = 13.$

(c) $x^3 - 2x^3 + 3x - 6 = -x^3 + 3x - 6 = -(2)^3 + 3 \times 2 - 6 = -8 + 6 - 6 = -8.$

2. Given : $a = -3$, $b = 2$ and $c = -2$

(a) $3a - \frac{b}{4} - bc = 3(-3) - \frac{2}{4} - 2 \times (-2) = -9 - \frac{1}{2} + 4 = -5 - \frac{1}{2} = \frac{-10 - 1}{2} = \frac{-11}{2}.$

(b) $\frac{3c - b^2}{2a} = \frac{3(-2) - (2)^2}{2(-3)} = \frac{-6 - 4}{-6} = \frac{-10}{-6} = \frac{5}{3}.$

(c) $\frac{10c - 2b^2}{3a} = \frac{10(-2) - (2)^2}{3(-3)} = \frac{-20 - 2 \times 4}{-9} = \frac{-20 - 8}{-9} = \frac{-28}{-9}.$

(d) $\frac{-6^2 + 2c}{3ab} = \frac{-(2)^2 + 2(-2)}{3 \times (-3) \times 2} = \frac{-4 - 4}{-18} = \frac{-8}{-18} = \frac{\cancel{8}^{4}}{\cancel{18}_{9}} = \frac{4}{9}.$

3. Given : $p = -1$ and $q = 4$

(a) $p^2 - 2q + pq - q^2 = (-1)^2 - 2 \times 4 + (-1) \times 4 - (4)^2 = 1 - 8 - 4 - 16 = 1 - 28 = -27.$

(b) $2p - 4q + 2pq - q^2 - 3pq^2 - 3p^2q = 2(-1) - 4(4) + 2(-1)(4) - (4)^2 - 3(-1)(4)^2 - 3(-1)^2 \times 4$

$= -2 - 16 - 8 - 16 + 48 - 12 = -42 - 12 + 48 = -54 + 48 = -6.$

7 Linear Equations

Exercise 7.1

1. Let the number of x. Then :

(a) $3x = 27$ (b) $x \times \frac{1}{4} = 12$ or $\frac{x}{4} = 12$ (c) $2x + (-4) = 16$ or $2x - 4 = 16$

(d) $9 - x = 20$ (e) $x + 12 = 25$ (f) $4 - \frac{x}{3} = -2$

2. (a) Twice a number added to –4 gives 24. (b) Nine times a numbers is 45.
(c) Two-third of a number is 15.
(d) Twice a number subtracted from five gives 20. (e) Six times a number is 24.

3. (a) We have $9x = 27$.
We substitute different values of x and find LHS and RHS.

Value of x	LHS	RHS	Is LHS = RHS?
1	$9 \times 1 = 9$	27	No
2	$9 \times 2 = 18$	27	No
3	$9 \times 3 = 27$	27	Yes

We find that for x = 3, LHS = RHS.
Thus, the solution of the equation is x = 3.

(b) We have $x + 7 = 11$.
We substitute different values of x and find LHS = RHS.

Value of x	LHS	RHS	Is LHS = RHS?
1	$x + 7 = 1 + 7 = 8$	11	No
2	$x + 7 = 2 + 7 = 9$	11	No
3	$x + 7 = 3 + 7 = 10$	11	No
4	$x + 7 = 4 + 7 = 11$	11	Yes

We find that for x = 4, LHS = RHS.
Thus, the solution of the equation is x = 4.

(c) Similar work to be done as (b) above.

(d) We have $\frac{y + 3}{5} = 2$. $\therefore\ y + 3 = 10$
We substitute different values of y and find LHS and RHS.

Value of y	LHS	RHS	Is LHS = RHS?
1	$y + 3 = 1 + 3 = 4$	10	No
3	$y + 3 = 3 + 3 = 6$	10	No
5	$y + 3 = 5 + 3 = 8$	10	No
6	$y + 3 = 6 + 3 = 9$	10	No
7	$y + 3 = 7 + 3 = 10$	10	Yes

We find the LHS = RHS for y = 78.
Thus, the solution of the equation is y = 7.

(e) Similar work to be done as (a).

4. (a) Given : $4 – x = 3$ and x = 2.
LHS = $4 – 2 \neq 2 \quad 3$ [Putting the value of x]
Thus, x = 2 does not satisfy the equation.

(b) Given : $–5 + y = 7$ and y = 12
LHS = $–5 + 12 = 7$ = RHS. [Putting the value of y]
Thus, y = 12 satisfies the equation.

(c) Given : $\frac{x-3}{4} = 3$ and $x = 15$.

$\text{LHS} = \frac{x-3}{4} = \frac{15-3}{4} = \frac{12}{4} = 3 = \text{RHS}$.

Thus, $x = 15$ satisfies the equation.

(d) Given : $x - \frac{1}{5} = \frac{4}{5}$ and $x = 5$.

$\text{LHS} = x - \frac{1}{5} = 5 - \frac{1}{5} = \frac{25-1}{5} = \frac{24}{5} \neq \text{RHS}$.

Thus, $x = 5$ does not satisfy the equation.

(e) Given : $2x - 3 = 23$ and $x = 12$.

$\text{LHS} = 2x - 3 = 2 \times 12 - 3 = 24 - 3 \neq 21$ RHS.

Thus, $x = 12$ does not satisfy the equation.

(f) Given : $4x + 2 = 36$ and $x = 8$.

$\text{LHS} = 4x + 2 = 4 \times 8 + 2 = 32 + 2 = 34$ RHS.

Thus, $x = 8$ does not satisfy the equation.

Exercise 7.2

1. (a) $4x = 28$

$\Rightarrow \frac{4x}{4} = \frac{28}{4}$ [Dividing both sides by 4]

$\Rightarrow x = 7$

Thus, $x = 7$ is the solution of the given equation.

Verification:

Substituting the value $x = 7$ in the given equation, we get $4x = 28$

$\text{LHS} = 4x = 4 \times 7 = 28 = \text{RHS}$

As LHS = RHS, hence, verifies.

(b) $8(x + 9) = 72$

$\Rightarrow \frac{\cancel{8}(x+9)}{\cancel{8}} = \frac{72}{8}$ [Dividing both sides by 8]

$\Rightarrow x + 9 = 9$

$\Rightarrow x + 9 - 9 = 9 - 9$ [Subtracting 9 from both sides]

$\Rightarrow x = 0$

Thus, $x = 0$ is the solution of the given equation.

Verification:

Substituting the value of $x = 0$ in the given equation $8(x + 9) = 72$.

$\text{LHS} = 8(x + 9) = 8(0 + 9) = 8 \times 9 = 72 = \text{RHS}$

As LHS = RHS, hence, the answer is correct.

(c) $\frac{4x}{3} + 1 = \frac{3}{6}$

$\Rightarrow \frac{4x}{3} + 1 - 1 = \frac{1}{2} - 1$ [Subtracting 1 from both sides]

$\Rightarrow \frac{4x}{3} = -\frac{1}{2}$

$\Rightarrow \frac{4x}{3} \times 3 = \frac{-1}{2} \times 3$ [Multiplying both sides by 3]

$\Rightarrow 4x = \frac{-3}{2}$

$\Rightarrow \frac{4x}{4} = \frac{-3}{2 \times 4}$ [Dividing both sides by 4]

$\Rightarrow x = \frac{-3}{8}$.

Thus, $x = \frac{-3}{8}$ is the solution of the given equation.

Verification:

It can be verified in the similar way as done before.

(d) Similar work to be done as (a).

(e) $8m - 6 = 42$

$\Rightarrow 8m = 42 + 6 = 48$ [By transposition]

$\Rightarrow \frac{8m}{8} = \frac{48}{8}$ [Dividing both sides by 8]

$\Rightarrow m = 6$

Thus, $m = 6$ is the solution of the given equation.

Verification can be done in the similar way as done before.

(f) $\frac{n}{9} - 2 = 4 - n$

$\Rightarrow \frac{n}{9} + n = 4 + 2$ [By transposition]

$\Rightarrow \frac{10n}{9} = 6$

$\Rightarrow \frac{10n}{\cancel{9}} + \cancel{9} = 6 \times 9$ [Multiplying both sides by 9]

$\Rightarrow 10n = 54$

$\Rightarrow \frac{10n}{10} = \frac{54}{10}$ [Dividing both sides by 10]

$\Rightarrow n = \frac{54}{10} = \frac{27}{5}$.

Thus, $n = \frac{27}{5}$. is the solution of the given equation.

Verification will be done in the same way as done before.

(g) $(7 + x) \div 6 = 9$

$\Rightarrow \frac{7 + x}{6} = 9$

$\Rightarrow \frac{7 + x}{6} \times 6 = 9 \times 6$ [Multiplying both sides by 6]

$\Rightarrow 7 + x = 54$

$\Rightarrow x + 7 - 7 = 54 - 7$

$\Rightarrow x = 47$

Thus, $x = 47$ is the solution of the given equation.

Verification will be done in the same way as done in (a) and (b).

(h) $\frac{x-3}{5} + 2 = \frac{x+1}{10}$

LCM of 5 and 10 = 10

Multiplying each term by the LCM, we get :

$\frac{x-3}{5} \times 10 \div 2 \times 10 = \frac{x+1}{10} \times 10$

$\Rightarrow 2(x - 3) + 20 = x + 1$

$\Rightarrow 2x + 14 = x + 1$

$\Rightarrow 2x - x = 1 - 14$

$\Rightarrow x = -13$

Thus, $x = -13$ is the solution of the given equation.

(i) $4(x + 3) = 5(2x - 3)$

$\Rightarrow 4x + 12 = 10x - 15$

$\Rightarrow 4x - 10x = -15 - 12$ [By transposition]

$\Rightarrow -6x = -27$

$\Rightarrow \frac{-6x}{-6} = \frac{-27}{-6}$ [Dividing both sides by –6]

$\Rightarrow x = \frac{\cancel{27}^{9}}{\cancel{6}_{2}} = \frac{9}{2} = 4\frac{1}{2}.$

Thus, $x = 4\frac{1}{2}$ is the solution of the given equation.

Verification will be done in the same way as done in (a) and (b).

2. (a) $11p - 2 = (p - 1)\,2$

$\Rightarrow 11p - 2 = 2p - 2$

$\Rightarrow 11p - 2p = -2 + 2$

$\Rightarrow 9p = 0$

$\Rightarrow p = \frac{0}{9} = 0.$

Thus, $p = 0$ is the solution of the given equation.

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

$\Rightarrow \frac{x+2}{3} \times 6 = \frac{x-2}{2} \times 6$ [Multiplying both sides by the LCM of 3 and 2]

$\Rightarrow (x + 2) \times 2 = (x - 2) \times 3$

$\Rightarrow 2x + 4 = 3x - 6$

$\Rightarrow 2x - 3x = -6 - 4$ [By transposition]

$\Rightarrow -x = -10$

$\Rightarrow x = 10$

Thus, $x = 10$ is the solution of the given equation.

(c) $x - (2x + 5) = 7 - \frac{x}{2}$

$\Rightarrow x - 2x - 5 = 7 - \frac{x}{2}$

$\Rightarrow -x - 5 = 7 - \frac{x}{2}$

$\Rightarrow -x + \frac{x}{2} = 7 + 5$ [By transposition]

$\Rightarrow \frac{-2x + x}{2} = 12$

$\Rightarrow \frac{-x}{2} \times 2 = 12 \times 2$ [Multiplying both sides by 2]

$\Rightarrow -x = 24$

$\Rightarrow x = -24$

Thus, $x = -24$ is the solution of the given equation.

(d) $3(m + 4) = 2(m - 2)$

$\Rightarrow 3m + 12 = 2m - 4$

$\Rightarrow 3m - 2m = -4 - 12$

$\Rightarrow m = -16$ [By transposition]

Thus, $m = -16$ is the solution of the given equation.

(e) $2(z + 9) = 9z - 2$

$\Rightarrow 2z + 18 = 9z - 2$

$\Rightarrow 2z - 9z = -2 - 18$

$\Rightarrow -7z = -20$

$\Rightarrow \frac{-7z}{-7} = \frac{-20}{-7}$ [Dividing both sides by –7]

$\Rightarrow z = \frac{20}{7}$.

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

$\Rightarrow 2x = \frac{3}{2} - \frac{1}{2} = \frac{2}{2} = 1$ [By transposition]

$\Rightarrow 2x = 1$

$\Rightarrow \frac{2x}{2} = \frac{1}{2}$ [Dividing both sides by 2]

$\Rightarrow x = \frac{1}{2}$.

Thus, $x = \frac{1}{2}$ is the solution of the given equation.

3. (a) $3(2t - 4) - 2(t + 3) = 5(t - 1)$

$\Rightarrow 6t - 12 - 2t - 6 = 5t - 5$

$\Rightarrow 6t - 2t - 5t = -5 + 12 + 6$ [By transposition]

$\Rightarrow 6t - 7t = 13$

$\Rightarrow -t = 13$

$\Rightarrow -t \times (-1) = 13 \times (-1)$

$\Rightarrow t = -13.$

Thus, the value of t is –13.

(b) $-7 = 4(p - 2)$

$\Rightarrow -7 = 4p - 8$

$\Rightarrow -7 + 8 = 4p$

$\Rightarrow 1 = 4p$

$\Rightarrow \frac{1}{4} = \frac{4p}{4}$ [Dividing both sides by 4]

$\Rightarrow \frac{1}{4} = p$

Thus, the value of p is $\frac{1}{4}$.

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

$\Rightarrow \frac{3x}{4} - \frac{x}{2} = 5$ [By transposition]

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

$\Rightarrow \frac{x}{4} = 5$

$\Rightarrow \frac{x}{4} \times 4 = 5 \times 4$ [Multiplying both sides by 4]

$\Rightarrow x = 20$

Thus, the value of x is 20.

(d) $2(3 - x) + 3(x - 2) = 2(2x - 4)$

$\Rightarrow 6 - 2x + 3x - 6 = 4x - 8$

$\Rightarrow x = 4x - 8$

$\Rightarrow x - 4x = -8$ [By transposition]

$\Rightarrow -3x = -8$

$\Rightarrow \frac{-3x}{-3} = \frac{-8}{-3}$ [Dividing both sides by –3]

$\Rightarrow x = \frac{8}{3}$.

Thus, the value of x is $\frac{8}{3}$.

Exercise 7.3

1. Let the unknown number be x.
   Then according to the question,
   $x + 15 = 38$
   $\Rightarrow x = 38 - 15 = 23$
   Thus, the required number is 23.

2. Let the number be x.

Then according to the question,

$\frac{x}{4} - 8 = 7$

$\Rightarrow \frac{x}{4} = 7 + 8 = 15$

$\Rightarrow x = 15 \times 4 = 60$

Thus, the required number is 60.

3. Let the age of the son be x years.
Then according to the question,
$7x = 56$

$\Rightarrow x = \frac{56}{7} = 8.$

Thus, the age of son is 8 years.

4. Let the breadth of the rectangular garden be x metres.
Then its length = (x + 8)m.
According to the question,
Perimeter of the garden = 304 m
$\Rightarrow$ 2(Length + Breadth) 304 m
$\Rightarrow$ 2(x + 8 + x) = 304 m
$\Rightarrow$ 2(2x + 8) = 304 m
$\Rightarrow$ 4x + 16 = 304 m
$\Rightarrow$ 4x = 304 – 16 = 288 m
$\Rightarrow$ x = 288 m ÷ 4 = 72 m
Thus, the breadth of the rectangular garden is 72 m and its length is x + 8 = 72 + 8 = 80.

5. Let the two consecutive numbers be x and x + 1.
Then according to the question,
x + x + 1 = 127
$\Rightarrow$ 2x = 127 – 1 = 126
$\Rightarrow$ x = 126 ÷ 2 = 63
$\Rightarrow$ x + 1 = 63 + 1 = 64
Thus, the two consecutive numbers are 63 and 64.

6. Let the denominator of the fraction be x.
Then its numerator will be x – 2.

$\therefore$ Fraction = $\frac{x-2}{x}$

According to the question,

$\frac{x-2-1}{x-1} = \frac{1}{3}$

$\Rightarrow \frac{x-3}{x-1} = \frac{1}{3}$

$\Rightarrow$ 3(x – 3) = 1 (x – 1) [By cross multiplication]
$\Rightarrow$ 3x – 9 = x – 1
$\Rightarrow$ 3x – x = –1 + 9 [By transposition]

$\Rightarrow 2x = 8$

$\Rightarrow x = 8 \div 2 = 4$

$\Rightarrow x - 2 = 4 - 2 = 2$

Thus, the fraction is $\frac{2}{4}$.

7. Let the number be x.

Then its one-fourth = $\frac{x}{4}$

According to the question,

$\Rightarrow \frac{x}{4} + 8 = 108$

$\Rightarrow \frac{x}{4} = 108 - 8 = 100$

$\Rightarrow \frac{x}{4} \times 4 = 100 \times 4$

$\Rightarrow x = 400$

Thus, the required number is 400.

8. Let the smaller number be x.

Then the bigger number will be x + x

According to the question,

$\Rightarrow x + x + 6 = 130$

$\Rightarrow 2x = 130 - 6 = 124$

$\Rightarrow x = 124 \div 2 = 62$

$\Rightarrow x + 6 = 62 + 6 = 68$

Thus, the numbers are 62 and 68.

9. Let the number of friends be x.

Then according to the question,

$4 \times x + 5 = 53$

$\Rightarrow 4x = 53 - 5$ [By transposition]

$\Rightarrow 4x = 48$

$\Rightarrow x = 48 \div 4 = 12$

Thus, there were 12 friends in Aditya's birthday party.

10. Let the number be x.

Then three fourth of the number = $\frac{3x}{4}$ and its two-third = $\frac{2x}{3}$.

According to the question,

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

$\Rightarrow \frac{3x \times 3 - 2x \times 4}{12} = 8$

$\Rightarrow 9x - 8x = 8 \times 12$

$\Rightarrow x = 96$

Thus, the number is 96.

Revision Exercise

1. See the **Answers** given in the book.

2. Similar work to be done as Q. 3 of Exercise 7.1

3. (a) Given : 4 is the solution of $9x - 5 = 40$

$\therefore 9x - 5 = 40$

LHS = $9x - 5 = 9 \times 4 - 5 = 36 - 5 = 31 \neq$ RHS

Thus, 4 is not the solution of the given equation.

(b) Given : $5x = -15$

LHS = $5x = 5 \times (-3) = -15$ = RHS

Thus, –3 is not the solution of the given equation.

(c) Given : $2p + 3 = 15$

LHS = $2p + 3 = 2 \times 5 + 3 = 10 + 3 = 13 \neq$ RHS

Thus, 5 is not the solution of the given equation.

(d) Given : $\frac{3m}{4} - 6 = 0$

LHS = $\frac{3m}{4} - 6 = \frac{3 \times (-2)}{4} - \frac{6}{1}$

$= \frac{-6}{4} - \frac{6 \times 4}{1 \times 4} = \frac{-6 - 24}{4} = \frac{-30}{4} = \frac{-15}{2} \neq$ RHS

Thus, –2 is not the solution of the given equation.

4. See the **Answers** given in the book.

5. (a) $4 - 2(x - 1) = 3(2x - 1) + 2(4x + 1)$

$\Rightarrow 4 - 2x + 2 = 6x - 3 + 8x + 2$

$\Rightarrow -2x + 6 = 14x - 1$

$\Rightarrow -2x - 14x = -1 - 6$

$\Rightarrow -16x = -7$

$\Rightarrow x = \frac{-7}{-16} = \frac{7}{16}$

Thus, the solution of the equation is $x = \frac{7}{16}$.

(b) $-8 = 4(m + 6)$

$\Rightarrow -8 = 4m + 24$

$\Rightarrow -4m = 24 + 8 = 32$ [By transposition]

$\Rightarrow m = \frac{32}{-4} = -8.$

Thus, the solution of the equation is $m = -8$.

(c) $3(2y - 4) - 1 = 2(2y + 2)$

$\Rightarrow 6y - 12 - 1 = 4y + 4$

$\Rightarrow 6y - 4y = 4 + 13$ [By transposition]

$\Rightarrow 2y = 17$

$\Rightarrow y = \frac{17}{2} = 8\frac{1}{2}.$

Thus, the solution of the given equation is $m = \frac{17}{2}$ or $8\frac{1}{2}$.

(d) $3 - 4(x - 1) = 5$

$\Rightarrow 3 - 4x + 4 = 5$

$\Rightarrow -4x + 7 = 5$

$\Rightarrow -4x = 5 - 7 = -2$

$\Rightarrow -4x = -2$

$\Rightarrow x = \frac{-2}{-4} = \frac{1}{2}$.

Thus, the solution of the given equation is $x = \frac{1}{2}$.

(e) $4(x + 13) = 26$

$\Rightarrow 4x + 52 = 26$

$\Rightarrow 4x = 26 - 52$

$\Rightarrow 4x = -26$

$\Rightarrow x = \frac{-26}{4} = \frac{-13}{2}$.

Thus, the solution of the given equation is $x = \frac{-13}{2}$.

(f) $y - \frac{2}{3} = 6$

$\Rightarrow y = 6 + \frac{2}{3} = \frac{6 \times 3 + 2}{3} = \frac{20}{3}$.

Thus, the solution of the given equation is $x = \frac{20}{3}$.

6. (a) Given : $2x - 1 = 5$

$\therefore$ LHS $= 2x - 1 = 2 \times (-3) - 1 = -6 - 1 = -7 \neq$ RHS

Thus, $x = -3$ is not the solution of the given equation.

(b) Given : $-4 - 2(x - 1) = -4x$

LHS $= -4 - 2x + 2 = -4 - 2 \times (-3) + 2$

$= -4 + 6 + 2 = -4 + 8 = 4$.

RHS $= -4x = -4 \times (-3) = 12$

As LHS $\neq$ RHS, so $x = -3$ is not the solution of the given equation.

(c) Given : $-3x + 5 = 8$

LHS $= -3x + 5 = -3 \times (-3) + 5 = 9 + 5 = 14 \neq$ RHS.

As LHS $\neq$ RHS, so $x = -3$ is not the solution of the given equation.

7. By the angle sum property of a triangle, we get :

$x - 1 + x + x + 1 = 180°$

$\Rightarrow 3x = 180°$

$\Rightarrow x = 180° \div 3 = 60°$

$\Rightarrow x - 1 = 60° - 1 = 59°$

and $x + 1 = 60° + 1° = 61°$

Thus, the angles of the triangle are 59°, 60° and 61°.

8. Let the two consecutive even numbers be x and x + 2. Then according to the question,

$x + x + 2 = 82$

$\Rightarrow 2x = 82 - 2 = 80$

$\Rightarrow x = 80 \div 2 = 40$

Thus, the consecutive even numbers are 40° and 42°.

9. Let the present age of Ananya be x years.

Then her father's age = 4x years

After 5 years :
Ananya's age = (x + 5) years
Her father's age = (4x + 5) years
According to the question,
$3(x + 5) = 4x + 5$
$\Rightarrow 3x + 15 = 4x + 5$
$\Rightarrow 3x - 4x = 5 - 15$
$\Rightarrow -x = -10$
$\Rightarrow x = 10$
$4x = 4 \times 10 = 40$
Thus, Ananya's present age is 10 years and of her father is 40 years.

10. Let the number be x.
Then its predecessor = x – 1
According to the question,

$$\frac{1}{10} \times x = \frac{1}{6} \times (x - 1) - 2$$

$$\Rightarrow \frac{x}{10} = \frac{x - 1}{6} - 2$$

$$\Rightarrow \frac{x}{10} - \frac{x - 1}{6} = -2$$

$$\Rightarrow \frac{3x - (x - 1)5}{30} = -2$$

$$\Rightarrow 3x - 5x + 5 = -60$$

$$\Rightarrow -2x = -60 - 5 = -65$$

$$\Rightarrow x = \frac{-65}{-2} = \frac{65}{2}.$$

Thus, the number is $\frac{65}{2}$.

Multiple Choice Questions

1. (a) $x - 2 = y$ has two variables, so it is not the answer.

   (b) $\frac{2}{m} = m + 3$ has variable as the denominator, so it is not the answer.

   (c) $\frac{x}{2} - 3 = 8$ is a linear equation in one variable.

   (d) $x^2 + 2 = 16$ is of degree 2, so it is not the answer.
   Thus, the correct option is (c)

2. One-fourth of x is 2 more than 7 can be expressed as $\frac{x}{4} - 2 = 7$. Thus, the correct option is (d).

3. In a linear, the maximum power of variable is 1. Thus, the correct option is (b)

4. $\frac{a-1}{a+1} = \frac{2}{3} \Rightarrow 3(a - 1) = 2(a + 1)$
   $\Rightarrow 3a - 3 = 2a + 2$

$\Rightarrow$ 3a – 2a = 2 + 3

$\Rightarrow$ a = 5

Thus, the correct option is (c).

5. $\frac{x}{3} = \frac{5}{9} \Rightarrow x = \frac{5 \times \cancel{3}^{1}}{\cancel{9}_{3}} = \frac{5}{3}$.

Thus, the correct option is $\frac{5}{3}$.

6. Let the number be x.

Then 4x + 4 = 40

$\Rightarrow$ 4x = 40 – 4 = 36

$\Rightarrow$ x = 36 ÷ 4 = 9.

Thus, the correct option is (b).

7. See the Answers given in the book.

8. See the Answers given in the book.

9. According to the question,

6x + 8 = 56

$\Rightarrow$ 6x = 56 – 8 = 48

$\Rightarrow$ x = 48 ÷ 6 = 8

Thus, the correct option is (b).

10. The age of the father after five years will be (3x + 5) years.

Thus, the correct option is (d).

Mental Maths.

A. See the **Answers** given in the book.

B.

1. Let the three consecutive odd numbers be x, x + 2 and x + 4.

Then x + x + 2 + x + 4 = 33

$\Rightarrow$ 3x + 6 = 33

$\Rightarrow$ 3x = 33 – 6 = 27

x = 27 ÷ 3 = 19.

Thus, the required three consecutive odd numbers are 9, 11 and 13.

2. Let the number be x.

Then 3x + 9 = 30

$\Rightarrow$ 3x = 30 – 9 = 21

$\Rightarrow$ x = 21 ÷ 3 = 7.

Thus, the number is 7.

3. One angle of a right angled triangle is 90°.

Let one of the remaining angles be x.

Then the other angle will be 2x.

By the angle sum property of a triangle:

x + 2x + 90° = 180°

$\Rightarrow$ 3x = 180° – 90° = 90°

$\Rightarrow$ x = 90° ÷ 3 = 30°

Thus, the angle of right-angled triangle are = 30°, 60° and 90°.

4. Let the original number be x.

Then according to the question:

4x – x = 60

$\Rightarrow$ 3x = 60

$\Rightarrow$ x = 60 ÷ 3 = 20

Thus, the original number is 20.

5. Let one of the two consecutive multiples be x.

Then the other number will be x + 9.

According to the question,

x + x + 9 = 99

$\Rightarrow$ 2x = 99 – 9 = 90

$\Rightarrow$ x = 90 ÷ 2 = 45

Thus, the required two consecutive multiples of 9 are 45 and 45 + 9 = 54.

Higher Order Thinking Skills (HOTS)

1. Given : 3x = 27

$\therefore$ x = 27 ÷ 3 = 9

Now, x = 3y

$\Rightarrow$ 9 = 3y $\quad\Rightarrow$ 9 ÷ 3 = y $\quad\Rightarrow$ y = 3.

Thus, the value of y is 3.

2. Given : $\frac{4x}{3}$ [ ] 4 = 16 and value of x = 3.

$\therefore$ $\frac{4x}{3}$ [ ] 4 = 16

$\Rightarrow$ $\frac{4 \times 3}{3}$ [ ] 4 = 16

$\Rightarrow$ 4 [ ] 4 = 16 [Substituting the value of x]

$\Rightarrow$ 4 × 4 = 16.

Thus, the required sign is multiplication sign (x).

3. $\frac{5x + 3}{3} = 11$

$\Rightarrow$ 5x + 3 = 11 × 3 = 33

$\Rightarrow$ 5x = 33 – 3 = 30 $\quad\Rightarrow$ x = 30 ÷ 5 = 6

Now, 5x + 3 = 5 × 6 + 3 = 33.

4. $\frac{2y - 2}{7y - 1} = \frac{2}{3}$

$\Rightarrow$ 3(3y – 2) = 2 (7y – 1) [By cross multiplication]

$\Rightarrow$ 9y – 6 = 14y – 2

$\Rightarrow$ 9y – 14y = –2 + 6

$\Rightarrow -5y = 4 \quad \Rightarrow y = \frac{4}{5}$

5. $3x^2 \times 2 = 241$

LHS $= 3x^2 \times 2 = 3 \times (-9)^2 \times 2 = 3 \times 81 \times 2 = 243 \times 2 = 243 - 2 = 241$.

Thus, the mathematical sign that replace × will be minus sign (–).

6. $\frac{2}{5x-2} = \frac{-1}{11} \Rightarrow 2 \times 11 = -1 \times (5x - 2)$

$\Rightarrow 22 = -5x + 2 \Rightarrow 5x = -22 + 2 = -20 \Rightarrow x = -20 \div 5 = -4$.

$\therefore 2x + 3 = 2 \times (-4) + 3 = -8 + 3 = -5$.

Thus, the value of $2x + 3$ is –5.

8 Comparing Quantities

Exercise 8.1

1. (a) $36 : 45 = \frac{36}{45} = \frac{36 \sqrt{9}}{45 \sqrt{9}}$ [HCF of 36 and 45 = 9]

$= \frac{4}{5} = 4 : 5$, which is the simplest form of the given ratio.

(b) $24.5 : 55 = \frac{24.5}{55} = \frac{245}{550}$

Dividing the numerator and the denominator by their HCF, we get

$\frac{245 \sqrt{5}}{550 \sqrt{5}} = \frac{49}{110}$

$= \frac{4.9}{11} = 4.9 : 11$

Thus, the simplest form of the given ratio is 4.9 : 11.

245 | 550 | 2
–490
60 | 245 | 4
–240
4 | 60 | 12
–60
0

$\therefore$ HCF of 245 and 550 = 5

(c) $\frac{1}{4} : \frac{1}{8} = 1 \times 8 : 4 \times 1$ [By cross multiplication]

$= 8 : 4 = \frac{8}{4} = \frac{2}{1} = 2 : 1$.

Thus, the simplest form of the given ratio is 2 : 1.

(d) $2.5 : 12.5 = \frac{2.5}{12.5} = \frac{25}{125}$

$= \frac{25 \sqrt{25}}{125 \sqrt{25}} = \frac{1}{5} = 1 : 5$. [HCF of 25 and 125 = 25]

Thus, the simplest form of the given ratio is 1 : 5.

2. (a) Ratio of 2 hours of 1 day = 2 hours : 24 hours [$\because$ 1 day = 24 hours]

$= \frac{2 \text{ hours}}{24 \text{ hours}} = \frac{2}{24} = \frac{1}{12} = 1 : 12$.

(b) Ratio of 55 paise to 1 rupee

= 55 paise : 100 paise [$\because$ 1 rupee = 100 paise]

$= \frac{55 \text{ paise}}{100 \text{ paise}} = \frac{55}{100} = \frac{55 \div 5}{100 \div 5}$ [HCF of 55 and 100 = 5]

$= \frac{11}{20}$ = 11:20.

(c) 1 year = 12 months

$\therefore$ Ratio of 4 months to 1 year

$= 4 \text{ months} : 12 \text{ months} = \frac{4 \text{ months}}{12 \text{ months}} = \frac{\cancel{4}^{1}}{\cancel{12}_{3}} = \frac{1}{3} = 1 : 3.$ [1 year = 12 months]

(d) 1 km = 1000 m.

$\therefore$ Ratio of 3 km to 500m.= $3000 : 500 = \frac{3000}{500} = \frac{\cancel{30}^{6}}{\cancel{5}_{1}} = \frac{6}{1} = 6 : 1.$

3. (a) Given : 5 : 6 and 10 : 12.

$5 : 6 = \frac{5}{6} = \frac{5 \times 2}{6 \times 2} = \frac{10}{12}.$

and $10 : 12 = \frac{10}{12}.$

Thus, both the ratio are equal.

(b) Given : $3 : 5 = \frac{3}{5}$ and $4 : 5 = \frac{4}{5}$

Now we have $\frac{3}{5}$ and $\frac{4}{5}$

The denominators of both the fractions are equal, i.e., 5.

So, we compare their numerators.

As 3 is smaller than 4, so $\frac{3}{5}$ is smaller than $\frac{4}{5}$.

Thus, 3 : 5 < 4 : 5.

(c) Given : 8 : 10 and 6 : 5.

$8 : 10 = \frac{8}{10} = \frac{4}{5}$

and $6 : 5 = \frac{6}{5}$

Denominators of both the fractions are same.

Comparing the numerators, we get 4 < 6.

$\therefore \frac{4}{5} < \frac{6}{5} \quad \Rightarrow 4 : 5 < 6 : 5$

(d) Given : 2 : 3 and 4 : 8

$2 : 3 = \frac{2}{3}$ and $4 : 8 = \frac{4}{8} = \frac{1}{2}.$

Now, we have $\frac{2}{3}$ and $\frac{1}{2}.$

By cross multiplication, we get

$\frac{2}{3} \times \frac{1}{2}$

$2 \times 2 \qquad 1 \times 3$

$4 \qquad 3$

As 4 is greater than 3, so $\frac{2}{3}$ is greater than $\frac{1}{2}$.

Thus, 2 : 3 is greater than 4 : 8.

4. We know that four terms a, b, c, d are said to be in proportion if :
Product of b and c = Product of a and
or Product of means = Product of extremes

(a) We have 3, 5, 4, 6.
Product of means = $5 \times 4 = 20$
Product of extremes = $3 \times 6 = 18$
As product of mean $\uparrow$ product of extremes.
Thus, the given numbers are not in proportion.

(b) We have 4, 5, 8, 10.
Product of means = $5 \times 8 = 40$
Product of extremes = $4 \times 10 = 40$
$\therefore$ Product of means = Product of extremes.
Thus, the given numbers are in proportion.

(c) We have 2.5, 5.2, 2, 4.
Product of means = $5.2 \times 2 = 10.4$
Product of extremes = $2.5 \times 4 = 10.0$
$\therefore$ Product of means $\uparrow$ Product of extremes.
Thus, the given numbers are not in proportion.

(d) We have 2, 4, 3, 6.
Product of means = $4 \times 3 = 12$
Product of extremes = $2 \times 6 = 12$
$\therefore$ Product of means = Product of extremes.
Thus, the given numbers are in proportion.

5. Given: a : b = 2 : 3. It means a = 2 and b = 3.
$\therefore$ $3a + 5b = 3 \times 2 + 5 \times 3 = 6 + 15 = 21$.
and $2a + 3b = 2 \times 2 + 3 \times 3 = 4 + 9 = 13$.
Thus, (3a + 5b) : (2a + 3b) = 21 : 13.

6. (a) We have 3 : 7 :: x : 35
By the proportion rule,
Product of means = Product of extremes.
$\Rightarrow$ $7 \times x = 3 \times 35$
$\Rightarrow$ $x = \frac{3 \times \cancel{35}^{5}}{\cancel{7}_{1}} = 3 \times 5 = 15.$
Thus, the value of x is 15.

(b) We have 5 : 9 :: 45 : x

By the proportion rule,

Product of extremes = Product of means

$\Rightarrow \quad 5 \times x = 45 \times 9$

$\Rightarrow \quad x = \frac{\cancel{45}^{9} \times 9}{\cancel{5}_{1}} = 9 \times 9 = 81.$

Thus, the value of x is 81.

7. Let the required number be x.

Then $4 + x : 5 + x = 5 : 6$

$\Rightarrow \frac{4 + x}{5 + x} = \frac{5}{6}$

$\Rightarrow 6(4 + x) = 5(5 + x)$ [By cross multiplication]

$\Rightarrow 24 + 6x = 25 + 5x$

$\Rightarrow 6x - 5x = 25 - 24$ [By transposition]

$\Rightarrow x = 1$

Thus, the required number to be added is 1.

8. Let the weights of bags of rice be 5x kg, 7x kg and 8x kg.

Then $5x + 7x + 8x = 2000$

$\Rightarrow 20x = 1000$ kg

$\Rightarrow x = 1000 \div 20 = 50$ kg

$\therefore 5x = 5 \times 50 = 250$ kg

$7x = 7 \times 50 = 350$ kg and

$8x = 8 \times 50 = 400$ kg.

Thus, the weights of boys of rice are 250 kg, 350 kg and 400 kg.

9. Let the mean proportion between 16 and 25 be x.

Then we have $16 : x :: x : 25$

$\therefore$ Product of means = Product of extremes

$\Rightarrow x \times x = 16 \times 25$

$\Rightarrow x \times x = 400 = 20 \times 20$

$\Rightarrow x = 20$

Thus, the mean proportion between 16 and 25 is 20.

10. Let the present ages of Sunita and Radha be 7x and 5x respectively.

Then their ages before eight years will be $(7x - 8)$ years and $(5x - 8)$ years.

According to the question.

$\frac{7x - 8}{5x - 8} = \frac{13}{7}$

$\Rightarrow (7x - 8) \times 7 = 13 \times (5x - 8)$

$\Rightarrow 49x - 56 = 65x - 104$

$\Rightarrow 49x - 65x = -104 + 56 \quad \Rightarrow -16x = -48 \quad \Rightarrow x = \frac{-48}{-16} = 3$

$\therefore 7x = 7 \times 3 = 21$ and $5x = 5 \times 3 = 15$.

Thus, the present ages of Sunita is 21 years and that of Radha is 15 years.

Exercise 8.2

1. Quantity of sugar bought for ₹ 585 = 15 kg

   $\therefore$ Quantity of sugar bought for ₹ 1 = $\frac{15}{585}$ kg

   $\therefore$ Quantity of sugar bought for ₹ 975 = $\frac{\cancel{15}^{1} \times \cancel{975}^{25}}{\cancel{585}_{39_1}}$ kg = 25 kg

   Thus, 25 kg of sugar can be bought for ₹ 975.

2. Distance covered by the train in 4 h = 340 km

   $\therefore$ Distance covered by the train in 1 h = $\frac{340}{4}$ km

   $\therefore$ Distance covered by the train in 9 h = $\frac{\cancel{340}^{85} \times 9}{\cancel{4}_1}$ = 85 × 9 = 765 km.

   Hence, the train will cover 765 km in 9 hours.

3. The worker earned Rs. 2760 in 6 days.

   $\therefore$ He earned ₹ 1 in $\frac{6}{2760}$ days

   $\therefore$ He earned ₹ 9200 in $\frac{\cancel{6}^{1} \times 9200}{\cancel{2760}_{460}}$ days = $\frac{\cancel{9200}^{20}}{\cancel{460}_1}$ = 20 days.

   Hence, the worker worked for 20 days.

4. It is a case of inverse variation.
   7 men dig a pond in 45 day
   $\therefore$ 1 man will dig the pond in = (45 × 7) days.

   $\therefore$ 35 men will dig the pond in = $\frac{45 \times \cancel{7}^{1}}{\cancel{35}_5}$ = $\frac{\cancel{45}^{9}}{\cancel{5}_1}$ = 9 days.

   Hence, 35 men will dig the pond in 9 days.

   Proportion Method

No. of men	No. of days
7	45
35	x

   As this case in of inverse variation.
   $\therefore$ 7 : 35 = x : 45
   $\Rightarrow$ 35 × x = 45 × 7 [Product of means = Product of extremes]
   $\Rightarrow$ x = $\frac{45 \times 7}{35}$ = 9.

   Hence, 35 men will dig the pond in 9 days.

5. Wages of 42 labourers per day = ₹ 13650

   $\therefore$ Wage of 1 labour per day = ₹ $\frac{13650}{42}$

$\therefore$ Wages of (42 + 18 = 60) labours = ₹ $\frac{13650 \times 60}{42}$ = ₹ 325 × 60 = ₹ 19,500.

Hence, the total wages of 60 labourers will be ₹ 19,500.

6. Time taken by a tapes of fill the swimming pool = 8 h

$\therefore$ Time taken by 1 tap = (8 × 9) h

$\therefore$ Time taken by 5 tape = $\frac{8 \times 9}{5}$ h = $\frac{8 \times 9 \times \cancel{60}^{12}}{\cancel{5}_{1}}$ min = 72 × 12 = 864 m = 14 h 24 m.

Hence, 5 taps working together will take 14 h 24 min to fill the swimming tool.

7. Reading 15 pages every day, Komal finishes the book in = 20 days.

Reading 1 page every day, she will finish the book in = (20 × 15) days.

Reading 20 pages every day, she will finish the book in = $\frac{\cancel{20} \times 15}{\cancel{20}}$ =15 days.

Hence, Komal will take 15 days to finish the book.

8. 1 dozen = 12 $\therefore$ 4 dozen = 4 × 12 = 48

Cost of 48 bananas = ₹ 160

$\therefore$ Cost of 1 banana = ₹ $\frac{160}{48}$

$\therefore$ Cost of 9 bananas = ₹ $\frac{\cancel{160}^{20} \times 9}{\cancel{48}_{6}}$ = $\frac{\cancel{20}^{10} \times 9}{\cancel{6}_{3}}$ = $\frac{10 \times \cancel{9}^{3}}{\cancel{3}_{1}}$ = ₹ (10 × 3) = ₹ 30.

Hence, the cost of 9 bananas is ₹ 30.

Exercise 8.3

1. To convert a fraction into percentage, multiply the fraction by 100 and put the symbol% at the end. Thus :

(a) $\frac{1}{4} = \left(\frac{1}{4} \times 100\right)\% = 25\%$

(b) $\frac{7}{8} = \left(\frac{7}{8} \times 100\right)\% = \frac{700}{8}\% = 87.5\%$

(c) $3\frac{1}{2} = \frac{7}{2} = \left(\frac{7}{2} \times 100\right)\% = 350\%$

(d) $\frac{17}{40} = \left(\frac{17}{\cancel{40}_{2}} \times \cancel{100}^{5}\right)\% = \frac{85}{2}\% = 42.5\%$

2. To convert a percentage into a fraction, multiply it by $\frac{1}{100}$ and remove the symbol%. Thus :

(a) $16\% = \frac{16}{100} = \frac{4}{25}$.

(b) $12\frac{1}{2}\% = \frac{25}{2}\% = \frac{\cancel{25}^{1}}{2} \times \frac{1}{\cancel{100}_{4}} = \frac{1}{8}$.

(c) $0.04\% = \frac{4}{100}\% = \frac{\cancel{4}}{\cancel{100}_{25}} \times \frac{1}{100} = \frac{1}{2500}$.

(d) $125\% = \cancel{125}^{5} \times \frac{1}{\cancel{100}_{4}} = \frac{5}{4} = 1\frac{1}{4}$.

3. To convert a percentage into a ratio, multiply the number by 100 and remove the symbol%. Thus :

(a) $45\% = \frac{\cancel{45}^{9}}{\cancel{100}_{20}} = \frac{9}{20} = 9 : 20.$

(b) $10\% = \frac{\cancel{10}^{1}}{\cancel{100}_{10}} = \frac{1}{10} = 1 : 10$

(c) $0.75\% = \frac{0.75}{100} = \frac{\cancel{75}^{3}}{\cancel{100}_{4} \times 100} = \frac{3}{400} = 3 : 400.$

(d) $150\% = \frac{150}{100} = \frac{15}{10} = \frac{3}{2} = 3 : 2.$

4. To convert a ratio into a percentage, convert the ratio into a fraction and then proceed as done in Q.1. Thus :

(a) $2 : 3 = \frac{2}{3} = \left(\frac{2}{3} \times 100\right)\% = \frac{200}{3}\% = 66\frac{2}{3}\%.$

(b) $15 : 26 = \left(\frac{15}{\cancel{26}_{13}} \times \cancel{100}^{50}\right) = \frac{750}{13}\% = 57\frac{9}{13}\%.$

(c) $8 : 5 = \left(\frac{8}{\cancel{5}_{1}} \times \cancel{100}^{20}\right)\% = 160\%.$

(d) $7 : 15 = \left(\frac{7}{15} \times 100\right)\% = \frac{\cancel{700}^{140}}{\cancel{15}_{3}} = \frac{140}{3}\% = 46\frac{2}{3}\%.$

5. To convert a decimal into a percentage, multiply it by 100 and place the symbol% at the end. Thus :

(a) $0.5 = (0.5 \times 100)\% = 50\%$

(b) $0.36 = (0.36 \times 100)\% = 36\%$

(c) $0.004 = (0.004 \times 100)\% = 0.4\%$

(d) $2.5 = (2.5 \times 100)\% = 250\%$

6. To convert a percentage into a decimal, divide the number by 100 and remove the symbol%. Thus :

(a) $22\% = \frac{22}{100} = 0.22.$

(b) $4.5\% = \frac{4.5}{100} = 0.045.$

(c) $105\% = \frac{105}{100} = 1.05.$

(d) $0.12\% = \frac{0.12}{100} = 0.0012.$

7. (a) $15\% \text{ of } 400 = \frac{15}{\cancel{100}_{1}} \times \cancel{400}^{4} = 15 \times 4 = 60.$

(b) $2.6\% \text{ of } 8 = \frac{2.6}{\cancel{100}_{25}} \times \cancel{8}^{2} = \frac{5.2}{25} = 0.208.$

(c) $0.5\%\text{ of }75 = \frac{0.5}{\cancel{100}_4} \times \cancel{75}^3 = \frac{0.5 \times 3}{4} = \frac{1.5}{4} = 0.375.$

(d) $15\frac{1}{4}\%\text{ of }250 = \frac{61}{4}\%\text{ of }250 = \frac{61}{\cancel{400}_8} \times \cancel{250}^5 = \frac{61 \times 5}{8} = \frac{305}{8} = 38.125.$

8. (a) $50\%\text{ of } ₹\,360 = ₹\ \frac{\cancel{50}^1}{\cancel{100}_2} \times 360 = ₹\ \frac{360}{2} = ₹\,180.$

(b) $2.4\%\text{ of }6\text{ kg} = \frac{2.4}{100} \times 6\text{ kg} = \frac{2.4}{100 \times 10} \times 6\text{ kg} = \frac{144}{1000} = 0.144\text{ kg}.$

(c) $20\%\text{ of }16\text{ litres} = \frac{\cancel{20}^1}{\cancel{100}_5} \times 16\text{ litres} = \frac{16}{5}\text{litres} = 3.2\text{ litres}.$

(d) $0.5\%\text{ of }6\text{ hours} = \frac{0.5}{100} \times 6\text{ hours} = \frac{\cancel{5}^1}{\cancel{100}_{20} \times 10} \times 6\text{ hours} = \frac{6}{200}\text{hours} = 0.03\text{ hours}.$

9. (a) Let x% of 70 is 700.

Then $\frac{x}{100} \times 70 = 700.$

$70\,x = 700 \times 100$

$x = \frac{\cancel{700}^{10} \times 100}{\cancel{70}_1}\% = 1000\%.$

Hence, 1000% of 70 is 700.

(b) Let x% of ₹ 25 is ₹ 25.

Then $\frac{x}{100} \times 25 = ₹\,25$

$x = \frac{\cancel{25} \times 100}{\cancel{25}}\% = 100\%$

Hence, 100% of ₹ 25 is ₹ 25.

(c) Let x% of 6 hours is 1 day.

Then $\frac{x}{100} \times 6 = 24$ [1 day = 24 hours]

$x = \frac{\cancel{24}^4 \times 100}{\cancel{6}_1}\% = 400\%$

Hence, 400% of 6 hours in 1 day.

(d) Let x% of 250g is 2.5 kg.

Then $\frac{x}{100} \times 250 = 2.5\text{ kg}$

$x = \frac{2.5 \times 100}{250} = \frac{2.5 \times 1000 \times 100}{250} = \frac{\cancel{2500}^{10} \times 100}{\cancel{250}_1} = 1000\%.$

10. (a) Let the required number be x.

Then 15% of x = 75

$$\frac{15}{100} \times x = 75$$

$$\Rightarrow x = \frac{\cancel{75}^{5} \times 100}{\cancel{15}_{1}} = 5 \times 100 = 500.$$

Hence, the required number is 500.

(b) Let the required number be x.

Then 1.2% of x = 240.

$$\Rightarrow \frac{1.2}{100} \times x = 240$$

$$\Rightarrow \frac{12}{1000} \times x = 240$$

$$\Rightarrow x = \frac{\cancel{240}^{20} \times 1000}{\cancel{12}_{1}} = 20 \times 1000 = 20000.$$

(c) Let the required number be x.

Then $6\frac{1}{2}\%$ of x = 4

$$\Rightarrow \frac{13}{2}\% \text{ of } x = 4$$

$$\Rightarrow \frac{13}{200} \times x = 4$$

$$\Rightarrow 13x = 4 \times 200$$

$$\Rightarrow x = \frac{800}{13} = 61.54.$$

Hence, the required number is 61.54.

(d) Let the required number be x.

Then 12.5% of x = 500.

$$\frac{12.5}{100} \times x = 500$$

$$\frac{125}{1000} \times x = 500$$

$$x = \frac{\cancel{500}^{4} \times 1000}{\cancel{125}_{1}} = 4 \times 1000 = 4{,}000.$$

Hence, the required number is 4,000.

11. 25% of ₹ 80 = ₹ $\frac{80 \times \cancel{25}^{1}}{\cancel{100}_{4}}$ = ₹ $\frac{\cancel{80}^{20}}{\cancel{4}_{1}}$ = ₹ 20

Now ₹ 80 – ₹ 20 = ₹ 60.

Thus, the required amount is ₹ 60.

12. Total number of apples in the box = 224.

Number of rotten apples = 25% of 224.

$= \frac{\cancel{25}^{1}}{\cancel{100}_{4}} \times 224 = \frac{224}{4} = 56$ apples

Number of good apples = 224 – 56 = 168 apples.
Thus, there are 168 apples in good condition.

13. Given : Students who passed = 95%
$\therefore$ Percentage of failed students = 100 – 95 = 5%
Number of failed students = 40
$\because$ 5% of the students = 40

$\therefore$ 100% of the students = $\frac{\cancel{40}^{8} \times 100}{\cancel{5}_{1}} = 800.$

14. Let the original price of the TV is ₹ x.

Then 20% of x = $\frac{20x}{100} = \frac{x}{5}$

According to the question,

$x + \frac{x}{5} = 2400$

$\Rightarrow \frac{5x + x}{5} = 2400$

$\Rightarrow 6x = 2400 \times 5$

$\Rightarrow x = \frac{2400 \times 5}{6} = 400 \times 5 = 2000.$

Hence, the original price of the TV is ₹ 2000.

15. Percentage of marks scored by Sajid = $\frac{\cancel{450}^{90} \times \cancel{100}^{1}}{\cancel{500}_{5}} = 90\%$

Percentage of marks scored by Rohit = $\frac{810 \times \cancel{100}^{1}}{\cancel{900}_{9}} = \frac{\cancel{810}^{90}}{\cancel{9}_{1}} = 90\%$

Both Sajid and Rohit scored the percentage of marks.
Hence the performance is equal.

16. 1 kg = 1000 g.
Quantity of iron in 1000g of ore = 15% = $\frac{15 \times \cancel{1000}^{10}}{\cancel{100}_{1}}$ g = 15 × 10 = 150g
To get 150g iron, ore needed = 1 kg

$\therefore$ To get 1 g iron, ore needed = $\frac{1000}{150}$

$\therefore$ To get 75 kg iron, ore needed = $\frac{\cancel{1000} \times \cancel{75}^{5} \times 1000}{\cancel{150}_{1}} = 500 \times 1000$ g = $\frac{500 \times \cancel{1000}}{\cancel{1000}}$ kg
= 500 kg.
Hence, 500 kg ore is needed to get 75 kg of iron.

17. **Given** : Population of a city = 3,45,000

$\therefore$ Number of females in the city = 45% of 3,45,000 = $\frac{45}{100} \times 3,45,000 = 1,55,250$

$\therefore$ Number of males in the city = 3,45,000 – 1,55,250 = 1,89,750.

Hence, the number of males in the city is 1,89,750.

18. Let the number be 100.

$\therefore$ Increased number = 100 + 20% of 100 = 100 + 20 = 120.

Decreased number = 120 – 20% of 120 = $120 - \frac{\cancel{20}}{\cancel{100}} \times \cancel{120} = 120 - 24 = 96$

As the decreased number is less than 100, so there is 0 decrease.

Decrease = 100 – 96 = 4

Decreased percentage = $\frac{4 \times \cancel{100}}{\cancel{100}}\% = 4\%$

Hence, the decrease percent is 4%.

19. Let the income of Imran be ₹ 100.

Then income of Sushil =₹ 100 – 10% of ₹ 100 = ₹ 100 – ₹ 10 = ₹ 90.

When Sushil's income is ₹ 90, then Imran's income = ₹ 100

When Sushil's income in ₹ 1, then Imran's income = $\frac{100}{90}$

When Sushil's income is ₹ 100, then Imran's income = $\frac{100 \times 100}{90} = ₹\ 111.1.$

Hence, Imran's income is 111.1 – 100 = 11.1% more than Sushil.

20. Let Mr. John's income be ₹ 100.

Then he spend = 70% of ₹ 100 = ₹ 70

He deposits = 10% of ₹ 100 = ₹ 10

Money left with John = ₹ (100 – 80) = ₹ 20.

When ₹ 20 are left with John, his income = ₹ 100

When ₹ 1 is left with him, his income = ₹ $\frac{100}{20}$

When ₹ 25000 are left with him his income = $\frac{\cancel{100}^{5} \times 25000}{\cancel{20}_{1}}$

= ₹ 25,000 × 5 = ₹ 1,25,000.

Hence, John's income is ₹ 1,25,000.

Exercise 8.4

1. (a) CP = SP – profit = ₹ 450 – ₹ 25 = ₹ 425.
   (b) CP = SP – profit = ₹ 3,750 – ₹ 450 = ₹ 3,300.
   (c) CP = SP + loss = ₹ 1,120 + ₹ 120 = ₹ 1,240.
   (d) CP = SP + loss = ₹ 1,000 + ₹ 425 = ₹ 1,425.

2. (a) SP = CP + gain = ₹ 875 + ₹ 50 = ₹ 925.
   (b) SP = CP + gain = ₹ 3,850 + ₹ 250 = ₹ 4100.
   (c) SP = CP – loss = ₹ 430 – ₹ 70 = ₹ 360.
   (d) SP = CP – loss = ₹ 1,000 – ₹ 125 = ₹ 875.

3. Given : CP of a scooter = ₹ 25,800 and money spent of its repairing = ₹ 1,200.

Net CP of the scooter = ₹ 25,800 + ₹ 1,200 = ₹ 27,000.

SP of the scooter = ₹ 26,000.

As SP is smaller than CP, so there is a loss.

Loss = ₹ 27,000 – 26,000 = ₹ 1,000

$\therefore$ Loss% = $\frac{\text{Loss}}{\text{CP}} \times 100 = \left(\frac{1000}{27000} \times 100\right)\% = \frac{100}{27}\% = 3.7\%$

Hence, the required loss percentage is 3.7%

4. Cost of 1 dozen eggs = ₹ 60

Cost of 18 dozen eggs = ₹ (60 × 18) = ₹ 1,080

SP of 1 egg = ₹ 5.50

SP of 216 eggs = ₹ (216 × 5.50) = ₹ 1,188 [$\because$ 18 dozen = 216]

As SP is greater than CP, so there in a gain.

Gain = ₹ 1188 – ₹ 1080 = ₹ 108.

Hence, Akram get a gain up ₹ 108.

5. Given : SP of two computer = ₹ 2,575 each.

Total SP of two computers = ₹ 2,575 × 2 = ₹ 5,150.

Gain of 1 computer = 10% of ₹ 2,575. = ₹ $\frac{10}{100} \times 2575$ = ₹ 257.50

SP of this computer = ₹ 2,757 + ₹ 257.50 = ₹ 2,832.50.

Loss of another computer = 10% of 2,575 = ₹ 257.50.

SP of this computer = ₹ 2575 – 257.50 = 2317.50.

SP of the computers = ₹ 2832.50 + ₹ 2317.50 = 5150.

Hence, Mudit neither gets = profit nor any loss in the whole transaction.

6. Let CP of the motorcycle be ₹ 100.

Then its price paid by Kaushal = ₹ 100 + 10% of ₹ 100. = ₹ 100 + ₹ 10 = ₹ 110.

Price of the Motorcycle paid by Vikash = 5% of ₹ 110 + ₹ 110 = ₹ 5.50 + 110 = 115.50

When Vikash paid ₹ 115.50 for motorcyle, then its CP = ₹ 100.

When Vikash paid ₹ 1 for motorcycle, then its CP = ₹ $\frac{100}{115.50}$

When Vikash paid ₹ 15750 for motorcycle, then its CP = ₹ $\frac{100 \times 15750}{115.50}$ = ₹ 13636.36.

Hence, Saurabh purchased motorcycle for ₹ 13636.36.

7. Let the CP of the TV be ₹ x

Then profit at 10% = ₹ $\frac{10x}{100}$ = ₹ $\frac{x}{10}$

Profit at 15% = ₹ $\frac{15x}{100} = \frac{3x}{20}$

Difference = $\frac{3x}{20} - \frac{x}{10} = 120.$

$\Rightarrow \frac{3x - 2x}{20} = 120.$

$\Rightarrow$ x = 120 × 20 = 2400.

Hence, CP of the TV is ₹ 2400.

8. Let CP of 1 pen be ₹ 1. Then CP of 15 pen = ₹ 15.

$\therefore$ SP of 10 pen = CP of 15 pen = ₹ 15

SP of 1 pen = ₹ 1.5

As SP > CP, so there is a profit.

Profit = ₹ 1.5 – ₹ 1 = ₹ 0.50.

$$\text{Profit percentage} = \frac{\text{Profit}}{\text{CP}} \times 100 = \frac{0.50 \times 100}{1}\% = \frac{50}{1}\% = 50\%$$

Hence, the gain percentage is 50%.

9. Given : SP = ₹ 4500 and gain = 5%.

$$\therefore \text{CP} = \frac{100}{100 + \text{gain}\%} \times \text{SP} = ₹\ \frac{100}{100 + 5} \times 4500 = ₹\ \frac{450000}{105} = ₹\ 4285.71.$$

Required gain = 10%

$$\therefore \text{SP} = \frac{100 + \text{gain}\%}{100} \times \text{CP} = ₹\ \frac{100 + 10}{100} \times 4285.71 = ₹\ \frac{110}{100} \times 4285.71 = ₹\ 4714.28$$

Hence, Shubham should sell the mobile for ₹ 4714.28.

10. Cost of 1 kg apples = ₹ 50.

$\therefore$ Cost of 25 kg apples = ₹ 50 × 25 = ₹ 1250.

Good apples = Total apples – Rotten apples = 25 kg – 2 kg = 23 Kg.

Required gain = 10%

$\therefore$ SP of apples = ₹ 1250 + 10% of ₹ 1250 = ₹ 1250 + ₹ 125 = ₹ 1375.

$\therefore$ SP of 1 kg apples = ₹ 1375 ÷ 23 = ₹ 59.78 = ₹ 60.

Hence, the fruit seller should sell the apples for ₹ 60 per kg.

Exercise 8.5

1. (a) $\text{Simple interest} = \frac{\text{Principal} \times \text{Rate} \times \text{Time}}{100} = ₹\ \frac{3700 \times 8 \times 3}{100} = ₹\ 37 \times 8 \times 3 = ₹\ 888.$

Amount = Principal + Simple Interest = ₹ ₹3700 + ₹ 888 = ₹ 4588.

(b) $\text{Simple Interest} = \frac{\text{Principal} \times \text{Rate} \times \text{Time}}{100} = ₹\ \frac{9575 \times 12.5 \times 5}{100} = ₹\ \frac{9575 \times \cancel{125}^{5} \times \cancel{5}^{1}}{\cancel{100}_{4} \times \cancel{10}_{2}}$

$= ₹\ \frac{9575 \times 5}{8} = ₹\ 5984.38.$

Amount = Principal + Simple Interest = ₹ 9575 + ₹ 5984.38 = ₹ 15559.38

(c) Similar work to be done as (b).

(d) $\text{Simple Interest} = \frac{\text{Principal} \times \text{Rate} \times \text{Time}}{100} = ₹\ \frac{\cancel{1000} \times 25 \times 1}{\cancel{100} \times 2 \times 2}$

$= ₹\ \frac{\cancel{10}^{5} \times 25}{\cancel{4}_{2}} = ₹\ \frac{125}{2} = ₹\ 62\frac{1}{2} = ₹\ 62.50.$

Amount = Principal + Simple Interest = ₹ 10000 + ₹ 62.50 = ₹ 10062.50.

(e) Similar work to be done as (d)

2. (a) $\text{Rate} = \dfrac{\text{Interest} \times 100}{\text{Principal} \times \text{Time}} = \dfrac{525 \times \cancel{100}}{\cancel{5000} \times \frac{9}{2}} = \dfrac{525 \times \cancel{2}^{1}}{\cancel{50}_{25} \times 9} = \dfrac{\cancel{525}^{21}}{\cancel{25}_{1} \times 9} = \dfrac{\cancel{21}^{7}}{\cancel{9}_{3}} = \dfrac{7}{3} = 2\dfrac{1}{3}\%$.

(b) $\text{Rate} = \dfrac{\text{Interest} \times 100}{\text{Principal} \times \text{Time}} = \dfrac{68 \times \cancel{100}^{10}}{3400 \times \cancel{10}_{1}} = \dfrac{\cancel{680}}{\cancel{3400}} = \dfrac{\cancel{68}^{2}}{\cancel{340}_{10}} = \dfrac{2}{10} = 0.2\%$.

(c) $\text{Rate} = \dfrac{\text{Interest} \times 100}{\text{Principal} \times \text{Time}} = \dfrac{125 \times 100}{975 \times \frac{9}{2}}$ [4 year 6 months = $\dfrac{9}{2}$ years]

$= \dfrac{\cancel{125}^{5} \times 100 \times 2}{\cancel{975}_{39} \times 9} = \dfrac{1000}{351} = 2.85\%$

3 (a) $\text{Time} = \dfrac{\text{Interest} \times 100}{\text{Principal} \times \text{Rate}} = \dfrac{450 \times \cancel{100}}{\cancel{8500} \times 6.25} = \dfrac{\cancel{450}^{18} \times \cancel{100}^{4}}{85 \times \cancel{625}_{25_1}}$

$= \dfrac{18 \times 4}{85} = \dfrac{72}{85} = 0.85$ years $= 10$ months

(b) $\text{Time} = \dfrac{\text{Interest} \times 100}{\text{Principal} \times \text{Rate}} = \dfrac{\cancel{55}^{11} \times 100}{\cancel{875}_{175} \times \cancel{11}} = \dfrac{\cancel{100}^{4}}{\cancel{175}_{7}} = \dfrac{4}{7}$ years.

4 $\text{Principal} = \dfrac{\text{Interest} \times 100}{\text{Time} \times \text{Rate}} = ₹\dfrac{1525 \times \cancel{100}^{2}}{\cancel{5} \times \cancel{10}} = ₹\ 3050.$

Hence, the required sum of money is ₹ 3050.

9 Lines and Angles

Exercise 9.1

1. Complement of
   (a) $65° = 90° - 65° = 25°$
   (b) $37° = 90° - 37° = 53°$
   (c) $0° = 90° - 0° = 90°$
   (d) $89° = 90° - 89° = 1°$
   (e) $15° = 90° - 15° = 75°$

2. Supplement of
   (a) $91° = 180° - 91° = 89°$
   (b) $22° = 180° - 22° = 158°$
   (c) $105° = 180° - 105° = 75°$
   (d) $179° = 180° - 179° = 1°$
   (e) $100° = 180° - 100° = 80$

3. (a) Complement
   (b) Supplement
   (c) Supplement
   (d) Complement
   (e) Complement

4. Let the required angle be x. Then its double $= 2x$

   According to the question:

   $x + 2x = 90° \Rightarrow 3x = 90° \Rightarrow x = 90° \div 3 = 30°$

Hence, the required angle is $2x = 2 \times 30° = 60°$.

5. (a) Required angle = $90° \div 2 = 45°$ (b) Required angle = $180° \div 2 = 90°$

6. Let one of the supplementary angles be x.

   Then other angle = $x + 42°$

   According to the question:

   $x + x + 42° = 180° \Rightarrow 2x = 180° - 42° = 138° \Rightarrow x = 138° \div 2 = 69°$

   Hence, the required angles are 69° and $69° + 42° = 111°$.

7. See the **Answers** given in the book.

8. (a) Value of $x = 180° - 30° = 150°$

   (b) Value of $x = 180° - (40° + 22°) = 180° - 62° = 118°$.

   (c) $2x + 2x + 20° + 4x + 100° = 360°$

   $\Rightarrow 8x + 120° = 360°$

   $\Rightarrow 8x = 360° - 120 = 240°$

   $\Rightarrow x = 240° \div 8 = 30°$

   Hence, the value of x is 30°.

   (d) $4x + x + x + 90° = 360°$

   $\Rightarrow 6x + 90° = 360° = 270°$

   $\Rightarrow x = 270° \div 6 = 45°$

   Hence, the value of x is 45°.

9. Let the angles be $2x$ and $3x$.

   Then $2x + 3x = 180°$

   $\Rightarrow 5x = 180°$

   $\Rightarrow x = 180° \div 5 = 36°$

   Hence, the value of x is 36°.

10. Let of the supplementary angles be x.

    Then the other angle $2x + 3x = 180°$

    $\Rightarrow 5x = 180°$

    $\Rightarrow x = 180° \div 5 = 36°$

    Hence, the value of x is 36°.

Exercise 9.2

1. See the **Answers** given in the book.

2. See the **Answers** given in the book.

3. (a) $\angle PQR = \angle LOR = 65°$ [Alternate angles]

   (b) $\angle LMN = \angle PQR = 65°$ [Alternate angles]

   (c) $\angle MOR = \angle LQR = 65°$ [Corresponding angles]

4. (a) $\angle 2 = \angle 3 = 45°$ [Vertically opposite angles]

   $\angle 1 + \angle 2 = 180°$ [Linear pair]

$\angle 1 + 45° = 180°$

$\angle 1 + 45° = 180° - 45° = 135°$.

$\angle 4 = \angle 1 = 135°$ [Vertically opposite angles]

$\angle 5 = \angle 1 = 135°$ [Corresponding angles]

$\angle 6 = \angle 2 = 45°$ [Corresponding angles]

$\angle 7 = \angle 6 = 45°$ [Vertically opposite angles]

$\angle 8 = \angle 5 = 135°$ [Vertically opposite angles]

5. $8x + 7x = 180°$ [Linear pair]

$\Rightarrow 15x = 180°$

$\Rightarrow x = 180° \div 15 = 12°$

$8x = 8 \times 12 = 96°$ and $7x = 7 \times 12 = 84°$

Now, $\angle 2 = 7x = 84°$ [Vertically opposite angles]

$\angle 1 = 8x = 96°$ [Vertically opposite angles]

5. We know that angles on the same side of a transversal are supplementary.

$x - 3 + 3x - 5 = 180°$

$\Rightarrow 4x - 8 = 180°$

$\Rightarrow 4x = 180° + 8° = 188°$

$\Rightarrow x = 188° \div 4 = 47°$

$x - 3 = 47 - 3 = 44°$ and $4x - 5 = 141 - 5 = 136°$

Hence, the angles are 44° and 136°.

7. Let the angles be x and $2x$.

Then $x + 2x = 180°$ [Linear pair]

$\Rightarrow 3x = 180°$

$\Rightarrow x = 180° \div 3 = 60°$

Hence, the angles are 60° and 120°.

8. From the given figure,

$\angle ARS = \angle BAQ = 30°$ [Corresponding angles]

$\angle x + = 30°$

Also, $\angle PQA = \angle QAB = 30°$ [Alternate angles]

Hence, the values of x and y are 30° and 30°.

9. From the given figure,

$x + y = 180°$

$\Rightarrow 2y + y = 180°$

$\Rightarrow 3y = 180°$

$\Rightarrow y = 180° \div 3 = 60°$

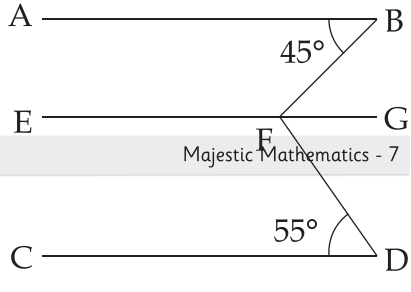
$x = 2 \times 60° = 120°$.

Hence, the values of $\angle x$ and $\angle y$ are respectively 120° and 60°.

10. See the **Answers** given in the book.

Revision Exercise

1. Similar work to be done as Q 1 of Exercise 9.1
2. Similar work to be done as Q 2 of Exercise 9.1
3. As the angle is less than 45°, its complement will be greater than 45°.
4. See the **Answers** given in the book.
5. Let one angle be x, then its complement will be $2x$.
   $x + 2x = 90°$ $\Rightarrow 3x = 90°$ $\Rightarrow x = 90° \div 3 = 30°$
   Hence, the angles are 30° and 60°.
6. Let one angle be x, then its supplement will be $5x$.
   $x + 5x = 180°$ $\Rightarrow 6x = 180°$ $\Rightarrow x = 180° \div 6 = 30°$
   Hence, the angles are 30° and 150°.
7. (a) $5x + 13x = 180°$ [Linear pair]
   $\Rightarrow 18x = 180°$
   $\Rightarrow x = 180° \div 18 = 10°$
   $\therefore$ $5x = 5 \times 10° = 50°$ and $13x = 13 \times 10° = 130°$.
   (b) $78° + x = 180°$ [Angles on the same side of transversal]
   $\Rightarrow x = 180° - 78° = 102°$.
   (c) Here, angle opposite to $2x$ is equal to $2x$.
   $\therefore$ $3x + 2x + 4x = 180°$ [Angles on the same side of the transversal]
   $\Rightarrow 9x = 180°$ $\Rightarrow x = 180° \div 9 = 20°$.
   $\therefore$ $3x = 3 \times 20° = 60°$, $2x = 2 \times 20° = 40°$ and $4x = 4 \times 20° = 80°$
8. See the **Answers** given in the book.
9. From the given figure,
   $\angle 1 = \angle C = 50°$ [Alternate angles]
   $\angle 6 = \angle A = 55°$ [Alternate angles]
   Now, $\angle 1 + \angle A + \angle 2 = 180°$ [Angle sum property of a triangle]
   $\Rightarrow 50° + 55° + \angle 2 = 180°$
   $\Rightarrow \angle 2 = 180° - 105° = 75°$
   $\angle 4 = \angle 2 = 75°$ [Opposite angles]
   Now, $\angle 2 + \angle 5 = 180°$ [Linear pair]
   $\angle 5 = 180° - 75° = 105°$ [Linear pair]
   $\angle 3 = \angle 5 = 105°$ [Opposite angles]
10. In the given figure, we produce EF to G.
    $\angle BFG = \angle ABF$ [Alternate angles]
    $\angle BFG = = 45°$



Now, $\angle DFG = \angle CDF$ [Alternate angles]

$\angle\angle DFG = 55°$

$\angle BFD = \angle BFG + \angle DFG = 45° + 55° = 100°$

11. See the **Answers** given in the book.

Multiple Choice Questions

1. The sum of linear pair angles is 180°. Hence, the correct option is (b).
2. If one angle of the linear pair decreases, the other angle will increase. Hence, the correct option is (b).
3. If the sum of an angle and half of its complement is 65°, then the angle is 40°. Hence, the correct option is (d).
4. Let the angles be $4x$ and $5x$. Then $4x + 5x = 90°$, i.e., $9x = 90°$.

   $x = 10°$

   $\therefore \quad 5x = 5 \times 10° = 50°$ and $4x = 4 \times 10° = 40°$.

   Hence, the correct option is (b).
5. Two intersecting lines have only one point in common. Hence, the correct option is (c).
6. For two given lines, infinite transversals can be drawn Hence, the correct option is (a).

Mental Maths

A. See the **Answers** given in the book.

B. See the **Answers** given in the book.

Higher Order Thinking Skills (HOTS)

A. See the **Answers** given in the book.

B. We know that the sum of complementary angles is 90°.

$\therefore \quad x - 12° + x + 4° = 90°$

$\Rightarrow \quad 2x = 4 \times 10° = 90° + 8 = 98°$

$\Rightarrow \quad x = 98° \div 2 = 49°$

$\Rightarrow \quad x - 12 = 49 - 12 = 37°$ and $x + 4 = 49° + 4° = 53°$

C. We know that the sum of complementary angles is 90°.

$\angle A + \angle B = 90°$

$\angle B = 90° - 50° = 40°$.

Now, $\angle A + \angle C = 180°$

$\angle C = 180° - 40° = 140°$.

D. We know that the corresponding angles are equal.

$\therefore \angle 1 = \angle 2$

$\Rightarrow 4x - 13° = x + 23°$

$\Rightarrow 4x - x = 23° + 13° = 36°$

$\Rightarrow x = 36° \div 3 = 12°$

$\therefore \angle 1 = 4x - 13° = 48° - 13° = 35°$.

and $\angle 2 = x + 23° = 12° + 23° = 35°$.

10 Triangles and Their Properties

Exercise 10.1

1. By angle sum property of a triangle:

   (a) $\angle P + \angle Q + \angle R = 180°$
   $62° + 72° + \angle R = 180°$
   $\angle R = 180° - 134° = 46°$

   (b) $\angle P + \angle Q + \angle R = 180°$
   $50° + 102° + \angle R = 180°$
   $\angle R = 180° - 152° = 28°$

   (c) Similar work to be done.

2. Let one angles of the triangle be $3x$, $4x$ and $5x$. Then by angle sum property of a triangle:
   $3x + 4x + 5x = 180°$
   $12x = 180° \quad \Rightarrow x = 180° \div 12 = 15°$
   $3x = 3 \times 15 = 45°$, $4x = 4 \times 15 = 60°$ and $5x = 5 \times 15 = 75°$.
   Hence, the angles of the triangle are 45°, 60° and 75°.

3. Let the third angle of the triangle be x. Then by angle sum property of a triangle:
   $34° + 34° + x = 180°$
   $\Rightarrow x = 180° - 64° = 116.$
   Hence, the measures of other angles are 34° and 116°.

4. Let the third angle of the right-angled triangle be x.
   Then $90° + 25° + x = 180°$ [By angle sum property of a triangle]
   $\Rightarrow x = 180° - 115° = 65°$
   Hence, the measure of other angle is 65°.

5. Let each of the equal angles of the right-angled triangle be x.
   Then $90° + x + x = 180°$ [By angle sum property of a triangle]
   $\Rightarrow 2x = 180° - 90° = 90°$
   $\Rightarrow x = 90° \div 2 = 45°.$
   Hence, each of the angles is 45°. The triangle is isosceles right triangle.

6. Let each of the equal angles of the isosceles triangle be x.
   Then its third angle will be $2x$.
   Now, $2x + x + x = 180°$ [By angle sum property of a triangle]
   $\Rightarrow 4x = 180°$
   $\Rightarrow x = 180° \div 4 = 45°.$
   Hence, angles of the triangle are 90°, 45° and 45°.

7. By angle sum property of a triangle:
   $\angle A + \angle B + \angle C = 180°$
   $\Rightarrow \angle A + \angle A + \angle A = 180°$ [Given $\angle A + \angle B + \angle C$]

$\Rightarrow 3\angle A = 180°$

$\Rightarrow \angle A = 180° \div 3 = 60°$

Hence, angles of the triangle are 60° each.

8. See the **Answers** given in the book.

9. (a) $\angle R = 180° - \angle Q + \angle P = 180° - (60° + 50°) = 180° - 110° = 70°$.

   (b) $\angle PST = \angle PQR = 60°$. [Corresponding angles]

   (c) $\angle PTS = \angle PRQ = 70°$. [Corresponding angles]

   (d) $\angle QST = 180° - \angle PST$ [Linear pair]

   $= 180° - 60° = 120°$.

10. We know that exterior angle is equal to sum of interior opposite angles.

   (a) $\angle x = 65° + 55° = 120°$

   (b) $\angle x = 60° + [180° - (60° + 45°)] = 60° + 75° = 135°$

   (c) $\angle x = 120° - (180° - 105°) = 120° - 75° = 45°$

Exercise 10.2

1. (a) Here, $30^2 = 900$, $18^2 = 324$ and $24^2 = 576$.

   As $324 + 576 = 900$, so these are sides of a right-angled triangle.

   (b) Here, $25^2 = 625$, $9^2 = 81$ and $17^2 = 279$

   $289 + 81 = 370 \neq 625$.

   Hence, the given sides are not the sides of a right-angled triangle.

   (c) Similar work to be done.

   (d) Similar work to be done.

2. (a) Here, 6 cm + 8 cm = 14 cm > 5 cm,

   6 cm + 5 cm = 11 cm > 8 cm

   and 8 cm + 5 cm = 13 cm > 6 cm

   In all the three cases, the sum of two sides is greater than the third side.

   Hence, the given sides can be the sides of a triangle.

   (b) Here, 3.5 cm + 9.5 cm = 13 cm > 5.5 cm,

   3.5 cm + 5.5 cm = 9 cm < 9.5 cm

   and 9.5 cm + 5.5 cm = 15 cm > 3.5 cm

   In one case, the sum of two sides is smaller than the third side.

   Hence, the given sides cannot be the sides of a triangle.

   (c) Similar work to be done.

   (d) Similar work to be done.

3. (a) Here, $15^2 = 225$, $36^2 = 1296$ and $39^2 = 1521$

   $225 + 1296 = 1521 = 1521$.

   Hence, the given numbers form Pythagorean triplets.

(b) Here, $5^2 = 25$, $10^2 = 100$ and $18^2 = 324$

$25 + 100 = 125 \neq 324$.

Hence, the given numbers do not form Pythagorean triplets.

(c) Here, $12^2 = 144$, $13^2 = 169$ and $15^2 = 225$

$144 + 169 = 313 \neq 225$.

Hence, the given numbers do not form Pythagorean triplets.

(d) Similar work to be done.

4. From the given figure, in right ΔPRQ,

$QR^2 = PQ^2 - PR^2 = (13\text{ cm})^2 - (12\text{ cm})^2 = 169\text{ cm}^2 - 144\text{ cm}^2 = 25\text{ cm}^2 = (5\text{ cm})^2$

$\therefore$ QR = 5 cm

Now, in right ΔPRS,

$SR^2 = PS^2 - PR^2 = (15\text{ cm})^2 - (12\text{ cm})^2 = 225\text{ cm}^2 - 144\text{ cm}^2 = 81\text{ cm}^2 = (9\text{ cm})^2$

$\therefore$ SR = 9 cm

$\therefore$ QS = QR + SR = 5 cm + 9 cm = 14 cm.

5. From the given figure, in right ΔABC,

$AC^2 = AB^2 + BC^2 = AB^2 + AB^2$ [Given, AB = AC]

$AC^2 = 2AB^2$ or $AB = \frac{1}{2} AC^2$

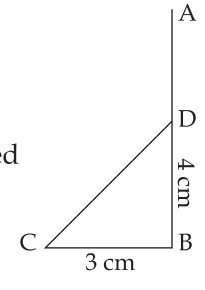
Hence, proved.

6. $(\text{Longest side})^2 = (6\text{ cm})^2 + (4.5\text{ cm})^2 = 36\text{ cm}^2 + 20.25\text{ cm}^2 = (56.25\text{ cm})^2$

Length of the longest side = 7.5 cm

Hence, the length of the longest side is 7.5 cm.

7. In the given figure, AB is the tree which broke down from D and touched the ground at C. Here, AD = CD. From right ΔCBD,



$(CD)^2 = (CB)^2 + (BD)^2$

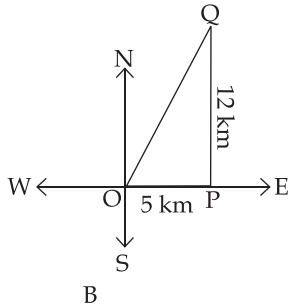
$=(3\text{ cm})^2 + (4\text{ cm})^2$

$= 9\text{ cm}^2 + 16\text{ cm}^2 = 25\text{ cm}^2 = (5\text{ cm})^2$

CD = 5 cm

Original height of the tree AD + BD = 5 cm + 4 cm = 9 cm.

8. From the figure, let Sundaram starts from O. From right ΔCBD,



$(OQ)^2 = (OP)^2 + (PQ)^2$

$=(5\text{ km})^2 + (12\text{ km})^2$

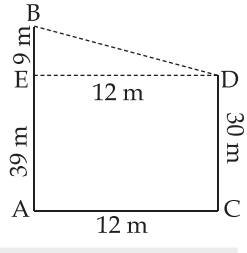
$= 25\text{ km}^2 + 144\text{ km}^2 = 169\text{ km}^2 = (13\text{ km})^2$

OQ = 13 km

Hence, Sundaram is 13 km from the initial point.

9. In the figure, let AB and CD are two towers.

Then DE = 12 m [By construction]



From right ΔBED,

$(BD)^2 = (BE)^2 + (ED)^2$ [By Pythagoras theorem]

$= (9\text{ m})^2 + (12\text{ m})^2$

$= 81\text{ m}^2 + 144\text{ m}^2 = 169\text{ m}^2 = (13\text{ m})^2$

$\Rightarrow$ BD = 13 m

Hence, the distance between the tops of the towers is 13 m.

10. Let ABCD be the rectangular park with one side Ab = 36 cm and diagonal AC = 39 cm.

Then from right ΔABC,

$(BC)^2 = (AC)^2 - (AB)^2$ [By Pythagoras theorem]

$= (39\text{ cm})^2 - (36\text{ cm})^2 = 1521\text{ cm}^2 - 1296\text{ cm}^2 = 225\text{ cm}^2 = (15\text{ cm})^2$

$\Rightarrow$ BC = 13 cm

Perimeter of the park = 2(length + breadth) = 2(36 cm + 15 cm) = 2 × 51 cm = 102 cm.

Hence, the perimeter of the rectangular park is 102 cm.

Revision Exercise

1. By angle sum property of a triangle:
   (a) One of the given angles is obtuse angle. So, the triangle is an obtuse-angled triangle.
   (b) All the angles are acute angles. So, the triangle is an acute-angled triangle.
   (c) One of the given angles is right angle and other angles are equal. So, the triangle is an isosceles right-angled triangle.
   (d) One of the given angles is right angle and other angles are acute angles. So, the triangle is a right-angled triangle.
2. Let the angles a and b be $2x$ and $3x$.

   Then $2x + 3x = 130°$ [Exterior angle is equal to sum of interior opposite angles.]

   $5x = 130° \Rightarrow x = 130° \div 5 = 26°$

   $2x = 2 \times 26° = 52°$ and $3x = 3 \times 26° = 78°$

   Hence, $\angle A = 52°$, $\angle B = 78°$ and $\angle C = 180° - (52° + 78°) = 180° - 130° = 50°$.
3. Let $\angle PRO$ be x. Then according to question, $\angle Q = 2x$ and $\angle P = 2x$.

   $\angle Q + \angle P + \angle R = 180°$ [Angle sum property of a triangle]

   $\Rightarrow 2x + 2x + x = 180° \Rightarrow 5x = 180° \Rightarrow x = 180° \div 5 = 36°$.

   $2x = 2 \times 36° = 72°$

   $\therefore \angle PRS = \angle P + \angle Q$ [Exterior angle is equal to sum of interior opposite angles.]

   $= 2x + 2x = 72° + 72° = 144°$.

   Hence, the measure of $\angle PRS$ is 144°.
4. Let one of the acute angles of the right-angled triangle be x.

   Then its other acute angle will be $x + 14°$.

   $x + 2x + 90° = 180°$ [Angle sum property of a triangle]

   $\Rightarrow 3x = 180° - 90° = 90°$

$\Rightarrow x = 90° \div 3 = 30°$.

Hence, the angles of the triangle are 30°, 60° and 90°.

5. Similar work to be done as Q 2 of Exercise 10.2.
6. Similar work to be done as Q 3 of Exercise 10.2.
7. (a) $\angle RSP = 90°$

   (b) $\angle PRS = 180° - (60° + 90°) = 180° - 150° = 30°$.

   (c) $\angle SRP = 90° - 60° = 30°$

   $\angle RQS = 180° - (90° + 30°) = 60°$.

   (d) $\angle SRQ = 90° - 30° = 60°$
8. (a) $\angle ABC = 110° - 50° = 60°$

   (b) $\angle BCD = \angle ACE = 110°$. [Opposite angles]

   (c) $\angle ECD = 180° - 110° = 70°$ [Linear pair]

   $\angle RQS = 180° - (90° + 30°) = 60°$.
9. $z = 90° - 50° = 40°$

   $y = 180° - 70° = 110°$ [Linear pair]

   (b) $\angle BCD = \angle ACE = 110°$. [Opposite angles]

   (c) $\angle ECD = 180° - 110° = 70°$ [Linear pair]

   $\angle RQS = 180° - (90° + 30°) = 60°$.
10. Let ABCD be the given rhombus with diameters AC = 12 cm BD = 16 cm.

    We know that diagonals of a rhombus bisect each other at right angles.

    From right ΔABO,

    $AB^2 = AO^2 + BO^2$ [By Pythagoras theorem]

    $= (6 \text{ cm})^2 + (8 \text{ cm})^2 = 36 \text{ cm}^2 + 64 \text{ cm}^2 = 100 \text{ cm}^2 = (10 \text{ cm})^2$

    AB = 10 cm

    Perimeter of the rhombus = 4 × side = 4 × 10 cm = 40 cm.

    Hence, the perimeter of the rhombus is 40 cm.

Multiple Choice Questions

1. Sum of the equal angles = 180° – 110° = 70°.

   Each of the equal angles = 70° ÷ 2 = 35°.

   Hence, the correct option is (b).
2. As two sides of the triangle are equal, so it is an isosceles triangle. Hence, the correct option is (c).
3. The correct option is (d).
4. The sum of two sides of a triangle is always greater than its third side. Hence, the correct option is (c).
5. The longest side of right-angled ABC is AC. Hence, the correct option is (c).
6. See the **Answers** given in the book.
7. The legs of an isosceles right-angled triangle are its altitudes. Hence, the correct option is (d).

8. See the **Answers** given in the book.
9. Using Pythagoras theorem, we find second side of the rectangle = 100 cm^2 – 64 cm^2 = 36 cm^2 = 6 cm. Therefore, its perimeter = 2 (8 cm + 6 cm) = 2 × 14 cm = 28 cm. Hence, the correct option is (b).

Mental Maths

A. See **Answers** given in the book.
B. See **Answers** given in the book.
C. See **Answers** given in the book..

Higher Order Thinking Skills (HOTS)

1. The sum of all angels of an equilateral triangle is 3 × 120° = 360°.
2. Let one angle of the triangle be x. Then according to the question,
   $x + 2x + 3x = 180° \Rightarrow 6x = 180° \Rightarrow x = 180° \div 6 = 30°$.
   Hence, the angles of the triangle are 30°, 60° and 90°.
3. Let one of the equal angles of the triangle be x. Then its third angle will be 2x.
   According to the question,
   $x + x + 2x = 180° \Rightarrow 4x = 180° \Rightarrow x = 180° \div 4 = 45°$.
   Hence, the angles of the triangle are 45°, 45° and 90°.
4. Let the smallest angle of the triangle be x. Then its largest angle will be $2x$.
   According to the question,
   $x + \frac{3}{4} \times 2x + 2x = 180°$
   $\Rightarrow 4x + 6x + 8x = 180° \times 4$
   $\Rightarrow 18x = 720° \Rightarrow x = 720° \div 18 = 40°$.
   Hence, the angles of the triangle are 40°, 60° and 80°
5. See **Answers** given in the book.
6. Similar work to be done of Q 3 of this Exercise.

11 Congruence of Triangles

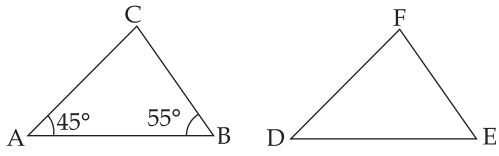
Exercise 11.1

1. (a) Two lines are said to be congruent if their lengths are equal.
   (b) Two angles are said to be congruent if their measures are equal.
   (c) Two squares are said to be congruent if one side of a square is equal to the side of the other square.
   (d) Two circles are said to be congruent if their radii are equal.
   (e) Two rectangles are said to be congruent if their length and breadth are equal.
2. Students will do it themselves.

3. Students will do it themselves.

4. In the given figure, ΔBOD is congruent to ∠AOC.

5. In the given figure, ΔBOD ≅ ΔBOD.
   Their corresponding parts must be equal.
   Thus, the measure of ∠E is 55°.



6. Equilateral triangles ΔBOD and ΔBOD are not congruent because their sides are not equal.

7. (a) ΔBOD is not congruent to ΔBOD, because their sides are of different measures.
   (b) For both the triangles to be congruent, QR should be equal to MN.

Exercise 11.2

1. (a) $\angle E \leftrightarrow \angle E$ (b) $\angle F \leftrightarrow \angle C$ (c) $\overline{DE} \leftrightarrow \overline{AB}$

2. See the **Answers** given in the book.

3. (a) $\angle L = \angle X$ (b) $\overline{MN} = \overline{YZ}$ (c) $\overline{XZ} = \overline{LM}$ (d) $\angle Y = \angle M$

4. (a) True (b) True (c) False (d) True

5. (a) QR = DE (b) QT = DF (c) $\angle T = \angle F$ (d) $\overline{RT} = \overline{EF}$

6. (a) Yes, ΔDEG ≅ ΔDFG
   (b) $\overline{DE} \leftrightarrow \overline{AB}$, $\overline{DE} = \overline{DF}$, $\overline{DG} = \overline{DG}$, $\angle DGE = \angle DGF$
   (c) ΔDEF is an isosceles triangle.

7. Measuring the three angles, we find that they are equal.

8. (a) ΔPQR ≅ ΔACB (b) ΔSPQ ≅ ΔQRS (c) ΔPQR ≅ ΔSRQ

Exercise 11.3

1. See the Answers given in the book.

2. ΔPQR and ΔABC are not congruent because angle-angle-angle (AAA) is not a congruence criterion.

3. See the **Answers** given in the book.

4. (a) From the given figure, in ΔPQR and ΔPSR:
   $\angle PSQ = \angle PSR$ [$\because$ PS ⊥ QR]
   $\angle QPS = \angle RPS$ [PS bisects ∠P]
   PS = PS [Common]
   ΔPSQ ≅ ΔPSR [By ASA congruence condition]
   Hence, proved.
   (b) Yes, QS = RS by CPCT.

5. See the **Answers** given in the book.

6. Given that ΔPQR ≅ ΔXYZ
   (a) XY = PQ = 3.8 cm
   (b) $\angle X = \angle P = 100°$
   (c) $\angle Y = \angle Q = 30°$
   (d) $\angle R = 180° - (100° + 30°) = 180° - 130° + 50°$.
   (e) $\angle Z = \angle R = 50°$.

7. Given that $\Delta PQR \cong \Delta ABC$

$\angle B = \angle Q = 100°$

$\Rightarrow x - 10 = 40°$

$\Rightarrow x = 40° + 10° = 50°$

Also, $\angle R = \angle C$

$\Rightarrow y + 5 = 55°$

$\Rightarrow y = 55° - 5° = 50°$

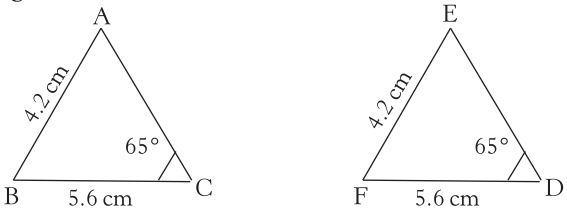
Hence, the values of x and y are respectively 50° and 50°.

Exercise 11.4

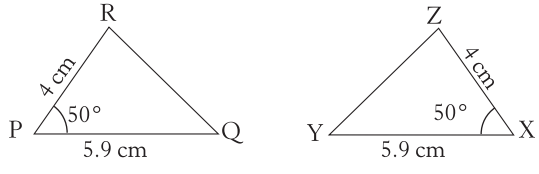
1. (a) Given triangles are not congruent because angles between their sides are not equal

(b) The given triangles are congruent because their sides and included angles are equal.

2. (a) ΔPQR is not congruent to ΔABC because $C \neq F$.



(b) ΔPQR is congruent to ΔXYZ because their corresponding sides and included angles are equal.



3. Yes, $\Delta ADB \cong \Delta ADC$ because

$AB = AC$	[Given]
$\angle B = \angle C$	[Angles opposite to equal sides are equal.]
$AD = AD$	[Common]
Yes AD bisects BC.	[By CPCT]

4. From the figure in $\Delta AOB \cong \Delta DOC$:

$AO = DO$	[Given]
$OB = OC$	[Given]
$\angle AOB = \angle DOC$	[Opposite angles are equal.]
$\Delta AOB \cong \Delta DOC$	[By SAS congruence condition]

Hence, proved.

5. See the **Answers** given in the book.

6. From the figure, in $\Delta ABC \cong \Delta FED$:

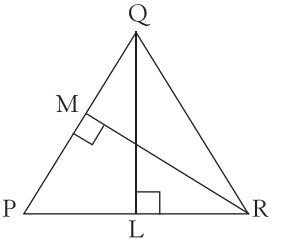
$AB = EF$	[Given]
$\angle A = \angle F$	[Given]
$AD = FC$	[Given]
$DC = DC$	[Common]

$\therefore AC = FD$

$\Delta ABC \cong \Delta FED$ [By SAS congruence condition]
Hence, proved.

Exercise 11.5

1. See the Answers given in the book.
2. To make $\Delta ABC \cong \Delta DEF$, one more side of both the triangles should be equal.
3. From the given figure in $\Delta PSQ \cong \Delta RSQ$:
   $PQ = RQ$ [Given]
   $\angle QSR = \angle QSP$ [$\because QS \perp PR$]
   $QS = QS$ [Common]
   $\therefore \Delta PSQ \cong \Delta RSQ$ [By RHS congruence condition]
   Hence, proved.
4. From the figure in ΔRQL and ΔQRM:
   $QL = RM$ [Given]
   $\angle RQL$ and $\angle QRM$ [Each of 90°]
   $QR = QR$ [Common]
   $\Delta RQL \cong \Delta QRM$ [By SAS congruence condition]
   Hence, proved.



5. From the given figure in $\Delta PNM \cong \Delta QOM$:
   $PM = MQ$ [M is midpoint of PQ.]
   $MN = MO$ [Given]
   $\angle PNM \cong \angle QOM$ [Each of 90°]
   $\Delta PNM \cong \Delta QOM$ [By SAS congruence condition]
   $\therefore PN = OQ$ [By CPCT]
   Also, $MN = OR$ and $NR = MO$ [Opposite sides]
   $\therefore PR = QR$
   Hence, ΔPQR is an isosceles triangle. Proved.

Exercise 11.6

1. See the Answers given in the book.
2. (a) SSS congruence condition (b) SAS congruence condition
3. See the **Answers** given in the book.
4. From the given figure, in $\Delta PRS \cong \Delta PRQ$:
   $\angle SPR = \angle RPQ$ [Given]
   $\angle RPS = \angle PRQ$ [Given]
   $PR = PR$ [Common]
   $\Delta PRS \cong \Delta PRQ$ [By ASA congruence condition]
5. From the given figure, in $\Delta OAB \cong \Delta OCB$:
   $BA = BC$ [Given]
   $\angle BCO = \angle BAO$ [Each of 90°]
   $BO = BO$ [Common]
   $\Delta OAB \cong \Delta OCB$ [By SAS congruence condition]

6. Given that $\Delta PQR \cong \Delta DEF$:

$\angle P = \angle D$

$\Rightarrow x + 20° = 2x - 35°$

$\Rightarrow x - 2x = -35° - 20°$

$\Rightarrow -x = -55°$

$\Rightarrow x = 55°$

Also, $\angle Q = \angle E$

$\frac{y}{2} = 30°$

$\Rightarrow y = 30° \times 2 = 60°$.

Again, $\angle R = \angle F$

$\Rightarrow z + 10° = 140 - z$

$\Rightarrow z + z = 140° - 10° = 130°$

$\Rightarrow z = 130° \div 2 = 65°$

Hence, $x = 55°$, $y = 60°$ and $z = 65°$

7. Yes, $\Delta ABC \cong \Delta DFE$ by RHS congruence condition.

8. From the given figure, in ΔPQS and ΔPRT:

PT = PS	[Given]
PQ = PR	[Equal sides of isosceles triangle]
$\angle QPR = \angle QPR$	[Common]
$\Delta PQS \cong \Delta PRT$	[By SAS congruence condition]
$\therefore$ PQ = PR	[By CPCT]

$\therefore$ QT = RS

Hence, proved.

9. From the given figure in ΔPQR and ΔPSR

PQ = PS	[Given]
QR = SR	[Given]
PR = PR	[Common]
ΔPQR and ΔPSR	[By SSS congruence condition]
$\angle QPR \cong \angle SPR$	[By CPCT]
Also, $\Delta QRP \cong \Delta SRP$	[By CPCT]

Hence, PR bisects $\angle P$ and $\angle Q$. Proved.

10. From the figure in ΔPTS and ΔQUS

PS = SQ	[S in mid point of PQ]
ST = SU	[Given]
$\angle PTS = \angle QUS$	[Each of 90°]

$\therefore \Delta PTS \cong \Delta QUS$

Join SR

Now in ΔPSR and ΔQSR

PS = QS	[Given]
$\angle P = \angle Q$	[By CPCT]
SR = SR	[Common]

$\therefore \Delta PSR \cong \Delta QSR$

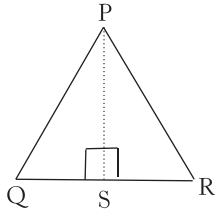
$\therefore$ PQ = PR

Hence, ΔPQR is an isosceles triangle. Proved.

11. See the **Answers** given in the book.

Revision Exercise

1. See the **Answers** given in the book.
2. See the **Answers** given in the book.
3. From the figure, in $\Delta PQS \cong \Delta PRS$:



PQ = PS [Equal sides of isosceles triangle]

$\angle PSQ = \angle PSR$ [Each of 90°]

PS = PS [Common]

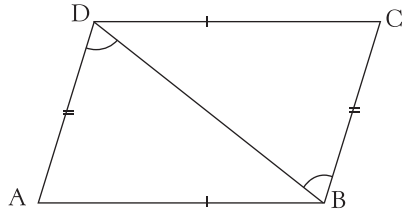
$\Delta PQS \cong \Delta PRS$

Hence, proved

4. $\Delta ABC \cong \Delta CDA$ by SAS congruence condition.
5. (a) ΔOCD and ΔOAB are not congruent, so this statement is not true.

   (b) ΔOCD and ΔBOA are not congruent, so this statement is not true.

   (c) $\Delta OCD \cong \Delta OBA$ by SAS congruence condition. So this statement is true.
6. (a) From the figure, in ΔABD and ΔBCD:



   AD = BC and AB = CD

   $\angle ADB$ and $\angle CBD$ [Alternate angles]

   $\Delta ABD \cong \Delta BCD$

   $\angle A = \angle C$ [By CPCT]

   Hence, ΔABD and ΔBCD are congruent by SAS congruence condition.

   (b) The triangles in the given figure are not congruent by SAS congruence condition.
7. Once of the angles of right triangle is always 90°.

   One of the other two acute angles = 25 [Given]

   $\therefore$ Other angle = 180° – (90° + 25°) = 180° – 115° = 65°.
8. Given that $\Delta ABC \cong \Delta PQR$

   $\angle A = \angle P = 180° – (90° + 40°) = 180° – 130° = 50°$

   Hence, $\angle P$ of ΔPQR is 50°.
9. See the **Answers** given in the book.
10. From the given figure,

    (a) OQ = OR (b) $\angle SQO = \angle TRO$ (c) $\Delta SOQ \cong \Delta TOR$

Multiple Choice Questions

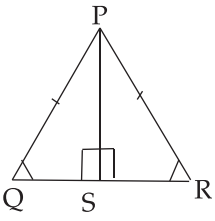
1. A square and a rhombus of side 3 cm each are not congruent. Hence, the correct option is (c).
2. By the angle sum property of a triangle.

   $\angle C$ of $\Delta ABC = 180° – (96° + 42°) = 42°$

   We know that sides opposite to equal angles are equal.

   $\therefore$ Sides AB and AC are equal.

Hence, the correct option is (b)



3. See the **Answers** given in the book.

4. All the three, i.e., ASA, SAS and RHS congruence conditions are true for $\Delta SOQ \cong \Delta TOR$.
   Hence, the option (d) is correct.

5. From the figure by ASA congruence condition, AC = PR. Hence, the correct option is (a).

6. Two squares are said to be congruent, if their sides are equal. Hence, the correct option is (b).

7. From the figure, if $\Delta ABC \cong \Delta DEF$, then AB = DF and CA = FD.
   Hence, the correct option is (b).

8. Plane figures of same size and shape are congruent. Hence, the correct option is (c).

9. See the **Answers** given in the book.

10. See the **Answers** given in the book.

Mental Maths

A. See the **Answers** given in the book.

B. See the **Answers** given in the book.

Higher Order Thinking Skills (HOTS)

1. As one side and all angles of both the triangles are equal, so $\Delta ABC \cong \Delta DEF$.

2. See the **Answers** given in the book.

3. Given that $\Delta PSR \cong \Delta RQP$
   $\therefore \angle Q = \angle S$
   $\Rightarrow 2y + 12 = y + 59$
   $\Rightarrow 2y - y = 59 - 12 = 47$
   $\Rightarrow y = 47°$
   $\angle S = y + 59° = 47° + 59° = 106°$.
   $\angle Q = 2y + 12 = 2 \times 47° + 12 = 94° + 12° = 106°$.
   (a) Now in ΔPQR,
   $\angle RPQ + \angle PQR + \angle PRQ = 180°$ [Angle sum property of a triangle]
   $42° + 106° + \angle PRQ = 180°$
   $\angle PRQ = 180° - 148° = 32°$.
   Also, $\angle SPQ = \angle QRP$ [Alternate angles]
   $\angle SPQ = 32°$.
   (b) $\angle SPQ = \angle QPR$ [Alternate angles]
   $\angle SPQ = 42°$
   and $\angle PRQ = 32°$ [Find in (a)]
   $\angle SRQ = \angle SRP + \angle QRP = 42° + 32° = 74°$.

4. See the **Answers** given in the book.

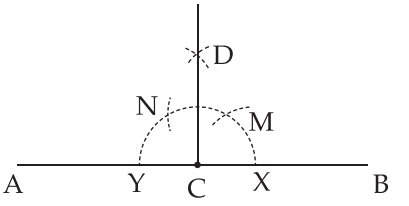
5. The given triangles are not congruent because no any congruence criterion is satisfied.

12 Constructions

Exercise 12.1

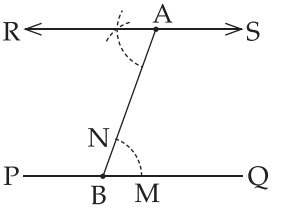
1. **Steps of construction:**
   - Draw a line segment AB = 6 cm and mark a point C on it.
   - With C as centre and a suitable radius draw an arc cutting AB at X and Y.
   - With X as centre and same radius, draw an arc cutting XY at a point M.
   - With M as centre and same radius, draw an arc cutting XY at a point N.
   - With M and N as centres and a suitable radius, draw arcs cutting each other at a point D.

     Thus, ∠ACD is the required angle of 90°.



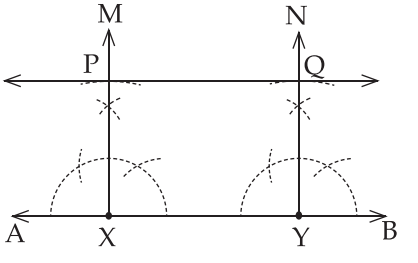
2. **Steps of construction:**
   - Draw a line segment PQ = 4.5 cm
   - Take a point A outside it.
   - Take a point B on PQ and join A to B.
   - With B as centre and a suitable radius, draw an arc cutting PQ at M and AB at N.
   - At A, draw ∠BAR such that ∠QAB = ∠BAR.
   - Join AR and produce it to S.

     Thus, RS is the required line parallel to OQ passing through the point A.



3. **Steps of construction:**
   - Draw a line AB.
   - Take two points X and Y on AB.
   - At X and Y, draw ∠AXM = ∠BYN = 90°.
   - With X and Y as centres and radius 3.5 cm, draw arcs cutting XM at P and YN at Q.

     Thus, PQ is the required line parallel to AB at a distance 3.5 cm

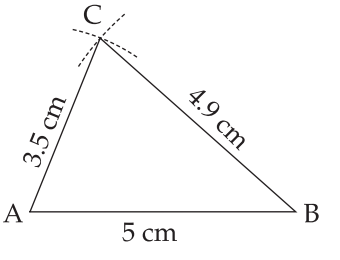


5. Similar work to be done as Q.4.

Exercise 12.1

1. See the **Answers** given in the book.
2. **Steps of construction:**
   - Draw a line segment AB = 5 cm.
   - With A as centre and radius 3.5 cm, draw an arc.
   - With B as centre and radius 4.9 cm, draw another arc cutting the previous arc at a point C.

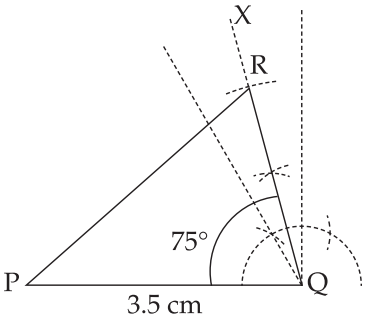
     Thus, ΔABC is the required triangle. It is a scalene triangle with base AB.



3. Similar work to be done as Q.2.

4. (a) **Steps of construction:**
   - Draw a line segment PQ = 4 cm.
   - At Q, draw ∠PQX = 75°.
   - With Q as centre and radius 5.8 cm, draw an arc cutting QX at a point R.
   - Join PR.

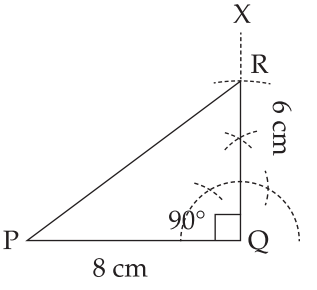
   Thus, ΔPQR is the required triangle.



   Similar work to be done for (b) and (c).

5. (a) **Steps of construction:**
   - Draw a line segment PQ = 8 cm.
   - At Q, draw ∠PQX = 90°.
   - With Q as centre and radius 6 cm, draw an arc cutting QX at a point R.
   - Join PR.

   Thus, ΔPQR is the required triangle.



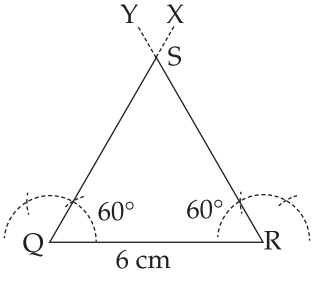
   $PR^2 = PQ^2 + QR^2$ [By Pythagoras theorem]

   $= (8\text{ cm})^2 + (6\text{ cm})^2 = 64\text{ cm}^2 + 36\text{ cm}^2 = 100\text{ cm}^2$

   $PR = 10\text{ cm}$.

   (b) **Steps of construction:**
   - Draw a line segment QR = 6 cm.
   - At Q, draw ∠RQX = 60°.
   - At Q, draw ∠QRX = 60°.
   - Join PS and RS.

   Thus, ΔPQR is the required triangle.

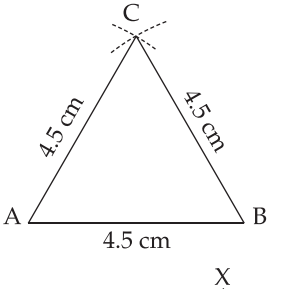


   (c) Similar work to be done as (b).

   (d) Similar work to be done as (b).

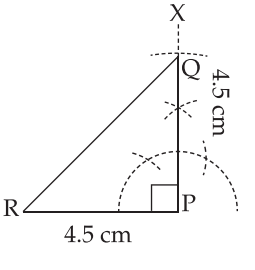
6. **Steps of construction:**
   - Draw a line segment AB = 4.5 cm.
   - With A as centre and radius 4.5 cm, draw an arc.
   - With B as centre and radius 4.4 cm, draw another arc cutting the previous arc at a point C.
   - Join AC and BC.

   Thus, ΔABC is the required equilateral triangle.



7. **Steps of construction:**
   - Draw a line segment PQ = 4.6 cm.
   - At P, draw ∠RPX = 90°.
   - With P as centre and radius 4.6 cm, draw another arc cutting PX at a point Q.
   - Join QR.

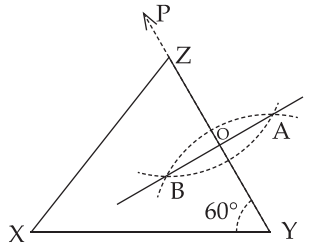
   Thus, ΔPQR is the required triangle.



8. **Steps of construction:**
   - Draw a line segment XY = 4.5 cm.
   - At Y, draw ∠XYP = 60°.
   - With Y as centre and radius 3.8 cm, draw an arc cutting PY at a point Z.
   - Join XZ.

     Thus, ΔXYZ is the required triangle.
   - With Y as centre and radius more than half of YZ, draw an arc.
   - With Z as centre and same radius, draw another arc cutting the previous arc. Let the arcs intersect at points A and B.
   - Join AB.

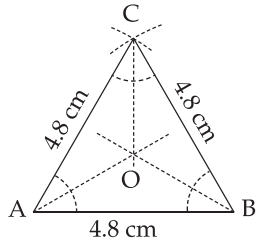
     Thus, AB is the perpendicular bisector of YZ.



9. **Steps of construction:**
   - Draw a line segment AB = 4.8 cm.
   - With A as centre and radius 4.8 cm, draw an arc.
   - With B as centre and radius 4.8 cm, draw another arc cutting the previous arc at a point C.
   - Join AC and BC.

     Thus, ΔABC is the required equilateral triangle.

   We draw the bisectors of angles which intersect at O.



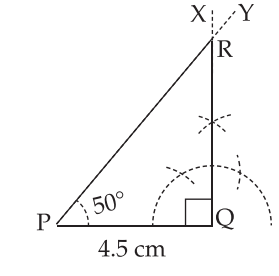
10. See the **Answers** given in the book.

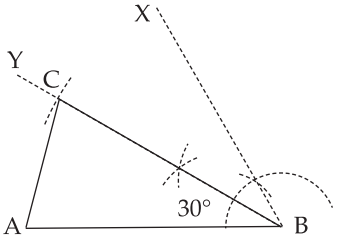
Revision Exercise

1. Similar work to be done as Q.2 of Exercise 12.1.
2. Similar work to be done as Q.1 of Exercise 12.1.
3. See the **Answers** given in the book.
4. **Steps of construction:**
   - Draw a line segment PQ = 4.4 cm.
   - At Q, draw ∠PQX = 90°.
   - At P, draw ∠QPY = 50° which intersects QX at a poiint R.

     Thus, ΔPQR is the required triangle.
5. Similar work to be done as Q.5 of Exercise 12.2.
6. Similar work to be done as Q.2 of Exercise 12.2.
7. **Steps of construction:**
   - Draw a line segment AB = 4.8 cm.
   - At B, draw ∠PQX = 90°.
   - At P, draw ∠QPY = 50° which intersects QX at a poiint R.

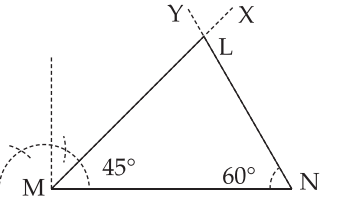
     Thus, ΔPQR is the required triangle.





8. **Steps of construction:**
   - Draw a line segment MN = 5.8 cm.
   - At M, draw ∠NMX = 45°.
   - At N, draw ∠MNX = 60° which intersects QX at a point R.

   Thus, ΔPQR is the required triangle. Side opposite to vertex M is NL.



9. Similar work to be done as Q.9 of Exercise 12.2.
10. ∠E of DEF = 180° – (45° + 75°) = 60°. Rest steps of constructing DEF are similar Q.9 of Exercise 12.2.

Multiple Choice Questions

1. The letter O has both reflection and rotational symmetry. Hence, the correct answer option is (d)
2. See the **Answers** given in the book.
3. The order of rotational symmetry of a figure having angle of rotation 72° is 5. Hence, the correct answer option is (d)
4. The letter R does not have reflection symmetry. Hence, the correct answer option is (b)
5. The letter N has no line s symmetry but has rotational symmetry of order 2. Hence, the correct answer option is (d)
6. See the **Answers** given in the book.
7. See the **Answers** given in the book.
8. A square has both line as well as rotational symmetry. Hence, the correct answer option is (b)
9. A rhombus has rotational symmetry of order 4. Hence, the correct answer option is (d)
10. A regular polygon has equal number of lines of symmetry equal to its sides. Hence, the correct answer option is (a)

Mental Maths

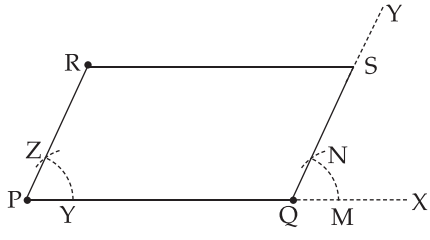
A. See the **Answers** given in the book.

B. See the **Answers** given in the book.

Higher Order Thinking Skills

1. No, because to draw a triangle one side is required.
2. No, because the sum of the given two angles is 180° which is contrasted.
3. **Steps of construction:**
   - Join the given points PQ and PR.
   - Produce PQ to X.
   - Draw ∠XQY = ∠QPR.
   - With Q as centre and radius PR, draw and arc cutting QY at a point S.
   - Join RS.

   Thus, PQRS is the required parallelogram.



4. Similar work to be done as Q.2 of Exercise 12.1.
5. No, because the sum of the given two angles is 180° which is contrasted.

13 Symmetry

Exercise 13.1

1. See the **Answers** given in the book.
2. Students will do it themselves.
3. Students will do it themselves.
4. (a) The given figure does not have any line of symmetry.
   Figures in (b), (c) and (d) have one line of symmetry.
5. The other name of the line of symmetry of a circle is diameter of the circle.
6. Students will do it themselves.

Exercise 13.2

1. See the **Answers** given in the book.
2. See the **Answers** given in the book.
3. See the **Answers** given in the book.
4. An isosceles triangle has one line of symmetry. The order of rotational symmetry of this triangle is 1.
5. The two letters of English alphabet having two lines of symmetry and rotational symmetry of order 2 are H and I or H and X.
6. Students will do it themselves.
7. The triangle with the given lines is a scalene triangle. So it does not have any line of symmetry.
8. The order of rotational symmetry of:
   (a) a parallelogram is 2. (b) an isosceles trapezium is 1.
   (c) letter V is 0. (b) a circle is infinite.
9. The order of rotational symmetry of the figure = 360° ÷ 60 = 6.
10. A regular hexagon has 6 lines of symmetry. It has the order of rotational symmetry of 6.

Revision Exercise

1.

	No. of lines of symmetry	Order of symmetry
(a)	0	2
(b)	1	0
(c)	1	0
(d)	4	4

(e)	1	0
(f)	1	0
(g)	2	4
(h)	4	4

2. A square has both lines of symmetry and rotational symmetry.
3. See the **Answers** given in the book.
4. (a) The letter E has only line of symmetry.
   (b) The letter S has only rotational symmetry.
   (c) The letter H has both line of symmetry and rotational symmetry.
   (d) The letters H and S have rotational symmetry of order 2.
5. See the **Answers** given in the book.
6. Students will do it themselves.
7. Students will do it themselves.

Multiple Choice Questions

See the **Answers** given in the book.

Mental Maths

A. See the **Answers** given in the book.

B. See the **Answers** given in the book.

Higher Order Thinking Skills

1. See the **Answers** given in the book.
2. See the **Answers** given in the book.
3. See the **Answers** given in the book.
4. (a) A circle has reflectional as well as rotational symmetry.
   (b) A semi-circle has reflectional symmetry.
5. A quadrilateral having four lines of symmetry is a square.
6. See the **Answers** given in the book.

14 Visualising Solid Shapes

Exercise 14.1

1. The complete table is given below.

S. No.	Shape	No. of edges	No. of faces	No. of vertices
(i)	Cube	12	6	8
(ii)	Cone	1	2	1

(iii)	Cylinder	2	3	0
(iv)	Cuboid	12	6	8

2. See the **Answers** given in the book.
3. Students will do it themselves.
4. (a) Cuboid (b) Cylinder (c) Cube
   (d) Square pyramid (e) Cone (c) Cube
5. See the **Answers** given in the book.
6. See the **Answers** given in the book.

Exercise 14.2

Students will do this exercise themselves. See for the drawn figures in the book.

Revision Exercise

1. (a) Sphere (b) Cylinder (c) Cone
   (d) Cuboid (e) Cube
2. Students will do it themselves.
3. Figure given in (a) can be the net of an equilateral triangular pyramid.
4. Students will do it themselves.
5. Students will do it themselves.
6. Students will do it themselves.
7. (a) Circle (b) Circle (c) Square (d) Rectangle
8. Dotted lines are not drawn correctly. Remove these lines to draw correct figure.
9. See the **Answers** given in the book.

Multiple Choice Questions

See the **Answers** given in the book.

Mental Maths

A. See the **Answers** given in the book.
B. See the **Answers** given in the book.

Higher Order Thinking Skills

1. The given cube is itself is a cube, only one cube is required. The length of the cube is 2 cm.
2. See the **Answers** given in the book.

15 Perimeter and Area

Exercise 15.1

1. Perimeter of the triangle = sum of its sides = 4.5 cm + 2.9 cm + 6.2 cm = 13.6 cm.

2. Given : One of equal sides of an isosceles triangle = 5.2 cm and its third side = 4.6 cm.
$\therefore$ Perimeter of the triangle = sum of its sides
= 5.2 cm + 5.2 cm + 4.6 cm = 15.0 cm.

3. Given : Side of a square = 2.5 cm.
$\therefore$ Perimeter of the square = 4 × side = 4 × 2.5 cm = 10 cm.

4. Let the breadth of the rectangle be x cm.
Then its length = $3x$ cm.
Perimeter of the rectangle = 24 cm [Given]
$\Rightarrow$ 2(Length + Breadth) = 24 cm
$\Rightarrow$ $2(3x + x) = 24$ cm
$\Rightarrow$ $2 \times 4x = 24$ cm
$\Rightarrow$ $x = 24$ cm $\div$ 8 = 3 cm
$\therefore$ $3x = 3 \times 3$ cm = 9 cm.
Thus, the length and breadth of the rectangle are respectively 9 cm and 3 cm.

5. Perimeter of the square = 22 cm. [Given]
$\Rightarrow$ 4 × side = 22 cm
$\Rightarrow$ side = 22 cm $\div$ 4 = 5.5 cm.
Hence, the length of each side of the square is 5.5 cm.

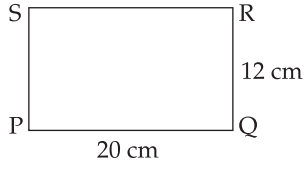
6. Let the length of the rectangle be 3x and its breadth be 2x.
Then perimeter of the rectangle = 320 m [Given]
$\Rightarrow$ 2 (Length + Breadth = 320 m.)
$\Rightarrow$ $2(3x + 2x) = 320$ m
$\Rightarrow$ $2 \times 5x = 320$ m
$\Rightarrow$ $10x = 320$ m
$\Rightarrow$ $x = 320$ m $\div$ 10 = 32 m
$\therefore$ $3x = 32 \times 3 = 96$ m and $2x = 32 \times 2 = 64$ m.
Hence, the length and breadth of the rectangle are respectively 96 m and 64 m.

7. Given : Side of a regular six-sided polygon = 4.5 cm.
$\therefore$ Perimeter of the polygon = 6 × side = 6 × 4.5 cm = 27.0 cm.
Hence, the perimeter of the six-sided regular polygon is 27 cm.

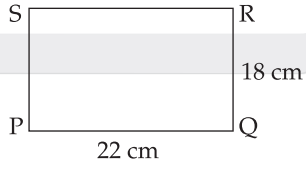
8. (a) Perimeter of the given figure
= 2 cm + 4 cm + 3 cm + 2 cm + 2 cm + 2 cm + 7 cm + 8 cm = 30 cm
(b) Perimeter of the given figure
= 4 cm + 5 cm + 7 cm + 7 cm + 7 cm + 5 cm + 4 cm + 17 cm = 56 cm
(c) Perimeter of the given figure = 4 cm + 5 cm + 6 cm + 8 cm = 23 cm

Exercise 15.2

1. (a) Area of the rectangle PQRS
= Length × Breadth
= PQ × QR
= 20 cm × 12 cm
= 240 cm^2.



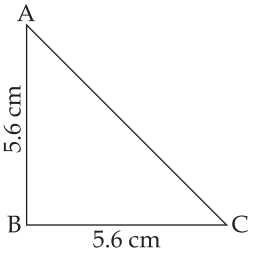
(b) Area of the rectangle PQRS



= Length × Breadth
= SR × PS
= 22 cm × 18 cm
= 396 cm^2.

2. (a) Area of the square of side 15 cm.
= Side × Side = 15 cm × 15 cm = 225 cm^2.
(b) Area of the square of side 24 cm.
= Side × Side = 24 cm × 24 cm = 576 cm^2.

3. Area of the isosceles right-angled triangle
$= \frac{1}{2} \times$ Base × Altitude $= \frac{1}{2} \times$ 5.6 cm × 5.6 cm
= 2.8 cm × 5.6 cm = 15.68 cm^2.



4. Let the breadth of the rectangle be x m.
Then its length = $(x + 15)$ m.
Perimeter of the rectangle = 198 m
2(Length + Breadth) = 198 m
$\Rightarrow x + 15 + x = 198 \div 2 = 99$ m
$\Rightarrow 2x + 15 = 99$ m
$\Rightarrow 2x = 99 - 15 = 84$ m
$\Rightarrow x = 84$ m $\div 2 = 42$ m.
$\therefore$ Breadth of the rectangle = 42 m.
Length of the rectangle = $x + 15 = (42 + 15)$ m = 57 m.
$\therefore$ Area of the rectangle = Length × Breadth = 57 m × 42 m = 2,394 m^2.
Hence, the area of the rectangle in 2394 m^2.

5. Given: perimeter of a square = 56 m
$\therefore 4 \times$ Side = 56 m
$\Rightarrow$ Side = 56 m $\div 4 = 14$ m.
Area of the square = Side × Side = 14 m × 14 m = 196 m^2.
Hence, area of the square in 196 m^2.

6. See the **Answers** given in the book.

7. Taking the side PQ as base, the SN is height.
Area of the parallelogram = Base × Height = PQ × SN = 20 cm × 10 cm = 200 cm^2.
Now, we consider QR as base of the parallelogram.
So, SM will be its height.
$\therefore$ Area of the parallelogram = 200 cm^2.
$\Rightarrow$ Base × Height = 200 cm^2.
$\Rightarrow$ QR × SM = 200 cm^2.
$\Rightarrow$ 16 cm × SM = 200 cm^2.
$\Rightarrow$ SM = 200 $cm^2 \div$ 16 cm = 12.5 cm.
Hence, the length of SM is 12.5 cm.

8. Let the altitude of the parallelogram be x cm.

Then its base = $2x$ cm

Area of the parallelogram = 162 cm^2 [Given]

$\Rightarrow$ Base × Height = 162 cm^2

$\Rightarrow$ $2x \times x = 162\ cm^2$

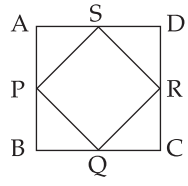
$\Rightarrow$ $2x^2 = 162\ cm^2$

$\Rightarrow$ $x^2 = 162\ cm^2 \div 2 = 81\ cm^2 = (9\ cm)^2$

$\Rightarrow$ $sx = 9$ cm

Hence, the height of the parallelogram is 9 cm and its base is 18 cm.

9. Let ABCD be the given square with P, Q, R and S as mid points of sides AB, BC, CD and DA respectively.



Area of square ABCD = 100 cm^2 [Given]

$\Rightarrow$ Side × Side = 100 cm

$\Rightarrow$ AB × BC = 100 cm^2

$\Rightarrow$ AB × AB = 100 cm^2 [Sides of a square are equal.]

$\Rightarrow$ $(AB)^2 = (10\ cm)^2$

$\Rightarrow$ AB = 10 cm = BC = CD = DA.

Now, AP = BP = 10 cm ÷ 2 = 5 cm [P is the midpoint of AB.]

Also BP = BQ

$\therefore$ $PQ^2 = PB^2 + BQ^2$

$\Rightarrow$ $PQ^2 = (5\ cm)^2 + (5\ cm)^2 = 25\ cm^2 + 25\ cm^2 = 50\ cm^2$

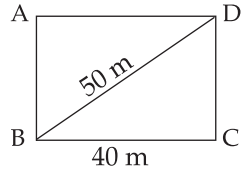
$\Rightarrow$ $PQ^2 = 25 \times 2$

$\Rightarrow$ $PQ = 5\sqrt{2}$ cm

Area of square PQRS = PQ × QR = $\left(5\sqrt{2} \times 5\sqrt{2}\right)\ cm^2 = 25 \times 2 = 50\ cm^2$ [Sides are equal]

Hence, the area of the square made by joining the mid points of the given square is 50 cm^2.

10. Let ABCD be the given rectangular park with side BC = 40 cm and diagonal BD = 50 cm.



Now in right ΔBCD, $BD^2 = BC^2 + CD^2$ [By Pythagoras Theorem]

$\Rightarrow$ $(50\ m)^2 = (40\ m)^2 + CD^2$

$\Rightarrow$ $2500\ m^2 = 1600\ m^2 + CD^2$

$\Rightarrow$ $CD^2 = 2500\ m^2 - 1600\ m^2 = 900\ m^2$

$\Rightarrow$ $CD^2 = (30\ m)^2$

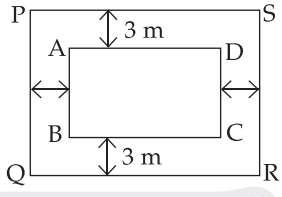
$\Rightarrow$ CD = 30 m

Now, area of the rectangular park ABCD = BC × CD = 40 m = 30 m = 1200 m^2.

Hence, the area of the rectangular park is 1200 m^2.

Exercise 15.3

1. Let ABCD be the given rectangular plot and PQRS represents the path around it. Area of the rectangular plot ABCD = AB × BC = 110 cm × 120 cm = 13200 m^2.



Length PS of outer rectangle PQRS = 120 + 3 + 3 = 126 m

Its breadth PQ = 110 + 3 + 3 = 116 m^2.

Area of outer rectangle PQRS = PS × PQ = 126 m × 116 m = 14616 m^2

Area of the = Area of outer rectangle PQRS – Area of ABCD

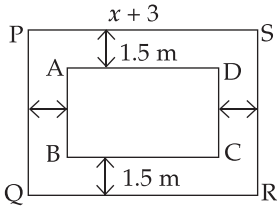
$= 14616\ m^2 - 13200\ m^2 = 1416\ m^2$

Hence, area of the path is $1416\ m^2$.

2. Let ABCD be the given square garden with side as x m. Also PQRS shows the outer side of the path. Side of the outer square PQRS = $(x + 3)$ m. Area of square ABCD = $x \times x = x^2$.

Area of the square PQRS = $(x + 3)(x + 3)$

$= x^2 + 3x + 3x + 9 = x^2 + 6x + 9$



$\therefore$ Area of the path = Area of PQRS – area of ABCD

$183\ m^2 = x^2 + 6x + 9 - x^2 = 6x + 9$

$\Rightarrow \quad 6x = 183 - 9 = 174$ m

$x = 174 \div 6 = 29$ m.

Area of the square garden = $29\ m \times 29\ m = 841\ m^2$.

Hence, the area of the square garden is $1416\ m^2$.

3. Let ABCD be the given field with two cross roads PQRS and LMNO.

Length of road PQRS = 170 m and its breadth = 2.5 m.

$\therefore$ Area of the road PQRS = $170\ m \times 2.5\ m = 425\ m^2$

Length of the road LMNO = 110 m and its breadth = 2.5 m

$\therefore$ Area of the road LMNO = $110\ m \times 2.5\ m = 425\ m^2$

Area of the common DEFG of both the roads = $2.5\ m \times 2.5\ m = 6.25\ m^2$

Area of cross roads = $425\ m^2 \times 275\ m^2 - 6.25\ m^2 = 693.75\ m^2$

4. Let ABCD be the given rectangular hall and PQRS be the verandah all around it.

Area of hall ABCD = $20\ m \times 18\ m = 360\ m^2$

Area of outer rectangle PQRS = $24\ m \times 22\ m = 528\ m^2$

$\therefore$ Area of the verandah = $528\ m^2 - 360\ m^2 = 168\ m^2$

$\therefore$ Cost of repairing the verandah = ₹ (168×20) = ₹ 3360.

5. Floor area of the courtyard = $4.8\ m \times 3.2\ m = 15.36\ m^2 = 153600\ cm^2$

Area of 1 tile = $10\ cm \times 10\ cm = 100\ cm^2$

$$\text{Number of tiles required} = \frac{\text{Floor area of the courtyard}}{\text{Area of 1 tile}} = \frac{153600\ cm^2}{100\ cm^2} = 1536 \text{ tiles.}$$

Hence, 1536 tiles are required to cover the floor.

6. Let ABCD be the given square and PQRS be the lace all around it.

Area of inner rectangle ABCD = $5\ m \times 1.6\ m = 8\ m^2$

Length of outer rectangle = 5 m + 0.30 m = 5.30 m [$\because$ 15 cm = 0.15 m]

Breadth of the outer rectangle = 1.6 m + 0.3 m = 1.9 m.

Area of outer rectangle PQRS = $5.30\ m \times 1.90\ m = 10.07\ m^2$

$\therefore$ Area of the lace = Area of PQRS – Area of ABCD = $10.07\ m^2 - 8\ m^2 = 2.07\ m^2$

When width of the lace is 50 cm, length of the lace

$= 2.07\ m^2 \div 0.50\ m = 4.14$ m [$\because$ 50 cm = 0.50 m]

7. Let ABCD be the given card board and PQRS be the painting.

Area of the outer rectangle ABCD = $7\ cm \times 5\ cm = 35\ cm^2$

Length of painting PQRS = 7 cm – 3 cm = 4 cm

Its breadth = 5 cm – 3 cm = 2 cm.
Area of PQRS = 4 cm × 2 cm = 8 cm^2
Area of the margin = Area of ABCD – Area of PQRS = 35 cm^2 – 8 cm = 27 cm^2

8. Let ABCD be the given plot.
Area of ABCD = 300 m × 200 m = 60000 m^2
Area of the road in the middle = 200 m × 4 m = 800 m^2
Area of three roads along length = (300 m × 4 m)
= 3 × 1,200 m^2 = 3,600 m^2
Area of all four roads = 800 m^2 + 3600 m^2 = 4400 m^2
The middle road crosses the other roads at three points.
Area of three common parts = 3(4 m × 4 m) = 3 × 16 m^2 = 48 m^2
Area of the plot for building houses = 60,000 m^2 – (4,400 m^2 – 48 m^2)
= 60,000 m^2 – 43,52 m^2 = 55,648 m^2
Hence, the required area of the plot for building houses is 55,648 m^2.

9. (a) Length of the unshaded rectangle = 35 cm – 5 cm = 30 cm.
Its breadth = 10 cm.
Area of unshaded rectangle = 30 cm × 10 cm = 300 cm^2.
Area of the whole rectangle = 35 cm × 25 cm = 875 cm^2.
∴ Area of the shaded region = 875 cm^2 – 300 cm^2 = 575 cm^2.
(b) Area of the rectangle = 80 m × 60 m = 4,800 cm^2.
Area of four unshaded squares on corners = 4(5m × 5m) = 4 × 25 m^2 = 100 m^2.
∴ Area of the shaded region = 4,800 m^2 – 100 m^2 = 4700 m^2.

Exercise 15.4

1. (a) **Given** : Radius, r = 21 cm
∴ Circumference of the circle = $2\pi r = 2 \times \frac{22}{7} \times 2.1 = 13.2$ cm.
(b) **Given** : Radius, r = 14 cm.
∴ Circumference of the circle = $2\pi r = 2 \times \frac{22}{\cancel{7}_1} \times \cancel{14}^{2} = 88$ cm
(c) **Given** : Diameter, d = 42 cm.
∴ Radius = diameter ÷ 2 = 42 cm ÷ 2 = 21 cm.
∴ Circumference of the circle = $2\pi r = 2 \times \frac{22}{\cancel{7}_1} \times \cancel{21}^{3} = 132$ cm
(d) Similar work to be done as (a).
Convert 0.7 m into cm as 0.7 m = 0.7 × 100 cm = 70 cm.

2. (a) Circumference of the circle = 0.314 cm [Given]
$2\pi r = 0.314$
$\Rightarrow 2 \times 314 \times r = 0.314$
$\Rightarrow r = \frac{0.314}{2 \times 3.14} = 0.05$ cm.
Hence, radius of the circle is 0.05 cm.

(b) $6\frac{2}{7} = \frac{44}{7}$ cm.

Circumference of the circle = $\frac{44}{7}$ cm.

$\Rightarrow 2\pi r = \frac{44}{7}$ cm.

$\Rightarrow r = \frac{44}{7 \times 2 \times \pi} = \frac{44}{7 \times 3.14 \times 2} = 1.0$ cm.

Hence, the radius of the circle is 1.0 cm.

(c) Circumference of the circle = 6 m 28 cm = 628 cm.

$\Rightarrow 2\pi r = \frac{44}{7}$ cm. = 628

$\Rightarrow r = \frac{628 \text{ cm}}{2 \times 3.14} = 100$ cm = 1 m.

Hence, the radius of the circle is 100 cm or 1 m.

(d) Similar work to be done.

3. (a) **Given** : radius, $r = 21$ cm.

$\therefore$ Area of the circle = $\pi r^2 = \frac{22}{7} \times 21 \text{ cm} \times 21 \text{ cm} = 1{,}386 \text{ cm}^2$.

(b) **Given** : radius = 3.5 cm.

$\therefore$ Area of the circle = $\pi r^2 = \frac{22}{7} \times 3.5 \times 3.5 = \frac{22}{\cancel{7}_1} \times \frac{\cancel{35}^5}{10} \times \frac{35}{10}$

$= \frac{22 \times 175}{100} = \frac{3850}{100} = 38.5 \text{ cm}^2$.

(c) **Given** : Diameter = 7 cm.

$\therefore$ Radius, r = diameter $\div$ 2 = 7 cm $\div$ 2 = 3.5 cm.

Do similar work as (b) above.

(d) **Given** : Diameter = $10\frac{1}{2}$ m = 10.5 m.

$\therefore$ Radius = diameter $\div$ 2 = 10.5 m $\div$ 2 = 5.25 m.

$\therefore$ Area of the circle = $\pi r^2 = \left(\frac{22}{7} \times 5.25 \times 5.25\right) \text{m}^2 = (22 \times 0.75 \times 5.25) \text{ m}^2 = 86.625 \text{ m}^2$

4. Circumference of the circle = 12.76 cm [Given]

$\Rightarrow 2\pi r = 12.76$ cm

$\Rightarrow r = \frac{12.76 \text{ cm} \times 7}{2 \times 22} = 0.29 \times 7 = 2.03$ cm.

$\therefore$ Diameter = Radius $\times$ 2 = 2.03 cm $\times$ 2 = 4.06 cm

Hence, the diameter of the circle is 4.06 cm.

5. **Given** : Diameter of the wheel of bicycle = 88 cm

$\therefore$ Radius of the wheel = diameter $\div$ 2 = 88 cm $\div$ 2 = 44 cm.

Circumference of the wheel = $2\pi r = 2 \times \frac{22}{7} \times 44 \text{ cm} = \frac{1936}{7}$ cm.

$\therefore$ Distance covered by the wheel in 1 revolution = $\frac{1936}{7}$ cm.

$\therefore$ Number of revolutions made by the wheel in 65 km. = $\frac{65 \times 1000 \times 100 \times 7}{1936}$ = 23,502.

Hence, the bicycle wheel make 23,502 revolutions to travel 65 km.

6. Area of the circular basket = 154 cm^2 [Given]

$\Rightarrow \pi r^2 = 154\ cm^2$

$\Rightarrow r^2 = \frac{154 \times 7}{22} = 7 \times 7 = 7^2\ m^2$

$\Rightarrow r = 7$ cm

$\therefore$ Circumference of the basket = $2\pi r = 2 \times \frac{22}{\cancel{7}} \times \cancel{7} = 44$ cm.

Hence, the circumference of the circular basket is 44 cm.

7. **Given** : radius of a circle = 21 cm.

$\therefore$ Area of the circle = $\pi r^2 = \frac{22}{\cancel{7}_1} \times \cancel{21}^3 \times 21 = 22 \times 63\ cm^2 = 1386\ cm^2$

Area of another circle = $2 \times 1386\ cm^2 = 2772\ cm^2$

$\Rightarrow \pi r^2 = 2772\ cm^2$

$\Rightarrow r^2 = \frac{2772 \times 7}{22} = (126 \times 7)\ cm^2 = 882\ cm^2 = (2 \times 441)\ cm^2 = 2 \times 21 \times 21\ cm^2$

$\Rightarrow r = 21\sqrt{2}$ cm $= 29.61$ [$\because \sqrt{2} = 1.41$]

$\therefore$ Diameter = radius $\times$ 2 = 29.61 $\times$ 2 cm = 59.22 cm

Hence, the required diameter of the circle is 59.22 cm.

8. **Given** : radius of the wooden wheel = 21 cm.

$\therefore$ Its area = $\pi r^2 = \frac{22}{\cancel{7}_1} \times \cancel{21}^3 \times 21 = 1386\ cm^2$

Area of circular cut piece = $\pi r^2 = \frac{22}{\cancel{7}_1} \times \cancel{14}^2 \times 14 = 616\ cm^2$ [Given, r = 14 cm]

Area of remaining portion = $1386\ cm^2 - 616\ cm^2 = 770\ cm^2$

Hence, the area of the remaining portion of the wheel is 770 cm^2

9. **Given** : R = 6 cm and r = 4 cm, where R and r are the outer and inner radii of the pipe.

$\therefore$ Area of the cross-section of the pipe.

$= \pi (R^2 - r^2) = 3.14\ (6^2 - 4^2)\ cm^2 = 3.14\ (36 - 16)\ cm^2 = 3.14 \times 20\ cm^2 = 62.80\ cm^2$.

Hence, the area of the cross-section of the pipe is 62.80 cm^2.

10. (a) Area of the square = side $\times$ side = $14 \times 14 = 196\ cm^2$.

Now, side of each triangle at corner = 14 cm $\div$ 2 = 7 cm.

Area of each triangle = $\frac{1}{2} \times$ base $\times$ height = $\frac{1}{2} \times 7$ cm $\times 7$ cm = $\frac{49}{2} cm^2$.

Area of all four triangles = $\cancel{4}^2 \times \frac{49}{\cancel{2}_1} cm^2 = 49 \times 2\ cm^2 = 98\ cm^2$.

Area of the shaded region = Area of the square – Area of four triangles

$= 196\ cm^2 - 98\ cm^2 = 98\ cm^2$.

Hence, the area of the shaded region of the figure is 98 cm^2.

(b) Area of the square = side × side = 5 cm × 5 cm = 25 cm^2.

Diameter of the circle inside the square = Side length of the square = 5 cm

Radius of the circle = 2.5 cm

$\therefore$ Area of the circle = $\pi r^2 = 3.14 \times 2.5\ cm \times 2.5\ cm = 3.14 \times 6.25\ cm^2 = 19.625\ cm^2$.

$\therefore$ Area of the shaded region = Area of the square – Area of the circle

$= 25\ cm^2 - 19.625\ cm^2 = 5.375\ cm^2$

Hence, the area of the shaded region of the figure is 5.375 cm^2.

(c) Area of the rectangle = length × breadth = 40 cm × 28 cm = 1120 cm^2.

Diameter of the semi circle = 28 cm

$\therefore$ 1st radius = 28 cm ÷ 2 = 14 cm.

$\therefore$ Area of the semi circle = $\frac{\pi r^2}{2} = \frac{22}{\cancel{7} \times \cancel{2}} \times \cancel{14} \times 14 = 22 \times 14\ cm^2 = 308\ cm^2$

Area of the shaded region = Area of the rectangle – Area of the semicircle

$= 1120\ cm^2 - 308\ cm^2 = 812\ cm^2$

Hence, the area of the shaded region is 812 cm^2.

Revision Exercise

1. Area of the square = side × side = 8 cm × 8 cm = 64 cm^2.
2. Area of the rectangle = length × breadth = 62 m × 50 m = 3100 cm^2.
3. Area of four windows = 4 (1.5 × 1)m^2 = 4 × 1.5 m^2 = 6.0 m^2.

   Area of two doors = 2(2m × 1.5m) = 2 × 3 m^2 = 6 m^2.

   Area of the ceiling = length × breadth = 10 m × 8 m = 80 m^2.

   Area of four walls = 2 (length × height + breadth × height) = 2 (10 m × 5 m + 8 m × 5 m)

   $= 2(50\ m^2 + 40\ m^2) = 2 \times 90\ m^2 = 180\ m^2$.

   Area of walls and ceiling = 180 m^2 + 80 m^2 = 260 m^2

   Area of the hall that will be painted = Area of walls and ceiling – Area of doors and windows.

   $= 260\ m^2 - (6\ m^2 + 6\ m^2)$

   $= 260\ m^2 - 12\ m^2 = 248\ m^2$

   Cost of painting = 248 × ₹ 20 = ₹ 4960.

   Hence, the required cost of painting is ₹ 4960.
4. Area of the right-angled $\Delta PQR = \frac{1}{2} \times$ Base × Height $= \frac{1}{2} \times 4.5\ cm \times 8\ cm = 18\ cm^2$.
5. Area of the square = 484 cm^2

   $\Rightarrow$ Side × Side = 484 cm^2.

   $\Rightarrow$ Side × Side = 22 cm × 22 cm

   $\Rightarrow$ Side = 22 cm

   Now, perimeter of the square = 4 × side = 4 × 22 cm = 88 cm.

   As same wire is bent to form the circle.

   $\therefore$ Circumference of the circle = 88 cm.

   $\Rightarrow 2\pi r = 88$ cm

$\Rightarrow r = \frac{88}{2\pi} = \frac{88 \times 7}{2 \times 22} = \frac{\cancel{88}^{2} \times 7}{\cancel{44}_{1}} = 14$ cm.

Area of the circle = $\pi r^2 = \frac{22}{\cancel{7}_{1}} \times \cancel{14}^{2} \times 14 = 44 \times 14$ cm^2 = 616 cm^2

Hence, the area of the circle is 616 cm^2.

6. Let C_1 and C_2 be the circumferences of the circles.

Then $C_1 : C_2 = 6 : 5$

$\frac{C_1}{C_2} = \frac{6}{5} \Rightarrow \frac{2\pi r_1}{2\pi r_2} = \frac{6}{5} \Rightarrow \frac{r_1}{r_2} = \frac{6}{5}$

Now, if A_1 and A_2 are area of the circles

$\therefore \frac{A_1}{A_2} = \frac{\pi r_1^2}{\pi r_2^2} \Rightarrow \frac{r_1^2}{r_2^2} = \frac{6^2}{5^2} = \frac{36}{25}$

$A_1 : A_2 = 36 : 25$

Hence, ratio of the areas of circles in 36 : 25.

7. Circumference of the inner circle = 440 m [Given]

$\Rightarrow 2\pi r = 440$ m

$\Rightarrow r = \frac{440}{2\pi} = \frac{\cancel{440}^{10} \times 7}{\cancel{2} \times \cancel{22}}$ m $= 10 \times 7 = 70$ m.

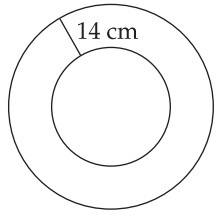
Radius of the outer circle = 70 m + 14 m = 84 m.

Length of fencing = Circumference of the outer circle

$= 2\pi r = 2 \times \frac{22}{\cancel{7}_{1}} \times \cancel{84}^{12} = 44 \times 12 = 528$ m.

Cost of fencing the outer circle of the trace = ₹ (528 × 100) = ₹ 52300.

Hence, the cost of fencing the outer circle of the track is ₹ 52,800.



8. Diameter of a ring = 3.5 cm [Given]

$\therefore$ It radius = diameter ÷ 2

= 3.5 cm ÷ 2 = 1.75 cm.

Wire used in 1 ring = Circumference of the ring = $2\pi r = 2 \times \frac{22}{7} \times 1.75$ cm = 44 × 0.25 = 11 cm.

Total length of the wire = 2 m 42 cm = 242 cm.

Number of rings that can be formed = 242 cm ÷ 11 cm = 22 rings.

Hence, 22 rings can be made from the given wire.

9. Area of the rectangular plot = Length × Breadth = 60 m × 5 m = 3000 m^2.

Area of the circular flowerbed = $\pi r^2 = \frac{22}{7} \times 1.75 \times 1.75$ [radius, r = diameter ÷ 2]

$= 22 \times 0.25 \times 1.75 = 9.625$ m^2

Floor area of the square tank = side × side = 2 m × 2 m = 4 m^2.

Total area of the flowerbed and square tank = 9.625 m^2 + 4 m^2 = 13.625 m^2

$\therefore$ Area of the plot without tank and flowerbed = 3000 m^2 – 13.625 m^2 = 2986.375 m^2.

10. (a) Area of the rectangle = length × breadth = 50 cm × 20 × = 1000 cm^2.

Both the triangles at corners of the rectangle are identical.

Sides containing right angle of each triangle are 10 cm and 25 cm.

Area of a triangle = $\frac{1}{2}$ × base × height = $\frac{1}{2}$ × 10 cm × 15 cm = $\frac{150}{2}$ cm^2 = 75 cm^2.

Area of both the triangles = 75 cm^2 + 75 cm^2 = 150 cm^2.

∴ Area of the shaded region = Area of rectangle – Area of triangles

= 1000 cm^2 – 150 cm^2 = 850 cm^2

(b) Diameter of the bigger circle = 20 m

∴ Its radius = diameter ÷ 2 = 20 m ÷ 2 = 10 m.

Area of the bigger circle = $\pi r^2 = \frac{22}{7} \times 10 \times 10 = \frac{2200}{7}$ m^2

Diameter of the smaller circle = 6 m.

∴ Its radius = diameter ÷ 2 = 6 m ÷ 2 = 3 m.

∴ Its area = $\pi r^2 = \frac{22}{7} \times 3\text{m} \times 3\text{m} = \frac{198}{7}$ m^2

Area of the rectangle = 4 m × 4 m = 16 m^2

∴ Area of the shaded region

= area of the bigger circle – sum of areas of smaller circle and rectangle

$= \frac{2200}{7}\text{m}^2 - \left(\frac{198}{7}\text{m}^2 + \frac{112}{7}\text{m}^2\right) = \frac{2200 - 310}{7}\text{m}^2 = \frac{1890}{7}\text{m}^2 = 270\text{ m}^2$

(c) Area of the semicircle with diameter 28 m = $\frac{\pi r^2}{2} = \frac{22}{\cancel{7}_1} \times \frac{\cancel{14}^2\text{ m} \times 14\text{m}}{2}$

$= \frac{22 \times 7 \times 14}{2} = \frac{616}{2}\text{m}^2 = 308\text{ m}^2$ [Radius = 28 cm ÷ 2]

As the diameters of smaller semicircles with are same, so their areas will be cancelled out.

Hence, the area of the shaded region is 308 m^2.

Multiple Choice Questions

1. Let the breadth of the rectangle be x cm.

Then its length = $2x$.

Perimeter of the rectangle = 270 cm.

$\Rightarrow$ 2(length + breadth) 270 cm

$\Rightarrow$ $2x + x$ = 270 cm ÷ 2 = 135 cm

$\Rightarrow$ $3x$ = 135 cm

$\Rightarrow$ x = 135 cm ÷ 3 = 45 cm

∴ Length = 2 x = 2 × 45 cm = 90 cm

Thus, the option (b) is correct.

2. In the given right triangle, sides forming right angle are 4 cm and 3 cm.

Area of right triangle = $\frac{1}{2}$ × base × altitude = $\frac{1}{2}$ × 4 cm × 3 cm = 6 cm.

Thus, the correct option is (d).

3. According to the question,

$$\frac{\text{Area of } C_1}{\text{Area of } C_2} = \frac{25}{1}$$

$$\Rightarrow \frac{\pi r_1^{\,2}}{\pi r_2^{\,2}} = \frac{25}{1} = \frac{r_1^2}{r_2^2} = \frac{25}{1}$$

$$\Rightarrow \frac{r_1^2}{r_2^2} = \frac{(5)^2}{(1)^2} = \frac{r_1}{r_2} = \frac{5}{1}$$

$$\therefore \frac{\text{Circumference of } C_1}{\text{Circumference of } C_2} = \frac{2\pi r_1}{2\pi r_2} = \frac{r_1}{r_2} = \frac{5}{1}.$$

Thus, the option (d) is correct.

4. Area of the parallelogram = Base × Height = 15 m × 0.6 m = 9.0 m^2.
Thus, the correct option is (b).

5. Let the side of the square be x.
Then its perimeter = 4 × side = $4x$.
When its side is doubled, i.e., $2x$.
Then its perimeter = 4 × side = 4 × $2x$ = $8x$ = 2 × $4x$.
Thus, the correct option is (a)

6. Area of the rectangle = 500 cm^2 [Given]
⇒ Length × Breadth = 500 cm^2
⇒ 25 cm × Breadth = 500 cm^2
⇒ Breadth = 500 cm^2 ÷ 25 cm = 20 cm.
∴ Perimeter of the rectangle = 2 (Length + Breadth)
⇒ 2(25 cm + 20 cm)
⇒ 2 × 45 cm = 90 cm
Thus, the correct option is (b).

7. Perimeter of the square = 360 m
⇒ 4 × Side = 360 m
⇒ Side = 360 m ÷ 4 = 90 m
∴ Area of the square = side × side = 90 m × 90 m = 8100 m^2.
Thus, the correct option is (c).

8. Area of the parallelogram = 300 cm^2
⇒ Base × Height = 300 cm^2
⇒ Base × 12.5 cm = 300 cm^2
⇒ Base = 300 cm^2 ÷ 12.5 cm = 24 cm.
Thus, the correct option is (a).

9. Number of squares required = $\frac{\text{Area of rectangle}}{\text{Area of a square}} = \frac{12\,\text{cm} \times 8\,\text{cm}}{4\,\text{cm} \times 4\,\text{cm}} = \frac{96\ \text{cm}^2}{16\ \text{cm}^2}$ = 6 squares.

Thus, the correct option is (a)

10. Perimeter of the semicircular disc = $\pi r + 2r = \left(\frac{22}{7} \times \frac{15.4}{2} + 15.4\right)$ cm
$= (24.2 + 15.4)$ cm $= 39.6$ cm

Thus, the correct option is (b).

Mental Maths

A. The students will do it themselves.

B. The students will do it themselves.

Higher Order Thinking Skills (HOTS)

1. Let the side of the square be x cm.
Then its perimeter = 4 × side = $4x$ cm.
Its area = side × side = x cm × x cm = x^2 cm.
When its side is doubled:
Perimeter = 4 × side = 4 × $2x$ = $8x$ cm.
Area = side × side = $2x \times 2x = 4x^2$
Thus, the perimeter of the square will become double and its area will be four times.

2. Let A_1 and A_2 be the areas of two squares.

Then $\frac{A_1}{A_2} = \frac{16}{1} \Rightarrow \frac{r_1^2}{r_2^2} = \frac{(4)^2}{(1)^2} \Rightarrow \frac{r_1}{r_2} = \frac{4}{1}$

$\therefore$ Perimeter of one square = $\frac{\text{Perimeter of one square}}{\text{Perimeter of another square}} = \frac{2\pi r_1}{2\pi r_2} = \frac{r_1}{r_2} = \frac{4}{1}$

Thus, the ratio of perimeters of the two squares is 4 : 1.

3. Radius of the circle = diameter ÷ 2 = 2.8 cm ÷ = 1.4 cm ...(i)

Circumference of the circle $= 2\pi r = 2 \times \frac{22}{\cancel{7}_1} \times \cancel{1.4}^{0.2}$ cm $= \cancel{44} \times 0.2 = 8.8$ cm ...(ii)

$\therefore$ Ratio of circumference to radius = $\frac{8.8 \text{ cm}}{1.4 \text{ cm}} = \frac{88}{14} = \frac{44}{7} = 44 : 7.$

4. Let h_1 and h_2 be the heights of the two triangles.
Then area of one triangle : area of another triangle = 4 : 3

$$\Rightarrow \frac{\frac{1}{2} \times \text{base} \times h_1}{\frac{1}{2} \times \text{base} \times h_2} = \frac{4}{3}$$

$$\Rightarrow \frac{16h_1}{9h_2} = \frac{4}{3} = \frac{\cancel{4}^1 \times 9}{3 \times \cancel{16}_4} = \frac{\cancel{9}^3}{\cancel{3}_1 \times 4} = \frac{3}{4}$$

$h_1 : h_2 = 3 : 4$

Hence, the required ratio of heights of triangles is 3 : 4.

5. Radius of the outermost circle = 4 cm + 5 cm + 6 cm = 15 cm.

Area of the outermost circle = $\pi r^2 = \frac{22}{7} \times 15 \text{ cm} \times 15 \text{ cm} = \frac{22 \times 225 \text{ cm}^2}{7} = 707.14 \text{ cm}^2.$

Thus, the area of the outermost circle is 707.14 cm^2.