The background features a large, stylized number '6' in the center, surrounded by various mathematical symbols and numbers. The symbols include pi, infinity, square roots, and fractions. The numbers are scattered around the '6', some appearing as part of mathematical expressions. The overall design is modern and educational.

NEW COUNTDOWN

THIRD EDITION

A Comprehensive Mathematics
Series for Grade 6

Step by Step
Solution Guide

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Preface

New Countdown Second Edition is a carefully structured and graded mathematics course, comprising eleven books for Classes Pre-Primary to Class 6. The pattern followed in the entire series ensures development in all areas of a child's growth through basic multi-focal knowledge, emphasising number skills and mathematical concepts.

The **Step by Step Solution Guide** is a comprehensive resource that complements the New Countdown series to provide a holistic framework within which students are able to understand, grasp, approach, and apply the learned mathematical concepts, and to successfully implement the objectives of the mathematics curriculum.

This guide highlights the patterns, approaches, functions, and relationships between the curriculum strands, so that the students can apply their mathematical knowledge and develop a holistic understanding of the subject that can then be translated into real-life application. The main objective of this guide is not to simply cross-reference the answers, but to guide the students through the thinking process upon approaching a mathematical problem, to reaching the correct answer. This guide, therefore, provides the extensive breakdown of not only solving the equation, but also the mental strategies, appropriate reasoning and formatting, and the ability to decipher what mathematical concepts can be applied to the particular question, in order to work towards the answer.

This in-depth breakdown of solving questions encompasses all the questions in each exercise, as well as the questions in the revision exercises. There are also helpful hints available in this guide that supplements a student's thinking process when approaching a certain problem. The helpful hints will help to avoid preemptive misconceptions that will be beneficial to students and teachers. They help guide the student towards the correct formula by effectively contextualising the mathematical concept and linking it to real-life application. The mathematical proofing, format, and reasoning is in line with the assessment expectations.

The Step by Step Guide provides thorough insight and furthers one's understanding of what is expected of a student in an examination beyond simply arriving at the right answer. This guide helps ensure that the process comes from a place of deep understanding and reasoning of mathematical concepts by guiding the students' approach and thinking process during problem solving, and therefore reaching the desired answer.



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Introduction to Sets

Exercise 1A

- (i), (iii), (v), (vii), and (viii) are well defined sets, because they have specific property which can easily be identified. While in (ii), (iv), and (vi) the terms tasty, naughty, and large are not well defined.
- (i) $2 \in P$ (ii) $5 \notin P$ (iii) $a \notin P$
(iv) $d \in Q$ (v) $g \notin Q$ (vi) $3 \notin Q$
- (i) $A = \{1, 2, 3, 4, 5, 6, 7, 8, 9\}$
(ii) $B = \{I, A, E\}$
(iii) $C = \{M, A, N, G, O\}$
(iv) $D = \{\text{white, green}\}$
(v) $E = \{5, 10, 15, 20\}$
(vi) $F = \{\text{blue, violet, indigo, green, yellow, orange, red}\}$
(vii) $G = \{3, 6, 9, 12\}$
- (ii), (iii), and (v) will form sets as they are well defined.
In (i), (iv), and (vi) strong, famous, and honest is not well defined.

Exercise 1B

1.

Helpful Hint

In tabular notation, all the elements of the set are listed within the curly brackets and separated by commas.

- $M = \{\text{Iskander Mirza, Ayub Khan, Yahya Khan, Gen. Ziaul Haq, Farooq Leghari, Rafiq Tarar, Pervez Musharraf, Asif Ali Zardari, Mamnoon Hussain}\}$
- $N = \{1, 2, 3, 4, 5\}$
- $A = \{3, 6, 9, \dots\}$
- $B = \{0, 2, 4, 6, 8\}$

- $C = \{3, 6, 9, 12, 15, 18\}$
- $D = \{\text{Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune}\}$
- $F = \{\text{Sunday, Monday, Tuesday, Wednesday, Thursday, Friday, Saturday}\}$
- $Q = \{\text{Bhutan, Bangladesh, Belgium, Bolivia, Bulgaria, Bahrain}\}$ etc.

2.

Helpful Hint

In set builder notation, the set is expressed in the form of a rule.

- $P = \{x : x \text{ is a letter of the English alphabet}\}$
- $Q = \{y : y \text{ is an even number}\}$
- $R = \{x : x \text{ is an odd number less than } 10\}$
- $S = \{y : y \text{ is a square number less than } 30\}$
- $T = \{x : x \text{ is the name of a month beginning with } J\}$
- $M = \{x : x \text{ is the only even prime number}\}$
- $V = \{z : z \text{ is a week day, starting with letter } t\}$
- $X = \{y : y \text{ is colour in a rainbow}\}$
- $A = \{x : x \text{ is multiple of } 4\}$
- $C = \{x : x \text{ is multiple of } 3\}$
- $E = \{x : x \text{ is multiple of } 7 \text{ between } 20 \text{ and } 50\}$
- $N = \{x : x \text{ is first } 3 \text{ multiples of } 6\}$

3.

Helpful Hint

In tabular form, all the elements of the set are listed within the curly brackets and separated by commas.

- $\{\text{Sunday, Monday, , Saturday}\}$

- (ii) {1, 2, 3,, 9}
- (iii) {14, 16, 18, 20}
- (iv) {11, 13, 15, 17, 19}
- (v) {Mercury, Venus, Earth, Mars, Jupiter}
- (vi) {10, 11, 12,, 99}

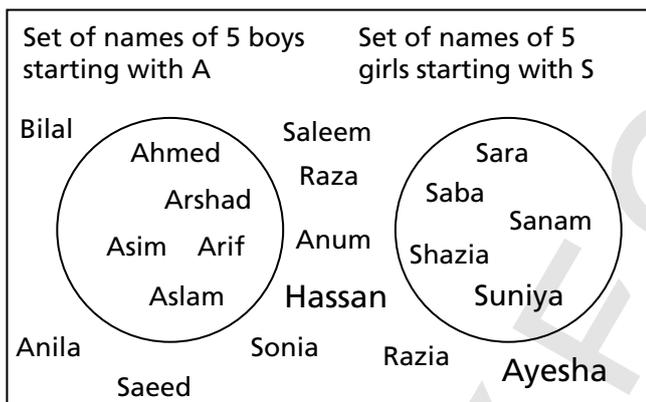
Exercise 1C

1.

Helpful Hint

A Venn diagram is a pictorial representation of a set.

- (i) — (v) are open sentences, therefore, any name, any animal, any famous personality or city can be written.
- (i) has been done for you.



Exercise 1D

1. (i) singleton (ii) infinite
 (iii) empty (iv) cardinality
 (v) {1, 2, 3, 4, 5, 6}
2. Reason
 - (i) False: Set P is given in tabular form.
 - (ii) True: By definition—limited number of students.
 - (iii) False: By definition – limited number of countries of the world
 - (iv) False '∈' denotes 'belong to'.
 - (v) True: 'a' is a member of the set.
 - (vi) False: 'c' is a member of the set.
3. (i), (ii), and (vi), are finite sets, because

they have limited number of elements.

While (iii), (iv), and (v) are infinite sets, because they have unlimited number of elements.

4. (i), (ii), and (v) are empty sets because these sets do not contain any element.
5. Students can write any two examples of their choice.
6. (i) 3 does not belong to set S, as it is a number not an alphabet.
 $\therefore S = \{a, b, c, d, e\}$
- (ii) 6 does not belong to set T, as it is an even number
 $\therefore T = \{3, 5, 7, 9\}$
- (iii) 35 does not belong to set X, as it is not a square number
 $\therefore X = \{4, 9, 25, 49\}$
- (iv) 9 does not belong to set Y, as it is not a prime number
 $\therefore Y = \{2, 3, 5, 7, 11, 13, 17, 19, 23\}$
- (v) Sindh does not belong to set R, as it is a province not a city of Pakistan.
 $\therefore R = \{\text{Karachi, Lahore, Islamabad, Quetta}\}$
- (vi) Onion does not belong to set F as it is a vegetable not a fruit.
 $F = \{\text{apple, orange, banana, guava, mango}\}$

Multiple Choice Questions 1

1. Option C: $P = \{2, 4, 6, 8\}$
 Reason: This Set P has all positive even integers less than 10.
 Option A and B are clearly incorrect as they contain both even and odd integers. Option D though has positive even numbers only, but includes 10 which contradicts the given statement (<10)
2. Option D: Five
 Reason: Set of odd numbers between 50 and 60 = {51, 53, 55, 57, 59}

3. Option C: $A = \text{Ostriches who can fly}$
Reason: This set will be an empty set because ostriches do not fly.
4. Option B: Set B
Reason: There are no element in set B.
Option A, C, and D are incorrect because they all have limited or unlimite elements.
5. Option A: {measuring tape}
Reason: Measuring tape does not belong to the geometry box.
In Option B, C, and D all items belong to the geometry box.
6. Option B: Infinite
Reason: The set of whole numbers is infinite because it contains unlimited number of elements.
Option A and C are incorrect while Option D is a contradictory statement.
7. Option C: Set B is a set of whole numbers
Reason: Set of whole numbers includes a zero while set B does not include a zero.
Option A, B, and D all are true.
8. Option A: $\text{Lily} \in P = \{\text{flowers in the pond}\}$
Option B, C, and D are incorrect because none of them represent the flower lily.



Revision 1: Sets

- Write the members of the following sets.
 - $A = \text{Odd numbers from 7 to 17}$
 $A = \{7, 9, 11, 13, 15, 17\}$
 - $B = \text{Months beginning with J}$
 $B = \{\text{January, June, July}\}$
 - $C = \text{Even numbers between 20 and 30}$
 $C = \{22, 24, 26, 28\}$
 - $D = \text{Prime numbers less than 13}$
 $D = \{2, 3, 5, 7, 11\}$
- Rewrite the following using set-builder notation:
 - $A = \{4, 8, 12, 16, \dots\}$
 $A = \{x : x \text{ is a multiple of } 4\}$
 - $B = \{2, 3, 5, 7, 11, 13, 17, \dots\}$
 $B = \{x : x \text{ is a prime number}\}$
 - $C = \{1, 4, 9, 16, 25, 36, \dots\}$
 $C = \{x : x \text{ is a perfect square and } x \in \mathbb{N}\}$
 - $D = \{1, 3, 5, 7, 9, 11, \dots\}$
 $D = \{x : x \text{ is an odd number}\}$
- Which of the following sets are finite, infinite or empty.
 - $A = \{12, 14, 16, 18, 18, 20, \dots\}$ Infinite
 - $B = \{15, 17, 19, 21\}$ Finite
 - Set of points on a line Infinite
 - Set of odd numbers exactly divisible by 2 Empty
 - Set of even numbers that can be divided exactly by 3 Infinite
 - Set of months in a year Finite
 - A woman who stepped on the moon Empty
- Fill in the blanks with \in or \notin .
 - $30 \notin \{1, 2, 3, 4, 5, 6\}$
 - $19 \in \{2, 3, 5, 7, 11, \dots\}$
 - $\{\text{bicycle}\} \notin \{\text{car, aeroplane, bus, train}\}$
 - $27 \notin \{1, 4, 9, 16, \dots\}$
 - $\{\text{parrot}\} \notin \{\text{cow, goat, cat, dog}\}$
- $A = \{x : x \text{ is an odd number} < 10\}$
 $B = \{x : x \text{ is a prime number} < 16\}$
 $C = \{x : x \text{ is a two-digit odd number less than } 20\}$
 - List the elements of A , B , and C .
 $A = \{1, 3, 5, 7, 9\}$
 $B = \{2, 3, 5, 7, 11, 13\}$
 $C = \{11, 13, 15, 17, 19\}$
 - List the elements common to B and C .
 $\{11, 13\}$
 - Find the set which contains the elements of A and C .
 $\{\phi\}$
- Express the following in tabular form:
 - $A = \text{Set of natural numbers between } 2 \text{ and } 7.$
 $\{3, 4, 5, 6\}$
 - $B = \text{Set of odd numbers less than } 10.$
 $B = \{1, 3, 5, 7, 9\}$
 - $C = \{x : x \text{ is a colour of the rainbow}\}.$
 $C = \{\text{violet, indigo, blue, green, yellow, orange, red}\}$
- Name each of the following sets.
 - $A = \{a, e, i, o, u\}$
 $A = \text{Set of vowels}$

- (ii) $B = \{\text{mother, father, sister, brother}\}$
 $B =$ Set of family members
- (iii) $C = \{1, 4, 9, 16\}$
 $C =$ Set of square numbers less than 25
- (iv) $P = \{3, 5, 7, 11, 13, 17\}$
 $P =$ Set of prime numbers between 2 and 19
- (v) $D = \{25\}$
 $D =$ Set of square of 5

8. $A =$ Set of odd positive integers from 8 to 20
 $A = \{9, 11, 13, 15, 17, 19\}$
 $B =$ Set of even numbers between 8 and 20
 $B = \{10, 12, 14, 16, 18\}$
 $C =$ Set of prime numbers between 8 and 20
 $C = \{11, 13, 17, 19\}$
 $D = \{x : x \in \text{positive numbers from 8 to 20, } x \text{ is a multiple of 7}\}$
 $D = \{14\}$

- (i) Write C and D in tabular form.
 $C = \{11, 13, 17, 19\}$
 $D = \{14\}$
- (ii) Determine the set of elements common in A and C.
 $A = \{9, 11, 13, 15, 17, 19\}$
 $C = \{11, 13, 17, 19\}$
Set of elements common in A and C:
 $\{11, 13, 17, 19\}$
- (iii) Determine the elements common in A and B.
 $A = \{9, 11, 13, 15, 17, 19\}$
 $B = \{10, 12, 14, 16, 18\}$
Set of elements common in A and B: ϕ

9. Write the missing element in each of the following sets
- (i) $A = \{\text{Letters of the word LAHORE}\}$
 $B = \{A, H, R, E, \underline{\hspace{1cm}}, \underline{\hspace{1cm}}\}$
 $B = \{A, H, R, E, \underline{L}, \underline{O}\}$
- (ii) $A = \{x : x \text{ is a month of the year beginning with A}\}$
 $B = \{\underline{\text{April}}, \underline{\text{August}}\}$

- (iii) $A = \{\underline{\hspace{1cm}}\}$,
 $B = \{x : x \text{ is the smallest whole number}\}$
 $A = \{0\}$
- (iv) $A = \{5, 10, 15, 20\}$,
 $B = \{x : x \text{ is a multiple of } \underline{5} \text{ less than 25}\}$



Integers

Exercise 2A

1. Fill in the blanks.

(i) The smallest natural number 1

(ii) The smallest whole number is 0

(iii) $512 + 205 = \underline{205} + 512$

(iv) $5430 + 0 = \underline{5430}$

(v) $54 + (36 + 40) = (54 + \underline{36}) + 40$

(vi) $\underline{18} + 0 = 0 + 18$

(vii) $6 \times 9 = 9 \times \underline{6}$

(viii) $5 \times (7 + 2) = (5 \times \underline{7}) + (\underline{5} \times 2)$

(ix) $\underline{5} = (3 + 4) = (\underline{5} \times 3) + (5 \times 4)$

(x) $6 \times \underline{1} = 6$

(xi) $5 + \underline{0} = 5$

(xii) $12 \div \underline{1} = 12$

(xiii) $\underline{0} \div 10 = 0$

(xiv) $\underline{0} \div 0 = 0$

2. (i) True statement, because all natural numbers are included in a set of whole numbers.
- (ii) False statement, because zero is a whole number but is not included in natural numbers.
- (iii) $8 - (4 - 2) = (8 - 4) - 2$

Helpful Hint

Solve brackets first on both sides.

LHS $8 - 2 = 6$

RHS $4 - 2 = 2$

LHS \neq RHS

\therefore false.

(iv) $10 - (6 - 4) = (10 - 6) - 4$

LHS: $10 - 2 = 8$

RHS: $4 - 4 = 2$

LHS \neq RHS

\therefore false.

(v) $15 - 12 = 12 + 15$

LHS = $15 - 12 = 3$

RHS = $12 + 15 = 27$

LHS \neq RHS

\therefore false.

(vi) $(16 \div 4) \div 2 = 16 \div (4 \div 2)$

\downarrow $4 \div 2 = 16 \div 2$ \downarrow

$2 \neq 8$

LHS \neq RHS

\therefore false.

(vii) $4 \times (5 \times 6) = (4 \times 5) \times 6$

\downarrow $4 \times 30 = 20 \times 6$ \downarrow

$120 = 120$

LHS = RHS

\therefore true.

(viii) $3 \times 4 + 1 = 3 \times 5$

$12 + 1 = 15$ (multiply first)

$13 \neq 15$

LHS \neq RHS

\therefore false.

(ix) $20 + 10 \div 2 = 30 \div 2$

$20 + 5 = 15$ (divide first)

$25 \neq 15$

LHS \neq RHS

\therefore false.

(x) $5 \div 10 = 2$
 $= \frac{1}{2}$ which is a fraction not a whole number.
 \therefore false.

(xi) $5 \div 5 = 1$
 $1 = 1$
 LHS = RHS
 \therefore true.

(xii) $12 \div 4 = 4 \div 12$
 $\frac{12}{4} = \frac{4}{12}$
 $3 \neq \frac{1}{3}$
 LHS \neq RHS
 \therefore false.

3. Largest 3-digit odd number = 999
 Smallest 3-digit even number = 100
 Difference = $999 - 100$
 $= 899$

4. (i) $542 \times 92 + 8 \times 542$

Helpful Hint

Use distributive property, therefore, take common.

$$= 542 \times (92 + 8)$$

$$= 542 \times 100$$

$$= 54200$$

(ii) $365 \times 99 + 365$
 $= 365 \times 99 + 365 \times 1$

Helpful Hint

Use multiplicative identity.

$$= 365 \times (99 + 1)$$

Helpful Hint

Use distributive property, therefore, take common.

$$= 365 \times 100$$

$$= 36500$$

(iii) $6 \times 612 + 4 \times 612$

Helpful Hint

Use distributive property, therefore, take common.

$$= 612 \times (6 + 4)$$

$$= 612 \times 10$$

$$= 6120$$

(iv) $238 \times 55 - 45 \times 238$

Helpful Hint

Use distributive property, therefore, take common.

$$= 238 \times (55 - 45)$$

$$= 238 \times 10$$

$$= 2380$$

Exercise 2B

1.

Helpful Hint

All negative numbers are written on the left side of zero on the number line. Larger the negative number smaller its value.

- (i) $-5, -2, 1, 3$
 (ii) $-8, -7, -2, -1$
 (iii) $-4, -2, 0, 2$

2. (i) $-9, -6, -3, \underline{0}, \underline{3}, \underline{6}$ (Rule: Add three to each term.)

(ii) $7, 4, 1, \underline{-2}, \underline{-5}, \underline{-8}$, (Rule: Subtract three from each term)

(iii) $2, 7, 12, 17, 22, 27$ (Rule: Add five to each term.)

3. (i) $-1, -2 < 0$

(ii) $-1, 0 > -2$

(iii) $-5, -4 < -3$

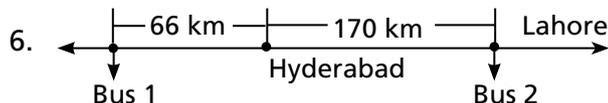
4. $-111 > -1111$

Reason: Larger the negative number smaller its value.

5. (i) 2, 0, -3, -5

(ii) 4, 1, -2, -5

(iii) 4, 2, -1, -2



Distance between the two buses:
 $66 + 170 = 236$ km

Exercise 2C

1. (i) True: [LHS = RHS that is $3 = 3$ (commutative law)]
- (ii) True: [$3 + (-5) = -2$ is an integer]
- (iii) False: [$5 + (-5) = 0$ is not a positive integer.]
- (iv) True: [LHS = RHS that is -25 (commutative law)]
- (v) True: [Any number multiplied by 0 is 0]
- (vi) False: [Negative of (-5) is $-(-5) = +5$]
- (vii) True: [LHS = RHS (distributive law)]
- (viii) False: [LHS \neq RHS that is $9 \neq 13$]
- (ix) False: [Any number multiplied by zero is zero.]
- (x) False: [LHS = RHS that is $27 - 27 \neq 54$]

2. (i) $-6, |-5|, |8|, |-11|, |-13|$

(ii) $-27, |-7|, |-9|, |14|, |-18|$

3. (i) $|74|, |-66|, |39|, |-30|, -52$

(ii) $85, |-76|, |-18|, |-2|, -45$

4. (i) $-29 - 11 + 40 = -40 + 40 = 0$

(ii) $-231 + 51 - 20 = -180 - 20 = -200$

(iii) $-107 + 97 - 10 = -10 - 10 = -20$

(iv) $3 - 14 + 10 = -11 + 10 = -1$

5. $\square + 150 = -129$

$\square = -129 - 150$

$\square = -279$

6. $\square + (-18) = 52$

$\square - 18 = 52$

$\square = 52 + 18$

$\square = 70$

7. $\square \times 8 = -160$

$\square = -\frac{160}{8}$

$\square = -20$

8. $-5 + 28 - (-20)$

$= -5 + 28 + 20$

$= 23 + 20$

$= 43$

9. $= -23 - (-11 + (-18))$

$= -23 - (-11 - 18)$

$= -23 - (-29)$

$= -23 + 29$

$= 6$

10. $-17 \times -1 = +17$

$[-(-17) = 17]$

Yes the product is negative of -17 .

11. (i) 170 (ii) 23 000 (iii) 290 000

(iv) $-40\ 000$

12. $\frac{-100}{\square} = -5$

[check: $\frac{-100}{20} = -5$]

$\frac{-100}{-5} = \square$

$\therefore \square = 20$

13. (i) $(-63) \div 7 = -9$

(ii) $(-56) \div (-8) = 7$

(iii) $112 \div (-7) = -16$

(iv) $(-231) \div (-11) = 21$

14. (i) -3 (ii) 9 (iii) 2

15. Year of birth: 1898

Year of death: 1971

Mrs. Ahmed lived for:

$$1971 - 1898 = 73 \text{ years}$$

16. Year of birth: 276 BCE

Year of death: 194 BCE

$$\text{Eratosthenes lived for: } 276 - 194 = 82 \text{ years}$$

17. Temperature at noon rose: $+ 11^{\circ}\text{C}$

Temperature at midnight fell: $- 5^{\circ}\text{C}$

$$\text{Change in temperature} = 11 - (-5)$$

$$= 11 + 5$$

$$= 16^{\circ}\text{C}$$

Exercise 2D

1. (i) $3\frac{2}{3} \times \frac{3}{11} + \left[2\frac{3}{4} \div 1\frac{1}{4} \times \left(-1\frac{2}{3}\right)\right] + \left(-\frac{1}{3}\right)$

$$= \frac{11}{3} \times \frac{3}{11} + \left[\frac{11}{4} \div \frac{5}{4} \times \left(-\frac{5}{3}\right)\right] - \frac{1}{3}$$

$$= 1 + \left[\frac{11}{4} \times \frac{4}{5} \times \frac{-5}{3}\right] - \frac{1}{3}$$

$$= 1 + \left[\frac{-11}{3}\right] - \frac{1}{3}$$

$$= 1 - \frac{11}{3} - \frac{1}{3}$$

$$= \frac{3 - 11 - 1}{3}$$

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

$$= -3$$

(ii) $\left(-\frac{1}{4} + \frac{1}{9}\right) \div \left[\left(\frac{1}{2} + \frac{1}{4}\right) \div \left(-\frac{1}{8}\right)\right]$

$$= \left(\frac{-9 + 4}{36}\right) \div \left[\left(\frac{2 + 1}{4}\right) \div \left(-\frac{1}{8}\right)\right]$$

$$= \frac{-5}{36} \div \left[\frac{3}{4} \times \frac{2}{1}\right]$$

$$= \frac{-5}{36} \div (-6)$$

$$= \frac{-5}{36} \times \frac{-1}{6}$$

$$= \frac{5}{216}$$

(iii) $0.13 - \left[17 - \left\{0.5 + 1.2 - (40 \div 2 \times 7)\right\}\right]$

$$= 0.13 - \left[17 - \left\{0.5 + 1.2 - 140\right\}\right]$$

$$= 0.13 - [17 + 138.3]$$

$$= 0.13 - 17 - 138.3$$

$$= -16.87 - 138.3$$

$$= -155.17$$

(iv)

$$\left\{16 \text{ of } (2.4 \div 1.2 - 0.9) - 3.25\right\} - (7.5 \times 10 + 4)$$

$$= \{16 \times 1.1 - 3.25\} - 79$$

$$= \{17.6 - 3.25\} - 79$$

$$= 14.35 - 79$$

$$= -64.65$$

(v) $14 - \left[16 - \left\{17 - (18 - 6 - 3)\right\}\right]$

$$= 14 - \left[16 - \{17 - 9\}\right]$$

$$= 14 - [16 - 8]$$

$$= 14 - 8$$

$$= 6$$

(vi) $\{6 \times (24 \div 12 - 9) - 12\} - \{8 \times 10 + (-4)\}$

$$= \{6 \times (-7) - 12\} - \{80 - 4\}$$

$$= \{-42 - 12\} - 76$$

$$= -54 - 76$$

$$= -130$$

(vii) $(-54 - 42) \div \{9 + (-5 \times -8) \div 4 - 3\}$

$$= -96 \div \{9 + 40 \div 4 - 3\}$$

$$= -96 \div \{9 + 10 - 3\}$$

$$= -96 \div \{19 - 3\}$$

$$= -96 \div \{16\}$$

$$= -6$$

(viii) $10 - \left[8 - \left\{2 - (7 - 9 + 2 - 3)\right\}\right]$

$$= 10 - \left[8 - \{2 - (-3)\}\right]$$

$$= 10 - \left[8 - \{2 + 3\}\right]$$

$$= 10 - [8 - 5]$$

$$= 10 - 3$$

$$= 7$$

$$\begin{aligned}
 \text{(ix)} \quad & -27 - \left[18 - \left\{ 16 - (9 - 8 - 1) \right\} \right] \\
 & = -27 - \left[18 - \left\{ 16 - 0 \right\} \right] \\
 & = -27 - \left[18 - 16 \right] \\
 & = -27 - 2 \\
 & = -29
 \end{aligned}$$

$$\begin{aligned}
 \text{(x)} \quad & 36 - \left[18 - \left\{ -14 + (-16 - 4 \div 2 \times 5) \right\} \right] \\
 & = 36 - \left[18 - \left\{ -14 + (-16 - 2 \times 5) \right\} \right] \\
 & = 36 - \left[18 - \left\{ -14 + (-16 - 10) \right\} \right] \\
 & = 36 - \left[18 - \left\{ -14 + (-26) \right\} \right] \\
 & = 36 - \left[18 - \left\{ -14 - 26 \right\} \right] \\
 & = 36 - \left[18 - \left\{ -40 \right\} \right] \\
 & = 36 - \left[18 + 40 \right] \\
 & = 36 - 58 \\
 & = -22
 \end{aligned}$$

2. (i) $25^2 = 25 \times 25 = 625$

(ii) $19^2 = 19 \times 19 = 361$

(iii) $21^2 = 21 \times 21 = 441$

(iv) $23^2 = 23 \times 23 = 529$

(v) $32^2 = 32 \times 32 = 1024$

(vi) $35^2 = 35 \times 35 = 1225$

(vii) $42^2 = 42 \times 42 = 1764$

(viii) $51^2 = 51 \times 51 = 2601$

(ix) $48^2 = 48 \times 48 = 2304$

(x) $92^2 = 92 \times 92 = 8464$

(xi) $86^2 = 86 \times 86 = 7396$

(xii) $75^2 = 75 \times 75 = 5625$

3. Number of rows of plants = 25
 Number of plants in each row
 = Number of rows of plants = 25
 \therefore total number of plants the gardner has
 is $25 \times 25 = 625$

4. $\square^2 + 13^2 = 794$

$$\square^2 + 169 = 794$$

$$\square^2 = 794^2 - 169$$

$$\square^2 = 625 \quad [25 \times 25 = 625]$$

\therefore the other number is 25.

5. $65^2 - 45^2$

$$= 4225 - 2025$$

$$= 2200$$

Multiple Choice Questions 2

1. Option B: True

Reason: Set of whole numbers
 $W = \{0, 1, 2, 3, \dots\}$

Option A, C, and D are incorrect
 statements.

2. Option B: Not always true

Reason: If two large 3-digit numbers are
 added, we may have to carry
 forward a number

Example:

$$\begin{array}{r}
 9 \ 3 \ 8 \\
 + \ 7 \ 0 \ 6 \\
 \hline
 1 \ 7 \ 4 \ 4
 \end{array}$$

3. Option C: -3

Reason: The numbers on LHS of 0 and
 closest to 0 are greater.

Option A and B are incorrect because larger
 the negative number, smaller its value

Option D: None of the above – contradictory
 statement as option C is correct.

4. Option C: + 23, + 3, 0, - 12, - 25

Reason: Positive numbers are greater
 than negative numbers. The
 above sequence is in decreasing
 order.

Incorrect options:

Option A: Incorrect sequence.

Option B: Numbers are in ascending order.

Option D: Incorrect sequence

3

Factors and Multiples

Exercise 3A

1. (i) 11, 3 (ii) 9, 12 (iii) 13, 6

2. (i) True (ii) True (iii) False
(iv) True

3. (i)

Helpful Hint

The first multiple will always be the number itself.

First 5 multiples of 17 are:

17, 34, 51, 68, 85

(ii) First 5 multiples of 23 are:

23, 46, 69, 92, 115

(iii) First 5 multiples of 47 are:

47, 94, 141, 188, 235

4.

Helpful Hint

The word 'between' tells that the given two numbers will not be included.

Multiples of 7 between 10 and 40 are:

14, 21, 28, 35

5.

Helpful Hint

The word 'less than' tells that the multiples will not exceed 50.

Multiples of 11 less than 50 are:

11, 22, 33, 44

6.

Helpful Hint

The word 'both' tells to consider common multiples of 2 and 3, while the word 'less than' tells that these common multiples will be below 50.

Multiples of 2 and 3 less than 50 are:

6, 12, 18, 24, 30, 36, 42, 48

7. (i) 105

The digit in the unit's place is 5 which is not divisible by 2.

\therefore 105 is not divisible by 2.

$$1 + 0 + 5 = 6$$

The sum of the digits of 105 is 6, which is divisible by 3.

\therefore 105 is divisible by 3.

The number 105 ends with 5.

\therefore 105 is divisible by 5.

Sum of the digits in the odd places:

$$1 + 5 = 6$$

Sum of the digits in the even places is 0.

Difference between the two sums:

$$6 - 0 = 6, \text{ which is not divisible by 11.}$$

\therefore 105 is not divisible by 11.

(ii) 997

The digit in the unit's place is not an even number.

\therefore 997 is not divisible by 2.

The sum of digits is $9 + 9 + 7 = 25$, which is not divisible by 3.

\therefore 997 is not divisible by 3.

The number does not end with 0 or 5

\therefore 997 is not divisible by 5.

Sum of the digits in odd places:

$$9 + 7 = 16$$

Sum of the digits in even places is 9.

Difference between the two sums:
 $16 - 9 = 7$, which is not divisible by 11.
 $\therefore 997$ is not divisible by 11

(iii) 2091

The digit in the unit's place is 1, which is not an even number.

$\therefore 2091$ is not divisible by 2.

$$2 + 0 + 9 + 1 = 12$$

The sum of the digits is 12, which is divisible by 3.

$\therefore 2091$ is divisible by 3.

The number 2091 does not end with a 0 or 5.

$\therefore 2091$ is not divisible by 5.

Sum of the digits in odd places is

$$2 + 9 = 11$$

Sum of the digits in even places is

$$0 + 1 = 1.$$

Difference between the two sums:

$$11 - 1 = 10.$$

$\therefore 2091$ is not divisible by 11

(iv). 2730

The digit in unit's place is 0.

$\therefore 2730$ is divisible by 2.

The sum of digits is $2 + 7 + 3 + 0 = 12$, which is divisible by 3.

$\therefore 2730$ is divisible by 3.

2730 ends with 0.

$\therefore 2730$ is divisible by 5.

Sum of digits at odd places:

$$2 + 3 = 5$$

Sum of digits at even places:

$$7 + 0 = 7$$

Difference between the two sums:

$$7 - 5 = 2, \text{ which is not divisible by 11.}$$

$\therefore 2730$ is not divisible by 11.

(v) 1331

The digit in unit's place is not an even number.

$\therefore 1331$ is not divisible by 2.

Sum of digits: $1 + 3 + 3 + 1 = 8$, which is not divisible by 3.

$\therefore 1331$ is not divisible by 3.

1331 does not end with 0 or 5.

$\therefore 1331$ is not divisible by 5

Sum of digits at odd places: $1 + 3 = 4$

Sum of digits at even places: $3 + 1 = 4$

Differences between the two sum:

$$4 - 4 = 0, \text{ which is divisible by 11}$$

$\therefore 1331$ is divisible by 11.

8. (i) 105, 126, 147, 168, and 189

(ii) 162, 189, 216, and 243

(iii) 111, 148, 185, and 222

9. (i) 1661

Sum of digits at odd places:

$$1 + 6 = 7$$

Sum of digits at even places:

$$6 + 1 = 7$$

Difference of the two sums:

$$7 - 7 = 0, \text{ which is divisible by 11.}$$

$\therefore 1661$ is divisible by 11.

(ii) 54 240

Sum of digits at odd places:

$$5 + 2 + 0 = 7$$

Sum of digits at even places:

$$4 + 4 = 8$$

Difference of the two sums:

$$8 - 7 = 1 \text{ which is not divisible by 11.}$$

$\therefore 54\ 240$ is not divisible by 11.

(iii) 15 315

Sum of digits at odd places:

$$1 + 3 + 5 = 9$$

Sum of digits at even places:

$$5 + 1 = 6$$

Difference of the two sums:

$$9 - 6 = 3 \text{ which is not divisible by 11.}$$

$\therefore 15\ 315$ is not divisible by 11.

(iv) 103 081

Sum of digits at odd places:

$$1 + 3 + 8 = 12$$

Sum of digits at even places:

$$0 + 0 + 1 = 1$$

Difference of the two sums:

$$12 - 1 = 11 \text{ which is divisible by } 11.$$

\therefore 103 081 is divisible by 11.

(v) 38 453

Sum of digits at odd places:

$$3 + 4 + 3 = 10$$

Sum of digits at even places:

$$8 + 5 + 13$$

Difference of the two sums:

$$13 - 10 = 3 \text{ which is not divisible by } 11.$$

\therefore 38 453 is not divisible by 11.

(vi) 769 494

Sum of digits at odd places:

$$7 + 9 + 9 = 25$$

Sum of digits at even places:

$$6 + 4 + 4 = 14$$

Difference of the two sums:

$$25 - 14 = 11 \text{ which is divisible by } 11.$$

\therefore 769 494 is divisible by 11.

10. (i) 21 (ii) 20 (iii) 9

These are open sentences, therefore, any number satisfying the condition is acceptable.

11.

Helpful Hint

To test whether the given numbers are divisible by 6, check if it is even and that its sum is divisible by 3.

(i) 504

The last digit is a multiple of 2.

The sum $5 + 0 + 4 = 9$, is divisible by 3.

\therefore 504 is divisible by 3.

504 is divisible by 2 and 3 both.

\therefore 504 is divisible by 6.

(ii) 306

306 is divisible by 2 and its sum is divisible by 3.

\therefore 306 is divisible by 6.

(iii) 4128

4128 is divisible by 2 and its sum is divisible by 3.

\therefore 4128 is divisible by 6.

(iv) 4510

4510 is divisible by 2 but its sum is not divisible by 3.

\therefore 4510 is not divisible by 6.

12. (i) 207

Sum of digits: $2 + 0 + 7 = 9$

9 is divisible by 9.

\therefore 9 is a divisor of 207.

(ii) 4050

Sum of digits:

$$4 + 0 + 5 + 0 = 9$$

9 is divisible by 9.

\therefore 9 is a divisor of 4050.

(iii) 2727

Sum of digits: $2 + 7 + 2 + 7 = 18$

18 is divisible by 9.

\therefore 9 is a divisor of 2727.

(iv) 3655

Sum of digits: $3 + 6 + 5 + 5 = 19$

19 is not divisible by 9

\therefore 9 is not a divisor of 3655.

Exercise 3B

1. (i) False

Helpful Hint

+	E	O
E	E	O
O	O	E

(ii) True

(iii) False [2 is even and prime]

(iv) False [1 is a natural number but it is neither prime nor composite]

- (v) False
- (vi) False
- (vii) False [4 is the smallest composite number]
- (viii) True

2. 47, 123, and 27001 are odd numbers.
458, 2732, and 15280 are even numbers.

3.

Helpful Hint

The word 'between' tells that the two given numbers will be excluded from the list

List of prime numbers between 50 and 75 are:

53, 59, 61, 67, 71, 73

4.

Helpful Hint

Twin prime are pair of prime numbers with a difference of two.

Twin primes between 50 and 80 are:
(59,61) and (71,73).

- 5. (i) $19 = 3 + 5 + 11$
- (ii) $35 = 5 + 11 + 19$
- (iii) $91 = 23 + 31 + 37$

6.

Helpful Hint

(11, 13), (59, 61), and (71, 73) are twin primes because their difference is 2

- (i) $24 = 11 + 13$
- (ii) $120 = 59 + 61$
- (iii) $144 = 71 + 73$

7.

Helpful Hint

The word 'below' 30 tells that the list of consecutive numbers will not contain 30

Five consecutive composite numbers

below 30 are:
24, 25, 26, 27, and 28

8.

Helpful Hint

The words 'just below' tells that the list of consecutive number will begin by counting backwards from 100.

The seven consecutive composite numbers just below 100 are:

90, 91, 92, 93, 94, 95, and 96

Multiple Choice Questions 3

- 1. Option C : All positive factors are listed here. Options A, B, and D are incorrect, because A contains multiples of 12, B contains even numbers, while D contains factors of 12 but 3 is missing.
- 2. Option A: 65
Correct answer is 65 when rule of four operations is applied.
 $[2 + 7 \times 9 = 2 + 63 = 65]$
- 3. Option B : True
Options A, C, D are in correct because they may or may not satisfy the test of divisibility by 11.
- 4. Option D: All the above
3294 is divisible by 9 and 3, because sum of digits $(3 + 2 + 9 + 4) 18$ is divisible by 9 and 3294 is also divisible by 27, because it is divisible by 9 and 3 both.
- 5. Option C: The set is infinite
Options A, B, and D are incorrect, because 1 is neither prime nor composite and 2 is the only even prime .
- 6. Option D: All of the numbers will be factors
Option A, B, and C are incorrect. For example if we have 500, it has two zeros at the end but it is not divisible by 8.

4

Factorisation: HCF and LCM

Exercise 4A

1.

Helpful Hint

Always start dividing by the smallest possible prime number.

(i) 360

2	360
2	180
2	90
3	45
3	15
5	5
	1

$$\begin{aligned} \therefore 360 &= 2 \times 2 \times 2 \times 3 \times 3 \times 5 \\ &= 2^3 \times 3^2 \times 5 \end{aligned}$$

(ii) 663

3	663
13	221
17	17
	1

$$\therefore 663 = 3 \times 13 \times 17$$

(iii) 5184

2	5184
2	2592
2	1296
2	648
2	324
2	162
3	81
3	27
3	9
3	3
	1

$$\begin{aligned} \therefore 5184 &= 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 3 \times 3 \\ &= 2^6 \times 3^4 \end{aligned}$$

(iv) 27 830

2	27830
5	13915
11	2783
11	253
23	23
	1

$$\begin{aligned} \therefore 27\,830 &= 2 \times 5 \times 11 \times 11 \times 23 \\ &= 2 \times 5 \times 11^2 \times 23 \end{aligned}$$

(v) 1875

3	1875
5	625
5	125
5	25
5	5
	1

$$\begin{aligned} \therefore 1875 &= 3 \times 5 \times 5 \times 5 \times 5 \\ &= 3 \times 5^4 \end{aligned}$$

(vi) 5022

2	5022
3	2511
3	837
3	279
3	93
31	31
	1

$$\begin{aligned} \therefore 5022 &= 2 \times 3 \times 3 \times 3 \times 3 \times 31 \\ &= 2 \times 3^4 \times 31 \end{aligned}$$

(vii) 1521

3	1521
3	507
13	169
13	13
	1

$$\begin{aligned}\therefore 1521 &= 3 \times 3 \times 13 \times 13 \\ &= 3^2 \times 13^2\end{aligned}$$

(viii) 8575

5	8575
5	1715
7	343
7	49
7	7
	1

$$\begin{aligned}\therefore 8575 &= 5 \times 5 \times 7 \times 7 \times 7 \\ &= 5^2 \times 7^3\end{aligned}$$

2.

Helpful Hint

If the HCF of two numbers is 1, then the numbers are co-prime.

(ii), (iv), and (v) are co-prime, because they have only 1 as a common factor.

(i) 6 and 8 have 1 and 2 as a common factor.

(iii) 21 and 24 have 1 and 3 as a common factor.

Therefore, both pairs are not co-prime.

3.

Helpful Hint

HCF is the product of common factors with lowest power.

$$\begin{aligned}\text{(i)} \quad 2^2 \times 3^3 &= 2 \times 2 \times \textcircled{3} \times \textcircled{3} \times 3 \\ 2^2 \times 3^2 \times 5 &= 2 \times 2 \times \textcircled{3} \times \textcircled{3} \times 5 \\ 3^2 \times 5 &= \textcircled{3} \times \textcircled{3} \times 5 \\ \therefore \text{HCF} &= 3^2 = 9\end{aligned}$$

$$\text{(ii)} \quad 2 \times 3^2 \times 5 = 2 \times 3 \times 3 \times \textcircled{5}$$

$$5^2 = \textcircled{5} \times 5$$

$$2^3 \times 3 \times 5 = 2 \times 2 \times 2 \times 3 \times \textcircled{5}$$

$$\therefore \text{HCF} = 5$$

4. (i) 36 and 84

2	36
2	18
3	9
3	3
	1

$$\begin{aligned}\therefore \text{Prime factors of } 36 &= 2 \times 2 \times 3 \times 3 \\ &= 2^2 \times 3^2\end{aligned}$$

2	84
2	42
3	21
7	7
	1

$$\begin{aligned}\therefore \text{Prime factors of } 84 &= 2 \times 2 \times 3 \times 7 \\ &= 2^2 \times 3 \times 7\end{aligned}$$

$$\therefore \text{HCF of } 36 \text{ and } 84 = 2^2 \times 3 = 12$$

(ii) 60 and 96

2	60
2	30
3	15
5	5
	1

$$\therefore 60 = 2 \times 2 \times 3 \times 5 = 2^2 \times 3 \times 5$$

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

$$\therefore 96 = 2 \times 2 \times 2 \times 2 \times 2 \times 3 = 2^5 \times 3$$

$$\therefore \text{HCF of } 60 \text{ and } 96 = 2^2 \times 3 = 12$$

(iii) 36, 54 and 108

2	36
2	18
3	9
3	3
	1

$$\begin{aligned}\therefore 36 &= 2 \times 2 \times 3 \times 3 \\ &= 2^2 \times 3^2\end{aligned}$$

2	54
3	27
3	9
3	3
	1

$$\begin{aligned}\therefore 54 &= 2 \times 3 \times 3 \times 3 \\ &= 2 \times 3^3\end{aligned}$$

2	108
2	54
3	27
3	9
3	3
	1

$$\begin{aligned}\therefore 108 &= 2 \times 2 \times 3 \times 3 \times 3 \\ &= 2^2 \times 3^3\end{aligned}$$

$$\begin{aligned}\therefore \text{HCF of } 36, 54 \text{ and } 108 \\ &= 2 \times 3^2 = 18\end{aligned}$$

(iv) 27, 36 and 45

3	27
3	9
3	3
	1

$$\therefore 27 = 3 \times 3 \times 3 = 3^3$$

2	36
2	18
3	9
3	3
	1

$$\therefore 36 = 2 \times 2 \times 3 \times 3 = 2^2 \times 3^2$$

3	45
3	15
5	5
	1

$$\begin{aligned}\therefore 45 &= 3 \times 3 \times 5 \\ &= 3^2 \times 5\end{aligned}$$

$$\therefore \text{HCF of } 27, 36 \text{ and } 45 = 3^2 = 9$$

(v) 84, 132 and 156

2	84
2	42
3	21
7	7
	1

$$\begin{aligned}\therefore 84 &= 2 \times 2 \times 3 \times 7 \\ &= 2^2 \times 3 \times 7\end{aligned}$$

2	132
2	66
3	33
11	11
	1

$$\begin{aligned}\therefore 132 &= 2 \times 2 \times 3 \times 11 \\ &= 2^2 \times 3 \times 11\end{aligned}$$

2	156
2	78
3	39
13	13
	1

$$\begin{aligned}\therefore 156 &= 2 \times 2 \times 3 \times 13 \\ &= 2^2 \times 3 \times 13\end{aligned}$$

$$\begin{aligned}\therefore \text{HCF of } 84, 132 \text{ and } 156 \\ &= 2^2 \times 3 = 12\end{aligned}$$

(vi) 125, 475 and 650

$$\begin{array}{r|l} 5 & 125 \\ \hline 5 & 25 \\ \hline 5 & 5 \\ \hline & 1 \end{array}$$

$$\therefore 125 = 5 \times 5 \times 5 = 5^3$$

$$\begin{array}{r|l} 5 & 475 \\ \hline 5 & 95 \\ \hline 19 & 19 \\ \hline & 1 \end{array}$$

$$\begin{aligned} \therefore 475 &= 5 \times 5 \times 19 \\ &= 5^2 \times 19 \end{aligned}$$

$$\begin{array}{r|l} 2 & 650 \\ \hline 5 & 325 \\ \hline 5 & 65 \\ \hline 13 & 13 \\ \hline & 1 \end{array}$$

$$\begin{aligned} \therefore 650 &= 2 \times 5 \times 5 \times 13 \\ &= 2 \times 5^2 \times 13 \end{aligned}$$

$$\therefore \text{HCF of } 125, 475 \text{ and } 650 = 5^2 = 25$$

(vii) 102, 595 and 357

$$\begin{array}{r|l} 2 & 102 \\ \hline 3 & 51 \\ \hline 17 & 17 \\ \hline & 1 \end{array}$$

$$\therefore 102 = 2 \times 3 \times 17$$

$$\begin{array}{r|l} 5 & 595 \\ \hline 7 & 119 \\ \hline 17 & 17 \\ \hline & 1 \end{array}$$

$$\therefore 595 = 5 \times 7 \times 17$$

$$\begin{array}{r|l} 3 & 357 \\ \hline 7 & 119 \\ \hline 17 & 17 \\ \hline & 1 \end{array}$$

$$\therefore 357 = 3 \times 7 \times 17$$

$$\therefore \text{HCF of } 102, 595 \text{ and } 357 = 17$$

5.

Helpful Hint

Divide the greater number by the smaller number. Then use the remainder as the divisor and the first divisor as the dividend. Continue dividing until the remainder is 0. The last divisor is the HCF of the given numbers.

(i) 300, 3996

$$\begin{array}{r} 13 \\ \hline 300 \overline{) 3996} \\ \underline{- 3900} \\ 96 \\ 96 \overline{) 300} \\ \underline{- 288} \\ 12 \\ 12 \overline{) 96} \\ \underline{- 96} \\ 0 \end{array}$$

\therefore HCF is 12

(ii) 5445, 9317

$$\begin{array}{r} 1 \\ \hline 5445 \overline{) 9317} \\ \underline{- 5445} \\ 3872 \\ 3872 \overline{) 5445} \\ \underline{- 3872} \\ 1573 \\ 1573 \overline{) 3872} \\ \underline{- 3146} \\ 726 \\ 726 \overline{) 1573} \\ \underline{- 1452} \\ 121 \\ 121 \overline{) 726} \\ \underline{- 726} \\ 0 \end{array}$$

\therefore HCF is 121

(iii) 399, 665 and 1463

$$\begin{array}{r} 1 \\ \hline 399 \overline{) 665} \\ \underline{- 399} \\ 266 \\ 266 \overline{) 399} \\ \underline{- 266} \\ 133 \\ 133 \overline{) 266} \\ \underline{- 266} \\ 0 \end{array}$$

$$\begin{array}{r} 11 \\ \hline 133 \overline{) 1463} \\ \underline{- 133} \\ 133 \\ 133 \overline{) 133} \\ \underline{- 133} \\ 0 \end{array}$$

\therefore HCF is 133

(iv) 427, 1159, 1281 and 3416

$$\begin{array}{r}
 2 \\
 \hline
 427 \overline{) 1159} \\
 \underline{- 854} \quad 1 \\
 305 \overline{) 427} \\
 \underline{- 305} \quad 2 \\
 122 \overline{) 305} \\
 \underline{- 244} \quad 2 \\
 61 \overline{) 122} \\
 \underline{- 122} \\
 0
 \end{array}$$

$$\begin{array}{r}
 21 \\
 \hline
 61 \overline{) 1281} \\
 \underline{- 122} \\
 61 \\
 \underline{- 61} \\
 0
 \end{array}$$

$$\begin{array}{r}
 65 \\
 \hline
 61 \overline{) 3416} \\
 \underline{- 305} \\
 366 \\
 \underline{- 305} \quad 1 \\
 61 \overline{) 61} \\
 \underline{- 61} \\
 0
 \end{array}$$

∴ HCF is 61

6.

Helpful Hint

Subtract the remainders to find the original numbers.

$$2300 - 32 = 2268 \text{ (remainder is 32)}$$

$$3500 - 56 = 3444 \text{ (remainder is 56)}$$

Now find HCF of 2268 and 3444.

2	2268	2	3444
2	1134	2	1722
3	567	3	861
3	189	7	287
3	63	41	41
3	21		1
7	7		
	1		

$$2268 = 2 \times 2 \times 3 \times 3 \times 3 \times 3 \times 7$$

$$= 2^2 \times 3^4 \times 7$$

$$3444 = 2 \times 2 \times 3 \times 7 \times 41$$

$$= 2^2 \times 3 \times 7 \times 41$$

$$\therefore \text{HCF} = 2^2 \times 3 \times 7 = 84$$

7. Length of the room = 12 m 15 cm

$$= 1215 \text{ cm}$$

Width of the room = 8 m 91 cm

$$= 891 \text{ cm}$$

3	1215	3	891
3	405	3	297
3	135	3	99
3	45	3	33
3	15	11	11
5	5		1
	1		

$$1215 = 3 \times 3 \times 3 \times 3 \times 3 \times 5$$

$$= 3^5 \times 5$$

$$891 = 3 \times 3 \times 3 \times 3 \times 11$$

$$= 3^4 \times 11$$

$$\therefore \text{HCF} = 3^4 = 3 \times 3 \times 3 \times 3 = 81$$

∴ length of the largest tile = 81 cm

8.

Helpful Hint

Find multiples of 24 between 100 and 150.

$$24 \times 1 = 24,$$

$$24 \times 2 = 48$$

$$24 \times 3 = 72,$$

$$24 \times 4 = 96$$

$$24 \times 5 = 120,$$

$$24 \times 6 = 144$$

Ignore the first four as they are less than 100. So the numbers between 100 and 150 with HCF 24 are 120 and 144.

2	120
2	60
2	30
3	15
5	5
	1

$$\therefore 120 = 2 \times 2 \times 2 \times 3 \times 5$$

$$= 2^3 \times 3 \times 5$$

2	144
2	72
2	36
2	18
3	9
3	3
	1

$$\therefore 144 = 2 \times 2 \times 2 \times 2 \times 3 \times 3$$

$$= 2^4 \times 3^2$$

$$\therefore \text{HCF of } 120 \text{ and } 144 = 2^3 \times 3 = 24$$

Exercise 4B

1. (i) Multiples of 4: 4, 8, 12, 16, 20, **(24)**, 28, 32, 36, 40
 Multiples of 6: 6, 12, 18, **(24)**, 30, 36, 42, 48, 54, 60
 Multiples of 8: 8, 16, **(24)**, 32, 40, 48, 56, 64, 72, 80
 Common multiple is 24
 $\therefore \text{LMC of } 4, 6, 8 = 24$

- (ii) Multiples of 10: 10, 20, 30, 40, 50, **(60)**, 70, 80, 90, 100
 Multiples of 15: 15, 30, 45, **(60)**, 75, 90, 105, 120, 135, 150
 Multiples of 20: 20, 40, **(60)**, 80, 100, 120, 140, 160, 180, 200
 Common multiple is 60
 $\therefore \text{LMC of } 10, 15, 20 = 2 \times 2 \times 3 \times 5 = 60$

2.

(i)

Helpful Hint

Find prime factors of each number.

3	45
3	15
5	5
	1

$$\therefore 45 = 3 \times 3 \times 5$$

$$= 3^2 \times 5$$

3	75
5	25
5	5
	1

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

$$= 3 \times 5^2$$

5	125
5	25
5	5
	1

$$\therefore 125 = 5 \times 5 \times 5$$

$$= 5^3$$

Helpful Hint

LCM is the product of all prime factors with the highest power.

$$\therefore \text{LMC of } 45, 75, 125 = 3^2 \times 5^3 = 9 \times 125 = 1125$$

(ii)	5	35	7	49	7	91
	7	7	7	7	13	13
		1		1		1

$$\therefore 35 = 5 \times 7 \quad \therefore 49 = 7 \times 7 = 7^2 \quad \therefore 91 = 7 \times 13$$

$$\therefore \text{LMC of } 35, 49, 91 = 5 \times 7^2 \times 13$$

$$= 5 \times 49 \times 13 = 3185$$

(iii)	2	42
	3	21
	7	7
		1

$$\therefore 42 = 2 \times 3 \times 7$$

2	48
2	24
2	12
2	6
3	3
	1

$$\therefore 48 = 2 \times 2 \times 2 \times 2 \times 3 = 2^4 \times 3$$

2	56
2	28
2	14
7	7
	1

$$\therefore 56 = 2 \times 2 \times 2 \times 2 \times 7 = 2^3 \times 7$$

$$\therefore \text{LMC of } 42, 48, 56 = 2^4 \times 3 \times 7$$

$$= 16 \times 3 \times 7 = 336$$

(iv)	2	28
	2	14
	7	7
		1

$$\therefore 28 = 2 \times 2 \times 7 = 2^2 \times 7$$

5	35
7	7
	1

$$\therefore 35 = 5 \times 7$$

2	56
2	28
2	14
7	7
	1

$$\therefore 56 = 2 \times 2 \times 2 \times 7 = 2^3 \times 7$$

2	84
2	42
3	21
7	7
	1

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

$$\therefore \text{LMC of } 28, 35, 56, 84 = 2^3 \times 3 \times 5 \times 7 \\ = 8 \times 3 \times 5 \times 7 = 840$$

3. (i)

2	45, 50
3	45, 25
3	15, 25
5	5, 25
5	1, 5
	1, 1

$$\therefore \text{LMC of } 45, 50 = 2 \times 3 \times 3 \times 5 \times 5 = 450$$

(ii)

2	14, 21, 56
2	7, 21, 28
2	7, 21, 14
3	7, 21, 7
7	7, 7, 7
	1, 1, 1

$$\therefore \text{LMC of } 14, 21, 28 = 2 \times 2 \times 2 \times 3 \times 7 = 168$$

(iii)

2	16, 24, 30, 40, 48
2	8, 12, 15, 20, 24
2	4, 6, 15, 10, 12
2	2, 3, 15, 5, 6
3	1, 3, 15, 5, 3
5	1, 1, 5, 5, 1
	1, 1, 1, 1, 1

$$\therefore \text{LMC of } 16, 24, 30, 40, 48 \\ = 2 \times 2 \times 2 \times 2 \times 3 \times 5 = 240$$

(iv)

2	36, 54, 72, 96, 108
2	18, 27, 36, 48, 54
2	9, 27, 18, 24, 27
2	9, 27, 9, 12, 27
2	9, 27, 9, 6, 27
3	9, 27, 9, 3, 27
3	3, 9, 3, 1, 9
3	1, 3, 1, 1, 3
	1, 1, 1, 1, 1

$$\therefore \text{LMC of } 36, 54, 72, 96, 108 \\ = 2 \times 2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 3 = 864$$

4.

Helpful Hint

To find the lowest hundred divisible by 15, 20, 25, find the LCM.

2	15, 20, 25
2	15, 10, 25
3	15, 5, 25
5	5, 5, 25
5	1, 1, 5
	1, 1, 1

$$\therefore \text{The lowest number divisible by } 15, 20, 25 \\ = 2 \times 2 \times 3 \times 5 \times 5 = 300$$

5.

Helpful Hint

First find the lowest number then add the remainder 3 to get the answer.

2	8, 10, 12, 30
2	4, 5, 6, 15
2	2, 5, 3, 15
3	1, 5, 3, 15
5	1, 5, 1, 5
	1, 1, 1, 1

$$\therefore \text{LCM of } 8, 10, 12, 30, \\ = 2 \times 2 \times 2 \times 3 \times 5 = 120$$

120 is less than 200, therefore, the next multiple will be $120 \times 2 = 240$ which lies between 200 and 500.

Since 3 is the remainder add it to 240.

$240 + 3 = 243$ is the lowest number between 200 and 500 which leaves a remainder 3 in each case when divided by 8, 10, 12, 30.

6. Find the LCM of these numbers first.

2	12, 15, 18, 27
2	6, 15, 9, 27
3	3, 15, 9, 27
3	1, 5, 3, 9
3	1, 5, 1, 3
5	1, 5, 1, 1
	1, 1, 1, 1

$$\therefore \text{LCM of } 12, 15, 18, 27 = 2 \times 2 \times 3 \times 3 \times 3 \times 5 \\ = 540$$

Subtract remainder in each case to find the common remainder: $12 - 8 = 4$;

$$15 - 11 = 4;$$

$$18 - 14 = 4;$$

$$27 - 23 = 4$$

Since 4 is the common remainder subtract 4 from 540.

$$\therefore 540 - 4 = 536$$

7. Find the LCM first.

2	40, 50, 60
2	20, 25, 30
2	10, 25, 15
3	5, 25, 15
5	5, 25, 5
5	1, 5, 1
	1, 1, 1

$$\therefore \text{LCM of } 40, 50, 60 = 2 \times 2 \times 2 \times 3 \times 5 \times 5 \\ = 600$$

Since, we require a 4 digit number find the next multiple $600 \times 2 = 1200$.

The remainder in each case is 5, therefore, add it to 1200: $1200 + 5 = 1205$.

8. Find the LCM first.

2	25, 30, 40
2	25, 15, 20
2	25, 15, 10
3	25, 15, 5
5	25, 5, 5
5	5, 1, 1
	1, 1, 1

$$\therefore \text{LCM of } 25, 30, 40 = 2 \times 2 \times 2 \times 3 \times 5 \times 5 \\ = 600$$

Since the remainder in each case is 5 ($25 - 5 = 20$; $30 - 5 = 25$; $40 - 5 = 35$) subtract 5 from 600: $600 - 5 = 595$

\therefore the greatest 5 digit number is: 99, 595.

9. Find the LCM first.

2	10, 12, 16, 18
2	5, 6, 8, 9
2	5, 3, 4, 9
2	5, 3, 2, 9
3	5, 3, 1, 9
3	5, 1, 1, 3
5	5, 1, 1, 1
	1, 1, 1, 1

$$\therefore \text{LCM of } 10, 12, 16, 18 \\ = 2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 5 = 720$$

Now find multiples of 720

720, 1440, 2160, 2880,

\therefore Lowest number that must be added to 2000 is 160.

$$2000 + 160 = 2160$$

10. First find the LCM.

2	8, 9, 12, 15
2	4, 9, 6, 15
2	2, 9, 3, 15
3	1, 9, 3, 15
3	1, 3, 1, 5
5	1, 1, 1, 5
	1, 1, 1, 1

$$\therefore \text{LCM of } 8, 9, 12, 15 = 2 \times 2 \times 2 \times 3 \times 3 \times 5 \\ = 360 \text{ min}$$

Now convert 360 minutes to hours:

$$360 \div 60 = 6 \text{ hrs}$$

\therefore The bells will toll after 6 hrs after 3 p.m. that is at 9 p.m.

11.

Helpful Hint

Product of two numbers = Product of their HCF and LCM.

$$3000 = 10 \times \text{LCM}$$

$$\therefore \text{LCM} = \frac{3000}{10} = 300$$

12. One number \times second number = HCF \times LCM

$$160 \times \text{second number} = 32 \times 1760$$

$$\text{Second number} = \frac{32 \times 1760}{160} = 352$$

13. Product of two numbers = HCF \times LCM

$$2400 = \text{HCF} \times 120$$

$$\therefore \text{HCF} = \frac{2400}{120} = 20$$

14. Product of two numbers = HCF \times LCM

$$\text{Product of two numbers} = 20 \times 3000 = 6000$$

One pair of numbers will be 20 and 300 and the second pair of numbers will be 60 and 100.

Remember: Although there are other factors of 6000, but only these two pairs will give the HCF 20 and LCM 300.

Multiple Choice Questions 4

1. Option D: 1000

Reason: 1000 is the highest common factor of 2000 and 3000.

Incorrect options:

Option A: 250 is a factor of 2000 and 3000, but it is not the highest common factor.

Option B: 300 is not a factor of 2000

Option C: 400 is not a factor of 3000.

2. Option A: 48

Reason: 48 is the lowest common multiple of 12, 24, 48.

Incorrect options:

Option B: 12 is not a multiple of 48

Option C: 96, though is a multiple of all 3 numbers, but it is not the lowest common multiple.

Option D: None of the above – contradictory statement as option A is correct.

3. Option C: 200

Reason: $1000 + 200 = 1200 \div 300 = 4$

Incorrect options:

Option A: $300 + 1000 = 13\ 000$ is not divisible by 300

Option B: $500 + 1000 = 1500$ is divisible by 300, but it is not the smallest number

Option D: $400 + 1000 = 1400$ which is not divisible by 200

4. Option B: 105

Reason: $30 \times \text{second number} = 15 \times 210$

$$\text{Second number} = \frac{15 \times 210}{30} = 105$$

Option A, C, and D are incorrect options because:

$$150 \times 30 \neq 15 \times 210$$

$$210 \times 30 \neq 15 \times 210$$

$$120 \times 30 \neq 15 \times 210$$

5. Option A: 30

Incorrect options:

Option B: 60 is divisible by 2, 3, and 5 but it is not the smallest number.

Option C: 20 is divisible by 2 and 5 but not divisible by 3.

Option D: None of the above – contradictory statement as option A is correct.

6. Option B: Only 1, 3, 5, 15, 25, 75

Incorrect options:

Option A and C: 75 is not a prime number so it has more than two factors.

Option D: all the above – contradictory statement as only Option B is correct.

7. Option A: $HCF < LCM$

Option B: $LCM > HCF$ and

Option C: $HCF = LCM$ (sometimes) are all correct options

Incorrect option:

Option D: Two of the above are true contradictory statement.

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Revision 2: Numbers

1. Sum of two numbers:

$$-20 + \square = 84$$

$$\square = 84 + 20$$

$$\square = 104$$

2. Difference of two numbers:

$$-15 - \square = 17 \text{ [given } (-15) \text{ is the bigger number]}$$

$$- \square = 17 + 15$$

$$- \square = 32$$

$$\square = -32$$

OR

$$-15 - \square = 17$$

$$-15 - 17 = \square$$

$$-32 = \square$$

3.

Helpful Hint

When odd number of negative signs are multiplied, the resulting sign will also be negative.

$$\begin{aligned} \text{(i)} \quad & (-13) \times (-10) \times (-7) \\ & = -910 \end{aligned}$$

Helpful Hint

When numbers are multiplied by zero, the result will be zero.

$$\begin{aligned} \text{(ii)} \quad & 8 \times (-24) \times 0 \times (-5) \\ & = 0 \end{aligned}$$

Helpful Hint

When two like signs are divided, the result is always positive.

$$\begin{aligned} \text{(iii)} \quad & -650 \div (-5) \\ & = 130 \end{aligned}$$

(iv)

Helpful Hint

When two unlike signs are divided, the result is always negative.

$$\begin{aligned} & 726 \div (-6) \\ & = -121 \end{aligned}$$

4.

Helpful Hint

A number is divisible by 4, if the number formed by the last two digits is divisible by 4.

(i) 598 746

Number formed by last two digit is 46 which is not divisible by 4.
Therefore, 598 746 is not divisible by 4.

(ii) 461 706

Number formed by last two digit is 06 which is not divisible by 06.
Therefore, 461 706 is not divisible by 4.

(iii) 54 964

Number formed by last two digits is 64 which is divisible by 4.
Therefore, 54 964 is divisible by 4.

(iv) 237 978

Number formed by last two digits is 78 which is not divisible by 4.
Therefore, 237 978 is not divisible by 4.

5.

Helpful Hint

If the sum of the digits of the number is divisible by 3, then the number is divisible by 3.

(i) 859 467

Sum of digits:
 $8 + 5 + 9 + 4 + 6 + 7 = 39$
Since, 39 is divisible by 3,
therefore, 859 467 is divisible by 3.

(ii) 34 576
Sum of digits: $3 + 4 + 5 + 7 + 6 = 25$
Since, 25 is not divisible by 3,
therefore, 34 576 is not divisible by 3.

(iii) 837 721
Sum of digits: $8 + 3 + 7 + 7 + 2 + 1 = 28$
Since, 28 is not divisible by 3,
therefore, 837 721 is not divisible by 3.

(iv) 56 149
Sum of digits: $5 + 6 + 1 + 4 + 9 = 25$
Since, 25 is not divisible by 3,
therefore, 56 149 is not divisible by 3.

6.

2	12
2	6
3	3
	1

Prime factors of 12 are $2 \times 2 \times 3$

7.

2	210
3	105
5	35
7	7
	1

Prime factors of 210 are $2 \times 3 \times 5 \times 7$

8. HCF of two numbers = 8
LCM of two numbers = 504
One of the number = 72
Product of HCF and LCM = Product of two numbers.

$$8 \times 504 = 72 \times \square$$

$$\begin{array}{r} 1 \quad 56 \\ 8 \times 504 \\ \hline 72 \end{array} = \square$$

$$56 = \square$$

\therefore the second number = 56.

Check:

$$8 \times 504 = 72 \times 56$$

$$4032 = 4032$$

$$\text{LHS} = \text{RHS}$$

9. To find the largest 4-digit number divisible by 18, 25, and 35 find the LCM of these numbers.

2	18, 25, 35
3	9, 25, 35
3	3, 25, 35
5	1, 25, 35
5	1, 5, 7
7	1, 1, 7
	1, 1, 1

$$\text{LCM of } 18, 25, 35 = 2 \times 3 \times 3 \times 5 \times 5 \times 7 = 3150$$

\therefore the first 4-digit number divisible by 18, 25, 35 is 3150.

Second 4-digit number will be
 $3150 \times 2 = 6300$

Third 4-digit number will be $3150 \times 3 = 9450$
 \therefore 9450 is the largest number divisible by 18, 25, 35.

10. Find the LCM of 16, 24, 30

2	16, 24, 30
2	8, 12, 15
2	4, 6, 15
2	2, 3, 15
3	1, 3, 15
5	1, 1, 5
	1, 1, 1

$$\text{LCM of } 16, 24, 30 = 2 \times 2 \times 2 \times 2 \times 3 \times 5 = 240$$

Now find multiples of 240 till you reach the required 5-digit number.

$$240 \times 2 = 480; \quad 240 \times 3 = 760; \quad 240 \times 4 = 960;$$

It is time consuming to find many multiples, so use approximation to find the highest 4-digit number.

$$240 \times 40 = 9600$$

$$240 \times 41 = 9841$$

$$240 \times 42 = 10\,080$$

\therefore the smallest 5-digit number divisible by 16, 24, 30 is 10 080.

11. (i) The smallest prime number is 97.
(ii) The largest prime factor of 105 is 7.
(iii) The largest perfect number less than 50 is 28.

Reason: A perfect number is a number whose divisors (except the number itself) add up to the number.

Divisors of 28 are: 1, 2, 4, 7, 14
(exclude 28)

Sum: $1 + 2 + 4 + 7 + 14 = 28$

- (iv) The pair of twin primes is 137, 139.
Reason: In other pairs 141 and 147 are not prime numbers, ($141 \div 3 = 47$ and $147 \div 7 = 21$) because they have more than two factors.

12.

2	180, 240, 270
3	90, 120, 135
5	30, 40, 45
	6, 8, 9

\therefore HCF of 180, 120, 270, = $2 \times 3 \times 5 = 30$

13.

2	400	1000
	-800	
2	200	400
	-400	
		000
3	200	750
	-600	
1	150	200
	150	150
3	50	150
		150
		000

14.

5	35, 55
	7, 11

Measuring container should be of 5 litre.

15.

2	14, 35, 28, 63
2	7, 35, 14, 63
3	7, 35, 7, 63
3	7, 35, 7, 21
5	7, 35, 7, 7
7	7, 7, 7, 7
	1, 1, 1, 1

\therefore LCM of 14, 35, 28, 63, is
 $2 \times 2 \times 3 \times 3 \times 5 \times 7 = 1260$

16.

2	10, 15, 20
2	5, 15, 10
3	5, 15, 5
3	5, 5, 5
5	1, 1, 1

\therefore least number of boxes of biscuits required is $2 \times 2 \times 3 \times 5 = 60$

5

Ratio and Rate

Exercise 5

1. (i) $13 : 39$
 $1 : 3$
- (ii) $42 : 63$
 $14 : 21$
 $2 : 3$
- (iii) $48 : 64$
 $24 : 32$
 $12 : 16$
 $6 : 8$
 $3 : 4$
- (iv) $6.4 : 8$
 $0.8 : 1$
 $8 : 10$
 $4 : 5$
- (v) $36 \text{ kg} : 80 \text{ kg}$
 $18 : 40$
 $9 : 20$
- (vi) $\text{Rs } 27 : \text{Rs } 63$
 $9 : 21$
 $3 : 7$
- (vii) $4 \text{ dozen} : 3 \text{ dozen}$
 $4 : 3$
- (viii) $60 \text{ cm} : 3 \text{ m}$
 $60 \text{ cm} : 300 \text{ cm}$
 $10 : 50$
 $1 : 5$
- (ix) $\text{Rs } 2 : \text{Rs } 80$
 $1 : 40$
- (x) $0.5 \text{ m} : 75 \text{ cm}$
 $10 : 15$
 $2 : 3$
2. copper : zinc
 $13.5 \text{ gm} : 4.5 \text{ gm}$
Or $135 : 45$
 $27 : 9$
 $3 : 1$

3. Coat of 9 textbooks at Rs 12 each
 $= 8 \times 12 = \text{Rs } 96$
Cost of 4 story books at Rs 9 each
 $= 4 \times 9 = 36$

Ratio textbooks : story books
 $\text{Rs } 96 : \text{Rs } 36$
 $8 : 3$

4.

Helpful Hint

Saving = income – expenditure
 $= \text{Rs } 7200 - \text{Rs } 6300 = \text{Rs } 900$

savings : income
 $\text{Rs } 900 : \text{Rs } 7200$
 $9 : 72$
 $1 : 8$

5. Money spent on chocolates: $\frac{3}{4}$
Money spent on chewing gum: $\frac{1}{4}$
Ratio chocolate : chewing gum
 $\frac{3}{4} : \frac{1}{4}$
 $\frac{3}{4} \times 4^1 : \frac{1}{4} \times 4^1$
 $3 : 1$
6. Mixture = 70 litre
Pure milk = 56 litre
Water = $70 - 56 = 14$ litre
Ratio milk : water
 $56 : 14$
 $8 : 2$
 $4 : 1$
7. Income = Rs 5400
Expenditure = Rs 4500
Saving = $\text{Rs } 5400 - \text{Rs } 4500 = \text{Rs } 900$
(i) income : expenditure
 $5400 : 4500$
 $54 : 45$
 $6 : 5$

(ii) income : saving
 5400 : 900
 54 : 9
 6 : 1

(iii) expenditure : saving
 4500 : 900
 45 : 9
 5 : 1

8. First quantity = 28
 Second quantity = ?
 Ratio of quantities 2 : 7

Or $\frac{2}{7} \times 14 = \frac{28}{98}$

9. Larger quantity = 84
 Smaller quantity = ?
 Ratio of quantities 7 : 12

Or $\frac{7}{12} \times 84 = \frac{49}{84}$

10. School A $\frac{275}{300}$

Or 275 : 300
 55 : 60
 11 : 12

School B : $\frac{120}{150}$

Or 120 : 150
 12 : 15
 3 : 5

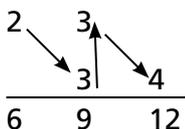
School A has a better record.

11. Mixture = 9 litres
Ratio milk : water
 5 : 1

Total ratio = 5 + 1 = 6

Ratio of water = $\frac{1}{6} \times 9 = \frac{3}{2} = 1\frac{1}{2}$

12. Continued ratio



Simplest form 2 : 3 : 4

13. **Share** Bilal : Asif : Iqbal
 4 : 5 :
 3 : 2
 12 : 15 : 10

Ratio of Bilal and Iqbal is 12 : 10 or 6 : 5

14. **Income** Amina : Ayesha : Sara
 3 : 5 :
 5 : 6
 15 : 25 : 30

Ratio in simplest form is 3 : 5 : 6

15. Let the number of boys be 'x'

boys : girls

4 : 3

x : 162

$\frac{4}{x} = \frac{3}{162}$

Applying cross product rule:

$\frac{4 \times 162}{3} = x$

216 = x

∴ there are 216 boys in the school.

girls : total students

162 : (162 + 216)

81 : 189

9 : 21

3 : 7

16. In 10 min Akram ran 70 m

In 1 min he ran $70 \div 10 = 7$ m

In 12 min Sohail ran 84 km

In 1 min he ran $84 \div 12 = 7$ m

Both ran at the same speed

17. Cost of 15 water bottles = Rs 75

Cost of 1 water bottle = $75 \div 15 =$ Rs 5

18. Charges for 60 min = Rs 150

Charges for 1 min = $150 \div 60 =$ Rs 2.50 min

19. In 70 min machine fills 350 cans
 In 1 min machine fills $350 \div 70 = 5$ cans
20. In 6 games score is 90 points
 Score per game is $90 \div 6 = 15$ points

Multiple Choice Questions 5

1. Option A: ice cream : milk = 2 : 1
 Reason: Ratio of quantities is given in the recipe of milkshake.
 Option B, C, and D are incorrect, because either ratio or the sequence of quantity is wrong.
2. Option A: 1 : 8
 Option B is incorrect because the ratio is reversed
 Option C and D are not in the simplest form.
3. Option B: 2 : 1
 Reason: lions : tigers
 4 : 2
 2 : 1
 Option A is incorrect, because quantity of tigers is wrong.
 In Option C and D ratio of tigers to lion is considered.
4. Option D: 2 : 3 : 4
 Option A, B, and C are not given in simplest form.
5. Option D: Ratio 1 = Ratio 2
 Reason: Ratio 1 = 3 : 5 : 8
 Ratio 2 = 12 : 20 : 32
 Ratio 1 is simplest form of Ratio 2, therefore, the two ratios are equivalent.
 Option A, B, and C are incorrect.

6. Option B: Less number of objects will cost more. The cost will reduce if the number of objects will be less.
 Option A, C, and D are correct statements, because if one quantity increases the other will also increase.
7. Option C: Rs 1305
 Option A, B, and D are incorrect.



Financial Arithmetic: Percentage

Exercise 6A

1. (i) $15\% = \frac{15}{100} = \frac{3}{20}$

(ii) $27\% = \frac{27}{100}$

(iii) $3.5\% = \frac{3.5}{100} = \frac{0.7}{20}$
 $= \frac{7}{200}$

2. (i) $\frac{1}{5} \times \frac{20}{100} = 20\%$

(ii) $\frac{2}{25} \times \frac{4}{100} = 8\%$

(iii) $\frac{3}{50} \times \frac{2}{100} = 6\%$

(iv) $0.35 \times 100 = 35\%$

(v) $4.2 \times 100 = 420\%$

3. (i) $\frac{7}{28} \times \frac{25}{100} = 25\%$

(ii) $\frac{20}{50} \times \frac{2}{100} = 40\%$

(iii) $\frac{60}{150} \times \frac{20}{100} = 40\%$

(iv) $\frac{44}{66} \times 100 = \frac{200}{3} = 66\frac{2}{3}$ or 66.6%

(v) $\frac{39.50}{1975} \times 100$

$$\begin{array}{r} 3950 \\ 1975 \overline{) 3950} \\ \underline{1975} \\ 1975 \\ \underline{1975} \\ 0 \end{array} = 2\%$$

4. suppose the percentage is x

$\therefore x\%$ of 240 = 30

$\frac{x}{100} \times 240 = 30$

$\therefore x = \frac{30 \times 100}{240} = \frac{25}{2} = 12\frac{1}{2} = 12.5$

$\therefore 12.5\%$ of 240 is 30.

5.

Helpful Hint

First find the number of minutes in a day

1 day = 24 hrs

= 24 × 60 (1 hr = 60 min)

= 1440 min

Suppose the percentage is x .

$x\%$ of 1440 min = 18 min

$\frac{x}{100} \times 1440 = 18$

$x = \frac{18 \times 100}{1440} = \frac{5}{4} = 1\frac{1}{4} = 1.25\%$

$\therefore 18$ min of 1 day is 1.25%.

6. Adila's salary = Rs 21,000

Adila saves per month = 16%

Amount saves per month : 16% of salary

$16\% \times 2100$

$\frac{16}{100} \times 2100 = 3360$

\therefore Adila saves Rs 3360 per month.

7. Total number of students = 1650
 Percentage of boys = 70%
 \therefore number of boys = 70% of 1650
 $= \frac{70}{100} \times 1650 = 1155$
 \therefore number of girls = 1650 – 1155
 $= 495$ girls

8. Suppose the total profit made is x .
 \therefore 60% of $x = 9000$
 Profit per year = Rs 9000

$$\frac{60}{100} \times x = 9000$$

$$x = \frac{9000 \times 100}{60} = 150\,000$$

\therefore total profit per year = Rs 150 000.

9. Total marks = 400
 Marks secured by Shahid = 338
 \therefore marks percentage of Shahid = $\frac{338}{400} \times 100$
 $= 84.5\%$

10.

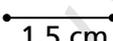
Helpful Hint

First find the exact measurement of the line in each case, then draw the lines accordingly.

- (i) 10% of 10 cm

$$\frac{10}{100} \times 10 = 1 \text{ cm}$$

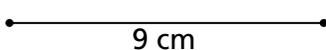

- (ii) 15% of 10 cm

$$\frac{15}{100} \times 10 = \frac{3}{2} = 1.5 \text{ cm}$$


- (iii) 3% of 10 cm

$$\frac{3}{100} \times 10 = 0.3 \text{ cm}$$

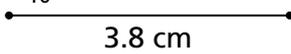

- (iv) 90% of 10 cm

$$\frac{90}{100} \times 10 = 9 \text{ cm}$$


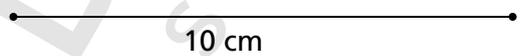
- (v) 5% of 10 cm

$$\frac{5}{100} \times 10 = \frac{1}{2} = 0.5 \text{ cm}$$


- (vi) 38% of 10 cm

$$\frac{38}{100} \times 10 = 3.8 \text{ cm}$$


- (vii) 100% of 10 cm

$$\frac{100}{100} \times 10 = 10 \text{ cm}$$


11.

Fractions	Equivalent percentages
$\frac{1}{2}$	50%
$\frac{3}{4}$	$\frac{3}{4} \times \frac{25}{1} \times 100 = 75\%$
$\frac{25}{100} = \frac{1}{4}$	25%
$\frac{7}{10}$	$\frac{7}{10} \times \frac{10}{1} \times 100 = 70\%$
$\frac{9}{25}$	$\frac{9}{25} \times \frac{4}{1} \times 100 = 36\%$
$12\frac{1}{2}\% \div 100$ $= \frac{25}{2} \times \frac{1}{100}$ $= \frac{1}{8}$	12 $\frac{1}{2}\%$
$33\frac{1}{2}\% \div 100$ $\frac{67}{2} \times \frac{1}{100} = \frac{67}{200}$	33 $\frac{1}{2}\%$
$\frac{19}{50}$	$\frac{19}{50} \times \frac{2}{1} \times 100 = 38\%$

Exercise 6B

1.

Helpful Hint

Convert bigger unit to smaller unit, when required

(i) 55 cm, 5 m

$$\begin{aligned} 1 \text{ m} &= 100 \text{ cm} \\ 5 \text{ m} &= 500 \text{ cm} \end{aligned}$$

$$\frac{55}{500} \times 100\% = 11\%$$

(ii) 72 g, 1.44 kg

$$\begin{aligned} 1 \text{ kg} &= 1000 \text{ g} \\ 1.44 \text{ kg} &= 1.44 \times 1000 \\ &= 1440 \text{ g} \end{aligned}$$

$$\frac{72}{1440} \times 100\% = 5\%$$

(iii) 18 days, 30 days

$$\frac{18}{30} \times 100\% = 60\%$$

(iv) 36 min, 6 hrs

$$\begin{aligned} 1 \text{ hr} &= 60 \text{ min} \\ 6 \text{ hrs} &= 6 \times 60 \text{ min} \\ &= 360 \text{ min} \end{aligned}$$

$$\frac{36}{360} \times 100\% = 10\%$$

(v) Rs 0.75, Rs 12.50

$$\frac{\text{Rs } 0.75}{\text{Rs } 12.50}$$

$$\frac{75}{1250} \times 100\% = 6\%$$

2.

Helpful Hint

First find the total number of students in each class

Number of students in class V

$$= 4 + 5 + 9 + 7 = 25$$

Number of students in class VI

$$= 7 + 5 + 6 + 12 = 30$$

(i) Percentage of students of class V who like mathematics:

$$\frac{9}{25} \times 100\% = 36\%$$

(ii) Percentage of students of class VI who like mathematics:

$$\frac{6}{30} \times 100\% = 20\%$$

(iii) Percentage of students of class V who like science:

$$\frac{7}{25} \times 100\% = 28\%$$

(iv) Percentage of students of class VI who like science:

$$\frac{12}{30} \times 100\% = 40\%$$

(v) Mathematics is the favourite subject among Class V students.

[9 out of 25 student like mathematics]

Science is the favourite subject among Class VI students.

[12 out of 30 student like science]

3. Mr Saleem covered 36% of 150 km.

$$\text{Therefore, he covered } \frac{36}{100} \times 150 = 54 \text{ km}$$

Mr Sabir covered 30% of 200 km.

$$\text{Therefore, he covered } \frac{30}{100} \times 200 = 60 \text{ km}$$

Thus, Mr Sabir covered more distance as compared to Mr Saleem.

4.

Helpful Hint

First find the total number of people who come to watch the match.

Number of men = 396

Number of women = 324

Total number of people = 396 + 324
= 720

Percentage of men = $\frac{396}{720} \times 100 = 55\%$

$$\text{Percentage of women} = \frac{324}{720} \times 100 = 45\%$$

Thus, men were more in number

[Simpler method:
If men are 55%, then women
are $100 - 55\% = 45\%$]

5.

Helpful Hint

To find the percentage increase or decrease, first find the difference. Then divide the difference by the original value.

$$\begin{aligned} \text{Actual price of the book} &= \text{Rs } 320 \\ \text{Reduced price of the book} &= \text{Rs } 240 \\ \text{Decrease in price of book} &= \text{Rs } (320 - 240) \\ &= \text{Rs } 80 \end{aligned}$$

$$\begin{aligned} \text{Percentage decrease in price} &= \frac{80}{320} \times 100\% \\ &= 25\% \end{aligned}$$

$$\begin{aligned} 6. \text{ Actual population of the town} &= 25000 \\ \text{Increased population of the town} &= 30000 \\ \text{Increase in population} &= 30000 - 25000 = 5000 \end{aligned}$$

$$\begin{aligned} \text{Percentage increase in population} &= \frac{5000}{25000} \times 100\% \\ &= 20\% \end{aligned}$$

$$\begin{aligned} 7. \text{ Actual price of the property} &= \text{Rs } 975500 \\ \text{Decreased price of the property} &= \text{Rs } 829175 \\ \text{Decrease in price of the property} &= \text{Rs } (975500 - 829175) \\ &= \text{Rs } 146325 \end{aligned}$$

$$\begin{aligned} \text{Percentage decrease in price} &= \frac{146325}{975500} \times 100\% \\ \text{in population} &= 15\% \end{aligned}$$

$$\begin{aligned} 8. \text{ Height of the boy} &= 108 \text{ cm} \\ \text{Increased height} &= 135 \text{ cm} \\ \text{Increase in height} &= (135 - 108) \text{ cm} \\ &= 27 \text{ cm} \end{aligned}$$

$$\begin{aligned} \text{Percentage increase in height} &= \frac{27}{108} \times 100\% \\ &= 25\% \end{aligned}$$

$$\begin{aligned} 9. \text{ Percentage in the first term examinations} &= \frac{41}{75} \times 100 \\ &= \frac{164}{3} = 54.66\% \end{aligned}$$

$$\begin{aligned} \text{Percentage in the second examinations} &= \frac{65}{75} \times 100 \\ &= \frac{260}{3} = 86.66\% \\ \text{Percentage increase} &= 86.66\% - 54.66\% \\ &= 32\% \end{aligned}$$

Helpful Hint

Another easier method is to find the increase in marks and then divide by the total marks.

$$65 - 41 = 24$$

$$\text{Percentage increase} = \frac{24}{75} \times 100 = 32\%$$

$$\begin{aligned} 10. \text{ Original rent of the house} &= \text{Rs } 35000 \\ \text{Rent after decrease} &= \text{Rs } 30800 \\ \text{Difference in rent} &= \text{Rs } 35000 - 30800 \\ &= \text{Rs } 4200 \end{aligned}$$

$$\begin{aligned} \text{Percentage decrease in rent} &= \frac{4200}{35000} \times 100 \\ &= 12\% \end{aligned}$$

Multiple Choice Questions 6

1. Option C: 70% = Rs 84

Reason: 70% of Rs 120

$$\frac{70}{100} \times 120 = 84$$

Option A is incorrect, because 120% means higher value.

Option B and D are also incorrect, because 20% and 30% will give less value.

2. Option A: 10

Reason: If 75% of pupils in a class of 40 passed, then 25% of pupils failed.

25% of 40 will be

$$\frac{25}{100} \times 40 = 10$$

Option B, C, and D are incorrect.

3. Option D: Final value is 45

Reason: Final value = $60 \times \frac{75}{100} = 45$

Option A, B, and C are incorrect.



Revision 3: Arithmetic

1. Time taken by car A : Time taken by car B
 2 hrs 30 min : 2 hrs 15 min
 $(2 \times 60 + 30)$ min : $(2 \times 60 + 15)$ min
 150 : 135
 30 : 27
 10 : 9

2. Total workers in a factory = 75
 Number of women workers = 20
 \therefore Number of male workers = $75 - 20 = 55$
 Male workers : Female workers
 55 : 20
 11 : 4

3. Total number of students = 318
 Number of students who got first division = 276
 \therefore number of students who get second division = $318 - 276 = 42$.
 Students with first division : Students with second division

$$\begin{array}{l} 276 : 42 \\ 138 : 21 \\ 46 : 7 \end{array}$$

4. Total number of buildings = 488
 Three-storied buildings : Four-storied buildings

$$5 : 3$$

$$\text{Total ratio} = 5 + 3 = 8$$

$$\therefore \text{four-storied building are } \frac{3}{8} \times \overset{61}{122} 488$$

$$= 183 \text{ buildings}$$

check: three-storied building

$$= \frac{5}{8} \times \overset{61}{488} = 305$$

$$183 + 305 = 488$$

5. Monthly income of Mr Jamil = Rs 80 000
 His expenses: = Rs 55 000
 His savings: Rs $(80\,000 - 55\,000)$ = Rs 25 000
 Monthly income of Mr Sohail = Rs 75 000
 His expenses: = Rs 55 000
 His savings: Rs $(75\,000 - 55\,000)$ = Rs 20 000
 Ratio of their savings:
 25 000 : 20 000
 25 : 20
 5 : 4

6. Ratios 3 : 5 and 5 : 8
 Expressing ratios in fractions: $\frac{3}{5}$ and $\frac{5}{8}$
 Comparing ratios: $\frac{3 \times 8}{5 \times 8}$ and $\frac{5 \times 5}{8 \times 5}$
 (make denominators same to compare)

$$= \frac{24}{40} \text{ and } \frac{25}{40}$$

$$\therefore \frac{3}{5} < \frac{5}{8}$$

\therefore ratio 5 : 8 is greater than 3 : 5.

Check:

$$\frac{3}{5} \times \frac{5}{8}$$

$$3 \times 8 < 5 \times 5$$

$$24 < 25$$

7. Ratio of dimensions of a piece of cloth is 8 : 5
Breadth of the cloth = 1.25 m

$$\frac{\text{Length}}{\text{Breadth}} = \frac{8}{5}$$

$$\frac{\text{Length}}{1.25} = \frac{8}{5}$$

$$\therefore \text{length} = \frac{8}{5} \times 1.25$$

$$= 8 \times 0.25 = 2$$

\therefore length of the cloth = 2 m

8. $a : b : c$ Given:
3 : 4 $a : b = 3 : 4$
2 : 3 $b : c = 2 : 3$
 $a : c = ?$

Note that 'b' is the common ratio.
Therefore, make it equal

$$a : b : c$$

$$3 : 4$$

$$2 \times 2 : 3 \times 2$$

$$a : b : c$$

$$3 : 4$$

$$4 : 6$$

Now $a : c$

$$3 : 6$$

$$1 : 2$$

9. Rohail's income per month = Rs 30000
Rohail's saving per month = Rs 7000
Rohail's expenditure per month
= Rs (30000 - 7000)
= Rs 23000

(i) income : expenses
30000 : 23000
30 : 23

(ii) expenses : savings
23000 : 7000
23 : 7

(iii) saving : income
7000 : 30000
7 : 30

10. Total amount = Rs 7475
Ratio = 3 : 7 : 13
Total ratio = 3 + 7 + 13 = 23

$$\frac{3}{23} \times \frac{325}{7475} = \text{Rs } 975$$

$$\frac{7}{23} \times \frac{325}{7475} = \text{Rs } 2275$$

$$\frac{13}{23} \times \frac{325}{7475} = \text{Rs } 4225$$

Check:

$$\text{Rs } (975 + 2275 + 4225)$$

$$= \text{Rs } 7475$$

11. (i) Ratio = 2 : 5

$$\frac{\text{Smaller amount}}{\text{Larger amount}} = \frac{2}{5}$$

$$\frac{\text{Smaller amount}}{275} = \frac{2}{5}$$

$$\text{Smaller amount} = \frac{2}{5} \times \frac{55}{275}$$

$$\therefore \text{smaller amount} = \text{Rs } 110$$

- (ii) Total amount = Rs 275 + Rs 110
= Rs 385

12. Ratio of savings to expenditure = 2 : 5
Expenditure of the family = Rs 3500
Saving of the family = ?
Total income of the family = ?

$$\frac{\text{Saving}}{\text{Expenditure}} = \frac{2}{5}$$

$$\text{Saving} = \frac{2}{5} \times \frac{700}{3500}$$

$$\therefore \text{saving} = \text{Rs } 1400$$

$$\therefore \text{total income} = \text{Expenditure} + \text{Savings}$$

$$= \text{Rs } 3500 + \text{Rs } 1400$$

$$\therefore \text{total income} = \text{Rs } 4900$$

13. **Ratio** orange juice : lemonade

$$3 : 4$$

$$\text{Total ratio} = 3 + 4 = 7$$

$$\text{Total amount of drink} = 2.8 \text{ litre}$$

Amount of orange juice

$$= \frac{3}{7} \times \overset{0.4}{\cancel{2.8}} = 1.2 \text{ litre}$$

Amount of lemonade

$$= \frac{4}{7} \times \overset{0.4}{\cancel{2.8}} = 1.6 \text{ litre}$$

14. Story books : Science books :

$$2475 : 1650$$

$$x : 1650$$

Ratio expressed as fraction is $\frac{2475}{1650}$

Science books : Mathematics books

$$1650 : x$$

Ratio expressed as fraction is $\frac{1650}{x}$

Equating both ratios:

$$\frac{2475}{1650} = \frac{1650}{x}$$

$$x = \frac{\overset{150}{\cancel{1650}} \times \overset{330}{\cancel{1650}}}{\underset{45}{\cancel{2475}}}$$

$$x = \frac{\overset{50}{\cancel{150}} \times \overset{22}{\cancel{330}}}{\underset{3}{\cancel{45}}} = 1100$$

∴ there are 1100 mathematics books.

15. (i) $\frac{13}{20} \times \overset{5}{\cancel{100}}\% = 65\%$

Or $\frac{13}{20} \times \frac{\overset{5}{\cancel{100}}}{100} = \frac{65}{100} = 65\%$

(ii) $\frac{\overset{2}{\cancel{4}}}{\underset{50}{\cancel{250}}} \times \overset{20}{\cancel{100}}\% = \frac{8}{5} = 1.6\%$

(iii) $\frac{17}{25} \times \overset{4}{\cancel{100}}\% = 68\%$

16. (i) 9%

$$= \frac{9}{100}$$

$$= 0.09$$

(ii) 7.5%

$$= \frac{7.5}{100}$$

$$= 0.075$$

(iii) 6.25%

$$= \frac{6.25}{100}$$

$$= 0.0625$$

17. (i) 2.3% of 200

$$\frac{2.3}{100} \times \cancel{200}$$

$$= 4.6$$

(ii) 36% of Rs 2500

$$\frac{36}{100} \times \cancel{2500}$$

$$= \text{Rs } 900$$

(iii) $8\frac{1}{3}\%$ of 300 kg

$$= \frac{8.333}{100} \times \overset{3}{\cancel{300}}$$

$$= 24.99 \text{ kg or } 25 \text{ kg}$$

(iv) $33\frac{1}{3}\%$ of 12 litre

$$= \frac{33.333}{100} \times \overset{3}{\cancel{12}}$$

$$= 4 \text{ litre}$$

18. Price of rice per kg in 2012 = Rs 90

Price of rice per kg in 2016 = Rs 120

Increase in price = 120 – 90 = Rs 30

$$\text{Percentage increase in price} = \frac{\overset{1}{\cancel{30}}}{\underset{3}{\cancel{90}}} \times 100$$

$$= \frac{100}{3}$$

$$= 3.33\%$$



Introduction to Algebra

Exercise 7A

- (i) True
(ii) False
(iii) True
(iv) True
(v) False
(vi) False
(vii) True
(viii) True
(ix) False

2. Reason

- | | |
|---------------|-------------------|
| (i) $x = 7$ | $7 + 2 = 9$ |
| (ii) $p = 5$ | $7 - 5 = 2$ |
| (iii) $y = 5$ | $3 \times 5 = 15$ |
| (iv) $x = 9$ | $45 \div 9 = 5$ |

- (i) $p + q$
(ii) $a - b$
(iii) $\frac{2}{3}x + 2y$
(iv) $m + n + mn$
(v) $3q - 2p$
(vi) $3a + 4b$
(vii) $m + \frac{n}{2}$
(viii) $\frac{a}{b} + ab$
(ix) $\frac{x}{3}(x - y)$
(x) $\frac{3}{4}x(5q - 2p)$

- (i) $a, b, -2c$
(ii) $-2xyz, -3xy, z$
(iii) $abc, 2fgh, -af^2, -bg^2, -ch^2$
- (i) $a - 3b + 4c$
(ii) $-5abc - 7bcd + 3abd$
(iii) $3u - \frac{1}{2}gt$

Exercise 7B

- (i) $x - 5$
(ii) $2p + q$
(iii) $(m - n) + (2m + n)$
 $m - n + 2m + n = 3m$

- $x = -3, y = 5, z = -2$

Substitute values of $x, y,$ and z in each question

- (i) $x + y - z$
 $= -3 + (5) - (-2)$
 $= -3 + 5 + 2$
 $= 2 + 2 = 4$
(ii) $2x - 3y + z$
 $= 2(-3) - 3(5) + (-2)$
 $= -6 - 15 - 2$
 $= -21 - 2$
 $= -23$
(iii) $\frac{x^2 - yz}{z^2}$
 $= \frac{(-3)^2 - (5)(-2)}{(-2)^2}$
 $= \frac{9 + 10}{4} = \frac{19}{4}$

$$\begin{aligned}
 \text{(iv)} \quad & \frac{x^2 + y^2 + z^2}{xyz} \\
 &= \frac{(-3)^2 + (5)^2 + (-2)^2}{(-3)(5)(-2)} \\
 &= \frac{9 + 25 + 4}{30} \\
 &= \frac{38}{30} = \frac{19}{15}
 \end{aligned}$$

$$\begin{aligned}
 \text{(v)} \quad & \frac{x+y}{z} + \frac{y+z}{x} \\
 &= \frac{-3+(5)}{-2} + \frac{5+(-2)}{-3} \\
 &= \frac{-3+5}{-2} + \frac{5-2}{-3} \\
 &= \frac{2^1}{-2_1} + \frac{3^1}{-3_1} \\
 &= -1 + (-1) = -1 - 1 \\
 &= -2
 \end{aligned}$$

$$\begin{aligned}
 \text{(vi)} \quad & \frac{2x + y - z}{x - 3y + z} \\
 &= \frac{2(-3) + (5) - (-2)}{-3 - 3(5) + (-2)} \\
 &= \frac{-6 + 5 + 2}{-3 - 15 - 2} \\
 &= \frac{-1 + 2}{-18 - 2} \\
 &= -\frac{1}{20}
 \end{aligned}$$

$$\begin{aligned}
 \text{(vii)} \quad & \frac{x(2y + 3z)}{3zx} \\
 &= \frac{-3[(2)(5) + 3(-2)]}{3(-2)(-3)} \\
 &= \frac{-3(10 - 6)}{18} \\
 &= \frac{-3(4)}{18} \\
 &= \frac{-12}{18} \\
 &= -\frac{2}{3}
 \end{aligned}$$

$$\begin{aligned}
 \text{(viii)} \quad & x^3 + 3xyz - y^3 + z^3 \\
 &= (-3)^3 + 3(-3)(5)(-2) - (5)^3 + (-2)^3 \\
 &= -27 + 90 - 125 - 8 \\
 &= 63 - 125 - 8 \\
 &= -62 - 8 = -70
 \end{aligned}$$

3. Given $a = 4$, $b = 9$, $c = 25$

$$\begin{aligned}
 & b^2 - 4ac \\
 &= (9)^2 - 4(4)(25) \\
 &= 81 - 400 \\
 &= -319
 \end{aligned}$$

4. Given $x = 1$

$$\begin{aligned}
 &= 1 - [1 - \{1 - (1 - \overline{1+x})\}] \\
 &\text{First substitute value of } x. \\
 &= 1 - [1 - \{1 - (1 - \overline{1+1})\}] \\
 &\text{Solve vinculum.}
 \end{aligned}$$

$$\begin{aligned}
 &= 1 - [1 - \{1 - (\cancel{1} - \cancel{1} - 1)\}] \\
 &= 1 - [1 - \{1 + 1\}] \\
 &= 1 - [1 - 2] \\
 &= 1 - [-1] \\
 &= 1 + 1 = 2
 \end{aligned}$$

5. Given $a = 7$ and $b = 6$

$$\begin{aligned}
 &= 4a^2 - 2[b + a(3 - a) + 3b^2] \\
 &\text{First simplify.} \\
 &= 4a^2 - 2[b + 3a - a^2 + 3b^2] \\
 &= 4a^2 - 2b - 6a + 2a^2 - 6b^2 \\
 &= 4a^2 + 2a^2 - 2b - 6a - 6b^2 \\
 &= 6a^2 - 2b - 6a - 6b^2
 \end{aligned}$$

Now substitute values.

$$\begin{aligned}
 &6(7)^2 - 2(6) - 6(7) - 6(6)^2 \\
 &= 6(49) - 12 - 42 - 6(36) \\
 &= 294 - 12 - 42 - 216 \\
 &= 282 - 42 - 216 \\
 &= 240 - 216 \\
 &= 24
 \end{aligned}$$

$$\begin{aligned}
 6. \quad (i) \quad & 2x + (-3x) + 5x \\
 & = (2 - 3 + 5)x \\
 & = (-1 + 5)x \\
 & = 4x
 \end{aligned}$$

$$\begin{aligned}
 (ii) \quad & 3abc + 2abc - 7abc \\
 & = 5abc - 7abc \\
 & = -2abc
 \end{aligned}$$

$$\begin{array}{r}
 (iii) \quad 2a + 3b \\
 \underline{3a - 4b} \\
 5a - b
 \end{array}$$

$$\begin{array}{r}
 (iv) \quad a + b - c \\
 \underline{3a + b - 2c} \\
 4a + 2b - 3c
 \end{array}$$

$$\begin{array}{r}
 (v) \quad 4a - 3b + 5c \\
 \underline{-5a + 4b - c} \\
 -a + b + 4c
 \end{array}$$

$$\begin{array}{r}
 (vi) \quad m^2 + mn + n^2 \\
 \underline{2m^2 - 3mn + 4n^2} \\
 -m^2 + mn - 2n^2 \\
 \underline{2n^2 - mn + 3n^2}
 \end{array}$$

$$\begin{array}{r}
 (vii) \quad 3x^2 - 4x^2 + 5x + 1 \\
 \underline{x^3 + 2x^2 - 3x + 4} \\
 4x^3 - 3x^2 + 4x - 5 \\
 \underline{8x^3 - 5x^2 + 6x}
 \end{array}$$

$$\begin{aligned}
 7. \quad (i) \quad & 8a - 5a = 3a \\
 (ii) \quad & 4x - 7x = -3x \\
 (iii) \quad & (x + 1) - (-2x) \\
 & = x + 1 + 2x \\
 & = 3x + 1 \\
 (iv) \quad & -x - (2x + 1) \\
 & = -x - 2x - 1 \\
 & = -3x - 1 \\
 (v) \quad & 7a + 8b \\
 & 2a + 3b \\
 & \underline{-} \\
 & \underline{5a + 5b}
 \end{aligned}$$

$$\begin{array}{r}
 (vi) \quad 4a + 2b - 3c \\
 \quad \quad 3a - b + c \\
 \underline{- \quad + \quad -} \\
 a + 3b - 4c
 \end{array}$$

$$\begin{array}{r}
 (vii) \quad 2x + y - 3z \\
 \quad \quad x - 2y - 3z \\
 \underline{- \quad + \quad +} \\
 x + 3y + 6z
 \end{array}$$

$$\begin{aligned}
 8. \quad & 1 - (5x^4 - 4x^3 + 3x^2 - 2x) \\
 & 1 - 5x^4 + 4x^3 - 3x^2 + 2x
 \end{aligned}$$

9.

Helpful Hint
Subtract to get the term that will be added.

$$\begin{array}{r}
 3a^3 - 3a^2 + 3a - 1 \\
 a^3 + 3a^2 - 3a + 1 \\
 \underline{- \quad - \quad + \quad -} \\
 2a^3 - 6a^2 + 6a - 2
 \end{array}$$

$$\begin{array}{r}
 10. \quad a^4 + 0 + 0 + 0 - 1 \\
 a^4 - 4a^3 + 6a^2 - 4a + 1 \\
 \underline{- \quad + \quad - \quad + \quad -} \\
 4a^3 - 6a^2 + 4a - 2
 \end{array}$$

$\therefore a^4 - 4a^3 + 6a^2 - 4a + 1$ should be subtracted from $a^4 - 1$ to get
 $a^4 - 4a^3 + 6a^2 - 4a + 1$

11.

Helpful Hint
First find the sum, then Subtract.

$$\begin{array}{r}
 \text{Add:} \quad -a^2 + 2a + 3 \\
 \quad \quad 3a^2 - 4a + 5 \\
 \underline{\quad \quad \quad} \\
 2a^2 - 2a + 8
 \end{array}$$

$$\begin{array}{r}
 \text{Subtract:} \quad 2a^2 - 2a + 8 \\
 \quad \quad \quad a^2 - a + 1 \\
 \underline{- \quad \quad \quad} \\
 a^2 - a + 7
 \end{array}$$

12.

Helpful Hint
First find the two sums and then subtract.

$$\begin{array}{r} \text{Step 1:} \quad l - m + 2n \\ \text{Add} \quad \frac{3l - 2m + n}{4l - 3m + 3n} \\ \frac{4l + 5m - 6n}{8l + 2m - 3n} \end{array}$$

$$\begin{array}{r} \text{Step 2:} \quad l + m + n \\ \text{Add} \quad \frac{2l + 3m + 4n}{3l + 4m + 5n} \end{array}$$

Now subtract the two sums.

$$\begin{array}{r} 8l + 2m - 3n \\ 3l + 4m + 5n \\ - \quad - \quad - \\ \hline 5l - 2m - 8n \end{array}$$

13. (i) $A + B + C$

$$\begin{array}{r} \text{A:} \quad x - y + z \\ \text{B:} \quad \frac{2x - 3y + 4z}{3x - 4y + 5z} \quad [\text{A} + \text{B}] \\ \text{C:} \quad \frac{4x - 5y - 6z}{7x - 9y - z} \quad [\text{add C}] \end{array}$$

(ii) $A - B + C$

$$\begin{array}{r} \text{Step 1: } A - B \\ \text{Subtract} \\ \text{A:} \quad x - y + z \\ \text{B:} \quad \frac{2x - 3y + 4z}{-x + 2y - 3z} \\ \hline \text{C:} \quad \frac{4x - 5y - 6z}{3x - 3y - 9z} \quad [\text{add C}] \end{array}$$

(iii) $A + B - C$

$$\begin{array}{r} \text{Step 1: } A + B \\ \text{A:} \quad x - y + z \\ \text{B:} \quad \frac{2x - 3y + 4z}{3x - 4y + 5z} \\ \hline \text{C:} \quad \frac{4x - 5y - 6z}{-x + y + 11z} \quad [\text{subtract C}] \end{array}$$

14. (i) $a + 2b - 3c - 4a - b + 2c$

$$\begin{array}{l} \text{Step 1:} \quad \text{Collect like terms, without} \\ \quad \quad \quad \text{changing signs} \\ \quad \quad \quad \underline{a - 4a} + \underline{2b - b} - \underline{3c + 2c} \end{array}$$

$$\begin{array}{l} \text{Step 2:} \quad \text{Simplify terms} \\ \quad \quad \quad - 3a + b - c \end{array}$$

$$\begin{array}{l} \text{(ii)} \quad l + m - 3n - m + 2l + 3n + 2m \\ \quad \quad \quad = l + 2l + m - m + 2m - 3n + 3n \\ \quad \quad \quad = 3l + 2m \end{array}$$

$$\text{(iii)} \quad (a^2 + 2a + 1) - (b^2 + 2a - 1)$$

Step 1: Open brackets. Remember the sign outside the bracket is multiplied by each term within the bracket.

$$\begin{array}{l} a^2 + 2a + 1 - b^2 - 2a + 1 \\ = a^2 + \cancel{2a} - \cancel{2a} - b^2 + 1 + 1 \\ = a^2 - b^2 + 2 \end{array}$$

Exercise 7C

Helpful Hint

Follow the order as given below in each sum.

- 1st Solve the vinculum: $\underline{\quad}$
- 2nd Solve the inner brackets:
Parenthesis: $(\)$
- 3rd Solve the middle brackets:
brackets: $\{ \}$
- 4th Solve the outer most brackets:
brackets $[\]$.

$$\begin{array}{l} 1. \quad 5x - \{3x + (4x - 2x)\} \\ \quad \quad = 5x - \{3x + 2x\} \quad (\text{simplify Parenthesis first}) \\ \quad \quad = 5x - \{5x\} \quad (\text{simplify bracket}) \\ \quad \quad = 5x - 5x \\ \quad \quad = 0 \end{array}$$

2.

Helpful Hint

Remember: If there is a negative sign outside the brackets, it is always better to solve in two steps, to avoid making an error.

Simplify parenthesis first.

$$\begin{array}{l} 8a - \{4a - (3a + 5a)\} \\ = 8a - \{4a - (8a)\} \\ = 8a - \{4a - 8a\} \\ = 8a - \{-4a\} \\ = 8a + 4a \\ = 12a \end{array}$$

$$\begin{aligned}
3. \quad & a + 3b - (b - 3a) - \{a - 2b - (a + 2b)\} \\
&= a + 3b - b + 3a - \{a - 2b - a - 2b\} \\
&= a + 3a + 3b - b - \{-4b\} \\
&= 4a + 2b + 4b \\
&= 4a + 6b
\end{aligned}$$

$$\begin{aligned}
4. \quad & 3\{a - 2(b - \overline{a - b})\} \\
&= 3\{a - 2(b - a + b)\} \text{ (simplify vinculum} \\
&\quad \text{first)} \\
&= 3\{a - 2(-a + 2b)\} \\
&= 3\{a + 2a - 4b\} \\
&= 3\{3a - 4b\} \\
&= 9a - 12b
\end{aligned}$$

$$\begin{aligned}
5. \quad & 5a - \{3b - \{4a - (5b - \overline{6a - 7b})\}\} \\
&= 5a - \{3b - \{4a - (5b - 6a + 7b)\}\} \\
&= 5a - \{3b - \{4a - (-6a + 12b)\}\} \\
&= 5a - \{3b - \{4a + 6a - 12b\}\} \\
&= 5a - \{3b - \{10a - 12b\}\} \\
&= 5a - \{3b - 10a + 12b\} \\
&= 5a - \{-10a + 15b\} \\
&= 5a + 10a - 15b
\end{aligned}$$

$$\begin{aligned}
6. \quad & 7a - 4b - \{5a - 3\{b - 2(a - b)\}\} \\
&= 7a - 4b - \{5a - 3\{b - 2a + 2b\}\} \\
&= 7a - 4b - \{5a - 3\{-2a + 3b\}\} \\
&= 7a - 4b - \{5a + 6a - 9b\} \\
&= 7a - 4b - \{11a - 9b\} \\
&= 7a - 4b - 11a + 9b \\
&= 7a - 11a - 4b + 9b \\
&= -4a + 5b
\end{aligned}$$

$$\begin{aligned}
7. \quad & a - [b - c + a - \{b - (c - a - \overline{a - b})\}] \\
&= a - [b - c + a - \{b - (c - a - a + b)\}] \\
&= a - [b - c + a - \{b - (c - 2a + b)\}] \\
&= a - [b - c + a - \{b - c + 2a - b\}] \\
&= a - [b - c + a - \{-c + 2a\}] \\
&= a - [b - c + a + c - 2a] \\
&= a - [-a + b] \\
&= a + a - b \\
&= 2a - b
\end{aligned}$$

$$\begin{aligned}
8. \quad & 10a - [4\{5a - 3(a - 1)\} - 3(4a - \overline{3a + 1})] \\
&= 10a - [4\{5a - 3a + 3\} - 3(4a - 3a - 1)] \\
&= 10a - [4\{2a + 3\} - 3(a - 1)] \\
&= 10a - [8a + 12 - 3a + 3] \\
&= 10a - [5a + 15] \\
&= 10a - 5a - 15 \\
&= 5a - 15 \text{ or } 5(a - 3)
\end{aligned}$$

$$\begin{aligned}
9. \quad & 2(a^2 - b^2) - 3\{a^2 - \{b^2 - a^2 + (a^2 - b^2 - a^2)\}\} \\
&= 2a^2 - 2b^2 - 3\{a^2 - \{b^2 - a^2 + a^2 - b^2 - a^2\}\} \\
&= 2a^2 - 2b^2 - 3\{a^2 - (-a^2)\} \\
&= 2a^2 - 2b^2 - 3\{a^2 + a^2\} \\
&= 2a^2 - 2b^2 - 3\{2a^2\} \\
&= 2a^2 - 2b^2 - 6a^2 \\
&= 2a^2 - 6a^2 - 2b^2 \\
&= -4a^2 - 2b^2 \\
&= -2(2a^2 + b^2)
\end{aligned}$$

$$\begin{aligned}
10. \quad & ab - [bc - \{ca + ab + (bc - \overline{ca - ab})\}] \\
&= ab - [bc - \{ca + ab + bc - ca + ab\}] \\
&= ab - [bc - \{2ab + bc\}] \\
&= ab - [bc - 2ab - bc] \\
&= ab + 2ab = 3ab
\end{aligned}$$

11. (i) $\frac{5}{2x} + \frac{y}{2x}$
 $= \frac{5+y}{2x}$ (LCM is $2x$)
- (ii) $24 - 8y^2 + z^2$
 $= 8(3 - y^2) + z^2$ (take 8 common)
- (iii) $xy + zx + ax$
 $= x(y + z + a)$ (take x common)
- (iv) $x^2y + x^2y^2 + x^2y^3$
 $= x^2y(1 + y + y^2)$ (take x^2y common)

12. (i) $5, 9, 13, 17, 21, 25, 29, 33$
 Rule: add 4 to each term.

- (ii) $40, 36, 32, 28, 24, 20, 16, 12$
 Rule: subtract 4 from each term.

- (iii) $0.003, 0.03, 0.3, 3, 30, 300, 3000, 30000$
 Rule: multiply each term by 10.

13. (i) n^{th} team = $6n$
 Let $n = 1$, then $6 \times 1 = 6$
 Let $n = 2$, then $6 \times 2 = 12$
 Let $n = 3$, then $6 \times 3 = 18$
 Let $n = 4$, then $6 \times 4 = 24$
 Let $n = 5$, then $6 \times 5 = 30$
 \therefore first five terms of the sequence are:
 6, 12, 18, 24, 30.
- (ii) n^{th} team = $n + 3$
 Let $n = 1$, then $1 + 3 = 4$
 Let $n = 2$, then $2 + 3 = 5$
 Let $n = 3$, then $3 + 3 = 6$
 Let $n = 4$, then $4 + 3 = 7$
 Let $n = 5$, then $5 + 3 = 8$
 \therefore first five terms of the sequence are:
 4, 5, 6, 7, 8.

- (iii) n^{th} team = $2n - 1$
 Let $n = 1$, then $2(1) - 1 = 1$
 Let $n = 2$, then $2(2) - 1 = 3$
 Let $n = 3$, then $2(3) - 1 = 5$
 Let $n = 4$, then $2(4) - 1 = 7$
 Let $n = 5$, then $2(5) - 1 = 9$
 \therefore first five terms of the sequence are:
 1, 3, 5, 7, 9.

- (iv) n^{th} team = $4n - 4$
 Let $n = 1$, then $4(1) - 4 = 0$
 Let $n = 2$, then $4(2) - 4 = 4$
 Let $n = 3$, then $4(3) - 4 = 8$
 Let $n = 4$, then $4(4) - 4 = 12$
 Let $n = 5$, then $4(5) - 4 = 16$
 \therefore first five terms of the sequence are:
 0, 4, 8, 12, 16.

- (v) n^{th} team = $2n + 5$
 Let $n = 1$, then $2(1) + 5 = 7$
 Let $n = 2$, then $2(2) + 5 = 9$
 Let $n = 3$, then $2(3) + 5 = 11$
 Let $n = 4$, then $2(4) + 5 = 13$
 Let $n = 5$, then $2(5) + 5 = 15$
 \therefore first five terms of the sequence are:
 7, 9, 11, 13, 15.

- (v) n^{th} team = $6n - 3$
 Let $n = 1$, then $6(1) - 3 = 3$
 Let $n = 2$, then $6(2) - 3 = 9$
 Let $n = 3$, then $6(3) - 3 = 15$
 Let $n = 4$, then $6(4) - 3 = 21$
 Let $n = 5$, then $6(5) - 3 = 27$
 \therefore first five terms of the sequence are:
 3, 9, 15, 21, 27.

14.

Helpful Hint

For the 15th term of the sequence $n = 15$

The rule of the sequence 2, 7, 12, 22, ... is $5n - 3$.

The 15th term of the sequence $5n - 3$ will be:

$$\begin{aligned} &= 5(15) - 3 \\ &= 75 - 3 = 72 \end{aligned}$$

\therefore the 15th term of the sequence is 72.

15. (i) The rule of the sequence 7, 9, 11, 13, 15, ... is $2n + 5$.

The 20th term of the sequence $2n + 5$ will be:

$$\begin{aligned} &= 2(20) + 5 \\ &= 40 + 5 = 45 \end{aligned}$$

\therefore the 20th term of the sequence is 45.

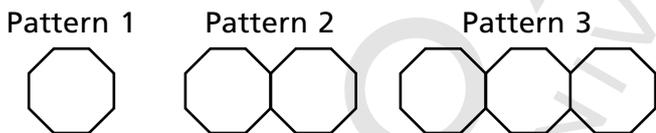
(ii) The rule of the sequence 4, 9, 14, 19, 24, ... is $5n - 1$.

The 20th term of the sequence $5n - 1$ will be:

$$\begin{aligned} &= 5(20) - 1 \\ &= 100 - 1 = 99 \end{aligned}$$

\therefore the 20th term of the sequence is 99.

16. The sequence of pattern is made from octagons with each side of 1 cm.



(i)

Helpful Hint

To find perimeter count the sides of the boundary only. Ignore the overlapping of common sides.

Perimeter of pattern 2 = 14 cm

(ii)

Pattern #	1	2	3	4
Perimeter	8 cm	14 cm	20 cm	26 cm

(iii) The rule for the perimeter of the n^{th} pattern is $6n + 2$

\therefore the perimeter of the 25th pattern will be

$$\begin{aligned} &6(25) + 2 \quad [n = 25] \\ &= 150 + 2 \\ &= 152 \text{ cm} \end{aligned}$$

(iv) Given perimeter = 38 cm

$$6(n) + 2 = 38$$

$$6n = 38 - 2$$

$$6n = 36$$

$$n = 36 \div 6$$

$$n = 6$$

\therefore the 6th pattern will have a perimeter of 38 cm.

Multiple Choice Questions 7

1. Option A: $x = y = a = 2$

Reason: Calculating the value of x , y , a , and b gives us the correct answer.

$$\begin{array}{l|l} \text{Given: } x + 3 = 5 & 3 + y = 5 \\ 2 + 3 = 5 & 3 + 2 = 5 \\ \therefore x = 2 & \therefore y = 2 \\ \\ a - 1 = 1 & 2 \times 2 = b \\ 2 - 1 = 1 & 4 = b \\ \therefore a = 2 & \end{array}$$

Option B, C and D are clearly incorrect

2. Option D: None of the above

Reason: When value of a is calculated it equals to 71.66, but it is not a whole number as required.

Option A, B, and C are incorrect.

3. Option A: 1

Reason: When the value of $\frac{3ab - 2ac}{3ab}$ is calculated with the given values, that is $a = 1$, $b = 2$ and $c = 0$

$$\begin{aligned} &= \frac{3(1)(2) - 2(1)(0)}{3(1)(2)} \\ &= \frac{6 - 0}{6} = 1 \end{aligned}$$

Options B, C, and D are clearly incorrect.

4. Option B: x

Reason: Simplification of the given expression gives x .

$$\begin{aligned} &2x + y - (x + y) \\ &= 2x + y - x - y \\ &= 2x - x \\ &= x \end{aligned}$$

Option A, C, and D are clearly incorrect.

5. Option D: 15

Reason: Rule of the sequence is add 2, then add 3, then add 4. Therefore, the next term will be found by adding 5 to the previous term.

$$\begin{array}{ccccccc} & +2 & +3 & +4 & +5 & & \\ & \curvearrowright & \curvearrowright & \curvearrowright & \curvearrowright & & \\ 1, & 3, & 6, & 10, & 15 & & \end{array}$$

Option A, B, and C are incorrect.

6. Option B: Square each term of the sequence 1, 2, 3, 4, 5, ...

Option A, C, and D are incorrect as they do not follow the correct rule of the sequence.



Linear Equations

Exercise 8

1. In these statements each word has a specific meaning.
- (i) Increased by 5: implies more than 5.
is 12: implies equal to 12
Let the number be ' x '. Therefore, the equation will be:
 $x + 5 = 12$
- (ii) Twice a number: implies two times the number.
decreased by 3: implies subtract 3 from the number
is 15: implies equal to 15
Let the number be ' x '. Therefore, the equation will be:
 $2x - 3 = 15$
- (iii) Four times a number: implies 4 times the number
six less: implies subtract 6 from the number
is 30: implies equal to 30.
Let the number be ' x '. Therefore, the equation will be:
 $4x - 6 = 30$
- (iv) One-fifth of a number: implies the number is divided by 5
Let the number be ' x '. Therefore, the equation will be:
 $\frac{x}{5} + 6 = 10$
- (v) Two-third of a number: implies $\frac{2}{3}$ of the number
subtracted from 8: implies 8 is written first
Let the number be ' x '. Therefore, the equation will be:
 $8 - \frac{2}{3}x = 4$

- (vi) Let the quotient of the number be ' x '.
Therefore, the equation will be:

$$\frac{x}{3} + 4 = 7$$

- (vii) Consecutive odd numbers: implies x and $(x + 2)$

Let the number be ' x '. Therefore, the equation will be:

$$x + (x + 2) = 12$$

- (viii) Here two ages are to be considered, that is present age and then the age after 12 years.

Helpful Hint

In such type of questions, always suppose the present age.

Let the present age = x

4 times the present age = $4x$

age after 12 years = $x + 12$

$$\therefore x + 12 = 4x$$

2. (i) $x + 2 = 7$

[Remember linear equations can be solved by balancing method or by transposition of terms.]

$$x + 2 - 2 = 7 - 2 \quad (\text{subtracting 2 from both sides})$$
$$\therefore x = 5$$

Method 2:

$$x = 7 - 2 \quad (\text{by transposition})$$

$$\therefore x = 5$$

[Note: Teachers and students can adopt any method for finding the value of the unknown quantity.]

(ii) $3x - 1 = 23$

$3x = 23 + 1$ (by transposition)

$3x = 24$

$\frac{3x}{3} = \frac{24}{3}$ (dividing both sides by 3)

$\therefore x = 8$

OR

$3x - 1 + 1 = 23 + 1$ (adding 1 on both sides)

$3x = 24$

$\frac{3x}{3} = \frac{24}{3}$ (dividing both sides by 3)

$\therefore x = 8$

(iii) $5x + 7 = 2(x + 2)$

$5x + 7 = 2x + 4$ (removing brackets)

$5x - 2x = 4 - 7$ (by transposition)

$3x = -3$

$\frac{3x}{3} = \frac{-3}{3}$ (dividing both sides by 3)

$\therefore x = -1$

(iv) $5x - 1 = 44$

$5x = 44 + 1$ (by transposition)

$5x = 45$

$\frac{5x}{5} = \frac{45}{5}$ (dividing both sides by 5)

$\therefore x = 9$

(v) $13t - 14 = 3t + 16$

$13t - 3t = 16 + 14$ (by transposition)

$10t = 30$

$\frac{10t}{10} = \frac{30}{10}$ (dividing both sides by 10)

$\therefore t = 3$

(vi) $3(t-1) - 2(2t+3) = 5(t+3)$

$3t - 3 - 4t - 6 = 5t + 15$ (removing brackets)

$3t - 4t - 3 - 6 = 5t + 15$ (collecting like terms)

$-t - 9 = 5t + 15$

$-t - 5t = 15 + 9$ (by transpositions)

$-6t = 24$

$\frac{-6t}{-6} = \frac{24}{-6}$ (dividing both sides by -6)

$\therefore t = -4$

(vii) $14(2t - 3) - 2(t + 2) = 10(3t - 4)$

$28t - 42 - 2t - 4 = 30t - 40$ (removing brackets)

$28t - 2t - 42 - 4 = 30t - 40$ (collecting like terms)

$26t - 46 = 30t - 40$

$26t - 30t = -40 + 46$ (by transposition)

$-4t = 6$

$\frac{-4t}{-4} = \frac{6}{-4}$ (dividing both sides by -4)

$t = \frac{6}{-4}$

$\therefore t = -\frac{3}{2}$ or $-1\frac{1}{2}$

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

$\frac{3x}{4} = 2x + 5$ (by transposition)

$3x = 4(2x + 5)$ (by transposition)

$3x = 8x + 20$ (remove brackets)

$3x - 8x = 20$ (by transposition)

$-5x = 20$

$\frac{-5x}{-5} = \frac{20}{-5}$ (dividing both sides by -5)

$\therefore x = -4$

(ix) $-0.2(x - 2.5) = 52.8$

$= -0.2x + 0.5 = 52.8$

$= -0.2x = 52.8 - 0.5$

$= -0.2x = 52.3$

$x = \frac{52.3}{-0.2}$

$x = -26.15$

(x) $4(2.8 - x) = -3.8 - x$

$11.2 - 4x = -3.8 - x$

$-4x + x = -3.8 - 11.2$

$-3x = -15$

$x = \frac{15}{3}$

$x = 5$

$$\begin{aligned}
 \text{(xi)} \quad & 0.2(x + 1) - 0.3(x - 1) = 0.4(x + 5) \\
 & = 0.2x + 0.2 - 0.3x + 0.3 = 0.4x + 2 \\
 & = -0.1x + 0.5 = 0.4x + 2 \\
 & = -x - 0.4x = 2 - 0.5 \\
 & = -0.5x = 1.5 \\
 & \quad x = \frac{1.5}{-0.5} = -\frac{15}{5} \\
 & \quad x = -3
 \end{aligned}$$

$$\begin{aligned}
 \text{(xii)} \quad & \frac{1}{3}(1 + x) = \frac{1}{2}(1 - x) \\
 & \frac{1+x}{3} \times \frac{2}{2} = \frac{1-x}{2} \times \frac{3}{3} \\
 & 2(1 + x) = 3(1 - x) \\
 & 2 + 2x = 3 - 3x \\
 & 2x + 3x = 3 - 2 \\
 & 5x = 1 \\
 & \quad x = \frac{1}{5}
 \end{aligned}$$

$$\begin{aligned}
 \text{(xiii)} \quad & \frac{3}{4}(1 + x) = \frac{1}{4}(5 + x) \\
 & \frac{3+3x}{4} = \frac{5+x}{4} \\
 & 3 + 3x = 5 + x \\
 & 3x - x = 5 - 3 \\
 & 2x = 2 \\
 & \quad x = \frac{2}{2} \\
 & \quad x = 1
 \end{aligned}$$

$$\begin{aligned}
 \text{(xiv)} \quad & \frac{1}{6}(x + 5) = \frac{5}{12}(x + 9) \\
 & \frac{x+5}{6} \times \frac{2}{2} = \frac{5x+45}{12} \times \frac{1}{1} \\
 & 12(x + 5) = 6(5x + 45) \\
 & 12x + 60 = 30x + 270 \\
 & 12x - 30x = 270 - 60 \\
 & -18x = 210 \\
 & \quad x = -\frac{210}{18} \\
 & \quad x = -\frac{35}{3} \text{ or } -11\frac{2}{3}
 \end{aligned}$$

$$\begin{aligned}
 \text{(xv)} \quad & \frac{7-x}{8} = \frac{3}{4} \\
 & 4(7-x) = 3 \times 8 \\
 & 28 - 4x = 24 \\
 & -4x = 24 - 28 \\
 & -4x = -4 \\
 & \quad x = 1
 \end{aligned}$$

$$\begin{aligned}
 \text{(xvi)} \quad & \frac{2x-5}{7x-3} = \frac{5}{4} \\
 & 4(2x-5) = 5(7x-3) \\
 & 8x - 20 = 35x - 15 \\
 & 8x - 35x = -15 + 20 \\
 & -27x = 5 \\
 & \quad x = -\frac{5}{27}
 \end{aligned}$$

$$\begin{aligned}
 \text{(xvii)} \quad & \frac{3-x}{7} = \frac{4-x}{5} \\
 & 5(3-x) = 7(4-x) \\
 & 15 - 5x = 28 - 7x \\
 & -5x + 7x = 28 - 15 \\
 & 2x = 13 \\
 & \quad x = \frac{13}{2} \text{ or } 6\frac{1}{2}
 \end{aligned}$$

$$\begin{aligned}
 \text{(xviii)} \quad & \frac{2x+2}{6} = \frac{3x-3}{30} \\
 & 30(2x+2) = 6(3x-3) \\
 & 60x + 60 = 18x - 18 \\
 & 60x - 18x = -18 - 60 \\
 & 42x = -78 \\
 & \quad x = \frac{-78}{42} \\
 & \quad x = -\frac{13}{7} \text{ or } -1\frac{6}{7}
 \end{aligned}$$

3.

Helpful Hint

Convert the sentences to algebraic expressions and equations.

Suppose Shirin's present age = x years

Her father's present age = $4x$ years

(4 times, her age ' x ')

After 18 years Shirin's age will be: $(x + 18)$ yrs.

After 18 years her father's age will be:

$(4x + 18)$ years

Father Shirin

$\therefore 4x + 18 = 2(x + 18)$ (2 times Shirin's age)

$$4x + 18 = 2x + 36$$

$$4x - 2x = 36 - 18$$

$$2x = 18$$

$$x = 9$$

\therefore Shirin's present age = 9 years

Her father's present age = $4x = 4 \times 9 = 36$ years

4. Total length of the pole = x metres

One part = 3 metres

Second part = $(2x - 17)$ metres



\therefore Length of the pole:

$$x = 3 + (2x - 17)$$

$$x = 3 + 2x - 17$$

$$x - 2x = 3 - 17$$

$$-x = -14$$

\therefore length of pole is 14 metres

Check:

$$x = 3 + (2x - 17)$$

$$14 = 3 + (2 \times 14 - 17)$$

$$14 = 3 + (28 - 17)$$

$$14 = 3 + 11$$

$$14 = 14$$

$$\text{LHS} = \text{RHS}$$

5. Let the number be 'x'

Triple the number = $3x$

Increase the result by 5: $3x + 5$

$$\therefore 3x + 5 = 44$$

$$3x = 44 - 5 \text{ (by transposition)}$$

$$3x = 39$$

$$x = 13 \text{ (dividing both sides by 3)}$$

\therefore the number is 13

Check:

$$3x + 5 = 44$$

$$3 \times 13 + 5 = 44$$

$$39 + 5 = 44$$

$$44 = 44$$

$$\text{LHS} = \text{RHS}$$

6. Let the number be 'x'

Twice the number : $2x$

half the number : $\frac{x}{2}$

$$\therefore 2x + \frac{x}{2} = 20$$

$$\frac{4x + x}{2} = 20 \text{ (find LCM)}$$

$$\frac{5x}{2} = 20 \text{ (by transposition)}$$

$$5x = 40 \text{ (dividing both sides by 5)}$$

$$\therefore x = 8$$

Check:

$$2x + \frac{x}{2} = 20$$

$$2 \times 8 + \frac{8}{2} = 20$$

$$16 + 4 = 20$$

$$20 = 20$$

$$\text{LHS} = \text{RHS}$$

7. Let the number be 'x'

Thrice the number : $3x$

Number decreased by 5 : $3x - 5$

Twice the number : $2x$

Exceeds by 1 unit : $2x + 1$

$$\therefore 3x - 5 = 2x + 1$$

$$3x - 2x = 1 + 5$$

$$x = 6$$

Check:

$$3x - 5 = 2x + 1$$

$$3(6) - 5 = 2(6) + 1$$

$$18 - 5 = 12 + 1$$

$$13 = 13$$

$$\text{LHS} = \text{RHS}$$

8. Let the first even number be 'x'
 then the second even number is : $(x + 2)$
 the third even number is: $(x + 2) + 2 = x + 4$
 \therefore Sum of three even numbers:

$$x + (x + 2) + (x + 4) = 36$$

$$x + x + 2 + x + 4 = 36$$

$$x + x + x + 2 + 4 = 36 \text{ (collecting like terms)}$$

$$3x + 6 = 36$$

$$3x = 36 - 6 \text{ (by transposition)}$$

$$3x = 30$$

$$\frac{3x}{3} = \frac{30}{3} \text{ (dividing both terms by 3)}$$

$$x = 10$$

Check:

$$x + (x + 2) + (x + 4) = 36$$

$$10 + (10 + 2) + (10 + 4) = 36$$

$$10 + 12 + 14 = 36$$

$$36 = 36$$

$$\text{LHS} = \text{RHS}$$

9. Suppose Mona's age is 'x' years

\therefore Sana's age is : $(x + 18)$ years

After 6 years Mona's age: $(x + 6)$ years

After 6 years Sana's age: $(x + 18) + 6 = x + 24$

$$\therefore x + 24 = 2(x + 6)$$

$$x + 24 = 2x + 12$$

$$24 - 12 = 2x - x$$

$$12 = x$$

\therefore Mona's present age = $x = 12$ years

$$\text{Sana's present age} = x + 24 = 12 + 24 = 36$$

Check:

$$x + 24 = 2(x + 6)$$

$$12 + 24 = 2(12 + 6)$$

$$36 = 2(18)$$

$$36 = 36$$

$$\downarrow \text{LHS} = \text{RHS}$$

10. Let the cost of the pen be Rs x .
 Twice the cost of the pen is Rs $2x$
 cost of book is Rs 8 more: Rs $(2x + 8)$
 cost of the book + cost of the pen = Rs 50

$$(2x + 8) + x = 50$$

$$2x + 8 + x = 50$$

$$3x + 8 = 50$$

$$3x = 50 - 8$$

$$3x = 42$$

$$x = 14$$

\therefore cost of the pen is Rs $x =$ Rs 14

$$\text{cost of the book is Rs } (2x + 8) = \text{Rs } (2 \times 14 + 8) = \text{Rs } 36$$

Check:

$$\begin{array}{l} (2x + 8) + x = 50 \\ 2 \times 14 + 8 + 14 = 50 \\ 28 + 8 + 14 = 50 \\ 50 = 50 \end{array}$$

$$\text{LHS} = \text{RHS}$$

11. Let the man's present age be 'x' years.

12 years ago his age was: $(x - 12)$ years

After 12 years his age will be: $x + 12$ years

$$\therefore 2(x - 12) = x + 12$$

$$2x - 24 = x + 12$$

$$2x - x = 12 + 24$$

$$x = 36$$

\therefore Man's present age = $x = 36$ years

Check:

$$\begin{array}{l} 2(x - 12) = x + 12 \\ 2(36 - 12) = 36 + 12 \\ 2(24) = 48 \\ 48 = 48 \\ \downarrow \text{LHS} = \text{RHS} \end{array}$$

Multiple Choice Questions 8

1. Option A: 8

Reason: According to the statement:

$$x - 4 = \frac{x}{2}$$

$$2x - 8 = x$$

$$2x - x = 8$$

$$\therefore x = 8$$

Option B, C, and D are clearly incorrect.

2. Option C: 4

Reason: According to the statement:

$$4x + 8 = 24$$

$$4x = 24 - 8$$

$$4x = 16$$

$$x = 4$$

Option A, B, and D are clearly incorrect.

3. Option D: In linear equations, power of the variable is always 1.

Reason: By definition a linear equation has one variable.

Option A, B, and C are clearly incorrect,

4. Option D: All the above options are true

Reason: Accordingly to the statement:

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

$$3x - 15 = x + 5$$

$$3x - x = 5 + 15$$

$$2x = 20$$

$$\therefore x = 10$$

Since Ronnie's present age is 10, therefore, option A, B, and C are all true statements.

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$$11. \frac{x}{5} = 2$$

$$\therefore x = 10$$

$$\begin{aligned}\text{Value of } 3x - 2 \\ &= 3(10) - 2 \\ &= 30 - 2 \\ &= 28\end{aligned}$$

$$12. 2x - 3 = 1$$

$$2x = 1 + 3$$

$$2x = 4$$

$$x = \frac{4}{2} = 2$$

$$3y - 1 = 5$$

$$3y = 5 + 1$$

$$3y = 6$$

$$y = \frac{6}{3} = 2$$

$$\therefore x + 2y$$

$$2 + 2(2) = 2 + 4 = 6$$

$$13. 4x - 1 = 11$$

$$4x = 11 + 1$$

$$4x = 12$$

$$x = \frac{12}{4} = 3$$

$$\therefore x^2 - x + 1$$

$$(3)^2 - 3 + 1$$

$$= 9 - 3 + 1$$

$$= 7$$

$$14. (i) 3x - 4 = 17$$

$$3x = 17 + 4$$

$$3x = 21$$

$$x = \frac{21}{3} = 7$$

$$(ii) \frac{x+1}{2} = 5$$

$$x + 1 = 10$$

$$x = 10 - 1$$

$$x = 9$$

$$(iii) \frac{x-5}{3} = 1$$

$$x - 5 = 3$$

$$x = 3 + 5$$

$$x = 8$$

$$(iv) \frac{4x-70}{2} = 1$$

$$4x - 70 = 2$$

$$4x = 2 + 70$$

$$4x = 72$$

$$x = \frac{72}{4}$$

$$\therefore x = 18$$

$$(v) \frac{x}{7} - 3 = 2 \quad \text{or} \quad \frac{x}{7} - 3 = 2$$

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

$$\frac{x}{7} = 5$$

$$\therefore x = 35$$

$$\frac{x-21}{7} = 2$$

$$x - 21 = 14$$

$$x = 14 + 21$$

$$\therefore x = 35$$

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

$$\frac{3x - 2x}{6} = 1$$

$$= \frac{x}{6} = 1$$

$$\therefore x = 6$$

$$(vii) 3x - \frac{x}{2} = 5$$

$$\frac{6x - x}{2} = 5$$

$$5x = 10$$

$$x = \frac{10}{5}$$

$$\therefore x = 2$$

$$(viii) \frac{x}{3} + \frac{3x}{2} = 11$$

$$\frac{2x + 9x}{6} = 11$$

$$11x = 66$$

$$x = \frac{66}{11}$$

$$\therefore x = 6$$

15. Let Tahir's present age = T
 \therefore Tahir's age 3 years ago = $T - 3$
 Let Masood's present age = M
 \therefore Masood's age 3 years ago = $M - 3$
 According to statements:
 Sum of Tahir and Masood's present ages : $T + M = 18$ equ. (i)
 $\therefore M = 18 - T$ equ. (ii)
 3 years ago their ages were:
 $T - 3 = 3(M - 3)$
 $T - 3 = 3M - 9$
 $T - 3M = -9 + 3$
 $T - 3M = -6$ equ. (iii)
 Substitute the value of 'M' from equ. (ii) in equ. (iii)
 $T - 3(18 - T) = -6$
 $T - 54 + 3T = -6$
 $T + 3T = -6 + 54$
 $4T = 48$
 $T = \frac{48}{4} = 12$
 \therefore Tahir's present age = 12 years.
 Substitute the value of T in equ. (i).
 $T + M = 18$
 $12 + M = 18$
 $M = 18 - 12 = 6$
 \therefore Masood's present age = 6 years
16. Let the smaller number be ' x '
 \therefore Larger number = $x + 5$
 Sum of numbers = 19
 $\therefore x + x + 5 = 19$
 $2x = 19 - 5$
 $2x = 14$
 $x = \frac{14}{2} = 7$
 \therefore smaller number = 7
 \therefore larger number = $x + 5$
 $= 7 + 5 = 12$
17. Let the first odd number be ' x '
 second odd number = $x + 2$
 third odd number = $(x + 2) + 2 = x + 4$
 Sum of three consecutive odd numbers = 39
 $\therefore x + x + 2 + x + 4 = 39$
 $3x + 6 = 39$
 $3x = 39 - 6$
 $3x = 33$
 $x = \frac{33}{3}$
 $\therefore x = 11$
 \therefore first odd number = 11
 second odd number = $x + 2 = 11 + 2 = 13$
 third odd number = $x + 4 = 11 + 4 = 15$
 \therefore three odd consecutive odd number are 11, 13, 15
 Check:
 $11 + 13 + 15 = 39$
18. Let the larger number be ' x '
 then the smaller number = $x - 4$
 \therefore according to the statement
 $3x + 4(x - 4) = 61$
 $3x + 4x - 16 = 61$
 $7x = 61 + 16$
 $7x = 77$
 $x = \frac{77}{7} = 11$
 \therefore the larger number is 11
 \therefore the smaller number is $x - 4 = 11 - 4 = 7$
 Check:
 $3(11) + 4(11 - 4) = 61$
 $33 + 4(7) = 61$
 $33 + 28 = 61$
 LHS = RHS



Geometry: Lines and Angles

Exercise 9A

- (i) collinear points (ii) unlimited
(iii) two points (iv) one; length
(v) two
- (i) False (ii) True (iii) False
(iv) True (v) False
- (i) $\overline{AB}, \overline{BC}, \overline{AC}, \overline{AD}, \overline{BD}$ and \overline{CD}
(ii) $\overline{AB}, \overline{BC}, \overline{AC}, \overline{AD}, \overline{BE}, \overline{CF}, \overline{DE}, \overline{EF}$ and \overline{DF}
- (i) line AB (ii) ray AB
(iii) ray BA (iv) line segment AB
- (i) infinite (ii) infinite
(iii) only one
- Student's examples will vary. For examples, parallel lines.
- (i) six (ii) only one (iii) four
- $\overline{AB}; \overline{BC}; \overline{AD}; \overline{DC}$
- (i) $\overleftrightarrow{EF}, \overleftrightarrow{GH}, \overleftrightarrow{AC}$ and \overleftrightarrow{BD} (ii) $\overleftrightarrow{AB}, \overleftrightarrow{AD}$ and \overleftrightarrow{AC}
- Seven

Exercise 9B

- (i) acute (ii) acute
(iii) right (iv) obtuse
(v) straight (vi) reflex
(vii) acute (viii) complete
(ix) reflex (x) reflex
- (i) four right angles
[One right angle = 90°]
 \therefore 4 right angles
 $= 90^\circ + 90^\circ + 90^\circ + 90^\circ = 360^\circ$
(ii) $2\frac{1}{2}$ right angles = $90^\circ + 90^\circ + 45^\circ = 225^\circ$
(iii) $\frac{2}{3}$ right angles = $\frac{2}{3} \times 90^\circ = 60^\circ$

$$(iv) \frac{1}{2} \text{ right angles} = \frac{1}{2} \times 90^\circ = 45^\circ$$

$$(v) 1\frac{1}{2} \text{ right angles} = \frac{3}{2} \times 90^\circ = 135^\circ$$

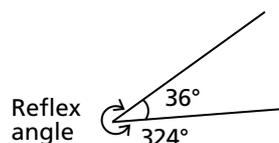
- (i) right angle
(ii) straight angle
(iii) right angle
(iv) acute
(v) obtuse
- (i) 270° (ii) 240° (iii) 210°
-

Helpful Hint

First find $\frac{2}{5}$ of a right angle.

$$\frac{2}{5} \times 90^\circ = 36^\circ$$

$$\therefore \text{reflex angle} = 360^\circ - 36^\circ = 324^\circ.$$



-

Helpful Hint

Two angles are complementary if their sum equals to 90° . To find the complement of any angle subtract it from 90° .

- Complement of 70° is : $90^\circ - 70^\circ = 20^\circ$
- 67° (iii) 31° (iv) 45°
- 90° (vi) 0° (vii) 10°
- 79.5° (ix) 60° (x) 89.5°

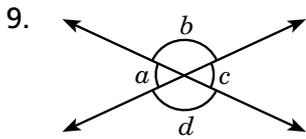
7.

Helpful Hint

Two angles are supplementary if their sum equals 180° . To find supplement of any angle, subtract it from 180° .

- (i) Supplement of 90° is:
 $180^\circ - 90^\circ = 90^\circ$
 (ii) 100° (iii) 180° (iv) 0°
 (v) 18° (vi) 95° (vii) 99.5°
 (viii) 80°

8. (i) $\angle COA, \angle AOB$
 (ii) $\angle TQP, \angle PQS; \angle PQS, \angle SQR;$
 $\angle SQR, \angle RQT; \angle RQT, \angle TQP.$
 (iii) $\angle COA, \angle AOD; \angle AOD, \angle DOB;$
 $\angle DOB, \angle BOC; \angle BOC, \angle COA$

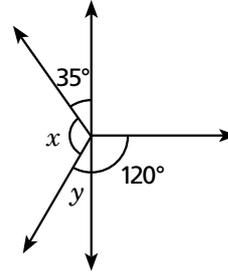


Given $a = 50^\circ$
 $\angle a + \angle b = 180^\circ$ (supplementary angles)
 $50^\circ + \angle b = 180^\circ$
 $\angle b = 180^\circ - 50^\circ$
 $\therefore \angle b = 130^\circ$
 Similarly, $\angle b + \angle c = 180^\circ$ (supplementary angles)
 $130^\circ + \angle c = 180^\circ$
 $\angle c = 180^\circ - 130^\circ$
 $\therefore \angle c = 50^\circ$
 or $\angle a = \angle c = 50^\circ$ (vertically opposite angles)
 And $\angle c + \angle d = 180^\circ$
 $50^\circ + \angle d = 180^\circ$ (supplementary angles)
 $\angle d = 180^\circ - 50^\circ$
 $\therefore \angle d = 130^\circ$

10.

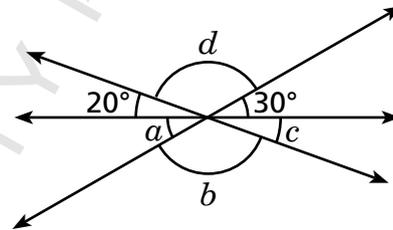
Helpful Hint

Angles on a straight line add up to 180°



$\angle y + 90^\circ = 120^\circ$
 $\angle y = 120^\circ - 90^\circ$
 $\therefore \angle y = 30^\circ$
 $\angle y + \angle x + 35^\circ = 180^\circ$ (\angle s on a st. line)
 $30^\circ + \angle x + 35^\circ = 180^\circ$
 $\angle x + 65^\circ = 180^\circ$
 $\angle x = 180^\circ - 65^\circ$
 $\therefore \angle x = 115^\circ$

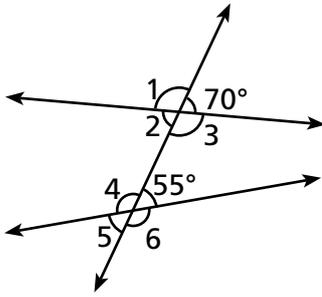
11.



$\angle a = 30^\circ$ (vertically opposite angles)
 $\angle c = 20^\circ$ (vertically opposite angles)
 $\angle a + 20^\circ + \angle d = 180^\circ$ (\angle s on a st. line)
 $30^\circ + 20^\circ + \angle d = 180^\circ$
 $50^\circ + \angle d = 180^\circ$
 $\angle d = 180^\circ - 50^\circ$
 $\therefore \angle d = 130^\circ$
 $\angle b + \angle c + 30^\circ = 180^\circ$ (\angle s on a st. line)
 $\angle b + 20^\circ + 30^\circ = 180^\circ$
 $\angle b + 50^\circ = 180^\circ$
 $\angle b = 180^\circ - 50^\circ$
 $\therefore \angle b = 130^\circ$

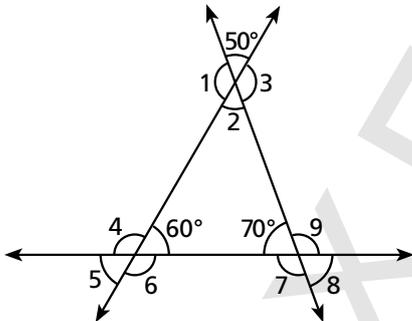
Hint: $\angle b$ and $\angle d$ are vertically opposite to each other, therefore, $\angle b = \angle d$. So, find either one of them and then equate.

12.



$70^\circ + \angle 3 = 180^\circ$ (supplementary angles)
 $\angle 3 = 180^\circ - 70^\circ$
 $\therefore \angle 3 = 110^\circ$
 $\angle 2 = 70^\circ$ (vertically opposite angles)
 $\angle 1 = \angle 3 = 110^\circ$ (vertically opposite angles)
 $\angle 5 = 55^\circ$ (vertically opposite angles)
 $\angle 4 + \angle 5 = 180^\circ$ (supplementary angles)
 $\angle 4 + 55^\circ = 180^\circ$
 $\angle 4 = 180^\circ - 55^\circ$
 $\therefore \angle 4 = 125^\circ$
 $\angle 6 = \angle 4 = 125^\circ$ (vertically opposite angles)

13.



$\angle 2 = 50^\circ$ (vertically opposite angles)
 $\angle 1 + 50^\circ = 180^\circ$ (supplementary angles)
 $\angle 1 = 180^\circ - 50^\circ$
 $\therefore \angle 1 = 130^\circ$
 $\angle 1 = \angle 3 = 130^\circ$ (vertically opposite angles)
 $\angle 5 = 60^\circ$ (vertically opposite angles)
 $\angle 4 + 60^\circ = 180^\circ$ (supplementary angles)
 $\angle 4 = 180^\circ - 60^\circ$
 $\therefore \angle 4 = 120^\circ$
 $\angle 4 = \angle 6 = 120^\circ$ (vertically opposite angles)
 $\angle 8 = 70^\circ$ (vertically opposite angles)

$\angle 9 + 70^\circ = 180^\circ$
 $\angle 9 = 180^\circ - 70^\circ$
 $\therefore \angle 9 = 110^\circ$
 $\angle 7 = \angle 9 = 110^\circ$ (vertically opposite angles)

Exercise 9C

1. Reason:

All statements are completed by facts.

- (i) Lines that maintain a constant distance between them are Parallel.
- (ii) When a transversal intersects two parallel lines, four interior angles are formed.
- (iii) Sum of the interior angles on the same side of the transversal is equal to 180° .
- (iv) When a transversal intersects two parallel lines, the alternate angles are equal.
- (v) When a transversal intersects two parallel lines, corresponding angles are formed on same side of the transversal.

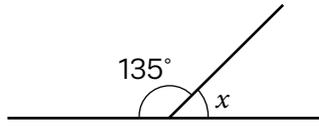
2. Reason:

- (i) False: Corresponding angles are equal to each other, therefore, they do not add up to 180° .
- (ii) True: By definition of alternate angles
- (iii) False: Transversal may or may not be perpendicular to parallel lines. Transversal can cut the parallel lines at any angle.
- (iv) False: Corresponding angles are equal, thus their sum cannot be 360° .
- (v) False: When two parallel lines are cut by a transversal, the sum of interior angles is 180° , thus supplementary.

3. (i) Yes, the given lines are parallel to each other, because alternate angles are equal.
- (ii) No, the given lines are not parallel to each other, because the corresponding angles are not equal.

- (iii) Yes, the given lines are parallel to each other, because alternate angles are equal.

4. (i)

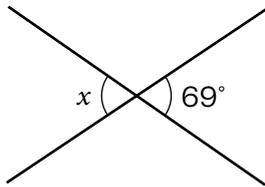


$$135^\circ + x = 180^\circ \text{ (supplementary angles)}$$

$$x = 180^\circ - 135^\circ$$

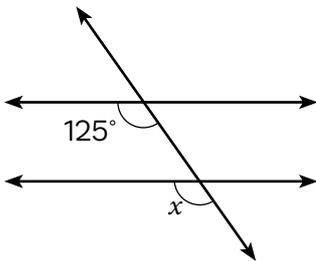
$$x = 45^\circ$$

(ii)



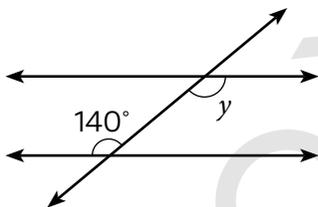
$$\angle x = 69^\circ \text{ (vertically opposite angles)}$$

(iii)



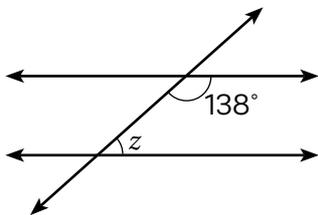
$$\angle x = 125^\circ \text{ (corresponding angles)}$$

(iv)



$$\angle y = 140^\circ \text{ (alternate angles)}$$

(v)

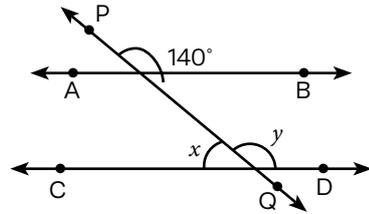


$$\angle z + 138^\circ = 180^\circ \text{ (interior angles)}$$

$$\angle z = 180^\circ - 138^\circ$$

$$\angle z = 42^\circ$$

5.



Given:

$$\overleftrightarrow{AB} \parallel \overleftrightarrow{CD}$$

\overleftrightarrow{PQ} is a transversal.

$$\angle y = 140^\circ \text{ (corresponding angles are equal)}$$

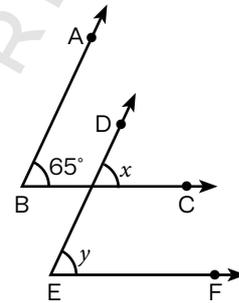
$$\angle x + \angle y = 180^\circ \text{ (supplementary angles add up to } 180^\circ)$$

$$\angle x + 140^\circ = 180^\circ$$

$$\angle x = 180^\circ - 140^\circ$$

$$\angle x = 40^\circ$$

6.



$$\overline{AB} \parallel \overline{ED}$$

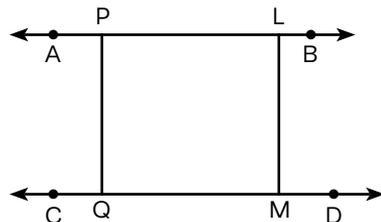
$$\overline{BC} \parallel \overline{EF}$$

$$\angle x = 65^\circ \text{ (corresponding angles)}$$

$$\angle x = \angle y \text{ (corresponding angles)}$$

$$\therefore \angle x = \angle y = 65^\circ$$

7.



Given:

$$\overleftrightarrow{AB} \parallel \overleftrightarrow{CD}$$

$$\overline{PQ} \perp \overleftrightarrow{AB}$$

$$\overline{LM} \perp \overleftrightarrow{CD}$$

$$\overline{PQ} = 1.4 \text{ cm}$$

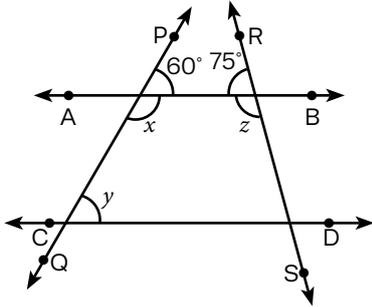
Helpful Hint:

The perpendicular distance between two parallel lines is always same.

Since, $m \overline{LM} = m \overleftrightarrow{PQ}$

Therefore, $m \overline{LM} = 1.4 \text{ cm}$

8.



Given:

$$\overleftrightarrow{AB} \parallel \overleftrightarrow{CD}$$

\overleftrightarrow{PQ} and \overleftrightarrow{RS} are two transversals.

$$\angle x + 60^\circ = 180^\circ \text{ (supplementary angles)}$$

$$\angle x = 180^\circ - 60^\circ$$

$$\angle x = 120^\circ$$

$$\angle x + \angle y = 180^\circ \text{ (sum of interior angles)}$$

$$120^\circ + \angle y = 180^\circ$$

$$\angle y = 180^\circ - 120^\circ$$

$$\angle y = 60^\circ$$

Note: $\angle y$ can be found directly also.

$$\angle y = 60^\circ \text{ (corresponding angles)}$$

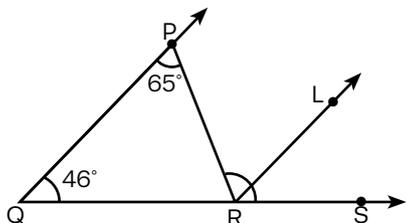
$$75^\circ + \angle z = 180^\circ \text{ (supplementary angles)}$$

$$\angle z = 180^\circ - 75^\circ$$

$$\angle z = 180^\circ - 75^\circ$$

$$\therefore \angle z = 105^\circ.$$

9.



Given:

$$\overleftrightarrow{RL} \parallel \overleftrightarrow{QP}$$

$$\angle PQR = 46^\circ$$

$$\angle QPR = 65^\circ$$

$$\angle PRS = ?$$

$$\angle PRL = \angle QPR = 65^\circ \text{ (alternate angles)}$$

$$\angle PQR = \angle LRS = 46^\circ$$

Now,

$$\angle PRS = \angle PRL + \angle LRS$$

$$\angle PRS = 65^\circ + 46^\circ$$

$$\angle PRS = 111^\circ$$

10.

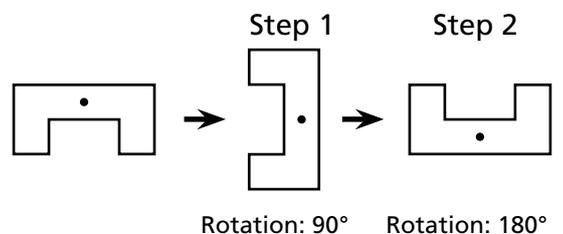
Helpful Hint:

- The order of rotation depends on number of times the shape matches the original shape in one complete rotation of 360° .
- Remember, every shape has a rotational symmetry of order 1, as it will always come back to its original position after one complete rotation of 360° .

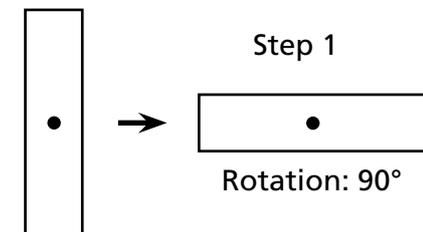
Order of rotational symmetry of:

- (i) letter H is two.
- (ii) letter N is two.
- (iii) letter X is four.
- (iv) letter I is two.
- (v) letter S is two.

11. (i)



(ii)



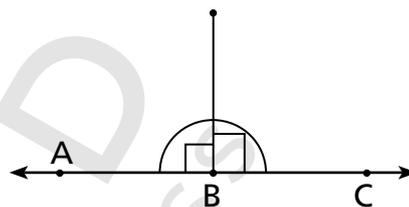
\therefore the angle of rotation will be 90° to come to the required shape.

12. The given parallelogram has rotational symmetry of order 2.

Multiple Choice Questions 9

- Option A: True
Reason: By definition of concentric circles the statement is correct.
Option B, C, and D are clearly incorrect.
- Option C: Unlimited
Reason: No matter at what degree a circle is rotated it will come back to its original shape.
Option A, B, and D are clearly incorrect.
- Option C: 3 dimensions
Reason: A solid has length, breadth, and height which shows it has 3 dimensions.
- Option D: A perpendicular can be drawn at the end point of a line segment.
Option A, and B are incorrect because perpendicular can be drawn at any point on the line or outside the line. Therefore, it may not necessarily be a bisector.
Option C, is incorrect, because two perpendicular lines make an angle of 90° with each other.
- Option A: Line AB has a number of points, which can be counted.
Reason: By definition a line has infinite (uncountable) number of points.
Option B, C, and D are clearly incorrect.
- Option C: 90°
Reason: An acute angle is less than 90° . In option A, B, and D all are acute angles.
- Option A: 130°
Reason: An obtuse angle is more than 90° , but less than 180° .
Option B: 240° is a reflex angle
Option C: 198° is a reflex angle
Option D: 180° is a straight angle

- Option D: 180°
Reason: By definition sum of angles of a triangle is 180° .
Option A, B, and C are clearly incorrect.
- Option C: True only when they are adjacent to each other
Reason: Two adjacent right angles will make an angle of 180°
 $\angle ABC = 180^\circ$



- Option A, B, and D are clearly incorrect
- Option B: False
Reason: An obtuse angle is less than 180° , and more than 90° . While two angles are supplementary if their sum is 180° . These two statements contradict each other.
Option A, C, and D are clearly incorrect.
 - Option B: 90°
Reason: Perpendicular lines make an angle of 90° to each other (\perp).
Option A, C, and D are clearly incorrect.
 - Option D: 0°
Reason: Two parallel lines never meet, so they do not make an angle.
Option A, B, and C are clearly incorrect, because if an angle is formed between them, then it means that they are meeting at a point.
 - Option B: It overlaps the other line
Option A, C, and D are clearly incorrect statements.

14. Option A: Vertically opposite angles.

Reason: By definition and can also be proved through an activity.

Option B is incorrect because supplementary angles are equal only when both the angles are of 90° .

Option C is incorrect because adjacent angles have common vertex and a common arm, but the angles are not necessarily equal.

Option D is incorrect because complementary angles are equal only when both the angles measure 45° .

15. Option C: Corresponding angles are equal.

Reason: By definition and can also be proved through an activity.

Option A, B, and D are clearly incorrect statement.

16. Option D: The distance between them remains the same.

Reason: The lines can only be parallel if they never meet, or do not intersect each other, and distance between them remains same.

Option A, B, and C are clearly incorrect statements

17. Option C: $96^\circ, 94^\circ$

Reason: $96^\circ + 94^\circ \neq 180^\circ$

Option A, B, and D are all correct pair of angles in each add up to 180° .

18. Option C : $\frac{5}{6}$ of 180°

Reason: $\frac{5}{6} \times 180 = 150^\circ$ which is an obtuse angle.

Option A, B, and D all angles are acute.

19. Option B: Complementary angles

$$\begin{aligned}\text{Reason: } & x^\circ + (90 - x)^\circ \\ & = x^\circ + 90^\circ - x^\circ \\ & = 90^\circ\end{aligned}$$

For example if $x = 30^\circ$, then

$$\begin{aligned}(90 - x)^\circ & = 90^\circ - 30^\circ \\ & = 60^\circ \\ 30^\circ + 60^\circ & = 90^\circ\end{aligned}$$

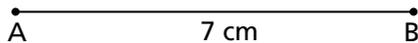


Practical Geometry

Exercise 10A

[Lines are not drawn to scale in these questions]

- Step 1: Open the points of a pair of divider of any length of your choice.
Step 2: Press the pointed ends on the note book.
Step 3: Denote the two marks as A and B.
Step 4: Join A to B.
Step 5: Measure the length of \overline{AB}



- Step 1: Measure \overline{AB} .
 $\overline{AB} = 4.5$ cm
Step 2: Draw $PQ = 4.5$ cm

A horizontal line segment with endpoints P and Q. Below the segment, the text "4.5 cm" is written.
- Step 1: Measure the given line segments.
 $\overline{EF} = 2$ cm
 $\overline{CD} = 3.5$ cm
 $\overline{GH} = 3.8$ cm
 $\therefore GH$ is the longest line segment
- Steps of construction:
Step 1: Measure \overline{MN} .
 $\overline{MN} = 6$ cm
Step 2: \overline{XY} is double of \overline{MN} .
 $\therefore \overline{XY} = (6 + 6)$ cm = 12 cm
Step 3: Draw $\overline{XY} = 12$ cm

A horizontal line segment with endpoints X and Y. Below the segment, the text "12 cm" is written.

Exercise 10B

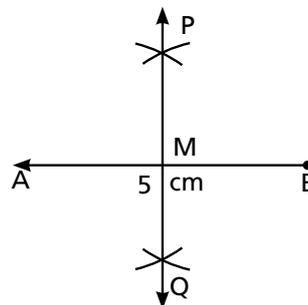
- (i) $\angle ABC = 75^\circ$
(ii) $\angle DEF = 90^\circ$
(iii) $\angle XYZ = 108^\circ$
(iv) $\angle RST = 34^\circ$

2.

Helpful Hint

Measure each pair of angles to check whether they are equal to less than or more than each other.

- $\angle ABC$ is equal to $\angle DEF$
 - $\angle XYZ$ is greater than $\angle RST$
 - $\angle PQR$ is less than $\angle MNL$
- (i) Steps of construction:
Step 1: Draw a line segment $\overline{AB} = 5$ cm
Step 2: With A as centre and a radius more than half of \overline{AB} , draw two arcs, one on each side of \overline{AB} as shown.
Step 3: With B as centre and with the same radius as before, draw two more arcs to cut the previous arcs at P and Q.
Step 4: Join P to Q. Produce \overline{PQ} in both directions to form \overleftrightarrow{PQ} .
Step 5: Measure \overline{AM} and \overline{MB} .
 $\overline{AM} = \overline{MB} = 2.5$ cm
Therefore, \overleftrightarrow{PQ} bisects the line segment \overline{AB} at M.



Follow the same steps in (ii), (iii), (iv) and (v)

4. (i) Steps of construction:

Step 1: Draw $\overline{AB} = 4$ cm. Mark a point N on it.

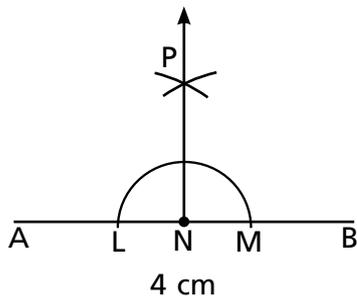
Step 2: With N as centre and with a suitable radius, draw an arc to intersect \overline{AB} at L and M.

Step 3: With L as centre and a radius of more than \overline{LM} , draw an arc above AB.

Step 4: With M as centre and the same radius, draw another arc to intersect the previous arc at P.

Step 5: Join P and N.

\overline{NP} is the required perpendicular to \overline{AB}



Follow the same steps of construction for:

(ii), (iii), (iv) and (v)

5. (i) Steps of construction:

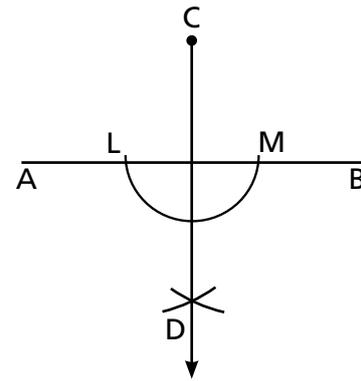
Step 1: Draw a line segment $\overline{AB} = 9$ cm. Take a point C lying outside and above it.

Step 2: With C as centre and with a suitable radius, draw an arc to intersect \overline{AB} at L and M.

Step 3: With L as centre, draw an arc with radius greater than half of \overline{LM} .

Step 4: With M as centre and the same radius, draw another arc to intersect the previous arc at D.

Step 5: Draw a line through C and D.

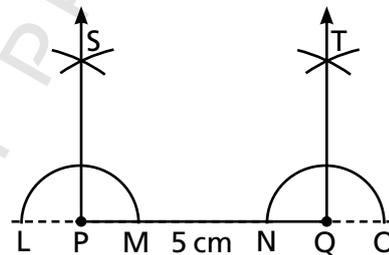


\overline{CD} is the required perpendicular to \overline{AB} .

6. Steps of construction:

Step 1: Draw a line segment $\overline{PQ} = 5$ cm.

Step 2: Follow the steps of construction of drawing a perpendicular as given in Q4 (i).



\overline{PS} is a perpendicular to \overline{PQ} at point P.

Similarly, \overline{QT} is a perpendicular to \overline{PQ} at point Q. The distance between the two perpendiculars \overline{PQ} and \overline{QT} is same, that is 5 cm.

Therefore, \overline{PQ} is parallel to \overline{QT} .

7. Follow the steps of construction on the given pages of NCD 6 textook to construct the following angles.

- (i) 60° (page: 159)
- (ii) 90° (page: 160)
- (iii) 45° (page: 160)
- (iv) 75° (page: 161)
- (v) 105° (page: 162)
- (vi) 120° (page: 161)

8. (i) Step of construction:

Step 1: Draw an angle of 30° using a protractor by following the steps given on page 159 of NCD textbook.

Step 2: Follow the steps of bisecting an angle given on page 159 of NCD textbook and bisect angle of 30° .

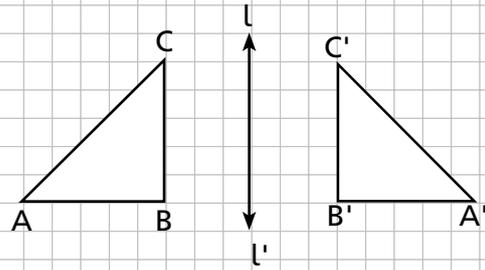
Follow the same steps of construction to draw and bisect each of the given angle.

(ii) 65° (iii) 130° (iv) 72° (v) 150°

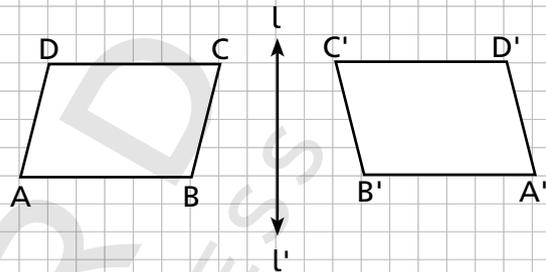
9. Follow the steps given in Q8 to draw an angle bisector of 90° .

10. Draw the reflection of the shapes by counting the number of small squares between the shape and the line of reflection.

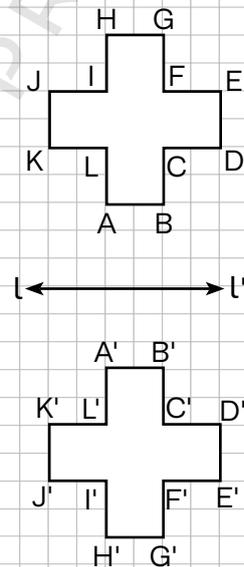
(i)



(ii)

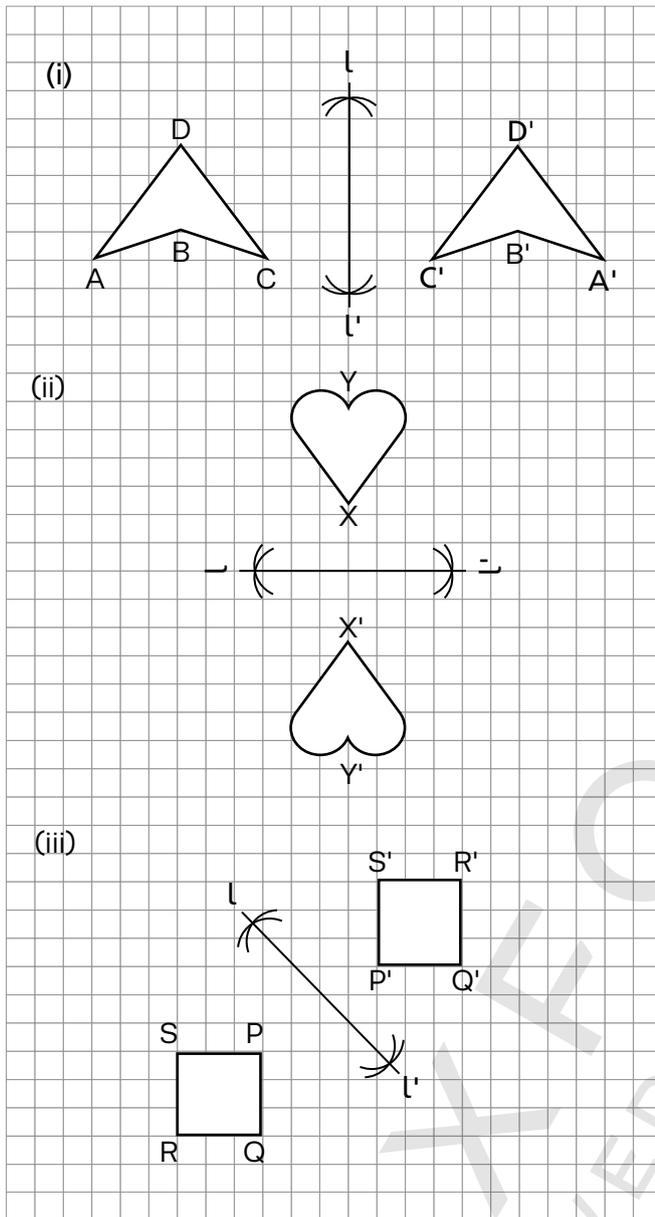


(iii)



11. Follow the steps of construction to draw the line of reflection, given on page 164 of the NCD textbook.

- (i) Take D and D' as centres to draw arcs.
- (ii) Take X and X' as centres to draw arcs.
- (iii) Take P and P' as centres to draw arcs.



Multiple Choice Questions 10

- Option D: False

Reason: By definition a line has no end points and can be extended on both sides, while a line segment has two end points.

Option A, B, and C are clearly incorrect.
- Option A: Never

Reason: A line segment cannot be longer than a line as it has two end points.

Option: B, C, and D are clearly incorrect.
- Option B: $\overline{LM} > \overline{PQ}$

Reason: \overline{PQ} lies between L and M.

Option A, C, and D are clearly incorrect.
- Option C: Angles

Reason: A protractor is used to draw and measure angles.

Option A, B, and D are incorrect, because arcs and curved lines are drawn with a pair of compasses, while a straight line is drawn with a ruler.
- Option D: Isosceles triangle

Reason: In an isosceles triangle two sides are equal.

Option A, B, and C are incorrect. Square has 4 lines of symmetry. Rectangle has 2 lines of symmetry, scalene triangle does not have a line symmetry, because all its sides are of different lengths.
- Option C: Circle

Reason: A circle has infinite points on the circumference.

Option A, B, and D are incorrect.

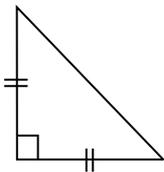
11 Triangles

Exercise 11A

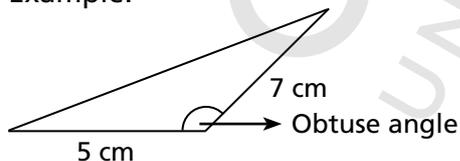
- Four; ΔPQR , ΔPRS , ΔPQS and ΔQRS
- (i) yes; equilateral (ii) isosceles
(iii) obtuse-angled
- (i) scalene (ii) isosceles
(iii) equilateral
- eight; ΔABC , ΔBCD , ΔCDA , ΔPAB , ΔPBC , ΔPCD , ΔPDA , ΔDAB ; four
- ΔABC , ΔADC , ΔATP , ΔCTQ , ΔCTR , ΔATS ; two
- (i) right-angled (ii) acute-angled
(iii) right-angled (iv) obtuse-angled

Exercise 11B

- (i) True
Example:



- (ii) False
Example:

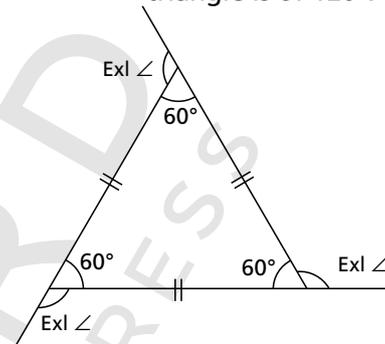


- (iii) True
Example:



- (iv) False

Example: Each Exl \angle of an equilateral triangle is of 120° .



2.

Helpful Hint

If the sum of the given angles is equal to 180° , then a triangle can be constructed.

- (i) ΔABC can be constructed because

$$m\angle A + m\angle B + m\angle C = 180$$

$$45^\circ + 60^\circ + 75^\circ = 180^\circ$$

- (ii) ΔABC cannot be constructed because

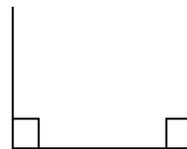
$$m\angle A + m\angle B + m\angle C \neq 180$$

$$65^\circ + 90^\circ + 35^\circ = 190^\circ > 180^\circ$$

- (iii) ΔABC cannot be constructed because

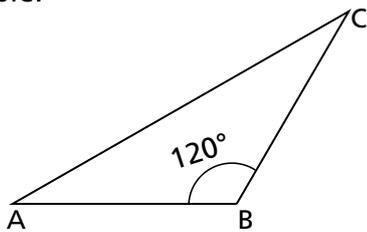
$$m\angle A = m\angle B = 90^\circ$$

A triangle cannot be constructed with two right angles.



- (iv) ΔABC can be constructed because one of the angle that is $m\angle B = 120^\circ$ and the second angle $m\angle C$ is less than $= 60^\circ$. This implies the third angle is also acute.

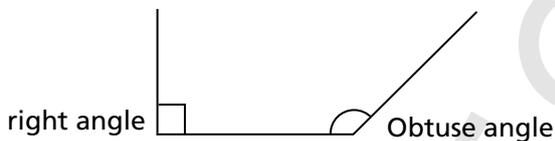
Example:



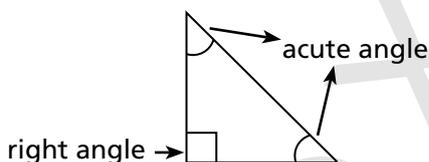
Note that a triangle can easily be constructed if one of the angle is obtuse and the remaining two are acute angles.

- (v) $\triangle ABC$ can be constructed because:
 $m\angle A + m\angle B + m\angle C = 180^\circ$
 $68^\circ + 50^\circ + 62^\circ = 180^\circ$

3. No an obtuse-angled triangle can never have a right angle because the sum of the three angles of a triangle cannot be greater than 180°



4. Yes, if one of the angle of a triangle is of 90° , then the other two must be acute.



5. (i) an equilateral: $60^\circ, 60^\circ, 60^\circ$
 (ii) an isosceles right-angle triangle: $90^\circ, 45^\circ, 45^\circ$

6. Ratio of angles = $2 : 3 : 5$
 Total ratio = $2 + 3 + 5 = 10$
 [sum of angles of a triangles = 180°]
 First angle: $\frac{2}{10} \times 180^\circ = 36^\circ$
 Second angle: $\frac{3}{10} \times 180^\circ = 54^\circ$
 Third angle: $\frac{5}{10} \times 180^\circ = 90^\circ$

[check: $36^\circ + 54^\circ + 90^\circ = 180^\circ$]

Since one of the angle is of 90° , therefore, it is a right-angled triangle.

7. Ratio of angles = $3 : 5 : 7$
 Total ratio = $3 + 5 + 7 = 15$
 [sum of angles of a triangle = 180°]

First angle: $\frac{3}{15} \times 180^\circ = 36^\circ$

Second angle: $\frac{5}{15} \times 180^\circ = 60^\circ$

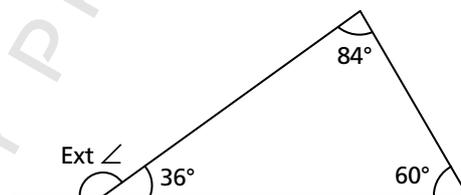
Third angle: $\frac{7}{15} \times 180^\circ = 84^\circ$

[check: $36^\circ + 60^\circ + 84^\circ = 180^\circ$]

To find the size of the greatest exterior angle choose the smallest angle.

Exterior angle = sum of the opposite two interior angles = $60^\circ + 84^\circ$

\therefore exterior angle = 144° .



8. Let the angles of the triangle be:

$m\angle A + m\angle B + m\angle C = 180^\circ$

[$m\angle B = m\angle C$ in an isosceles triangle]

$100^\circ + x + x = 180^\circ$

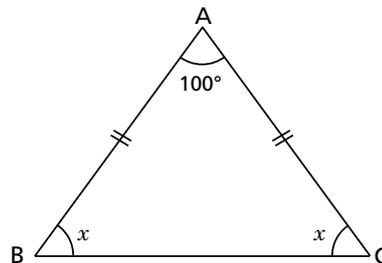
$2x = 180^\circ - 100$

$2x = 80^\circ$

$x = 40^\circ$

Check: $100^\circ + 40^\circ + 40^\circ = 180^\circ$

\therefore each angle is of 40° .



9. Let the angles of the triangle be:

$$m\angle A + m\angle B + m\angle C = 180^\circ$$

$$54^\circ + 54^\circ + x = 180^\circ$$

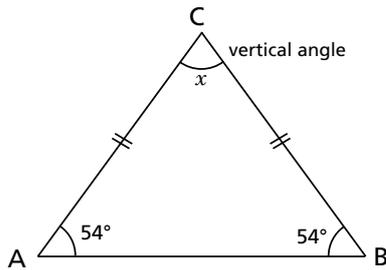
$$108^\circ + x = 180^\circ$$

$$x = 180^\circ - 108^\circ$$

$$x = 72^\circ$$

\therefore the vertical angle is 72° .

[Since it is an isosceles triangle both base angles will be same]



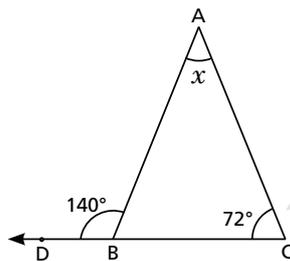
10. Ext $\angle =$ sum of the opposite two int \angle s

$$m\angle DBA = m\angle A + m\angle C$$

$$140^\circ = x + 72^\circ$$

$$140^\circ - 72^\circ = x$$

$$\therefore x = 68^\circ$$



11. In $\triangle ABC$:

$$m\angle A + m\angle B + m\angle C = 180^\circ$$

$$84^\circ + x + x = 180^\circ$$

$$2x + 84^\circ = 180^\circ$$

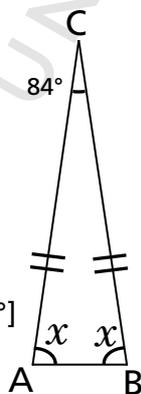
$$2x = 180^\circ - 84^\circ$$

$$2x = 96^\circ$$

$$x = 48^\circ$$

\therefore each base angle is of 48° .

[Check: $84^\circ + 48^\circ + 48^\circ = 180^\circ$]



12. $115^\circ + y = 180^\circ$ (supplementary angles)

$$y = 180^\circ - 115^\circ$$

$$\therefore y = 65^\circ$$

Ext $\angle =$ sum of opposite two int \angle s

$$115^\circ = x + 64^\circ$$

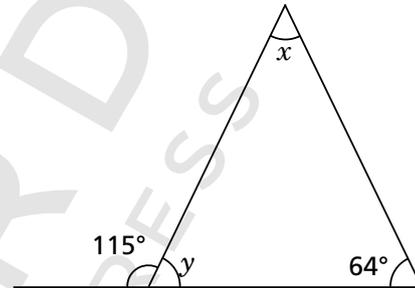
$$115^\circ - 64^\circ = x$$

$$\therefore x = 51^\circ$$

Check:

$$\angle x + \angle y + 64^\circ = 180^\circ$$

$$51^\circ + 65^\circ + 64^\circ = 180^\circ$$



- 13.

Helpful Hint

First find $\angle B$ and $\angle C$ in $\triangle ABC$.

In $\triangle ABC$, $m\angle A + m\angle B + m\angle C = 180^\circ$

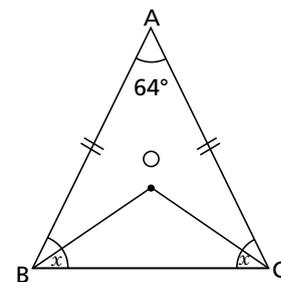
$$64^\circ + x + x = 180^\circ \text{ (base s of an iso } \Delta \text{.)}$$

$$64^\circ + 2x = 180^\circ$$

$$2x = 180^\circ - 64^\circ$$

$$2x = 116^\circ$$

$$x = 58^\circ$$



We know that $\triangle ABC$

$$\angle ABC = \angle ACB = x = 58^\circ$$

$$\therefore m\angle ABO = m\angle OBC = \frac{x}{2}$$

$$= \frac{58^\circ}{2} = 29^\circ$$

In $\triangle BCO$, \overline{BO} and \overline{CO} are angle bisectors which meet at O.

$\therefore \triangle BOC$ is also an isosceles triangle where the base angles are equal.

$$\therefore m\angle OBC = m\angle OCB = 29^\circ$$

$$\text{In } \triangle OBC: m\angle B + m\angle C + m\angle O = 180^\circ$$

$$29^\circ + 29^\circ + \angle O = 180^\circ$$

$$58^\circ + \angle O = 180^\circ$$

$$\angle O = 180^\circ - 58^\circ$$

$$\angle O = 122^\circ$$

$$\therefore \angle BOC = 122^\circ$$

Multiple Choice Questions 11

1. Option B: False

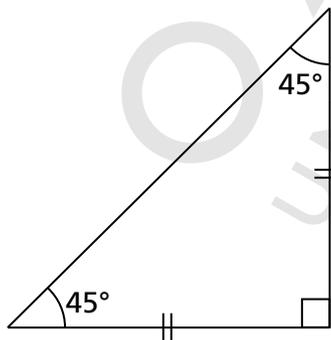
Reason: By definition a scalene triangle has all three sides of unequal length, while an equilateral triangle has three equal sides. Therefore, a scalene triangle can not be an equilateral triangle.

Option A, C, and D are clearly incorrect.

2. Option A: True

Reason: In a right-angled triangle if the remaining two angles are 45° each, then it is an isosceles triangle too. In other words, if two sides of a right-angled triangle are equal, then the base angles are also equal.

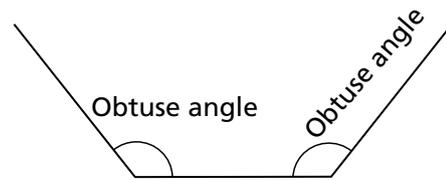
Option B, C, and D are clearly incorrect.



3. Option C: False

Reason: If there are two obtuse angles the figure will not be a closed figure.

Option A, B, and D are clearly incorrect.



4. Option A: Greater than the length of the third side

Reason: The sum of two sides will always be greater

Example: In $\triangle ABC$,

$$m\overline{AB} + m\overline{AC} > m\overline{BC}$$

$$7 \text{ cm} + 8 \text{ cm} > 5 \text{ cm}$$

$$15 \text{ cm} > 5 \text{ cm}$$

Similarly: $m\overline{AB} + m\overline{BC} > m\overline{AC}$

$$7 \text{ cm} + 5 \text{ cm} > 8 \text{ cm}$$

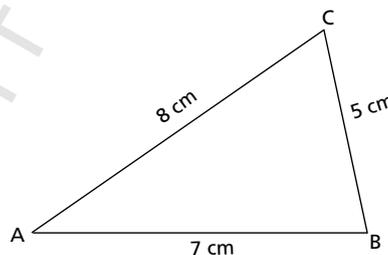
$$12 \text{ cm} > 8 \text{ cm}$$

Also: $m\overline{BC} + m\overline{AC} > m\overline{AB}$

$$5 \text{ cm} + 8 \text{ cm} > 7 \text{ cm}$$

$$13 \text{ cm} > 7 \text{ cm}$$

Option B, C, and D contradict the true statement.



5. Option D: 180°

Reason: Verified through activity on page 172 of NCD textbook.

Option A, B, and C are incorrect.

6. Option D: False

Reason: The given statement is false because by definition the exterior angle is equal to the sum of the two opposite interior angles.

Option A, B, and C are clearly incorrect.



Perimeter and Area

Exercise 12A

1.

Helpful Hint

- i) The complete squares enclosed within the figure are counted.
- ii) The squares which have a part greater than half part enclosed within the figure are counted.
- iii) The squares which have a part less than half part enclosed within the figure are ignored.
- iv) The squares that are exactly halved by the figure are then counted. Two such half-squares would form a complete square; so, half the number is taken.
- v) The numbers obtained in steps (i), (ii), and (iv) are added to obtain the area of the figure.

- (i) Number of complete squares enclosed is 5.
 \therefore area of the figure is 5 sq cm.
- (ii) Number of complete squares enclosed is 5.
 \therefore area of the figure is 5 sq cm.
- (iii) Number of complete squares enclosed is 6.
 \therefore area of the figure is 6 sq cm.
- (iv) Number of complete squares enclosed is 1.
Number of half-squares is 2, therefore, half of the number is 1.
 \therefore area of the figure is $(1 + 1) = 2$ sq cm.
- (v) Number of complete squares enclosed is 4.

Number of half-square is 4, therefore, half of the number is 2.

\therefore area of the figure is $(4 + 2) = 6$ sq cm.

- (vi) Number of complete squares enclosed is 2.

Number of half-squares is 2, therefore, half of the number is 1.

\therefore area of the figure is $(2 + 1) = 3$ sq cm.

- (vii) Number of complete squares enclosed is 2.

Number of half-squares is 1, therefore, half of the number is 0.5.

Number of squares more than half is 2.

Number of squares less than half (1) to be ignored.

\therefore area of the figure is.

$(2 + 0.5 + 2) = 4.5$ sq cm

- (viii) Number of complete squares enclosed is 4.

Number of half-squares is 4, therefore, half of the number is 2.

\therefore area of the figure is $(4 + 2) = 6$ sq cm.

2. Number of complete squares enclosed is 3.

Number of square less than half to be ignored.

\therefore area of each part is 3 sq cm.

Exercise 12B

1. (i) Perimeter
(ii) 16 square centimetre
(iii) $P = 2(l + b)$ where ' l ' is length and ' b ' is breadth of the rectangle.
(iv) $A = l \times b$
(v) 9 cm

2. (i) True
 Area = $l \times b = (15 \times 50) \text{ m} = 750 \text{ m}^2$
- (ii) False
 The three sides of the triangle sum up to 15 m.
- (iii) True
 Perimeter of a square = $4l$ where ' l ' is the length of one side of the square.
- (iv) False
 Area of a triangle = $\frac{\text{base} \times \text{height}}{2}$
- (v) False
 Area of square = l^2
 $= 1 \text{ cm} \times 1 \text{ cm}$
 $= 1 \text{ cm}^2$
3. (i) Perimeter of a square = $4l$ where ' l ' is the side of the square.
 $P = 4 \times 8 \text{ cm} = 32 \text{ cm}$
- (ii) Perimeter of a rectangle = $2(l + b)$ when l = length and b = breadth
 $P = 2(6 + 4) \text{ cm}$
 $= 20 \text{ cm}$
- (iii) Perimeter of a triangle = sum of length of all the 3 sides.
 $P = (3 + 4 + 5) \text{ cm}$
 $= 12 \text{ cm}$
- (iv) Length of rectangle = 8 cm
 Breadth of rectangle = $8 \div 2 = 4 \text{ cm}$
 Perimeter of rectangle = $2(l + b)$
 $= 2(8 + 4) \text{ cm}$
 $= 24 \text{ cm}$
- (v) Perimeter of a triangle = Sum of length of all 3 sides
 $= (5.5 + 5.5 + 5.5) \text{ cm}$
 $= 16.5 \text{ cm}$

Helpful Hint:

All three sides of an equalitarian triangle are equal.

4. (i) $P = \overline{mAB} + \overline{mBC} + \overline{mCD} + \overline{mDA}$
 $= (3 + 5.2 + 4 + 3) \text{ cm}$
 $= 15.2 \text{ cm}$
- (ii) $P = (6 + 7 + 10 + 5 + 12 + 20 + 10) \text{ m}$
 $= 70 \text{ metres.}$

5. Perimeter of rectangular land = $2(l + b)$
 $= 2(8 + 5)$
 $= 26 \text{ m}$

The length of wire needed to fence the field once = 26 m
 The length of wire for fencing 4 lines = 26×4
 $= 104 \text{ m}$

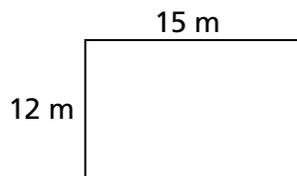
6. The perimeter of rectangular garden = $2(l + b)$
 $= 2(105 + 75)$
 $= 2(180)$
 $= 360 \text{ m}$

360 m will cover 1 round
 3600 m will cover $3600 \div 360 = 10$ rounds.

7. Data:
 Length = 15 m
 Breadth = 12 m
 Perimeter = ?
 cost of 1 m = Rs 25

Helpful Hint

It is always easier to draw a figure for better understanding.



Perimeter of a rectangle = $l + b + l + b$
 or $2l + 2b$
 or $2(l + b)$

∴ perimeter of the rectangular field.

$$\begin{aligned} &= 2(l + b) \\ &= 2(15 + 12) \\ &= 2(27) \\ &= 54 \text{ m} \end{aligned}$$

Cost of fencing 1 metre = Rs 25

$$\begin{aligned} \therefore \text{cost of fencing 54 metres} &= 25 \times 54 \\ &= \text{Rs } 1350 \end{aligned}$$

8. (i) Area of a rectangle = Length \times Breadth
 $= (15 \times 9) \text{ m}$
 $= 135 \text{ m}^2$

(ii) Area of a rectangle = L \times B
 $= (32 \times 24) \text{ m}$
 $= 768 \text{ m}^2$

(iii) Area of a rectangle = L \times B
 $= (5 \times 3.5) \text{ m}$
 $= 17.5 \text{ m}^2$

(iv) Area of a rectangle = L \times B
(converting 2 m 25 cm into m:
 $2 \text{ m} + 0.25 \text{ m} = 2.25 \text{ m}$)
 $= 4.5 \times 2.25$
 $= 10.125 \text{ m}^2$

9. (i) Area of square = $l \times l$
 $= 21 \times 21$ ($l = 21 \text{ cm}$)
 $= 441 \text{ cm}^2$

(ii) Area of square = $l \times l$
 $= 4.5 \times 4.5$ ($l = 4.5 \text{ m}$)
 $= 20.25 \text{ m}^2$

(iii) Area of square = $l \times l$
 $= 1.2 \times 1.2$ ($l = 1.2 \text{ m}$)
 $= 1.44 \text{ m}^2$

(iv) Area of square = $l \times l$
(converting 2 m 50 cm into m
 $2 \text{ m} + 0.50 \text{ m} = 2.5 \text{ m}$) $= (2.5 \times 2.5) \text{ m}$
 $= 6.25 \text{ m}^2$
($l = 2 \text{ m } 50 \text{ cm}$)

10. Data:

$$\begin{aligned} \text{Area} &= 216 \text{ m}^2 \\ \text{Length} &= 18 \text{ m} \\ \text{breadth} &= ? \\ \text{Area of rectangle} &= l \times b \end{aligned}$$

$$\begin{aligned} \therefore \text{breadth of rectangle} &= \frac{\text{Area}}{\text{Length}} \\ &= \frac{216}{18} \end{aligned}$$

$$\therefore \text{breadth of rectangle} = 12 \text{ m}$$

11. Data:

$$\begin{aligned} \text{Area} &= 336 \text{ m}^2 \\ \text{Breadth} &= 16 \text{ m} \\ \text{Length} &= ? \\ \text{Area of rectangle} &= l \times b \end{aligned}$$

$$\begin{aligned} \therefore \text{breadth of rectangle} &= \frac{\text{Area}}{\text{Breadth}} \\ &= \frac{336}{16} \end{aligned}$$

$$\therefore \text{breadth of rectangle} = 21 \text{ m}$$

12. Data:

$$\begin{aligned} \text{Length} &= 36 \text{ m} \\ \text{Breadth} &= 25 \text{ m} \\ \text{Area} &= ? \\ \text{cost of } 1 \text{ m}^2 &= \text{Rs } 3 \end{aligned}$$

Helpful Hint

Levelling the ground means area of the playground is to be found.

$$\begin{aligned} \text{Area of a rectangle} &= l \times b \\ \therefore \text{area of the playground} &= (36 \times 25) \text{ m} \\ &= 900 \text{ m}^2 \end{aligned}$$

$$\begin{aligned} \text{Cost of levelling } 1 \text{ m}^2 &= \text{Rs } 3 \\ \therefore \text{cost of levelling } 900 \text{ m}^2 &= 3 \times 900 \\ &= \text{Rs } 2700 \end{aligned}$$

13. Data:

$$\begin{aligned} \text{Length} &= 6 \text{ m} \\ \text{Area} &= ? \\ \text{Cost of } 1 \text{ m}^2 &= \text{Rs } 200 \end{aligned}$$

Helpful Hint

Flooring a square room means area of the room is to be found.

$$\text{Area of a square} = l \times l$$

$$\begin{aligned} \therefore \text{Area of a square room} &= (6 \times 6) \text{ m} \\ &= 36 \text{ m}^2 \end{aligned}$$

Cost of flooring 1 m² = Rs 200

$$\therefore \text{cost of flooring } 36 \text{ m}^2 = 36 \times 200 = \text{Rs } 7200$$

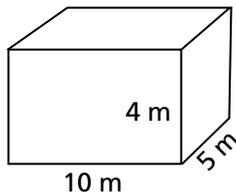
14. Data:

Length = 10 m

Breadth = 5 m

Height = 4 m

Area of each wall = ?

**Helpful Hint**

Draw a figure of a room, which looks like a cuboid.

Remember:

- The opposite two walls will have same dimensions.
- The roof and floor dimensions are to be ignored.
- Height remains the same, while the length and breadth change.

$$\begin{aligned} \text{(i) Area of two opposite walls} &= 2(\text{length} \times \text{height}) \\ &= 2(10 \times 4) \text{ m} \\ &= 80 \text{ m}^2 \end{aligned}$$

$$\begin{aligned} \text{Area of the other two opposite walls} &= 2(\text{breadth} \times \text{height}) \\ &= 2(5 \times 4) \text{ m} \\ &= 40 \text{ m}^2 \end{aligned}$$

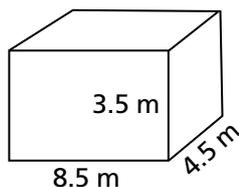
$$\begin{aligned} \therefore \text{area of all four walls} &= 80 \text{ m}^2 + 40 \text{ m}^2 \\ &= 120 \text{ m}^2 \end{aligned}$$

(ii) Data:

Length = 8.5 m

Breadth = 4.5 m

Height = 3.5 m



Area of each wall = ?

$$\begin{aligned} \text{Area of two opposite walls} &= 2(\text{length} \times \text{height}) \\ &= 2(8.5 \times 3.5) \text{ m} \\ &= 2(29.75) \text{ m}^2 \\ &= 59.5 \text{ m}^2 \end{aligned}$$

$$\begin{aligned} \text{Area of the other two opposite walls} &= 2(\text{breadth} \times \text{length}) \\ &= 2(4.5 \times 3.5) \text{ m} \\ &= 2(15.75) \text{ m}^2 \\ &= 31.5 \text{ m}^2 \end{aligned}$$

$$\begin{aligned} \therefore \text{area of all four walls} &= 59.5 \text{ m}^2 + 31.5 \text{ m}^2 \\ &= 91 \text{ m}^2 \end{aligned}$$

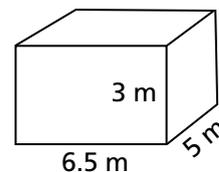
(iii) Data:

Length = 6.50 m

= 6.50 m

Breadth = 5 m

Height = 3 m



$$\begin{aligned} \text{Area of two opposite walls} &= 2(\text{length} \times \text{height}) \\ &= 2(6.50 \times 3) \text{ m} \\ &= 2(19.50) \text{ m}^2 \\ &= 39 \text{ m}^2 \end{aligned}$$

$$\begin{aligned} \text{Area of the other two opposite walls} &= 2(\text{breadth} \times \text{height}) \\ &= 2(5 \times 3) \text{ m} \\ &= 30 \text{ m}^2 \end{aligned}$$

$$\begin{aligned} \therefore \text{Area of all four walls} &= 39 \text{ m}^2 + 30 \text{ m}^2 \\ &= 69 \text{ m}^2 \end{aligned}$$

15. Data:

Length = 8 m

Breadth = 6 m

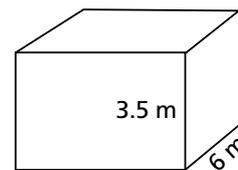
Height = 3.5 m

Area of walls = ?

cost of white-washing 1 m² = Rs 50

Area of two opposite walls

$$\begin{aligned} &= 2(\text{length} \times \text{height}) \\ &= 2(8 \times 3.5) \text{ m} \\ &= 56 \text{ m}^2 \end{aligned}$$



$$\begin{aligned} \text{Area of the other two opposite walls} &= 2(\text{breadth} \times \text{height}) \\ &= 2(6 \times 3.5) \text{ m} \\ &= 42 \text{ m}^2 \end{aligned}$$

$$\begin{aligned} \therefore \text{Area of all four walls} &= 56 \text{ m}^2 + 42 \text{ m}^2 \\ &= 98 \text{ m}^2 \end{aligned}$$

$$\text{Cost of white-washing } 1 \text{ m}^2 = \text{Rs } 50$$

$$\begin{aligned} \therefore \text{Cost of white-washing } 98 \text{ m}^2 &= 50 \times 98 \\ &= 4900 \end{aligned}$$

$$\begin{aligned} 16. \text{ Area of the floor} &= \text{length} \times \text{breadth} \\ &= (12 \times 9) \text{ m} \\ &= 108 \text{ m}^2 \end{aligned}$$

$$\text{Cost of tiling } 1 \text{ m}^2 \text{ of the floor} = \text{Rs } 50$$

$$\begin{aligned} \text{Cost of tiling } 108 \text{ m}^2 \text{ of the floor} &= 108 \times 50 \\ &= \text{Rs } 5400 \end{aligned}$$

Exercise 12C

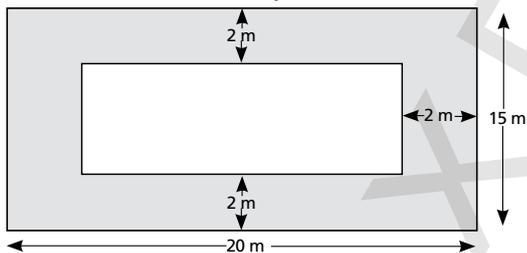
1. (i) Data:

$$\text{Length of larger rectangle} = 20 \text{ m}$$

$$\text{Breadth of larger rectangle} = 15 \text{ m}$$

$$\text{Width of shaded region} = 2 \text{ m}$$

$$\text{Area of the shaded portion} = ?$$



Helpful Hint

To find the length and breadth of the smaller rectangle subtract the width of the shaded region from both the length and the breadth.

$$\begin{aligned} \therefore \text{Length of the smaller rectangle} &= 20 \text{ m} - (2 + 2) \text{ m} \\ &= 16 \text{ m} \end{aligned}$$

$$\begin{aligned} \text{and the length of the smaller rectangle} &= 15 \text{ m} - (2 + 2) \text{ m} \\ &= 11 \text{ m} \end{aligned}$$

$$\begin{aligned} \text{Area of the larger rectangle} &= (20 \times 15) \text{ m} = 300 \text{ m}^2 \end{aligned}$$

$$\begin{aligned} \text{Area of the smaller rectangle} &= (16 \times 11) \text{ m} \\ &= 176 \text{ m}^2 \end{aligned}$$

$$\begin{aligned} \text{Area of the shaded region} &= \text{Area of the larger rectangle} - \text{Area of the smaller rectangle} \\ &= (300 - 176) \text{ m}^2 \\ &= 124 \text{ m}^2 \end{aligned}$$

$$\begin{aligned} \text{(ii) Area of the larger square} &= l^2 \\ &= (15 \times 15) \text{ m} \\ &= 225 \text{ m}^2 \end{aligned}$$

$$\begin{aligned} \text{Area of the smaller square} &= l^2 \\ &= (9 \times 9) \text{ m} \\ &= 81 \text{ m}^2 \end{aligned}$$

$$\begin{aligned} \text{Area of the shaded region} &= \text{Area of larger square} - \text{Area of smaller square} \\ &= (225 - 81) \text{ m}^2 \\ &= 144 \text{ m}^2 \end{aligned}$$

2. Data:

$$\text{Length} = 50 \text{ m}$$

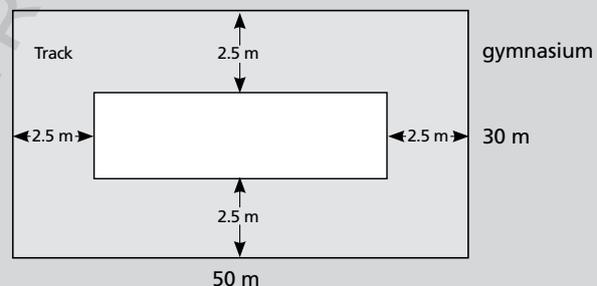
$$\text{Breadth} = 30 \text{ m}$$

$$\text{Width of track} = 2.5 \text{ m}$$

$$\text{Area of track} = ?$$

Helpful Hint

Draw a figure first.



Helpful Hint

Since the track is inside and all around the gymnasium the width of track will be subtracted from the length and breadth from all four sides.

$$\begin{aligned} \therefore \text{the inner length} &= 50 \text{ m} - (2.5 + 2.5) \text{ m} = 45 \text{ m} \\ \text{and the inner breadth} &= 30 - (2.5 + 2.5) \text{ m} \\ &= 25 \text{ m} \end{aligned}$$

Area of the larger rectangle
 $= \text{length} \times \text{breadth}$
 $= (50 \times 30) \text{ m}$
 $= 1500 \text{ m}^2$

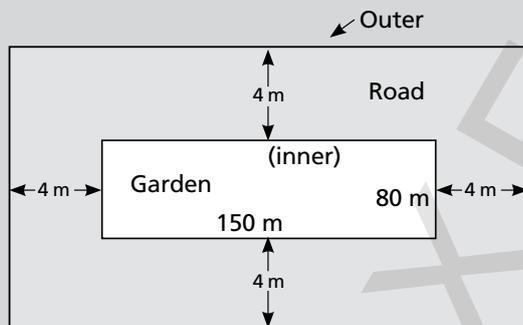
Area of the smaller rectangle
 $= \text{length} \times \text{breadth}$
 $= (45 \times 250) \text{ m}$
 $= 1125 \text{ m}^2$

\therefore area of the track = Area of the larger rectangle – Area of the smaller rectangle
 $= (1500 - 1125) \text{ m}^2$
 $= 375 \text{ m}^2$

3. Data:
 Length = 150 m
 Breadth = 80 m
 Width of road = 4 m
 Cost of paving $1 \text{ m}^2 = \text{Rs } 120$

Helpful Hint

Draw a figure first.



Helpful Hint

Since the road is outside and all around the garden, the width of the road will be added to the length and the breadth of the garden.

\therefore the outer length $= 150 \text{ m} + (4 + 4) \text{ m}$
 $= 158 \text{ m}$
 and the outer breadth $= 80 \text{ m} + (4 + 4) \text{ m}$
 $= 88 \text{ m}$

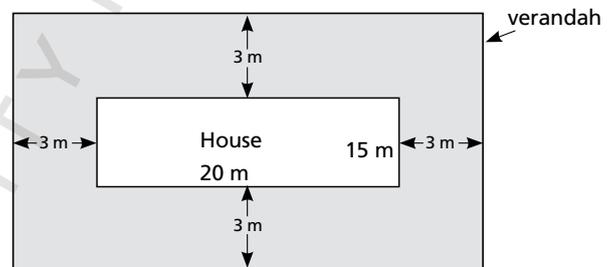
Area of the larger rectangle
 $= \text{length} \times \text{breadth}$
 $= (158 \times 88) \text{ m}$
 $= 13\,904 \text{ m}^2$

Area of the smaller rectangle
 $= \text{length} \times \text{breadth}$
 $= (150 \times 80) \text{ m}$
 $= 12\,000 \text{ m}^2$

\therefore Area of the road = Area of the larger rectangle – Area of the smaller rectangle
 $= (13\,904 - 12\,000) \text{ m}^2$
 $= 1\,904 \text{ m}^2$

Cost of paving $1 \text{ m}^2 = \text{Rs } 120$
 Cost of paving $1\,904 \text{ m}^2 = 120 \times 1\,904$
 $= \text{Rs } 228\,480$

4. Data:
 Length = 20 m
 Width = 15 m
 Width of verandah = 3 m
 Cost of flooring $1 \text{ m}^2 = \text{Rs } 200$



Helpful Hint

Since the verandah is outside and all around the house, the width of the verandah will be added to the length and the breadth of the house.

\therefore the outer length $= 20 \text{ m} + (3 + 3) \text{ m}$
 $= 26 \text{ m}$
 and the outer breadth $= 15 \text{ m} + (3 + 3) \text{ m}$
 $= 21 \text{ m}$

\therefore the area of the outer rectangle
 $= (26 \times 21) \text{ m} = 546 \text{ m}^2$
 and the area of the inner rectangle
 $= (20 \times 15) = 300 \text{ m}^2$
 Area of the verandah =

Area of the larger rectangle – Area of the smaller rectangle = $(546 - 300) \text{ m}^2 = 246 \text{ m}^2$

Cost of flooring $1 \text{ m}^2 = \text{Rs } 200$

\therefore cost of flooring $246 \text{ m}^2 = 200 \times 246$
 $= \text{Rs } 49200$

5. (i) Area of a parallelogram = $b \times h$
 $= (25 \times 10) \text{ cm} = 250 \text{ cm}^2$
- (ii) Area of a parallelogram = $b \times h$
 $= (16 \times 9) \text{ cm} = 144 \text{ cm}^2$
- (iii) Area of a triangle = $\frac{1}{2} \times b \times h$
 $= \frac{1}{2} \times 12^6 \times 5$
 $= 30 \text{ cm}^2$
- (iv) Area of a triangle = $\frac{1}{2} \times b \times h$
 $= \frac{1}{2} \times 18^9 \times 18$
 $= 162 \text{ cm}^2$
- (v) Area of a triangle = $\frac{1}{2} \times b \times h$
 $= \frac{1}{2} \times 6^1 \times 15$
 $= 45 \text{ cm}^2$
- (vi) Area of a trapezium = $\frac{1}{2} \times (\text{Sum of parallel sides}) \times \text{height}$
 $= \frac{1}{2} \times (20 + 35) \times 14$
 $= \frac{1}{2} \times 55 \times 14^7$
 $= 385 \text{ cm}^2$
- (vii) Area of a trapezium = $\frac{1}{2} \times (\text{Sum of parallel sides}) \times \text{height}$
 $= \frac{1}{2} \times (21 + 17) \times 15$
 $= \frac{1}{2} \times 38^{19} \times 15$
 $= 285 \text{ cm}^2$
- (viii) Area of a parallelogram = $b \times h$
 $= (7.5 \times 5.5) \text{ cm}$
 $= 41.25 \text{ cm}^2$

6. Area of parallelogram = base \times height

$$645 \text{ cm}^2 = b \times 15 \text{ cm}$$

$$\frac{645 \text{ cm}^2}{15 \text{ cm}} = b$$

$$43 \text{ cm} = b$$

\therefore length of its sides is 43 cm.

7.

Helpful Hint

Draw a figure and then solve. Hence height of the flag is unknown

$$\text{Area of a triangle} = \frac{1}{2} \times b \times h$$

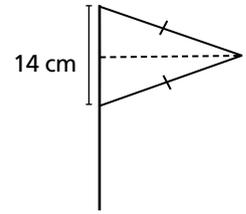
$$196 \text{ cm}^2 = \frac{1}{2} \times 14^7 \text{ cm} \times h$$

$$196 \text{ cm}^2 = 7 \text{ cm} \times h$$

$$\frac{196 \text{ cm}^2}{7 \text{ cm}} = h$$

$$28 \text{ cm} = h$$

\therefore the perpendicular distance from the tip of the flag to the third side is 28 cm.



Multiple Choice Questions 12

1. Option A: Area = Length \times Breadth
Reason: Correct formula for finding the area of a square or rectangle.
Option B, C, and D are clearly incorrect.
2. Option D: Length = 13 cm, Width = 7 cm
Incorrect Options:
Option A: L = 23, B = 17 cm
[Hint: Long multiplication is not required. Approximation and logic will give the right answer.]
Here 23 rounded down and 17 rounded up are approximately equal to 20.
Therefore, $20 \times 20 = 400$ which is far beyond the given area 91 cm^2 .
Option B and C will give a decimal answer.
3. Option A: 1 km
Reason: Since one side of the square is 1 km, therefore, its perimeter will be 4 km. The horse runs twice the square garden, therefore, the covered length is 8 km.
Incorrect Options:
Option B: 1.5 km means perimeter will be 6 km and its twice will be 12 km.

Option C: 4 km means perimeter will be 16 km which exceeds the correct answer.

Option D: 2 km means perimeter will be 8 km which seems to be correct but don't forget that the horse runs twice, that is 16 km, which exceeds the correct answer.

4. Option D: Total edge around the pool
 $= 2(16 + 8) = 48$ m

Reason: The edge ground the pool will be its perimeter: $P = 2(l + b)$. Hence width is 8 cm and length is twice the width, that is 16 m.

Incorrect Options:

Option A and B are clearly incorrect as to find the perimeter we do not multiply the length with breadth.

Option C seems to be correct but remember there are two lengths and breadths, therefore, the sum should be multiplied by 2.

5. Option B: True if each side of the square is 4 units.

Reason: If each side of the square is 4 units then, $P = 2(l + b)$.
 $= 2(4 + 4) = 16$ units
 $A = l \times b = 4 \times 4 = 16$ units

Option A, C, and D are clearly incorrect.

6. Option B: True

Reason: Let us suppose length of a rectangle is 5 cm and breadth is 3 cm.

$$\begin{aligned}\text{Area of rectangle} &= l \times b \\ &= (5 \times 3) \text{ cm} \\ &= 15 \text{ cm}^2\end{aligned}$$

Now, double the sides, then length of the new rectangle will be 10 cm and breadth will be 6 cm.

$$\begin{aligned}\text{Area of the new rectangle} \\ &= (10 \times 6) \text{ cm} = 60 \text{ cm}^2\end{aligned}$$

This proves that if the length and breadth of a rectangle is doubled then the area of the new rectangle becomes 4 times as large ($15 \times 4 = 60$).

Helpful Hint

Use different values of length and breadth to justify the answer.

Option A, C, and D are clearly incorrect.

7. Option A: 17.5 cm^2

Reason: Value of area found by using the formula $A = \frac{1}{2} \times b \times h$

Option B, C, and D are clearly incorrect.

8. Option B: 600 cm^2

Reason: Length of rectangle = 30 cm
Breadth of rectangle = half of length + 5

$$\begin{aligned}&= (30 \text{ cm} \div 2) + 5 \text{ cm} \\ &= (15 + 5) \text{ cm} \\ &= 20 \text{ cm} \\ \therefore \text{area of rectangle} &= l \times b \\ &= 30 \text{ cm} \times 20 \text{ cm} \\ &= 600 \text{ cm}^2\end{aligned}$$

Option A, C, and D are incorrect.

9. Option C: 10.5 cm

Reason: Since it is an equilateral triangle, all sides will be 3.5 cm

Therefore, $P = (3.5 + 3.5 + 3.5) \text{ cm}$

$$P = 10.5 \text{ cm}$$

In Option B value is correct, but the given unit of area makes it incorrect.

Option A and D are clearly incorrect.

10. Option D: By dividing it into two triangles and adding their areas

Reason: Area of a trapezium can be found by using the formula:
 $\frac{1}{2}$ (sum of parallel sides) \times height or as given.

Option A, B, and C are clearly incorrect statement in option D.

Helpful Hint

Find area the trapezium given in Q5(vi) by dividing it into two triangles. Do you get the same result?

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Volume and Surface Area

Exercise 13

1. (i) Data:

$$\text{Length} = 12 \text{ cm}$$

$$\text{Breadth} = 10 \text{ cm}$$

$$\text{Height} = 8 \text{ cm}$$

$$\text{Volume} = ?$$

Volume of a cuboid

$$= \text{length} \times \text{breadth} \times \text{height}$$

$$= (12 \times 10 \times 8) \text{ cm}$$

$$= 960 \text{ cm}^3$$

(ii) Data:

$$\text{Length} = 4 \text{ m}$$

$$\text{Breadth} = 2.5 \text{ m}$$

$$\text{Height} = 1.5 \text{ m}$$

$$\text{Volume} = ?$$

Volume of a cuboid

$$= l \times b \times h$$

$$= (4 \times 2.5 \times 1.5) \text{ m}$$

$$= 15 \text{ m}^3$$

(iii) Data:

$$\text{Length} = 2 \text{ m } 50 \text{ cm} = 2.50 \text{ m}$$

$$\text{Breadth} = 1 \text{ m}$$

$$\text{Height} = 75 \text{ cm} = 0.75 \text{ m}$$

$$\text{Volume} = ?$$

Volume of a cuboid

$$= l \times b \times h$$

$$= (2.50 \times 1 \times 0.75) \text{ m}$$

$$= 1.875 \text{ m}^3$$

2. Data:

$$\text{Length} = 2 \text{ m}$$

$$\text{Breadth} = 1.5 \text{ m}$$

$$\text{Height} = 1 \text{ m}$$

$$\text{Volume} = ?$$

$$\text{Volume of the tin can} = l \times b \times h$$

$$= (2 \times 1.5 \times 1) \text{ m}$$

$$= 3 \text{ m}^3$$

Now convert units:

$$1 \text{ m} = 100 \text{ cm}$$

$$\therefore 1 \text{ m}^3 = (100 \times 100 \times 100) \text{ cm}^3$$

$$\therefore 3 \text{ m}^3 = 3 \times 1\,000\,000 = 3\,000\,000 \text{ cm}^3$$

$$1000 \text{ cm}^3 = 1 \text{ litre}$$

\therefore the amount of kerosene oil that the tin can hold:

$$\frac{3000000}{1000} \text{ litre}$$

$$= 3000 \text{ litre}$$

3. Data:

$$\text{Length} = 5 \text{ m}$$

$$\text{Breadth} = 3 \text{ m}$$

$$\text{Height} = 1.5 \text{ m}$$

$$\text{Volume} = ?$$

$$\text{Volume of the tank} = l \times b \times h$$

$$= (5 \times 3 \times 1.5) \text{ m}$$

$$= 22.5 \text{ m}^3$$

4. Data:

$$\text{Length} = 75 \text{ cm}$$

$$\text{Breadth} = 50 \text{ cm}$$

$$\text{Height} = 40 \text{ cm}$$

$$1 \text{ side of the small cube} = 0.1 \text{ m}$$

$$= 0.1 \text{ m} \times 100 = 10 \text{ cm}$$

$$\text{Number of cubes that can be carved} = ?$$

Helpful Hint

Convert units first. All units should be either in cm or m.

Volume of the block of wood

$$\begin{aligned} &= l \times b \times h \\ &= (75 \times 50 \times 40) \text{ cm} \\ &= 150\,000 \text{ cm}^3 \end{aligned}$$

Volume of the small block

$$\begin{aligned} &= (10 \times 10 \times 10) \text{ cm} \\ &= 1000 \text{ cm}^3 \end{aligned}$$

Number of cubes that can be carved

$$\begin{aligned} &= \frac{150000}{1000} \\ &= 150 \text{ cubes} \end{aligned}$$

5. (i) Data:

Length of each side = 1.5 m

Volume = ?

$$\begin{aligned} \text{Volume of cube} &= l \times b \times h \\ &= (1.5 \times 1.5 \times 1.5) \text{ m} \\ &= 3.375 \text{ m}^3 \end{aligned}$$

(ii) Data:

Length of each side = 60 cm

Volume = ?

$$\begin{aligned} \text{Volume of cube} &= l \times b \times h \\ &= (60 \times 60 \times 60) \text{ cm} \\ &= 216\,000 \text{ cm}^3 \end{aligned}$$

(iii) Data:

Length of each side

$$\begin{aligned} &= 2\frac{2}{3} \text{ m} \\ &= \frac{8}{3} \text{ m} \end{aligned}$$

Volume of cube = $l \times b \times h$

$$\begin{aligned} &= \left(\frac{8}{3} \times \frac{8}{3} \times \frac{8}{3}\right) \text{ m} \\ &= \frac{512}{27} \text{ m}^3 \\ &= 18\frac{26}{27} \text{ m}^3 \end{aligned}$$

6. Data:

Length of each side of bigger cube

$$2.1 \text{ m} \times 100 = 210 \text{ cm}$$

Length of each side of smaller cube = 35 cm.

Number of cubes that can be obtained = ?

Helpful Hint

Make the units same.

Volume of the bigger wooden block

$$\begin{aligned} &= l \times b \times h = (210 \times 210 \times 210) \text{ cm} \\ &= 9\,261\,000 \text{ cm}^3 \end{aligned}$$

Volume of the small cube

$$\begin{aligned} &= l \times b \times h = (35 \times 35 \times 35) \text{ cm} \\ &= 42\,875 \text{ cm}^3 \end{aligned}$$

Number of small cubes that can be obtained:

$$\begin{aligned} &= \frac{9261000}{42875} \\ &= 216 \text{ cubes} \end{aligned}$$

7. Data:

Length = 6 m

Breadth = 5 m

Height = 3.5 m

Capacity of smaller tank = 120 litre.

Number of smaller tanks that the storage room can hold?

Volume of the storage room

$$\begin{aligned} &= l \times b \times h \\ &= (6 \times 5 \times 3.5) \text{ m} \\ &= 105 \text{ m}^3 \end{aligned}$$

Convert m^3 into cm^3 :

$$1 \text{ m} = 100 \text{ cm}$$

$$\begin{aligned} 1 \text{ m}^3 &= (100 \times 100 \times 100) \text{ cm}^3 \\ &= 1\,000\,000 \text{ cm}^3 \end{aligned}$$

$$\therefore 105 \text{ m}^3 = 105\,000\,000 \text{ cm}^3$$

$$1 \text{ litre} = 1000 \text{ cm}^3$$

$$\therefore 120 \text{ litre} = 120\,000 \text{ cm}^3$$

Number of smaller tanks that storage room can hold:

$$\begin{aligned} &= \frac{105000000}{120000} \\ &= 875 \text{ tanks} \end{aligned}$$

8. Volume of the cube with edge 3 cm
 $= (3 \times 3 \times 3) \text{ cm}$
 $= 27 \text{ cm}^3$
 Now, 27 cm^3 makes 1 cube
 $\therefore 135 \text{ cm}^3$ will make $135 \div 27$ cubes
 $= 5$ cubes

9. We have to find the area of 4 walls and ceiling. Opposite walls have equal area.
 The area of 2 opposite walls
 $2(9 \times 4) \text{ m} = 2 \times 36 = 72 \text{ m}^2$
 The area of other 2 opposite walls
 $2(6 \times 4) = 2 \times 24 = 48 \text{ m}^2$
 The area of the ceiling $= (6 \times 9) \text{ m} = 54 \text{ m}^2$
 Total area to be plastered
 $= (72 + 48 + 54) \text{ m}^2$
 $= 174 \text{ m}^2$
 Cost of plastering $1 \text{ m}^2 = \text{Rs } 100$
 Cost of plastering $174 \text{ m}^2 = 100 \times 174$
 $= \text{Rs } 17\,400$

10. $l = 2 \text{ m}$, $b = 80 \text{ cm}$, and $h = 60 \text{ cm}$
 Volume of a cuboid $= l \times b \times h$
 $= 200 \times 80 \times 60$

Helpful Hint:

$$2 \text{ m} = 200 \text{ cm}$$

$$= 960\,000 \text{ cm}^3$$

$$= 960\,000 \div 1\,000\,000$$

$$= 0.96 \text{ m}^3$$

- Surface Area of a cuboid
 $= 2(lb + bh + hl)$
 $= 2[(200 \times 80) + (80 \times 60) + (60 \times 200)]$
 $= 2[(16\,000 + 4800 + 12\,000)]$
 $= 2 \times 32\,800$
 $= 65\,600 \text{ cm}^2$
 $= 65\,600 \div 10\,000$
 $= 6.56 \text{ m}^2$

11. Volume of a cube $= l^3$
 Total surface Area of a cube $= 6l^2$
 One side of the cube $= 1.5 \text{ m}$

$$\text{Volume} = 1.5 \times 1.5 \times 1.5$$

$$= 3.375 \text{ m}^3$$

$$\text{Surface area} = 6 \times 1.5 \times 1.5$$

$$= 13.5 \text{ m}^2$$

12. The volume of cube 1 $= 3 \times 3 \times 3 = 27 \text{ m}^3$
 The volume of cube 2 $= 4 \times 4 \times 4 = 64 \text{ m}^3$
 The volume of cube 3 $= 5 \times 5 \times 5 = 125 \text{ m}^3$
 Total volume of melted metal
 $= 27 + 64 + 125 = 216 \text{ cm}^3$
 Hence, the volume of new cube $= 216 \text{ cm}^3$

Helpful Hint:

Find a number which is multiplied three times to give an answer 216.

$$6 \times 6 \times 6 = 216$$

$$\text{One edge of the new cube} = 6 \text{ cm}$$

$$\text{Surface area of new cube} = 6l^2$$

$$= 6 \times 6 \times 6$$

$$= 216 \text{ cm}^2$$

- \therefore (i) Volume of the new cube $= 216 \text{ cm}^3$
 (ii) Surface area of the new cube $= 216 \text{ cm}^2$

Multiple Choice Questions 15

1. Option A: True
 Reason: by definition
 Option B, C, and D are clearly incorrect
2. Option D: All the above
 Reason:
 Option A: $V = l \times b \times h$
 $40 = 10 \times 2 \times 2$
 $40 = 40$
 Option B: $v = l \times b \times h$
 $40 = 4 \times 10 \times 1$
 $40 = 40$
 Option C: $V = l \times b \times h$
 $40 = 5 \times 2 \times 4$
 $40 = 40$

3. Option B: 6 cm

Reason: Since it is a cube, all three sides will have the same length.

$$\therefore (6 \times 6 \times 6) \text{ cm} = 216 \text{ cm}^3$$

Option A, C, and D do not give the correct volume.

4. Option C: 27 times the original

Reason: Volume of original cube
 $= (1 \times 2 \times 3) \text{ cm} = 6 \text{ cm}^3$

Volume of the cube whose sides have been increased 3 times

$$= (1 \times 3) \times (2 \times 3), (3 \times 3) \text{ cm}$$

$$= (3 \times 6 \times 9) \text{ cm} = 162 \text{ cm}^3$$

$$\text{Increase in volume} = \frac{162}{6}$$

$$= 27 \text{ times the original}$$

5. Option B: 8, 27, 64, 125, 216, 343, 512, 729 cubic metres

Reason: The sentence, 'between the first and the last' means the volumes will be from the second to the ninth value.
That is $2^3, 3^3, 4^3, 5^3, 6^3, 7^3, 8^3, 9^3$

Option A and D contradict the given statement.

In Option C volume of the first and the last is included, which also contradicts the given statement.

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Revision 5: Mensuration

1. (i) $P = 2(L + B)$
 $= (18 + 12) \text{ m}$
 $= 2(30) \text{ m}$
 $\therefore P = 60 \text{ m}$

Data:
 $L = 18 \text{ m}$
 $B = 12 \text{ m}$
 $P = ?$

(ii) $P = 2(L + B)$
 $= 2(12 + 9) \text{ m}$
 $= 2(21) \text{ m}$
 $\therefore P = 42 \text{ m}$

Data:
 $L = 12 \text{ m}$
 $B = 9 \text{ m}$
 $P = ?$

(iii) $P = 2(L + B)$
 $= 2(70 + 50) \text{ m}$
 $= 2(120) \text{ m}$
 $\therefore P = 240 \text{ cm}$

Data:
 $L = 70 \text{ cm}$
 $B = 50 \text{ cm}$
 $P = ?$

(iv) $P = 2(L + B)$
 $= 2(15 + 8) \text{ m}$
 $= 2(23) \text{ m}$
 $\therefore P = 46 \text{ mm}$

Data:
 $L = 15 \text{ mm}$
 $B = 8 \text{ mm}$
 $P = ?$

(v) $P = 2(7.5 + 4.2) \text{ m}$
 $= 2(11.7) \text{ m}$
 $\therefore P = 23.4 \text{ m}$

Data:
 $L = 7.5 \text{ m}$
 $B = 4.2 \text{ m}$
 $P = ?$

(vi) $P = 2L + 2B$
 $200 = 2(60) + 2B$
 $200 = 120 + 2B$
 $200 - 120 = 2B$
 $80 = 2B$
 $\frac{80}{2} = B$

Data:
 $L = 60 \text{ cm}$
 $P = 200 \text{ cm}$
 $B = ?$

$\therefore \text{breadth} = 40 \text{ cm}$

(vii) $P = 2L + 2B$
 $28 = 2L + 2(5)$
 $28 = 2L + 10$
 $28 - 10 = 2L$
 $18 = 2L$
 $\frac{18}{2} = L$
 $\therefore \text{length} = 9 \text{ m}$

Data:
 $L = ?$
 $B = 5 \text{ m}$
 $P = 28 \text{ m}$

2. $P = 2L + 2B$
 $P = 2(8.5) + 2(6)$
 $P = 17 + 12$
 $P = 29 \text{ cm}$
 $\text{Area} = L \times B$

Data:
 $L = 8.5 \text{ m}$
 $B = 6 \text{ m}$
 $P = ?$
 $\text{Area} = ?$

$= 8.5 \times 6$
 $\therefore \text{area} = 51 \text{ cm}^2$

3. (i) $P = 2L + 2B$
 $= 2(12) + 2(9)$
 $= 24 + 18$
 $P = 42 \text{ m}$
 $\text{Area} = L \times B$
 $= 12 \times 9$
 $\therefore \text{area} = 108 \text{ m}^2$

Data:
 $L = 12 \text{ m}$
 $P = ?$
 $B = 9 \text{ m}$
 $\text{Area} = ?$

(ii) Data:
Perimeter = ?
Base = 8 m
Height = 6 m
Area = ?
Perimeter of triangle

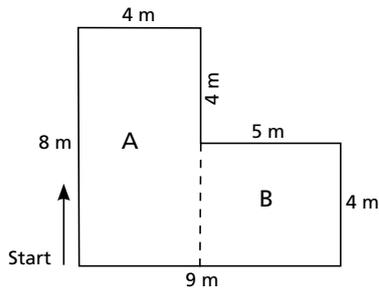
$= (6 + 8 + 10) \text{ m}$
 $= 24 \text{ m}$

$$\begin{aligned}\text{Area of triangle} &= \frac{1}{2} \times \text{base} \times \text{height} \\ &= \frac{1}{2} \times 8 \times 6 \\ \therefore \text{area} &= 24 \text{ m}^2.\end{aligned}$$

(iii)

Helpful Hint

First find the missing sides, then add all sides to find perimeter.



Perimeter of shape:
 $= (8 + 4 + 4 + 5 + 4 + 9) \text{ m}$
 $= 34 \text{ m}$

To find the area of the shape divide it into two rectangles A and B.

Area of rectangle A $= 4 \times 8$
 $= 32 \text{ m}^2$

Area of rectangle B $= 4 \times 5$
 $= 20 \text{ m}^2$

Total area = area of rectangle A + area of rectangle B
 $= (32 + 20) \text{ m}^2 = 52 \text{ m}^2$

4.

Helpful Hint

To find the framing required find the perimeter.

$P = 2L + 2B$	Data:
$= 2(40) + 2(25)$	$L = 40 \text{ m}$
$= 80 + 50$	$B = 25 \text{ m}$
$= 130 \text{ cm}$	$P = ?$

\therefore framing required to make a picture = 130 cm.

5. $P = 2(L + B)$	Data:
$= 2(20 + 12) \text{ m}$	$L = 20 \text{ m}$
$= 2(32) \text{ m}$	$B = 12 \text{ m}$
$= 64 \text{ m}$	$P = ?$

Wire required for 1 row = 64 m

Wire required for 2 rows = 64×2
 $= 128 \text{ m}$

6. $P = 2(L + B)$	Data:
$= 2(1.75 + 1.25) \text{ m}$	$L = 1.75 \text{ m}$
$= 2(3) \text{ m}$	$B = 1.25 \text{ m}$
$= 6 \text{ m}$	Cost per m = Rs 4.50

Cost of 1 m = Rs 4.50

Cost of 6 m = 4.50×6
 $= \text{Rs } 27$

7. $P = 2(L + B)$	Data:
$= 2(15 + 8) \text{ m}$	$L = 15 \text{ m}$
$= 2(23) \text{ m}$	$B = 8 \text{ m}$
$= 46 \text{ m}$	

One round of the lawn = 46 m

\therefore in five rounds Naila will cover = 46×5
 $= 230 \text{ m}$

8. $P = 2L + 2B$	Data:
$72 = 2(25) + 2B$	$L = 25 \text{ m}$
$72 = 50 + 2B$	$B = 72 \text{ m}$
$72 - 50 = 2B$	Width = ?
$22 = 2B$	
$\frac{22}{2} = B$	

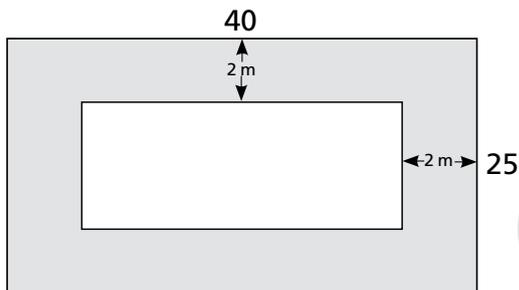
\therefore breadth of the rectangle = 11 m.

9. Data:	
Length = 150 m	
Breadth = 80 m	
Area = ?	
Area of one flower bed = $L \times B$	
$= (150 \times 80) \text{ m}^2$	
$= 12\,000 \text{ m}^2$	
Area of eight flower beds = $12\,000 \times 8$	
$= 96\,000 \text{ m}^2$	

10. Data:
 Length = 9 m
 Breadth = 6 m
 Area = ?
 Cost of 1 m² = Rs 150
 Area of room = L × B
 = (9 × 6) m²
 = 54 m²
 Cost of carpeting 1 m² = Rs 150
 Cost of carpeting 54 m² = Rs 150 × 54
 = Rs 8100

11.

Helpful Hint
 Draw the picture first.



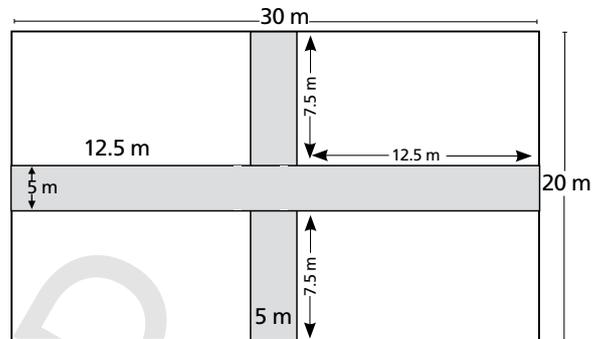
- Data:
 Length = 40 m
 Breadth = 25 m
 Width of the path = 2 m
 Area of the path = ?

Helpful Hint
 Find the dimensions of the inner rectangle.

- Length of the inner rectangle = 40 - 4 = 36 m
 Breadth of the inner rectangle = 25 - 4 = 21 m
 Area of the outer rectangles field = L × B
 = (40 × 25) m²
 = 1000 m²
 Area of inner rectangle = (36 × 21) m²
 = 756 m²
 Area of the path = Area of outer rectangle
 - Area of inner rectangle
 = (1000 - 756) m²
 = 244 m²

12.

Helpful Hint
 Draw the figure and find the dimensions.



- Data:
 Length = 30 m
 Breadth = 20 m
 Cost of constructing 1 m² = Rs 15
 Length = 30 - 5 = $\frac{25}{2}$ = 12.5 m
 Breadth = 20 - 5 = $\frac{15}{2}$ = 7.5 m
 Area of the horizontal road
 = 30 × 5 = 150 m²
 Area of two vertical roads
 = 7.5 × 5 × 2 = 75 m²
 Total area of the roads = (150 + 75) m²
 = 225 m²
 Cost of constructing 1 m² road = Rs 15
 Cost of constructing 225 m² road = 225 × 15
 = Rs 3375

13. (i) False: because 1 l = 0.001 m³
 (ii) True: because area of floor and roof is ignored.
 (iii) False: because volume of cuboid
 = 12 × 4 × 3 = 144 cm³ and volume of
 cube = 12 × 12 × 12 = 1728 cm³
 (iv) False: Let us suppose each side of the
 cube = x cm
 Then volume of the cube
 = x × x × x = x³ cm³
 When the side of cube is tripled = 3x

Then volume of the new cube

$$= 3x \times 3x \times 3x$$

$$= 27x^3 \text{ cm}^3$$

For example, let $x = 2$ cm

When the side is tripled $= 3 \times 2 = 6$ cm

$$\text{Then volume} = 6 \times 6 \times 6 = 216 \text{ cm}^3$$

Now the volume has increased 27 times.

$$\text{That is } 27 \times 8 = 216$$

- (v) False: because a cuboid has only 6 faces not 8.

14. Area of rectangular sheet $= l \times b$
 $= 29.5 \times 20$
 $= 590 \text{ cm}^2$

15.

Helpful Hint

To find the cost of watering the lawn find the covered area of the lawn first

$$\begin{aligned} \text{Covered area of the lawn} &= l \times b \\ &= (16 \times 15) \text{ m} \\ &= 240 \text{ m}^2 \end{aligned}$$

Cost of watering the lawn = area \times cost per square metre

$$\begin{aligned} &= 240 \times 2.50 \\ &= \text{Rs } 600 \end{aligned}$$

16. Volume of the tank $= l \times b \times h$
 $= 35 \times 11 \times 10$
 $= 3850 \text{ cm}^3$

Helpful Hint

$$1 \text{ litre} = 1000 \text{ cm}^3$$

$$\begin{aligned} \text{Litre of petrol the tank car hold} &= \frac{3850}{1000} \\ &= 3.350 \text{ litres} \end{aligned}$$

17.

Helpful Hint

To find the cost of pointing a wooden block, calculate the surface area of the block first and then the cost of painting.

Data

$$l = 3 \text{ cm}$$

$$b = 1.5 \text{ cm}$$

$$h = 8 \text{ cm}$$

$$\text{cost of painting} = \text{Rs } 40/\text{m}^2$$

Total surface area of the block:

$$\begin{aligned} &= 2(l \times b) + 2(b \times h) + 2(l \times h) \\ &= 2(3 \times 1.5) + 2(1.5 \times 8) + 2(3 \times 8) \\ &= 2(4.5) + 2(12) + 2(24) \\ &= 9 + 24 + 48 \\ &= 81 \text{ cm}^2 \end{aligned}$$

$$\text{Cost of painting the block} = \text{Rs } 40 \text{ per m}^2$$

$$\begin{aligned} \therefore \text{cost of painting the block} &= 81 \times 40 \\ &= \text{Rs } 3240 \end{aligned}$$

18. Volume of tank $= l \times b \times h$

$$= 7.5 \times 3.2 \times 22$$

$$= 528 \text{ m}^3$$

Litres of water required to fill the tank:

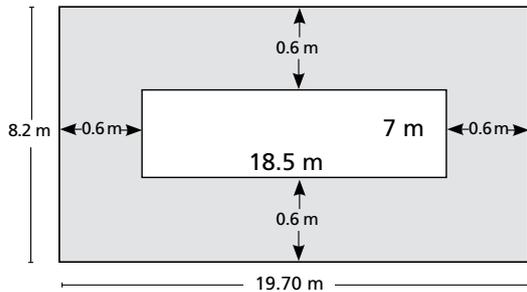
$$\begin{aligned} &\frac{528 \text{ m}^3}{0.001 \text{ m}^3} && [1 \text{ litre} = 0.001 \text{ m}^3] \\ &\text{or } \frac{528 \times 1000}{0.001 \times 1000} \end{aligned}$$

$$\therefore \text{litres required to fill the tank} = 528\,000. \text{ l}$$

19.

Helpful Hint

- Draw a figure of the garden along with a path all around it.
- Convert 60 cm to metre making all units same as the cost given is per square metre.
- Find the measurements of bigger rectangle by adding as the path is all around it.



$$100 \text{ cm} = 1 \text{ m}$$

$$60 \text{ cm} = 0.60 \text{ m}$$

∴ length of the larger rectangle is

$$(18.5 + 0.60 + 0.60) \text{ m} = 19.7 \text{ m}$$

breadth of the larger rectangle is

$$(7 + 0.6 + 0.6) \text{ m} = 8.2 \text{ m}$$

$$\begin{aligned} \therefore \text{area of larger rectangle} &= 19.7 \times 8.2 \\ &= 161.54 \text{ m}^2 \end{aligned}$$

Area of smaller rectangle

$$\begin{aligned} &= (18.5 \times 7) \text{ m} \\ &= 129.5 \text{ m}^2 \end{aligned}$$

Area of path = Area of larger rectangle –
Area of smaller rectangle

$$\begin{aligned} &= (161.54 - 129.5) \text{ m}^2 \\ &= 32.04 \text{ m}^2 \end{aligned}$$

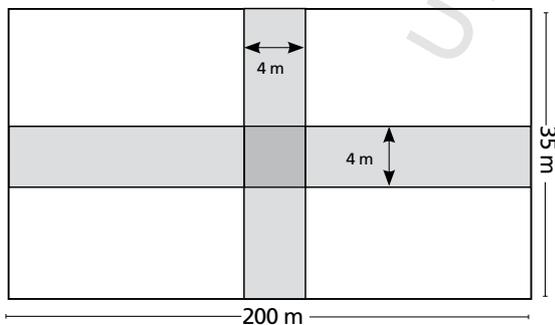
$$\text{Cost of paving } 1 \text{ m}^2 = \text{Rs } 60$$

$$\begin{aligned} \text{Cost of paving } 32.04 \text{ m}^2 &= 32.04 \times 60 \\ &= \text{Rs } 1922.40 \end{aligned}$$

20.

Helpful Hint

- Draw a figure to make the problem clear.
- The dark shaded area overlaps so consider it once only.



Area of horizontal road

$$= (200 \times 4) \text{ m} = 800 \text{ m}^2$$

$$\text{Area of vertical road} = 35 \times 4 = 140 \text{ m}^2$$

Area of overlapping region

$$= (4 \times 4) \text{ m} = 16 \text{ m}^2$$

$$\begin{aligned} \therefore \text{total area of the road} &= (800 + 140 - 16) \text{ m}^2 \\ &= 924 \text{ m}^2 \end{aligned}$$

$$\text{Cost of dismantling } 1 \text{ m}^2 = \text{Rs } 3.75$$

$$\begin{aligned} \text{Cost of dismantling } 924 \text{ m}^2 \\ &= \text{Rs } 3.75 \times 924 \text{ m}^2 = \text{Rs } 3465 \end{aligned}$$

$$21. \text{ Width of the corridor} = 1.2 \text{ m}$$

$$\text{Length of the corridor} = 4.5 \times 1.2 = 5.4 \text{ m}$$

$$\text{Area of the corridor} = w \times l$$

$$\begin{aligned} \text{Area of the corridor} &= (1.2 \times 5.4) \text{ m} \\ &= 6.48 \text{ m}^2 \end{aligned}$$

$$\text{Cost of carpeting } 1 \text{ m}^2 = \text{Rs } 125$$

$$\begin{aligned} \text{Cost of carpeting } 6.48 \text{ m}^2 &= \text{Rs } 125 \times 6.48 \text{ m}^2 \\ &= \text{Rs } 810 \end{aligned}$$

$$22. \text{ (i) Area of the terrace} = l \times b$$

$$\begin{aligned} &= (10.5 \times 2.8) \\ &= 29.4 \text{ m}^2 \end{aligned}$$

$$\text{Area of the smaller tile} = l \times b$$

$$\begin{aligned} &= (0.14 \times 0.14) \text{ m} \quad [14 \text{ cm} = 0.14 \text{ m}] \\ &= 0.0196 \text{ m}^2 \end{aligned}$$

$$\begin{aligned} \text{Number of tiles required} &= \frac{29.4}{0.0196} \\ &= 1500 \text{ tiles} \end{aligned}$$

$$\text{Cost of 1 tile} = \text{Rs } 8.50$$

$$\begin{aligned} \text{Cost of 1500 tiles} &= \text{Rs } 8.50 \times 1500 \\ &= \text{Rs } 12750 \end{aligned}$$

$$\text{(ii) Area of the bigger tile} = l \times b$$

$$\begin{aligned} &= (0.175 \times 0.175) \text{ m} \quad [17.5 \text{ cm} = 0.175 \text{ m}] \\ &= 0.030625 \text{ m}^2 \end{aligned}$$

$$\begin{aligned} \text{Number of tiles required} &= \frac{29.4}{0.030625} \\ &= 960 \text{ tiles} \end{aligned}$$

$$\text{Cost of 1 tile} = \text{Rs } 8.50$$

$$\begin{aligned}\text{Cost of 960 tiles} &= \text{Rs } 8.50 \times 960 \\ &= \text{Rs } 8160\end{aligned}$$

$$\begin{aligned}\text{Money saved} &= \text{Rs } (12750 - \text{Rs } 8160) \\ &= \text{Rs } 4590\end{aligned}$$

$$\begin{aligned}23. \text{ Area of the courtyard} &= l \times b \\ &= (10.5 \times 1.89) \text{ m} \\ &= 19.845 \text{ m}^2\end{aligned}$$

Helpful Hint

Convert 21 cm to metre

$$21 \text{ cm} \div 100 = 0.21 \text{ m}$$

$$\begin{aligned}\text{Area of tile} &= (0.21 \times 0.21) \text{ m} \\ &= 0.0441 \text{ m}^2\end{aligned}$$

$$\begin{aligned}\text{Number of tiles required} &= \frac{19.845}{0.0441} \\ &= 450 \text{ tiles}\end{aligned}$$

$$\begin{aligned}24. \text{ Volume of the box} &= l \times b \times h \\ &= (18 \times 9 \times 1.98) \text{ cm} \\ &= 320.76 \text{ cm}^3\end{aligned}$$

$$\begin{aligned}\text{Volume of the dice} &= (1.8 \times 1.8 \times 1.8) \text{ cm} \\ &= 5.832 \text{ cm}^3\end{aligned}$$

$$\begin{aligned}\text{Number of dice that can fit in the box} &= \frac{320.76}{5.832} \\ &= 55 \text{ dice}\end{aligned}$$

$$\begin{aligned}25. \text{ Amount of soil removed} &= l \times b \times h \\ &= (16 \times 5 \times 0.75) \text{ m}\end{aligned}$$

$$\text{Volume of soil removed} = 60 \text{ m}^3$$

To find the length of the soil layer:

$$\text{Volume} = l \times b \times h$$

$$60 = l \times 4 \times 0.125$$

$$l = \frac{v}{b \times h}$$

$$l = \frac{60}{4 \times 0.125}$$

$$l = 120 \text{ m}$$



Data Handling

Exercise 14A

1.

Helpful Hint

- Mean of set of data = $\frac{\text{Sum of values}}{\text{Number of quantities}}$
- Median is the middle value when data is arranged in ascending or descending order.
- Mode is the most occurring value in the data

- (i) Mean height of the plants is 121
- (ii) Mode of the ages of 5 students is 9
- (iii) Mean of the data is 6
- (iv) Arrange the data in ascending order:
10, 13, 14, 15, 17

Median of the data is 14.
It is the middle value.

- (v) Mode of data is 2.
It occurs the most.

2. (i) False: because mean is the sum of the values divide by the number of quantities.
- (ii) False: because, median is the middle value when data is arranged in ascending or descending order.
- (iii) False: because, median of the value of a set of data which is even can be found by finding the average of the two middle values.
- (iv) False: because, mode of a set of data can be none, one or more.
- (v) False: because there is no value which occurs frequently.

3. (i) Mean = $\frac{135 + 270 + 186 + 309 + 320}{5}$
 $= \frac{1220}{5} = 244$

(ii) Mean = $\frac{7.36 + 9.12 + 6.01 + 0.99 + 8.31}{5}$
 $= \frac{31.79}{5} = 6.358$ or 6.36

(iii)

Helpful Hint

Convert all values to the same unit

Mean = $\frac{18.250 \text{ g} + 6000 \text{ g} + 80 \text{ g} + 1.550 \text{ g} + 45 \text{ g}}{5}$
 $= \frac{6144.8 \text{ g}}{5} = 1228.96 \text{ g}$

- (iv) Mean first 7 negative numbers

$$= \frac{(-1) + (-2) + (-3) + (-4) + (-5) + (-6) + (-7)}{7}$$
$$= \frac{-28}{7} = -4$$

- (v) Mean of prime numbers between 10 and 25

$$= \frac{11 + 13 + 17 + 19 + 22}{5}$$
$$= \frac{83}{5} = 16.6$$

- (vi) Mean of first 7 perfect squares

$$= \frac{1 + 4 + 9 + 16 + 25 + 36 + 49}{7}$$
$$= \frac{140}{7} = 20$$

4.

Helpful Hint

- Find average of each term/exam.
- Find arrange of each subject.

Subject	1st Term	Mid-year	2nd Term	Final	Subject average
English	35	38	27	40	35
Urdu	28	32	25	35	30
G. Science	40	37	40	43	40
Maths	48	42	45	49	46
Average of each term/exam.	37.75	37.25	34.25	41.75	

- (i) Ahmed's average marks in English = 35
 \therefore Ahmed's highest average marks in languages were in English.
- (ii) Ahmed's highest average score was in final exams, that is 41.75.
- (iii) Ahmed's average in mathematics during the year was 46.
- (iv) Difference in Ahmed's average score of final exams and mid-year:
 $41.75 - 37.25 = 4.5$.
5. Guess of the 1st child = 1 kg 300 g or 1300 g
 Guess of the 2nd child = 1 kg 250 g or 1250 g
 Guess of the 3rd child = 1 kg 500 g or 1500 g
 Average weight of the book
 $= \frac{1300 \text{ g} + 1250 \text{ g} + 1500 \text{ g}}{3}$
 $= \frac{4050 \text{ g}}{3}$
 $= 1350 \text{ g}$ or 1 kg 350 g
6. (i) Mean of daily wages of 7 workers
 $= \frac{\text{Rs } (125 + 110 + 140 + 150 + 135 + 120 + 130)}{7}$
 $= \text{Rs } \frac{910}{7} = \text{Rs } 130$.
- (ii) Arranging the data in ascending order:
 110, 120, 125, 130, 135, 140, 150
 \therefore the median is Rs 130.
 (130 is the middle value of the data)
- (iii) No value occurs frequently, therefore, mode is none.

7. (i) Mean of marks obtained in a mathematics test by 15 students.
 $21 + 27 + 19 + 30 + 25 + 25 + 28 + 26 + 25 + 28 + 22 + 19 + 33 + 7 + 10 / 15$
 $= \frac{345}{15}$
 $= 23$ marks

- (ii) Arranging the data in ascending order:
 7, 10, 19, 19, 21, 22, 25, 25, 25, 26, 27, 28, 28, 30, 33
 Since, 25 is the middle value, therefore, the median is 25.
- (iii) Since, 25 is the most occurring value, the mode is 25.

Exercise 14B

1. (i) All bars in a multiple bar graph must be of the same width.
- (ii) In a pie chart data items are represented in a circle.
- (iii) In a pie chart, number of data items equals to the number of sectors.
- (iv) The letters of the word 'PAKISTAN' are placed in a bag. The probability of a vowel being taken out is $\frac{3}{8}$.
- (v) The probability that the sum of two even numbers is even is 100%.
2. (i) False: discrete data can be counted.
- (ii) True: by definition.
- (iii) True: in general the bars are always of the same width in a bar/multiple bar graph.
- (iv) False: sum does not rise from the west.
- (v) True: in a hexagonal spinner numbered 1, 2, 3, 4, 5, and 6 there are 3 even (2, 4, 6) and 3 odd (1, 3, 5) numbers. Therefore, the probability of occurrence even and odd numbers is 50% each.

3.

Helpful Hint

In each of the following questions, first read the graph carefully and find value of each item.

- (i) Tickets sold for charity show by agents of different cities.
- (ii) Tickets sold by agents:

Bahwalpur	: 100
Quetta	: 30
Rawalpindi	: 90
Multan	: 50
Kasur	: 80
Total tickets sold	: <u>350</u>
- (iii) Maximum number of tickets were sold in Bahwalpur.
- (iv) Minimum number of tickets were sold in Quetta.
- (v) The statement is true, because tickets sold in Bahwalpur were 100 and that in Multan were 50.

- 4. (i) Monthly expenses of two families on different items.
- (ii) Family 1:
Food, because the amount spent on food is Rs 30000.
Family 2:
Education, because the amount spent on education is Rs 30000.
- (iii) For both families the least expenditure is on miscellaneous items. That is family 1 spends Rs 10000 and family 2 spends Rs 5000 only.
- (iv) Both families spent the same amount on rent, that is Rs 20000.
- (v) Total monthly expenditure of each family:

	Family 1	Family 2
Food:	Rs 30 000	Rs 25 000
Education:	Rs 25 000	Rs 30 000
Rent:	Rs 20 000	Rs 20 000
Telephone:	Rs 15 000	Rs 10 000
Electricity:	Rs 15 000	Rs 20 000
Miscellaneous:	Rs 10 000	Rs 5000
Total	<u>Rs 115 000</u>	<u>Rs 110 000</u>

Savings of family 1 = Rs 25 000

Savings of family 2 = Rs 20 000

Monthly income of family 1 = Expenditure + Savings = Rs 115 000 + Rs 25 000
= Rs 140 000

Monthly income of family 2 = Expenditure + Savings = Rs 110 000 + Rs 20 000
= Rs 130 000

- 5. (i) Number of boys and girls playing different games.
- (ii) Maximum number of boys play hockey
- (iii) Maximum number of girls play badminton.
- (iv) Badminton is equally played by boys and girls.
- (v) Boys play football four times as compared to girls.
- (vi) Number of boys who play hockey = 90
Number of girls who play hockey = 50
Total number of boys and girls who play hockey = 140

6.

	Week 1	Week 2	Week 3	Week 4	Week 5
Farm 1	200 kg	300 kg	400 kg	150 kg	350 kg
Farm 2	400 kg	300 kg	300 kg	400 kg	100 kg
Total	600 kg	600 kg	700 kg	550 kg	450 kg

- (i) Tomatoes picked by both farms in five weeks:
(600 + 600 + 700 + 550 + 450) kg
= 2900 kg
- (ii) In week 3, Farm 1 picked 400 kg of tomatoes.
- (iii) Tomatoes picked by Farm 2 in week 4
= 400 kg
Total quantity of tomatoes picked in week 4
= 550 kg
∴ percentage of tomatoes picked
picked by Farm 2 = $\frac{400}{550} \times 100\%$
= 72.7%

- (iv) Quantity of tomatoes picked by Farm 1
= 1400 kg
Total quantity of tomatoes picked
= 2900 kg
Percentage of total quantity of
tomatoes by Farm 1 = $\frac{1400}{2900} \times 100\%$
= 48%

- (v) Ratio of tomatoes picked in week 3 to week 4.

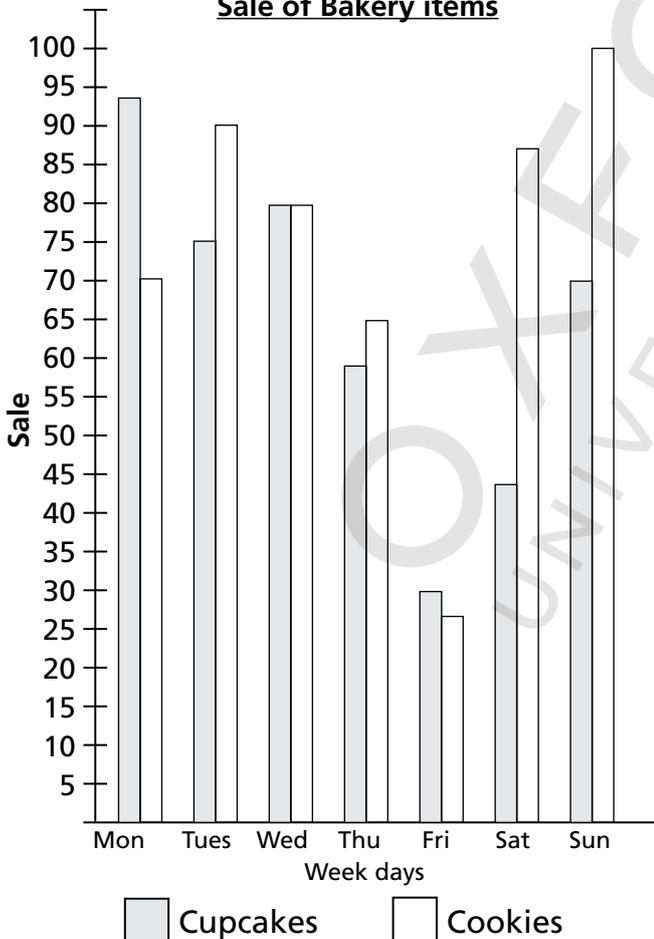
Week 3	:	Week 4
700	:	550
70	:	55
14	:	11

7.

Helpful Hint

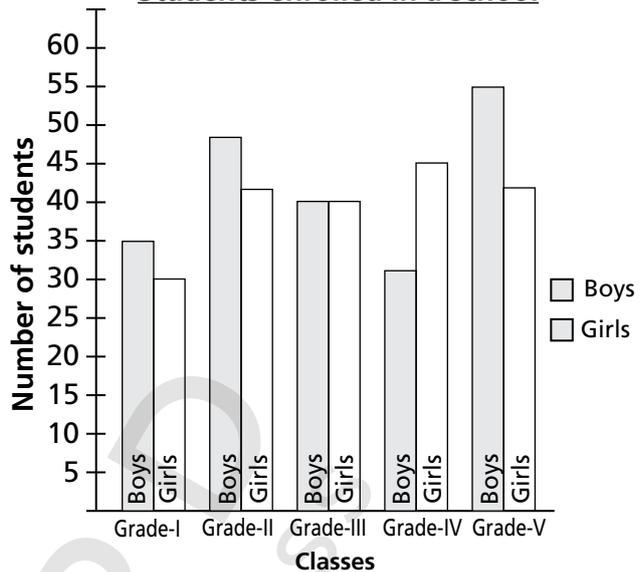
- Chose the scale of the smallest and the largest value along the vertical axis.
- Draw the bars of same width leaving same distance between them.

Sale of Bakery items



8.

Students enrolled in a school



9. (i) Total number of cars parked on Monday.

$$11 + 9 + 28 + 30 + 12 = 90$$

- (ii) Red cars are least in number.

- (iii) One-third of the total number of cars

$$\frac{1}{3} \times 90 = 30$$

\therefore white cars are one-third of the total.

- (iv) Percentage of red cars: $\frac{9}{90} \times 100 = 10\%$

10. (i) Number of employees who took part in the survey:

$$2 + 5 + 13 + 8 + 12 = 40$$

- (ii) Majority of employees travel by bus, that is 13.

- (iii) Bicycles : Cars

$$8 \quad : \quad 2$$

$$4 \quad : \quad 1$$

Bicycle are four times the number of cars.

- (iv) Cars are least in number.

11. (i) More people bought crystal vases, that is 23 less people bought picture frame, that 18.

- (ii) Number of toys sold = 4

$$\text{Number of paintings sold} = 8$$

$$\text{Difference} = 8 - 4 = 4$$

\therefore four less toys were sold as compared to paintings.

(iii) Total sale = $18 + 23 + 8 + 4 + 7 = 60$

Flowers sold = 8

Paintings sold = 7

Total sale = 15

$$25\% \text{ of sale} = \frac{25}{100} \times 60 = 15$$

\therefore sale of paintings and flowers together make up 25% sales.

(iv) Use a protractor to measure the angle. Sector angle of flowers is 42° .

12. (i) Most popular drink is coffee (49).

(ii) Fresh juice and milkshake are equally liked, that is 25 each.

(iii) Least popular drink is tea (8).

(iv) Number of customers who participated in the survey:
 $13 + 25 + 49 + 8 + 25 = 120$

13. (i) Probability that the selected student has blood group AB is $7/35$.

(ii) Probability that the selected student does not have blood group AB = $28/35$.

14. (i) Even numbers from 1 to 50 are 25.
 \therefore the probability that the counter has an even number = $25/50$.

(ii) 2-digit numbers from 1 to 50 are 41.
 \therefore the probability that the counter has a 2-digit number is $41/50$.

(iii) There are 10 multiples of 5 from 1 to 50.
 \therefore the probability that the counter has a multiple of 5 = $10/50$ or $1/5$.

(iv) There are 7 perfect squares from 1 to 50.
 \therefore the probability the counter has a perfect square is = $7/50$.

Multiple Choice Questions 16

1. Option D: Sector

Reason: Sector is a part of circle, while on a bar graph data is represented as a bar.

Option A, B, and C are part of a bar graph.

2. Option A: Speed of a vehicle on different days.

Reason: Speed will continuously vary, thus value will change. Therefore, cannot be represented on a bar graph.

Option B, C, and D can be represented on a bar graph.

3. Option D: 360°

Reason: A pie chart is a circle and there are 360° in one complete rotation.

Option A, B, and C are all clearly incorrect statements.

4. Option B: The data is grouped.

Reason: The data is neither organised in ascending or descending order nor grouped.

Option A, C, and D are all correct statements.

5. Option C: In year 2013 and year 2015 same number of toys were manufactured.

Reason: In 2013 three thousands toys were manufactured, while in 2015 four thousand toys were manufactured.

Option A, B, and D are all correct statements.

6. Option C: True

Reason: By definition, graphs give instant visual information about changes that take place in a particular situation.

Option A, B, and D are clearly in correct statements.

7. Option D: True

Reason: Multiple bar graph shows relations between different values of data.

Option A, B, and C are incorrect statements.

8. Option C: $\frac{1}{4}$

Reason: $\frac{\text{Number of red balls}}{\text{Total number of outcome}}$

$$\frac{12}{12 + 20 + 16} = \frac{12}{48} = \frac{1}{4}$$

Option A, B, and D are clearly incorrect.

9. Option D: $\frac{1}{4}$

Reason: When two coins are tossed together the four possible outcomes are HH, TT, HT, TH.

Therefore, the probability that both will show head is $\frac{1}{4}$

Option A, B, and C are incorrect statements.