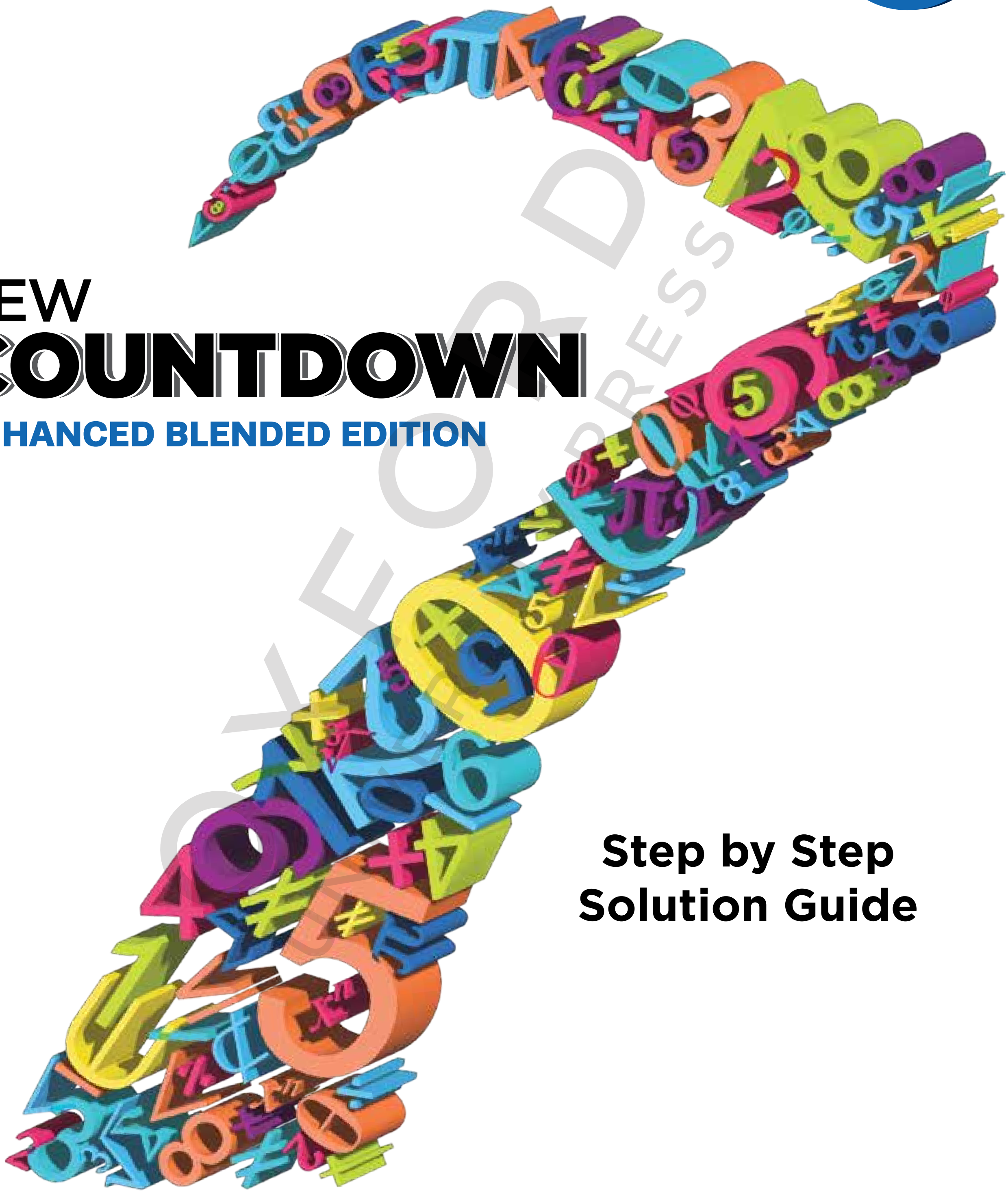
7

NEW

COUNTDOWN

ENHANCED BLENDED EDITION



Step by Step Solution Guide

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Preface

New Countdown Third Edition **(*Enhanced Blended Edition*)** is a carefully structured and graded mathematics course, comprising eleven books for Classes Pre-Primary to Class 8. 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 pre-emptive 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.

Finally, apart from the step-by-step worked solutions themselves, the end of this guide also includes a direct answer key that can be used for cross-referencing purposes by the teacher. These answers correlate to the model paper in the Assessment Resource Pack.

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.

CONTENTS

1 SETS

Exercise 1

Helpful Hints:

- Union of two or more sets include all the elements in the given sets.
- The difference of two sets A and B is the set of elements of A which are not in set B.
- If all the elements of B are also the members of A, then B is a subset ($\subset$) of A.

1. (i) The set of natural numbers greater than 10 and less than 17 is {11, 12, 13, 14, 15, 16}.
   (ii) The set of prime numbers from 1 to 30 is {2, 3,5,7,11, 13, 17, 19, 23, 29}.
   (iii) $\{2, 4, 6, 8, 10, 12\} \cup \{1, 3, 5, 7, 9, 11\}$
   $= \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12\}$.
   (iv) $\{7, 13, 18, 21, 25\} - \{13, 21, 25\} = \{7, 18\}$
   (v) B is a $\subset$ of A, because all the members of B are also the members of A.
2. (i) False, because both the sets do not have any elements in common.
   (ii) True by definition
   (iii) True by definition
   (iv) True
   If there is no member of $A \cap B$, then $A \cap B$ does not have common members.
   (v) False, because the difference of two sets consists of the members of first set which are not the members of second set.
3. (i) $\mathbb{Z} = \{ -3, -2, -1, 0, 1, 2, 3\}$
   (ii) $\mathbb{O} = \{3, 9, 15, 21, 27\}$
   (iii) $\mathbb{P} = \{53, 59, 61, 67, 71, 73, 79, 83, 89\}$
   (iv) $\mathbb{E} = \{10, 12, 14, 16, 18\}$
4. $A = \{2, 4, 6, 8\}$, $B = \{1, 3, 5, 7\}$
   $A \cup B = \{2, 4, 6, 8\}$ U $\{1, 3, 5, 7\}$
   $A \cup B = \{1, 2, 3, 4, 5, 6, 7, 8\}$
5. $A = \{3, 6, 9\}$, $B = \{ \}$
   $A \cup B = \{3, 6, 9\}$, U $\{ \}$
   $A \cup B = \{3, 6, 9\}$
6. $R = \{1, 2, 3, 4, 5, 6\}$, $S = \{0, 3, 6, 9\}$,
   $T = \{1, 3, 5, 7\}$
   (i) $R \cap T = \{1, 2, 3, 4, 5, 6\} \cap \{1, 3, 5, 7\}$
   $R \cap T = \{1, 3, 5\}$
   (ii) $S \cap R = \{0, 3, 6, 9\} \cap \{1, 2, 3, 4, 5, 6\}$
   $= \{3, 6\}$
   (iii) $T \cap S = \{1, 3, 5, 7\} \cap \{0, 3, 6, 9\}$
   $= \{3\}$
7. (i) $A \cup B = \{0, 1, 2, 3\} \cup \{2, 3, 4, 5, 6\}$
   $= \{0, 1, 2, 3, 4, 5, 6\}$
   (ii) $B \cup C = \{2, 3, 4, 5, 6\} \cup \{5, 6, 7, 8\}$
   $= \{2, 3, 4, 5, 6, 7, 8\}$
   (iii) $C \cup D = \{5, 6, 7, 8\} \cup \{2, 4, 6, 8\}$
   $= \{2, 4, 5, 6, 7, 8)$
   (iv) $A \cap B = \{0, 1, 2, 3,\} \cap \{2, 3, 4, 5, 6\}$
   $= \{2, 3\}$
   (v) $B \cap C = \{2, 3, 4, 5, 6\} \cap \{5, 6, 7, 8\}$
   $= \{5, 6\}$
   (vi) $C \cap D = \{5, 6, 7\ 8\} \cap \{2, 4, 6, 8\}$
   $= \{6, 8\}$
   (vii) $A' = \mathbb{U} - A$
   $= \{0, 1, 2, \ldots, 8\}, - \{0, 1, 2, 3,\}$
   $= \{4, 5, 6, 7, 8\}$
   (viii) $B' = \mathbb{U} - B$
   $= \{0, 1, 2, \ldots, 8\}, - \{2, 3, 4, 5, 6\}$
   $= \{0, 1, 7, 8\}$

(ix) C' = $\mathbb{U}$ – C
= {0, 1, 2, ..., 8}, – {5, 6, 7, 8}
= {0, 1, 2, 3, 4}

(x) D' = $\mathbb{U}$ – D
= {0, 1, 2, ..., 8}, – {2, 4, 6, 8}
= {0, 1, 3, 5, 7}

(xi) A\B = A – B
= {0, 1, 2, 3} – {2, 3, 4, 5, 6}
= {0, 1}

(xii) C\D = C – D
= {5, 6, 7, 8} – {2, 4, 6, 8}
= {5, 7}

(xiii) B\A = B – A
= {2, 3, 4, 5, 6} – {0, 1, 2, 3,}
= {4, 5, 6}

(xiv) D\A = D – A
= {2, 4, 6, 8} – {0, 1, 2, 3}
= {4, 6, 8}

8. $\mathbb{U}$ = A∪A'
= {1, 3, 5, 7, 9} ∪ {4, 5, 6, 7, 12}
$\mathbb{U}$ = {1, 3, 4, 5, 6, 7, 9, 12}

9. Taking LHS: (A ∪ B)′
(A ∪ B) = {5, 6, 7} ∪ {1, 3, 5}
= {1, 3, 5, 6, 7}
(A ∪ B)′= $\mathbb{U}$ – (A ∪ B)
= {1, 2, 3, 4, 5, 6, 7} – {1, 3, 5 ,6, 7}
= {2, 4}

Taking RHS: A′ ∩ B′
A′= {1, 2, 3, 4, 5, 6, 7} – {5, 6, 7}
= {1, 2, 3, 4}
B′ = {1, 2, 3, 4, 5, 6, 7} – {1, 3, 5}
= {2, 4, 6, 7}
A′ ∩ B′ = {1, 2, 3, 4} ∩ {2, 4, 6, 7}
= {2, 4}
LHS = RHS
Hence, (A ∪ B)′ = A′ ∩ B′(Proved).

10. Taking LHS: (A ∩ B)′
(A ∩ B) = {b, c, d} ∩ {a, e, d}
= {d}
(A ∩ B)′= $\mathbb{U}$ – (A ∩ B)
= {a, b, c, d, e, f} – {d}
= {a, b, c, e, f}
Taking RHS A′ ∪ B′
A′= {a, b, c, d, e, f} – {b, c, d}
= {a, e, f}
B′ = {a, b, c, d, e, f } – {a, e, d}
= {b, c, f}
A′ ∪ B′= {a, e, f} ∪ {b, c, f}
= {a, b, c, e, f}
LHS = RHS
Hence, (A ∩ B)′ = A′ ∪ B′(Proved).

Multiple Choice Question 1

1. Option A is correct.
Set B of even numbers will be subtracted from set A.
2. Option A is correct.
Rectangular region is the universal set.
3. Option B is correct.
A'= $\mathbb{U}$ – A and B' = $\mathbb{U}$ – B
The set containing all the members of A' and B' will be A' ∪ B'.
4. Option C is correct.
$\mathbb{U}$/A = $\mathbb{U}$ – A = A'
5. Option B is correct.
Equivalent sets are the sets having same number of elements.

2 Rational Numbers

Exercise 2A

1.

Helpful Hint

A number in the form $\frac{a}{b}$ where a and b are integers and $b \neq 0$ is a rational number.

(i), (ii), (iv), (v), and (vi) are rational numbers because their denominator are not zero.

2. (i) 7 (ii) – 5 (iii) – 9 (iv) 21

3. $\frac{(-7) \times 2}{21-2} = \frac{-14}{19}$

Helpful Hint

A negative denominator or numerator can be made positive by multiplying numerator and denominator with same negative number.

4. (i) $\frac{15-4}{37 \times (-2)} = \frac{11}{-74}$

(ii) $\frac{11 \times (-1)}{-74 \times (-1)} = \frac{-11}{74}$

5. (i) $-\frac{3}{7} = \frac{3 \times 2}{-7 \times 2} = \frac{6}{-14}$

(ii) $-\frac{3}{7} = \frac{-3 \times 5}{7 \times 5} = \frac{-15}{35}$

(iii) $-\frac{3}{7} = \frac{3 \times 1}{-7 \times 1} = \frac{3}{-7}$

(iv) $-\frac{3}{7} = \frac{3 \times 3}{(-7) \times 3} = \frac{9}{-21}$

6. (i) $\frac{-2}{-5} = \frac{-2 \times (-1)}{-5 \times (-1)} = \frac{2}{5}$

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

(iii) $\frac{-2}{-5} = \frac{-2 \times (-8)}{-5 \times (-8)} = \frac{16}{40}$

(iv) $\frac{-2}{-5} = \frac{-2 \times 10}{-5 \times 10} = \frac{-20}{-50}$

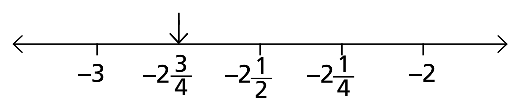
7. (i) $-\frac{7}{1} = \frac{-7}{1}$

(ii) $\frac{-5}{-2} = \frac{-5 \times (-1)}{-2 \times (-1)} = \frac{5}{2}$

(iii) $\frac{-31}{-3} = \frac{-31 \times (-1)}{-3 \times (-1)} = \frac{31}{3}$

(iv) $-\frac{9}{5} = \frac{-9}{5}$

8. (i) $-\frac{11}{4} = -2\frac{3}{4}$



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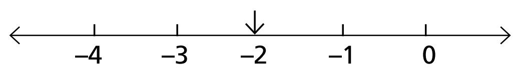

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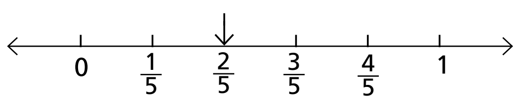

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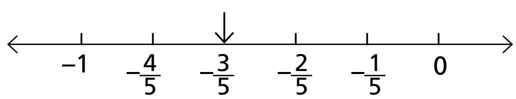


9. Yes, $\frac{2}{-3} = -\frac{2}{3}$

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

Exercise 2B

Helpful Hint

When the numerator and denominator of a rational number have no common divisor other than 1 and the denominator of the number is positive, then the rational number is its standard form.

1. (i) $\frac{56}{-96} = \frac{56 \div 8}{-96 \div 8} = \frac{7 * (-1)}{-12 * (-1)}$

$= \frac{-7}{12}$

(ii) $\frac{3}{4} = \frac{3 * 15}{4 * 15} = \frac{45}{60}$

$\frac{11}{15} = \frac{11 * 4}{15 * 4} = \frac{44}{60}$

Now 45 > 44

$\therefore \frac{45}{60} > \frac{44}{60}$

or $\frac{3}{4} > \frac{11}{15}$

Helpful Hint

The product of a number and its reciprocal is always 1.

(iii) Reciprocal of $\frac{5}{7}$ is $\frac{7}{5}$

(iv) $\frac{5}{7} = \frac{5 * 5}{7 * 5} = \frac{25}{35}$

$\frac{2}{5} = \frac{2 \quad 7}{5 \quad 7} = \frac{14}{35}$

25 > 14

$\therefore \frac{25}{35} > \frac{14}{35}$

or $\frac{5}{7} > \frac{2}{5}$

Hence, $\frac{5}{7}$ is greater than $\frac{2}{5}$.

2. (i) $\frac{4}{6} = \frac{2}{3}$

(ii) $\frac{4}{-9} = -\frac{4}{9}$

(iii) $\frac{-11}{-13} = \frac{11}{13}$

(iv) $\frac{-21}{-28} = \frac{21}{28} \quad \frac{3}{4}$

(v) $\frac{42}{-48} = \frac{42 \div 6}{-48 \div 6} = \frac{7 \times (-1)}{-8 \times (-1)} = \frac{-7}{8}$

3.

Helpful Hint

Every positive rational number is greater than a negative rational number.

(i) $\frac{2}{7} > \frac{-3}{7}$ or $\frac{2}{7} > -\frac{3}{7}$

(ii) $-\frac{4}{9} = -\frac{4 * 2}{9 * 2} = -\frac{8}{18}$

$-\frac{5}{6} = -\frac{5 * 3}{6 * 3} = -\frac{15}{18}$

– 8 > – 15

$\therefore \frac{-8}{18} > \frac{-15}{18}$ or $-\frac{4}{9} > -\frac{5}{6}$

(iii) $\frac{4}{7} = \frac{4 * 2}{7 * 2} = \frac{8}{14}$

$\frac{1}{2} = \frac{1}{2} = \frac{1 * 7}{2 * 7} = \frac{7}{14}$

8 > 7

$\therefore \frac{8}{14} > \frac{7}{14}$ or $\frac{4}{7} > \frac{1}{2}$

(iv) $\frac{-3}{-4} = \frac{-6}{8}$

$\frac{-5}{8} > -\frac{6}{8}$

– 5 > – 6

$\frac{-5}{8} > \frac{-3}{4}$

(v) $\frac{5}{-8}, \frac{-7}{11}$

$\frac{5 \times 11}{-8 \times 11} = \frac{55}{-88}$

$\frac{-7 \times -8}{11 \times -8} = \frac{56}{-88}$

$\frac{55}{-88} > \frac{56}{-88}$ or $\frac{5}{-8} > \frac{-7}{11}$

(vi) $\frac{-5}{-21} > \frac{-3}{-13}$

Use the same steps as given above.

4.

Helpful Hint

To compare two fractions we make them equivalent, then compare the numerators. Larger numerator makes larger fraction.

(i) $\frac{-7}{12} \square \frac{5}{-8}$

$\frac{-7 \times 2}{12 \times 2} = \frac{-14}{24}, \frac{-5 \times 3}{8 \times 3} = \frac{-15}{24}$

$\frac{-14}{24} > \frac{-15}{24}$ or $\frac{-7}{12} \boxed{>} -\frac{5}{8}$

$\frac{-7}{12} > \frac{5}{-8}$

(ii) $\frac{-4}{9} \square \frac{-3}{7}$

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

$\frac{-28}{63} < \frac{-27}{63}$ or $\frac{-4}{9} \boxed{<} \frac{-3}{7}$

(iii) $\frac{-7}{-8} \square \frac{14}{17}$

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

$\frac{-119}{-136} > \frac{-112}{-136}$ or $\frac{-7}{-8} \boxed{>} \frac{14}{17}$

(iv) $\frac{-2}{9} \square \frac{8}{-36}$

$\frac{8}{-36} = -\frac{8}{36} = \frac{-2}{9}$

$\frac{-2}{9} \boxed{=} \frac{8}{-36}$

Solve (v) and (vi) using the above method.

(v) $\frac{5}{8} \boxed{>} \frac{25}{45}$

(vi) $\frac{4}{6} \boxed{>} \frac{1}{12}$

5. $= \frac{-7}{10}, \frac{8}{-15}, \frac{19}{30}, \frac{-2}{-5}$

Writing in standard form:

$= \frac{-7}{10}, \frac{-8}{15}, \frac{19}{30}, \frac{2}{5}$

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

Arranging in descending order:

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

$= \frac{19}{30}, \frac{-2}{-5}, \frac{-8}{15}, \frac{-7}{10}$

6. (i) $\frac{1}{-3}$ or $\frac{-1}{3}$

(ii) $-\frac{9}{2}$

(iii) $\frac{-8}{-3}$ or $\frac{8}{3}$

(iv) $\frac{-\cancel{3}^{1}}{4} \times \frac{-5}{-\cancel{6}^{2}}$

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

7.

Helpful Hint

To round off a rational number, we convert the rational number into decimal number.

(i) $\frac{25}{4}$

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

$= \frac{625}{100}$

= 6.25

= 6.3 (rounded off to the nearest tenth)

(ii) $= \frac{\cancel{102}^{51}}{\cancel{16}_{8}}$

$= \frac{51}{8}$

= 6.375

6.375 rounded off is the nearest tenth in 6.4

6.375 rounded off to the nearest hundredth is 6.38

(iii) $\frac{777}{16}$

= 48.5625

48.5625 rounded off to the nearest tenth is 48.6

48.5625 rounded off to the nearest hundredth is 48.56

48.5625 rounded off to the nearest thousandth is 48.563

Exercise 2C

Helpful Hint

When two or more rational numbers are added, subtracted, multiplied, or divided, the result is another rational number.

1. (i) True
   (ii) True
   (iii) True
   (iv) False
   The product of a number with its multiplicative inverse is 1. Multiplicative inverse of a number is exactly reciprocal of the number.
   (v) True

Helpful Hint

Rational number are added or subtracted by converting them into equivalent fractions.

2. (i) $\frac{3}{5} + \left(\frac{-2}{5}\right)$

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

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

$= \frac{1}{5}$

(ii) $\frac{-5}{8} + \frac{1}{4}$

$= \frac{-5}{8} + \frac{2}{8}$

$= \frac{-5+2}{8}$

$= \frac{-3}{8} = -\frac{3}{8}$

(iii) $\frac{3}{7} + \left(\frac{-2}{7}\right)$

$= \frac{3}{7} - \frac{2}{7}$

$= \frac{3-2}{7}$

$= \frac{1}{7}$

(iv) $-\frac{3}{11} + \left(\frac{-5}{11}\right)$

$= -\frac{3}{11} - \frac{5}{11}$

$= \frac{-3-5}{11}$

$= -\frac{8}{11}$

3. (i) $-\frac{7}{11}+\frac{1}{6}$

$= \frac{-42+11}{66}$

$= \frac{-31}{66}$

$= -\frac{31}{66}$

(ii) $\frac{-3}{-7}+\frac{2}{5}$

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

$= \frac{15+14}{35}$

$= \frac{29}{35}$

(iii) $\frac{-7}{9}+\frac{2}{7}$

$= \frac{-49+18}{63}$

$= \frac{-31}{63} = -\frac{31}{63}$

(iv) $\frac{3}{4}-\frac{2}{5}$

$= \frac{15-8}{20}$

$= \frac{7}{20}$

4. Taking LHS:

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

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

$= \frac{2}{45}-\frac{3}{4}$

$= \left(\frac{8-135}{180}\right)$

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

Taking RHS:

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

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

$= -\frac{2}{5}+\left(\frac{16-27}{36}\right)$

$= -\frac{2}{5}+\left(-\frac{11}{36}\right)$

$= -\frac{2}{5}-\frac{11}{36}$

$= \frac{-72-55}{180}$

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

LHS = RHS (Associative law is verified).

5. (i) $-\frac{6}{7}-\frac{-2}{7}$

$= -\frac{6}{7}+\frac{2}{7}$

$= \frac{-6+2}{7}$

$= -\frac{4}{7}$

(ii) $\frac{7}{24}-\frac{11}{36}$

$= \frac{21-22}{72}$

$= -\frac{1}{72}$

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

$= \frac{10}{63}+\frac{6}{7}$

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

$= \frac{64}{63}$

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

$= -\frac{11}{13}+\frac{5}{26}$

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

$= -\frac{17}{26}$

6. (i) $\frac{3}{7}+\frac{5}{9}-\frac{-2}{3}$

$= \frac{3}{7}+\frac{5}{9}+\frac{2}{3}$

$= \frac{27+35+42}{63}$

$= \frac{104}{63}$

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

$= -\frac{4}{11}-\frac{2}{3}+\frac{5}{9}$

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

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

$= \frac{-47}{99}$

$= -\frac{47}{99}$

(iii) $-\frac{1}{6}+\left(\frac{-2}{3}\right)-\frac{1}{3}$

$= -\frac{1}{6}-\frac{2}{3}-\frac{1}{3}$

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

$= \frac{-7}{6}$

$= -\frac{7}{6}$

7. (i) $\frac{\cancel{4}^1}{\cancel{15}_5}\times\frac{\cancel{3}^1}{\cancel{8}_2}$

$= \frac{1}{10}$

(ii) $\frac{\cancel{3}^1}{11}\times-\frac{2}{\cancel{9}_3}$

$= -\frac{2}{33}$

(iii) $\left(-\frac{5}{7}\right)\times\frac{14}{15}$

$= \frac{-\cancel{5}^1}{\cancel{7}^1}\times\frac{\cancel{14}^2}{\cancel{15}_3}$

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

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

$(\frac{-\cancel{8}^2}{5}\times\frac{3}{\cancel{4}_1})+(\frac{7}{\cancel{8}}\times-\frac{\cancel{16}^2}{25})$

$= -\frac{6}{5}+(-\frac{14}{25})$

$= -\frac{6}{5}-\frac{14}{25}$

$= \frac{-30-14}{25}$

$= \frac{-44}{25}$

(ii) $(\frac{7}{25}\times\frac{-15}{28})-(\frac{-3}{5}\times\frac{4}{9})$

$= (\frac{\cancel{7}^1}{\cancel{25}_5}\times-\frac{\cancel{15}^3}{\cancel{28}_4})-(-\frac{\cancel{3}^1}{5}\times\frac{4}{\cancel{9}_3})$

$= -\frac{3}{20}+\frac{4}{15}$

$= -\frac{-9+16}{60}$

$= \frac{7}{60}$

(iii) $(\frac{-3}{4} \times \frac{-8}{15}) - (\frac{2}{3} \times \frac{-3}{5}) - (\frac{-4}{7} \times \frac{-14}{15})$

$= (-\frac{3^1}{4_1} \times -\frac{8^2}{15_5}) - (\frac{2}{3} \times -\frac{3}{5}) - (-\frac{4}{7_1} \times \frac{-14^2}{15})$

$= \frac{2}{5} + \frac{2}{5} - \frac{8}{15}$

$= \frac{6 + 6 - 8}{15}$

$= \frac{4}{15}$

9. LHS:

$\left(-\frac{5}{8} \times \frac{4}{15}\right) \times \frac{-3}{4}$

$= \left(-\frac{5}{8_2} \times \frac{4^1}{15_3}\right) \times \left(\frac{-3}{4}\right)$

$= -\frac{1}{6_2} \times \left(\frac{-3}{4}\right)$

$= \frac{1}{8}$

RHS:

$-\frac{5}{8} \times \left(\frac{4}{15} \times \frac{-3}{4}\right)$

$= -\frac{5}{8}\left(\frac{4}{15_5} \times -\frac{3}{4}\right)$

$= -\frac{5}{8} \times -\left(\frac{1}{5}\right)$

$= \frac{1}{8}$

LHS = RHS

10.

Helpful Hint

The absolute value of $\left|\frac{a}{b}\right| = \frac{|a|}{|b|}$

(i) $\left|\frac{7}{8}\right|$

$= \frac{|7|}{|8|}$

$= \frac{7}{8}$

(ii) $\left|\frac{-3}{6}\right|$

$= \frac{|-3|}{|5|}$

$= \frac{3}{5}$

(iii) $\left|\frac{4}{11}\right|$

$= \frac{|4|}{|11|}$

$= \frac{4}{11}$

(iv) $\left|\frac{-5}{6}\right|$

$= \frac{|-5|}{|6|}$

$= \frac{5}{6}$

(iv) $\left|\frac{-8}{9}\right|$

$= \frac{|-8|}{|9|}$

$= \frac{8}{9}$

Multiple Choice Questions 2

1. Option A is correct.

   When $\frac{4}{7}$ is subtracted from $-\left(\frac{2}{5}\right)$ we get $\left(-\frac{34}{35}\right)$.

2. Option B is correct.

   The values of the numbers increase as we move from left to right.

3. Option D is correct.

   Set of irrational numbers is not contained in the set of rational numbers.

4. Option B is correct.

   Subtraction is not commutative for example 4 – 2 ≠ 2 – 4

5. Option B is correct.

   By converting the fractions in equivalent fractions, we get the correct answers.

6. Option C is correct because absolute value of a negative number is positive.

3 Decimal Numbers

Exercise 3

Helpful Hint

- To convert a common fraction into an decimal fraction, we find and equivalent fraction with denominator having power of 10.
- To convert a percentage into fraction, first convert the percentage into a fraction with denominator 100, then convert the fraction into decimal numbers.
- To convert a decimal number into a fraction, the denominator has power of 10, depending on the number of digits.

1. (i) 0.5 (ii) 0.23 (iii) 40%
   (iv) $\frac{219}{100}$ (v) recurring

2. (i) True: $0.5 = \frac{5 \times 10}{10 \times 10} = \frac{50}{100}$
   (ii) False: The denominator has power 1 to 10, so decimal point will be after one digit from right.
   (iii) True: $345\% = \frac{345}{100} = 3.45$
   (iv) False: A rational number gives a terminating decimal if its denominator is 2, 5 or 2 and 5.
   (v) True: The tenth place is greater than 5 so the number will be rounded up to 24.

3. (i) (c)
   (ii) (a)
   (iii) (d)
   (iv) (b)

4. (i) 3.1276

Correct to the nearest whole number

③.1276

Helpful Hint
1 ∠ 5; drop all the digits after decimal

$3.1276 \approx 3$

Correct to one decimal places

3.①276

Helpful Hint
2 ∠ 5; drop all the digits to the right of 1

$3.1276 \approx 3.1$

Correct to two decimal places

3.1②76

Helpful Hint
7 ⦣ 5; add 1 to 2 and drop all the digits after 2

3.1②76 ≈ 3.13

Correct to three decimal places

3.12⑦6

Helpful Hint
6 > 5; add 1 to 7 and drop next digit.

$3.1276 \approx 3.128$

Follow the hints given in (i) to solve (ii), (iii), (iv) and (v).

(ii) 312.76

Correct to the nearest whole number

(312).76 ≈ 313

Correct to one decimal place

312.(7)6 ≈ 312.8

Correct to two decimal places

312.76 ≈ 312.76

Correct to three decimal places

312.76 ≈ 312.760

(iii) 1.00125

Correct to the nearest whole number

1.00125 ≈ 1

Correct to one decimal place

1.00125 ≈ 1.0

Correct to two decimal place

1.00125 ≈ 1.00

Correct to three decimal place

1.00125 ≈ 1.001

(iv) 0.0125

Correct to the nearest whole number

0.0125 ≈ 0

Correct to one decimal places

0.0125 ≈ 0

Correct to two decimal places

0.0125 ≈ 0.01

Correct to three decimal places

0.0125 ≈ 0.013

(v) 0.00125

Correct to the nearest whole number

0.00125 ≈ 0

Correct to one decimal place

0.00125 ≈ 0

Correct to two decimal places

0.00125 ≈ 0

Correct to three decimal places

0.00125 ≈ 0.001

5. (i) 2(9).06

0 < 5; drop 0 and 6

2(9).06 ≈ 29

(ii) 210.5(3)

210.5(3) ≈ 210.53

(iii) 0.(8)26

2 < 5

0.(8)26 ≈ 0.8

(iv) 112.9(9)9

9 > 5

112.9(9)9 ≈ 113

(v) 3(7).678

6 > 5; add 1 to 7 and drop 6, 7, and 8

3(7).678 ≈ 38

(vi) 416.5(9)5

Next digit to 9 is 5; add 1 to 9 and drop 5

416.595 ≈ 416.6

(vii) 4.58(4)67

6 > 5; add 1 to 4; drop 6 and 7

4.58(4)67 ≈ 4.585

(viii) 7.91(6)59

Next digit to 6 is 5; add 1

7.91(6)59 ≈ 7.917

(ix) 3.5(4)545

Next digit to 4 is 5; add 1 to 4 and drop all to right)

3.5(4)545 = 3.55

6. (i) (x) 39.06 *circle 9*

0 < 5

39.06 = 39 *circle 9*

(ii) $\frac{1 \times 2}{5 \times 2}$

$= \frac{2}{10}$

$= 0.2$

(iii) $\frac{1 \times 2}{50 \times 2}$

$= \frac{2}{100}$

$= 0.02$

(iv) $\frac{1 \times 5}{20 \times 5}$

$= \frac{5}{100}$

$= 0.05$

(v) $\frac{1 \times 4}{s25 \times 4}$

$= \frac{4}{100}$

$= 0.04$

(vi) $\frac{1 \times 25}{40 \times 25}$

$= \frac{25}{1000}$

$= 0.025$

(vii) $\frac{3 \times 25}{4 \times 25}$

$= \frac{75}{100}$

$= 0.75$

(viii) $\frac{2 \times 2}{5 \times 2}$

$= \frac{4}{10}$

$= 0.4$

7. (i)

```
     0.4
5 )  20
    -20
    ---
     ××
```

$\frac{2}{5} = 0.4$

(ii)

```
      0.1
30 )  30
     -30
     ---
      ××
```

$\frac{3}{30} = 0.1$

(iii)

```
      0.68
25 )  170
     -150
     ----
       200
      -200
      ----
       ×××
```

$\frac{17}{25} = 0.68$

(iv)

```
     3.4
5 )  17
    -15
    ---
     20
    -20
    ---
     ××
```

$\frac{17}{5} = 3.4$

(v) $-\frac{5}{8}$

```
8 )  5 0 ( 0.625
    -4 8
    ----
      20
     -16
     ---
      40
     -40
     ---
      ××
```

$-\frac{5}{8} = -0.625$

(vi) $-\frac{18}{125}$

```
       0.144
125 )  180
      -125
      ----
        550
       -500
       ----
        500
       -500
       ----
        ×××
```

$-\frac{18}{125} = -0.144$

8. (i) $\frac{13}{4}$

The denominator $4 = 2 \times 2$. The prime factors of the denominator are all 2s.

$\therefore \frac{13}{4}$ can be written as terminating decimal.

(ii) $\frac{5}{80}$

The denominator $80 = 2 \times 2 \times 2 \times 2 \times 5$. The prime factors are 2s and 5.

$\therefore \frac{5}{80}$ is a terminating decimal.

(iii) $\frac{-13}{15}$

The denominator $15 = 3 \times 5$. One of the factors is 3.

$\therefore \frac{13}{15}$ is not a terminating decimal.

(iv) $\frac{5}{7}$

The factors of 7 are 7 and 1 which are other than 2 or 5.

$\therefore \frac{5}{7}$ is not a terminating decimal.

(v) $-\frac{2}{3}$

The factors of denominator are $3 = 3 \times 1$. One of the factors is 3.

$\therefore -\frac{2}{3}$ is not a terminating decimal.

(vi) $-\frac{3}{125}$

The factors of 125 are $5 \times 5 \times 5$.

$\therefore -\frac{3}{125}$ is a terminating decimal.

9. (ii) $\frac{3}{7}$

The factor of $7 = 7 \times 1$, which are not 2 or 5.

$\therefore \frac{3}{7}$ is not a terminating decimal.

(iii) $\frac{-17}{3}$

The factors of 3 are 3×1.

$\therefore \frac{-17}{3}$ is not a terminating decimal.

(iv) $\frac{-8}{15}$

The denominator $15 = 3 \times 5$.

$\therefore -\frac{8}{15}$ is not a terminating decimal.

(v) $\frac{1}{14}$

The denominator $14 = 2 \times 7$.

$\therefore \frac{1}{14}$ is not a terminating decimal.

(viii) $\frac{7}{11}$

The denominator $11 = 11 \times 1$

$\therefore \frac{7}{11}$ is not a terminating decimal.

10. (i) 0.25

$= \frac{\cancel{25}^{1}}{\cancel{100}^{4}}$

$= \frac{1}{4}$

(ii) 0.007

$= \frac{7}{1000}$

(iii) 5.04

$= \frac{\overset{126}{\cancel{504}}}{\underset{25}{\cancel{100}}}$

$= \frac{126}{25}$

(iv) 0.0095

$= \frac{\overset{19}{\cancel{95}}}{\underset{2000}{\cancel{10000}}}$

$= \dfrac{19}{2000}$

(v) $\dfrac{4.33}{0.05}$

$= \dfrac{433 \times \cancel{100}}{5 \times \cancel{100}}$

$= \dfrac{433}{5}$

(vi) $\dfrac{0.0099}{4.95}$

$= \dfrac{\cancel{99}^{\cancel{11}^{1}} \times \cancel{100}}{\cancel{495}_{\cancel{55}_{5}} \times 100\cancel{00}}$

$= \dfrac{1}{500}$

(vii) $\dfrac{1.2144}{0.012}$

$= \dfrac{\cancel{12144}^{\cancel{1012}\ 506} \times \cancel{1000}}{\cancel{12}_{1} \times \cancel{10000}_{\cancel{10}_{5}}}$

$= \dfrac{506}{5}$

11. (i) $\dfrac{2}{3}$

```
     0.666
  3 ) 20
     -18
       20
     -18
       20
     -18
        2
```

$\dfrac{2}{3} = 0.\dot{6}$

(ii) $\dfrac{3}{11}$

```
      0.2727
  11 ) 30
      -22
        80
       -77
        30
       -22
        80
       -77
         3
```

$\dfrac{3}{11} = 0.\dot{2}\dot{7}$

(iii) $2\dfrac{3}{7}$

```
     2.428571
  7 ) 17
     -14
       30
      -28
       20
      -14
        60
       -56
        40
       -35
         50
        -49
         10
        - 7
          3
```

$2\dfrac{3}{7} = 2.\dot{4}2857\dot{1}$

(iv) $10\dfrac{8}{11}$

changing the fractional part into decimal

```
      0.7272
  11 ) 80
       77
       30
      -22
        80
       -77
        30
       -22
        8
```

$\dfrac{8}{11} = 10.\dot{7}\dot{2}$

(v) $\frac{4}{333}$

$$
\begin{array}{r|l}
 & 0.012012 \\
333 & 400 \\
 & -333 \\
 & \quad 670 \\
 & \quad -666 \\
 & \qquad 400 \\
 & \qquad -333 \\
 & \qquad\quad 670 \\
 & \qquad\quad -666 \\
 & \qquad\qquad 4
\end{array}
$$

$\frac{4}{333} = 0.\dot{0}1\dot{2}$

(vi) $10\frac{311}{495}$

changing the fractional part into decimal

$$
\begin{array}{r|l}
 & .62828 \\
495 & 3110 \\
 & -2970 \\
 & \quad 1400 \\
 & \quad -990 \\
 & \qquad 4100 \\
 & \qquad -3960 \\
 & \qquad\quad 1400 \\
 & \qquad\quad -990 \\
 & \qquad\qquad 4100 \\
 & \qquad\qquad -3960 \\
 & \qquad\qquad\quad 140
\end{array}
$$

$10\frac{311}{495} = 10.6\dot{2}\dot{8}$

12. (i) $4\frac{1}{6}$

$$
\begin{array}{r|l}
 & 0.166 \\
6 & 10 \\
 & -6 \\
 & \quad 40 \\
 & \quad -36 \\
 & \qquad 40 \\
 & \qquad -36 \\
 & \qquad\quad 4
\end{array}
$$

$4\frac{1}{6} = 4.1\dot{6}$

(ii) $5\frac{5}{18}$

$$
\begin{array}{r|l}
 & .277 \\
18 & 50 \\
 & -36 \\
 & \quad 140 \\
 & \quad -126 \\
 & \qquad 140 \\
 & \qquad -126 \\
 & \qquad\quad 14
\end{array}
$$

$5\frac{5}{18} = 5.2\dot{7}$

(iii) $6\frac{16}{33}$

$$
\begin{array}{r|l}
 & .4848 \\
33 & 160 \\
 & 132 \\
 & \quad 280 \\
 & \quad -264 \\
 & \qquad 160 \\
 & \qquad -132 \\
 & \qquad\quad 280 \\
 & \qquad\quad -264 \\
 & \qquad\qquad 16
\end{array}
$$

$6\frac{16}{33} = 6.\dot{4}\dot{8}$

(iv) $10\frac{7}{75}$

$$
\begin{array}{r|l}
 & 0.0933 \\
75 & 700 \\
 & -675 \\
 & \quad 250 \\
 & \quad -225 \\
 & \qquad 250 \\
 & \qquad -225 \\
 & \qquad\quad 25
\end{array}
$$

$10\frac{7}{75} = 10.09\dot{3}$

(v) $13\frac{9}{37}$

```
       .243243
  37 ) 90
      -74
       160
      -148
        120
       -111
          90
         -74
          160
         -148
           120
          -111
             9
```

$13\frac{9}{37} = 13.\dot{2}4\dot{3}$

(vi) $1\frac{41}{185}$

```
        .2216216
  185 ) 410
       -370
         400
        -370
          300
         -185
          1150
         -1110
             400
            -370
              300
             -185
              1150
             -1110
                 40
```

$\therefore \quad 1\frac{41}{185} = 1.2\dot{2}1\dot{6}$

(vii) $1\frac{3}{14}$

```
       .214214214
  14 ) 30
      -28
        20
        14
         60
        -56
          40
         -28
           20
          -14
            60
           -56
             40
            -28
              20
             -14
               60
              -56
                 4
```

$\therefore \quad 1\frac{3}{14} = 1.\dot{2}1\dot{4}$

(viii) $\frac{40}{41}$

```
       .97560975
  41 ) 400
      -369
        310
       -287
         230
        -205
          250
         -246
            400
           -369
             310
            -287
              230
             -205
               25
```

$\therefore \quad \frac{40}{41} = 0.\dot{9}756\dot{0}$

(ix) $90\frac{5}{11}$

```
      .4545
11 )  50
     -44
       60
      -55
        50
       -44
         60
        -55
          5
```

$\therefore \quad 90\frac{5}{11} = 90.\dot{4}\dot{5}$

(x) $6\frac{6}{7}$

```
    .857142
7 )  60
    -56
      40
     -35
       50
      -49
        10
         7
         30
        -28
          20
         -14
           6
```

$\therefore \quad 6\frac{6}{7} = 6.\dot{8}5714\dot{2}$

13.

Helpful Hint

Comparing the respective digits of both the numbers from left to right.

(i) 4.56 > 4.13

(ii) 2.061 > 2.006

(iii) 0.331 > 0.330

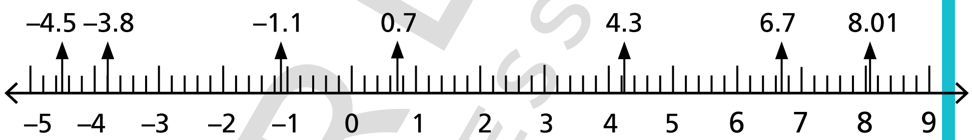
(v) 8.690 < 8.699

14.

Helpful Hint

- On a number line, negative numbers lie on the left of zero and positive number lie on the right of zero.
- When we compare numbers and order them on a number line, the number increases as we move to the right and decreases as we move towards left.

Taking the help from given hint, arrange 6.7, 4.3, 8.01, – 4.5, 0.7, –1.1, –3.8 in ascending order on a number line given below.



Hence, the ascending order is – 4.5, – 3.8, – 1.1, 4.3, 67, 8.01

15. Hassan had 674.95 cm of the cloth

He cut off 217.43 cm

Length of remaining cloth

= 674.95 – 217.43

= 457.52 cm

Rounding off the length of remaining cloth to one decimal place we get,

457.52 cm ≈ 457.5 cm

Multiple Choice Questions 3

1. Option B is correct.

   To round off 35.6, check the digit next to whole number i.e. 35. Next digit is 6, $6 \geq 5$, take. 6 as 1 and add to 35.

   $35.6 = 36$

2. Option C is correct because denominator $10 = 2 \times 5$ i.e a multiple of 2 and 5.
3. Option A is correct. 47 is appearing repeatedly.
4. Option B is correct, because digit at fourth decimal place is 6; $6 \geq 5$, then 1 will be added to 5.
5. Option D is correct, the denominator of the fraction is not a multiple of 2 and 5.
6. Option D is correct.
7. Option B is correct.

   $\frac{15}{8} = 15 \div 8 = 1.875$

8. Option C is correct. Find the sum of two numbers and subtract from 100.
9. Option A is correct.

   $2.33 \times 5.66 = 13.1878 \approx 13.188$ (rounded off to 3 decimal places)

4 Squares and Square Roots

Exercise 4

1.

Helpful Hint

Square of a number is obtained by multiplying the number with itself.

Fill in the blanks

(i) $0.5 \times 0.5 = 0.25$

(ii) $\sqrt{100} = \sqrt{10 \times 10} = 10$

(iii) 5

$125 \times 5 = 625$ is the perfect square of 25.

(iv) two

Helpful Hint

Helpful hint 2 insert

(v) $\left(\frac{4}{3}\right)^2 = \frac{16}{9}$

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

2.

Helpful Hint

To find the square of a rational number we find the square of numerator and square of denominator separately.

(i) False, because 500 is half of 1000.

(ii) False, because a perfect square can not have only on zero at ones place. It must have even number of zeros.

(iii) True, because 5 × 5 has 5 on its ones place.

(iv) True, They are 1, 4, 9, 16, 25, 36, 49, 64, 81, 100

(v) False, because square root of 15 is less than square root of 16. Hence, it is less than 4.

3. (i) Square of 19 = 19 × 19
= 361

(ii) Square of 27 = 27 × 27
= 729

(iii) Square of 35 = 35 × 35
= 1225

(iv) Square of 41 = 41 × 41
= 1681

4. (i)

3	729
3	243
3	81
3	27
3	9
3	3
	1

$\therefore 729 = 3 \times 3 \times 3 \times 3 \times 3 \times 3$

$= \overline{3 \times 3} \times \overline{3 \times 3} \times \overline{3 \times 3}$

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

$\sqrt{729} = \sqrt{\overline{3 \times 3} \times \overline{3 \times 3} \times \overline{3 \times 3}}$

Helpful Hint

Number from each pair of numbers taken once.

= 3 × 3 × 3 time
= 27

(ii)

3	1089
3	363
11	121
	11

$\therefore 1089 = 3 \times 3 \times 11 \times 11$

$= \overline{3 \times 3} \times \overline{11 \times 11}$

$= 3^2 \times 11^2$

$\therefore \sqrt{1089} = \sqrt{3^2 \times 11^2}$

$= \sqrt{\overline{3 \times 3} \times \overline{11 \times 11}}$

$= 3 \times 11$

$= 33$

(iii)

5	1225
5	245
7	49
7	7
	1

$\therefore 1225 = \overline{5 \times 5} \times \overline{7 \times 7}$

$= 5^2 \times 7^2$

$\therefore \sqrt{1225} = \sqrt{\overline{5 \times 5} \times \overline{7 \times 7}}$

$= 5 \times 7$

$= 35$

(iv)

2	1764
2	882
3	441
3	147
7	49
	7

$\therefore 1764 = \overline{2 \times 2} \times \overline{3 \times 3} \times \overline{7 \times 7}$

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

$\sqrt{1764} = \sqrt{\overline{2 \times 2} \times \overline{3 \times 3} \times \overline{7 \times 7}}$

$= 2 \times 3 \times 7$

$= 42$

(v)

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

$\therefore 256 = \overline{2 \times 2} \times \overline{2 \times 2} \times \overline{2 \times 2} \times \overline{2 \times 2}$

$= 2^2 \times 2^2 \times 2^2 \times 2^2$

$\sqrt{256} = \sqrt{2^2 \times 2^2 \times 2^2 \times 2^2}$

$\sqrt{256} = \sqrt{\overline{2 \times 2} \times \overline{2 \times 2} \times \overline{2 \times 2} \times \overline{2 \times 2}}$

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

$= 16$

(vi)

3	441
3	147
7	49
7	7
	1

$\therefore 441 = 3 \times 3 \times 7 \times 7$

$= 3^2 \times 7^2$

$\sqrt{441} = \sqrt{\overline{3 \times 3} \times \overline{7 \times 7}}$

$= 3 \times 7$

$= 21$

(vii)

19	361
19	19
	1

Helpful Hint

Prime numbers have only 2 factors, 1 and the number itself.

$\therefore 361 = \overline{19 \times 19}$

$= 19^2$

$\sqrt{361} = \sqrt{19^2}$

$= \sqrt{\overline{19 \times 19}}$

$= 19$

(viii)

2	400
2	200
2	100
2	50
5	25
5	5
	1

$\therefore$ 400 $= \overline{2 \times 2} \times \overline{2 \times 2} \times \overline{5 \times 5}$

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

$\sqrt{400} = \sqrt{2^2 \times 2^2 \times 5^2}$

$= \sqrt{\overline{2 \times 2} \times \overline{2 \times 2} \times \overline{5 \times 5}}$

$= 2 \times 2 \times 5$

$= 20$

Helpful Hint

To find the square root of decimal number, convert the number into fraction and take the square root of number and denominator separately.

5. (i) 56.25

$= \frac{5625}{100}$

Taking the square root of numerator and denominator separately.

$\sqrt{56.25} = \sqrt{\frac{5625}{100}}$

$\sqrt{5625} = \sqrt{\overline{3 \times 3} \times \overline{5 \times 5} \times \overline{5 \times 5}}$

By prime factorisation

$= 3 \times 5 \times 5$

$\sqrt{5625} = 75$

Now $\sqrt{100} = \sqrt{10 \times 10} = 10$

$\sqrt{100} = 10$

$\therefore \sqrt{56.25} = \frac{75}{10}$

$= 7.5$

(ii) 10.24

$= \frac{1024}{100}$

$\sqrt{10.24} = \frac{\sqrt{1024}}{\sqrt{100}}$

Taking require root of numerator and denominator separately.

$\sqrt{1024} = \sqrt{2^2 \times 2^2 \times 2^2 \times 2^2 \times 2^2}$

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

$= 32$

$\sqrt{100} = \sqrt{10 \times 10} = 10$

$\frac{\sqrt{1024}}{\sqrt{100}} = \frac{32}{10}$

$= 3.2$

Hence, $\sqrt{10.24} = 3.2$

(iii) $\frac{225}{169}$

$\sqrt{\frac{225}{169}} = \frac{\sqrt{225}}{\sqrt{169}} = \frac{\sqrt{\overline{3 \times 3} \times \overline{5 \times 5}}}{\sqrt{13 \times 13}}$

$= \frac{3 * 5}{13} = \frac{15}{13}$

(iv) $\frac{324}{121}$

$\sqrt{\frac{324}{121}} = \frac{\sqrt{324}}{\sqrt{121}} = \frac{\sqrt{2 \times 2 \times \overline{3 \times 3} \times \overline{3 \times 3}}}{\sqrt{11 \times 11}}$

$\frac{324}{121} = \frac{2 \times 3 \times 3}{11}$

$= \frac{18}{11}$

6.

2	21168
2	10584
2	5292
2	2646
3	1323
3	441
3	147
7	49
	7

$\therefore$ $21168 = \overline{2 \times 2} \times \overline{2 \times 2} \times \overline{3 \times 3} \times 3 \times \overline{7 \times 7}$

2, and 7 appear in pairs; 3 has a pair and one 3 is single.

$\therefore$ 2118 must be divided by 3 to become a perfect square i.e.

$21168 \div 3 = 7056$ is a perfect square of 84.

7. Number of soldiers = 1545

Having formed a square formation 24 soldiers were left.

$1545 - 24 = 1521$

Now find $\sqrt{1521}$

$\sqrt{1521} = \sqrt{\overline{3 \times 3} \times \overline{13 \times 13}}$
$= 3 \times 13$
$= 39$

The front row consists of 39 soldiers.

8. To find the number of rows, take square root of 1024.

$\sqrt{1024} = \sqrt{2^2 \times 2^2 \times 2^2 \times 2^2 \times 2^2}$
$= 2 \times 2 \times 2 \times 2 \times 2$
$= 32$

There are 32 rows of trees.

9. Taking the square root of 529.

23	529
23	23
	1

$\sqrt{529} = \sqrt{\overline{23 \times 23}}$

$= 23$

23 students are standing in each row.

10. Taking the square root of 324,

2	324
2	162
3	81
3	27
3	9
3	3
	1

$\sqrt{324} = \sqrt{\overline{2 \times 2} \times \overline{3 \times 3} \times \overline{3 \times 3}}$
$= \sqrt{2^2 \times 3^2 \times 3^2}$
$= 2 \times 3 \times 3$
$= 18$

The length of each side = 18 m.

11. Taking the square root of 6400,

2	6400
2	3200
2	1600
2	800
2	400
2	200
2	100
2	50
5	25
5	5
	1

$\sqrt{6400} =$
$\sqrt{\overline{2 \times 2} \times \overline{2 \times 2} \times \overline{2 \times 2} \times \overline{2 \times 2} \times \overline{5 \times 5}}$
$\sqrt{6400} = \sqrt{2^2 \times 2^2 \times 2^2 \times 2^2 \times 5^2}$
$= 2 \times 2 \times 2 \times 2 \times 5$
$= 80$

$\therefore$ Length of the side of the table = 80 cm

12. First, we find the factors of 216.

2	216
2	108
2	5 4
3	27
3	9
3	3
	1

$\therefore$ $216 = \overline{2 \times 2} \times 2 \times 3 \times \overline{3 \times 3}$

We see that 2×3 do not appear in pair. 216 must be divided by 2×3 i.e. 6 to become a perfect square

$\therefore$ $216 \div 6 = 36 = 6^2$

13. We will find the square of 25.

$\therefore \quad (25)^2 = 25 \times 25$

$= 625$

There are 625 plants.

Multiple Choice Question 4

1. Option B is correct.
   A, C, and D are incorrect options because unit pairs.
2. Option A is correct.

   B, C, and D are perfect square because they all have factors in pairs.
3. Option C is correct.
   A, B, and D are incorrect options; the square root of 49 is 7.
4. Option B is correct.
   Option A, C and D are incorrect because square of these numbers do not have 4 at their unit place 2 or 8 have 4 their unit place.
5. Option A is correct.
   Option B, C, and D are incorrect. Square of these numbers do not have 4 at their unit place.
6. Option D is correct.
   Option A, B, and C are incorrect because A is a whole number which can not be a square root of a decimal number.
   B and C on squaring will give 4 decimal and 6 decimal numbers which are incorrect.
7. Option B is correct.
   Option A, C, and D are incorrect:
   $1.7 \times 34 \times 0.8 = 46.24$
   The square root of 46.24 should have one decimal place.
8. Option C is correct
   $17 \times 17 = 289$

1 Revision 1: Numbers

1. (i) $-\frac{5}{8} = -\frac{5 \times -3}{8 \times -3} = \frac{15}{-24}$

(ii) $-\frac{5 \times -7}{8 \times -7} = \frac{35}{-56}$

2.

Helpful Hint:
Smaller number is always on the left of a greater number on a number line.

(i) $-\frac{1}{3}$ and $\frac{1}{4}$

$-\frac{1}{3}$ is on the left of $\frac{1}{4}$ on the number line, because $-\frac{1}{3} < \frac{1}{4}$

(ii) $\frac{3}{5}$ and $\frac{5}{7}$

$\frac{3 \times 7}{5 \times 7} = \frac{21}{35}$ and $\frac{5 \times 5}{7 \times 5} = \frac{25}{35}$

$\frac{25}{35} > \frac{21}{35}$

$\therefore \frac{3}{5} < \frac{5}{7}$

$\frac{3}{5}$ is on the left of $\frac{5}{7}$

(iii) $\frac{6}{7}$ and $\frac{3}{4}$

$\frac{6 \times 4}{7 \times 4} = \frac{24}{28}$ and $\frac{3 \times 7}{4 \times 7} = \frac{21}{28}$

$\frac{21}{28} < \frac{24}{28}$

$\frac{3}{4} < \frac{6}{7}$

$\frac{3}{4}$ is on the left of $\frac{6}{7}$,

(iv) $\frac{4}{9}$ and $\frac{6}{11}$

$\frac{4 \times 11}{9 \times 11} = \frac{44}{99}$ and $\frac{6 \times 9}{11 \times 9} = \frac{54}{99}$

$\frac{44}{99} < \frac{54}{99}$

$\frac{4}{9} < \frac{6}{11}$

$\therefore \frac{4}{9}$ is on the left of $\frac{6}{11}$

3. (i) $\frac{2}{3}$ and $\frac{4}{7}$

Express $\frac{2}{3}$ and $\frac{4}{7}$ as rational numbers with a common denominator.

$\frac{2}{3} = \frac{2 \times 7}{3 \times 7} = \frac{14}{21}$

$\frac{4}{7} = \frac{4 \times 3}{7 \times 3} = \frac{12}{21}$

Now $14 > 12$

$\therefore \frac{14}{21} > \frac{12}{21}$

or $\frac{2}{3} > \frac{4}{7}$

Hence, $\frac{2}{3}$ is greater.

(ii) $\frac{5}{7}$ and $\frac{7}{10}$

Express $\frac{5}{7}$ and $\frac{7}{10}$ as rational numbers with a common denominator.

$\frac{5 \times 10}{7 \times 10} = \frac{50}{70}$; $\frac{7 \times 7}{10 \times 7} = \frac{49}{70}$

Now $50 > 49$

$\therefore \frac{50}{70} > \frac{49}{70}$

or $\frac{5}{7} > \frac{7}{10}$

Hence, $\frac{5}{7}$ is greater.

(iii) $-\frac{4}{5}$ and $-\frac{7}{9}$

Express $-\frac{4}{5}$ and $\frac{-7}{9}$ as rational numbers with a common denominator.

$-\frac{4 \times 9}{5 \times 9} = -\frac{36}{45}$

$-\frac{7 \times 5}{9 \times 5} = -\frac{35}{45}$

$-36 < -35$

$\therefore \frac{-36}{45} < \frac{-35}{45}$

or $\frac{-4}{5} < \frac{-7}{9}$

or $-\frac{4}{5} < -\frac{7}{9}$

or $-\frac{7}{9} > -\frac{4}{5}$

Hence, $-\frac{7}{9}$ is greater.

4.

Helpful Hint: The middle value of two rational numbers is the mean value of the numbers.

To find the middle value we find the mean value of the given number as following

$\frac{1}{2} + \frac{3}{4} = \frac{2+3}{4} = \frac{5}{4}$

$\frac{5}{4} \div 2 = \frac{5}{8}$ first middle number

Now to find another middle value we proceed.

$\frac{5}{8} + \frac{3}{4} = \frac{5+6}{8} = \frac{11}{8}$

$\frac{11}{8} \div 2 = \frac{11}{16}$ second middle number

5. (i) Correct

Reason: All integers can be expressed as $\frac{a}{b}$ where a and b are integers and $b \neq 0$

(ii) Correct

Zero is an integer and all integers are rational numbers.

(iii) Incorrect

There are many rational number (or fractional number between two consecutive integers).

(iv) Correct

(v) Incorrect

- is a rational number if q ≠ o

6. Sum of two rational number = $\frac{4}{5}$

One of the number $= -\frac{3}{4}$

The other number $= \frac{4}{5} - \left(\frac{-3}{4}\right)$

$= \frac{4}{5} + \frac{3}{4}$

$= \frac{16+15}{20}$

$= \frac{31}{20}$

$\therefore$ The other number is $\frac{31}{20}$

7. The required number $= -\frac{3}{4} - \frac{3}{7}$

$= \frac{-21-12}{28}$

$= -\frac{33}{28}$

8. The required number $= \frac{-1}{2} - \frac{3}{4}$

$= \frac{-4-6}{8}$

$= -\frac{10}{8}$

$= -\frac{5}{4}$

$\therefore$ The required number is $-\frac{5}{4}$

9.

Helpful Hint: Converting rational numbers in decimal numbers becomes easy if denominator is converted into powers of 10

(i) $\frac{31}{100} = 0.31$

(since denominator is 10 × 10. So the decimal point will be after two digits form right).

(ii) $\frac{54}{250}$

$= \frac{54 * 4}{250 * 4}$

$= \frac{216}{1000}$

$= 0.216$

(iii) $\frac{26}{125}$

$= \frac{26 * 8}{125 * 8}$

$= \frac{208}{1000}$

$= 0.208$

(iv) $\frac{39}{50}$

$= \frac{39 * 2}{50 * 2}$

$= \frac{78}{100}$

$= 0.78$

10. (i) $\frac{7}{9}$ or $\frac{7}{90}$

Helpful Hint:
Make the denominators same, by using equivalent fractions.

$\therefore \frac{7}{9} = \frac{7 * 10}{9 * 10}$

$= \frac{70}{90}$

Now, we have $\frac{70}{90}$, $\frac{7}{90}$

$\frac{70}{90} > \frac{7}{90}$

Hence, $\frac{7}{9} > \frac{7}{90}$

(ii) $\frac{3}{2}$ or $\frac{4}{3}$

Making the denominators same, we have,

$\frac{3}{2} = \frac{3 * 3}{2 * 3} = \frac{9}{6}$

$\frac{4}{3} = \frac{4 * 2}{3 * 2} = \frac{8}{6}$

Now, we have

$\frac{9}{6}$, $\frac{8}{6}$

$\frac{9}{6} > \frac{8}{6}$

Hence, $\frac{3}{2} > \frac{4}{3}$

11. (i) $\sqrt{2401} = \sqrt{7 \times 7 \times 7 \times 7}$

$= \sqrt{7^2 \times 7^2}$

$= 7 \times 7$

$\therefore \sqrt{2401} = 49$

(ii) 38.44

$38.44 = \frac{3844}{100}$

Taking square roots of numerator and denominator,

$\sqrt{3844} = \sqrt{2 \times 2 \times 31 \times 31}$

$= 2 \times 31$

$= 62$

$\sqrt{100} = \sqrt{10 \times 10} = 10$

$\frac{\sqrt{3844}}{\sqrt{100}} = \frac{62}{10}$

Hence, $\sqrt{38.44} = 6.2$

(iii) $\frac{441}{625}$

$\sqrt{441} = \sqrt{3 \times 3 \times 7 \times 7}$

$\therefore = 3 \times 7$

$\sqrt{441} = 21$

Now $\sqrt{625} = \sqrt{5 \times 5 \times 5 \times 5}$

$= 5 \times 5$

$\therefore \sqrt{625} = 25$

$\sqrt{\frac{441}{625}} = \frac{21}{25}$

(iv) $361 = 19 \times 19$

$\sqrt{361} = \sqrt{19 \times 19}$

$= 19$

$\therefore \sqrt{361} = 19$

12. Finding the prime factors of 3615

3	3675
5	1225
5	245
7	49
7	7
	1

$\therefore$ $3675 = 3 \times \overline{5 \times 5} \times \overline{7 \times 7}$

$\therefore$ 5 and 7 are pairs, but 3 can not be paired. Squared numbers always have pairs of factors, so, if 3675 is divided by 3 we get 1225 which is square of 35.

13. (i) $4\frac{1}{2} \times 3\frac{2}{3} \div \frac{11}{18} - \frac{2}{3}$

$= \frac{9}{2} \times \frac{11}{3} \div \frac{11}{18} - \frac{2}{3}$

$= \frac{\cancel{9}^{3}}{\cancel{2}_{1}} \times \frac{\cancel{11}^{1}}{\cancel{3}_{1}} \times \frac{\cancel{18}^{9}}{\cancel{11}_{1}} - \frac{2}{3}$

$= 27 - \frac{2}{3}$

$= \frac{81 - 2}{3}$

$= \frac{79}{3}$

$= 26\frac{1}{3}$

(ii) $4\frac{3}{4} \times 3\frac{1}{3}\left(1\frac{1}{2} - \frac{3}{4}\right)$

$= \frac{19}{4} \times \frac{10}{3}\left(\frac{3}{2} - \frac{3}{4}\right)$

$= \frac{19}{4} \times \frac{10}{3}\left(\frac{6-3}{4}\right)$

$= \frac{19}{\cancel{4}_{2}} \times \frac{\cancel{10}^{5}}{\cancel{3}} \times \frac{\cancel{3}}{4}$

$= \frac{95}{8}$

$= 11\frac{7}{8}$

5 Rate, Ratio, and Proportions

Exercise 5

1. (i) direct
   (ii) Rs 800
   (iii) decreased
   (iv) inverse
   (v) 8:3

2. (i) True:
   The number of items and prices paid are in direct variation with each other. More we buy, the more we pay.
   (ii) False: more people will need more food.
   (iii) True:
   Greater the speed, longer will be the distance covered.
   (iv) False: He will plant 10 saplings in 5 hours.
   (v) True: Half distance will take half of the time.

3. (i) Direct variation
   If the number of pencils are more, the cost will be more.
   If the number of pencils are less, the cost will be less.
   (ii) Inverse variation
   More number of men will complete the job in less number of days.
   Less number of men will complete the job in more number of days.
   (iii) Inverse variation
   The greater the speed, lesser will be the tim,e taken to cover a given distance.
   Similarly the lesser the speed, longer will be the time taken to cover the given distance.
   (iv) Direct variation
   When a car is moving at a constant speed, the distance covered will depend on time taken. A greater distance will be covered in longer time.

4. (i) Let the new quantity be x.
   New quantity: Old quantity = 5:3
   $x : 9 = 5:3$
   $\frac{x}{9} = \frac{5}{3}$
   $x = \frac{5}{\cancel{3}} \times \cancel{9}^{3}$
   $= 15$
   $\therefore$ the new increased quantity is 15.

   (ii) Let the new quantity be x. We write,
   New quantity: Old quantity = 5:18
   $x : 72 = 5:18$
   $\frac{x}{72} = \frac{5}{18}$
   $x = \frac{5}{\cancel{18}} \times \cancel{72}^{4}$
   $= 20$
   $\therefore$ the new decreased quantity is 20.

   (iii) Let the new quantity be x. We write,
   New quantity: Old quantity = 5:2
   $x : 25 = 5:2$
   $\frac{x}{25} = \frac{5}{2}$
   $x = \frac{5}{2} \times 25$
   $x = \frac{125}{2}$
   $x = 62.5$ kg
   $\therefore$ the new increased quantity is 62.5 kg.

   (iv) Let the new quantity be x. We write,
   New quantity: Old quantity = 7:11
   $x : 110 = 7 : 11$
   $\frac{x}{110} = \frac{7}{11}$
   $x = \frac{7 \times \cancel{110}^{10}}{\cancel{11}}$

$x = 70$ km

$\therefore$ the new decreased quantity is 70 km.

5.

Helpful Hint:
Q (5 – 11) are based on direct variation.

Tickets : Cost (Rs)

10   200

25   x

$$\frac{10}{25} = \frac{200}{x}$$

$$10x = 200 \times 25$$

$$x = \frac{200 \times 25}{10} = 500$$

The cost of 25 tickets is Rs 500.

6. Length (m): increase in length (cm)

5   1500

x 15000

$$\frac{5}{x} = \frac{1500}{15000}$$

$$1500\,x = 15000 \times 5$$

$$x = \frac{\overset{10}{\cancel{15000}} \times 5}{\cancel{1500}}$$

$$= 50$$

50 metres cloth can be bought in Rs 15,000

7. Mass (kg)   Increase in length (cm)

50 : 2.5

x 7.5

$$\frac{50}{x} = \frac{2.5}{7.5}$$

$$2.5 \times x = 7.5 \times 50$$

$$x = \frac{\overset{3}{\cancel{7.5}} \times 50}{\cancel{2.5}}$$

$$= 150$$

150 kg will produce an increase of 7.5 cm.

8.

Helpful Hint:
Commission is directly proportional to the worth of goods.

Commission (Rs) : Worth (Rs)

200   2000

x 30,000

$$\frac{200}{x} = \frac{2000}{30000}$$

$$x = \frac{\cancel{30000} \times \cancel{200}}{\cancel{2000}_{10}}$$

$$= 3000$$

The agent will get the commission of Rs 3000.

9.

Weight (kg) : Cost (Rs)

150   3000

x 8500

$$\frac{150}{x} = \frac{3000}{8500}$$

$$3000 \times x = 8500 \times 150$$

$$x = \frac{\overset{425}{\cancel{8500}} \times \cancel{150}}{\underset{20}{\cancel{3000}}}$$

$$x = 425$$

$\therefore$ 425 kg sugar can be purchased.

10. 2.5 kg = 2500 g

Sheet of paper : Weight (grams)

7   28

x : 2500

$$\frac{7}{x} = \frac{28}{2500}$$

$$28 \times x = 2500 \times 7$$

$$x = \frac{\overset{625}{\cancel{2500}} \times \cancel{7}}{\cancel{28}}$$

$$= 625$$

625 sheets of paper would weight 2.5 kg.

11. Kilometres : Litres

44   5

x 48

$$\frac{44}{x} = \frac{5}{48}$$

$$5 \times x = 48 \times 44$$

$$x = \frac{48 \times 44}{5}$$

$$= \frac{2112}{5}$$

The car travels 422.4 km.

12. 1 hr = 3600 seconds

Distance (km)	:	Time (sec)
3		3600
x		18

$$\frac{3}{x} = \frac{3600}{18}$$

$$x = \frac{\cancel{18}^{3} \times 3}{\cancel{3600}_{\cancel{1200}\ 200}}$$

$$= \frac{3}{200}$$

$$= 0.015$$

= 15 metres

13. There is an inverse variation.

Men	:	Days
8		12
24		x

$$\frac{8}{24} = \frac{x}{12}$$

$$24\,x = 12 \times 8$$

$$\frac{\cancel{12}^{1} \times \cancel{8}^{4}}{\cancel{24}_{2}}$$

$$x = 4$$

4 days will be required to complete the job.

14.

Men	:	Days
6		20
x		15

$$\frac{6}{x} = \frac{15}{20}$$

$$15\,x = 20 \times 6$$

$$\frac{\cancel{20}^{4} \times \cancel{6}^{2}}{\cancel{15}_{3}}$$

$$= 8$$

8 men will complete the job in 15 days.

6 men are already working.

∴ 8–6 = 2 extra men should be engaged to get the work done in 15 days.

15.

Helpful Hint:
According to Islamic law of inheritance:
Widow's share = $\frac{1}{8}$ of the property
Son's share = 2 × daughter's share.

Wife's share = $\frac{1}{8} \times 250000$

= Rs 31250

Amount left for 2 daughters and son

= Rs 250,000 – Rs 31,250

= Rs 218,750

Ratio of son's share to daughters share = 2 : 1

Share of son	:	Share of daughters
2	:	1 × 2 = 2

Total number of shares = 2 + 2 = 4

Each share = $\frac{1}{4} \times 218750$

= Rs 54687.50

∴ Wife's share = Rs 31250

Son's share = 2 × 54687.50

= Rs 109,375

Each daughter's = Rs 54,687.50

16. Worth of property = Rs 750,000

Pay off debt = Rs 50,000

Remaining money = Rs 750,000–Rs 50,000

= Rs 700,000

Share of son	:	Share of daughter
2	:	1

Sons' share	:	daughter's share
2 × 2	:	1
4	:	1

Sum of the ratios = 4 + 1 = 5

Share of daughter = $\frac{1}{\cancel{5}} \times \cancel{700,000}^{140,000}$

= Rs 140,000

Share of son = $\frac{2}{\cancel{5}} \times \cancel{700,000}$

= Rs 280,000

Multiple Choice Questions 5

1. Option B is correct $x = \frac{48 \times 11}{22} = 24$
2. Option D is correct $x = \frac{1500}{100}$
3. Option C is correct.

   The train is travelling at a speed of 80 km/h. In one hour it travels 80 km, and in another half hour it will ravel 40 km. The total distance covered in $1\frac{1}{2}$ hr = 80+40 = 120 km.
4.

> **Helpful Hint:**
> Increasing a quantity by the ratio b : a, where b > a. We multiply the quantity with $\frac{b}{a}$

   Option A is correct.

5. Option D is correct. All the other options are varying directly.
6. Option D is correct. There is an inverse variation.

   Number of days = $\frac{\cancel{52}^{4} \times \cancel{3}^{1}}{\cancel{39}_{\cancel{13}_{1}}} = 4$

   Options A, B, and C are incorrect.
7. Option B is correct.

   Number of toys = $\frac{100 \times 4}{5} = 80$

   Options A, C, and D are incorrect.
8. Option D is correct.

   There is a direct variation between the distance and the time.

   Distance travelled in 5 hours

   $= \frac{\cancel{120}^{40} \times 2 \times 5}{\cancel{3}_{1}} = 400$ km.

   Options A, B, and C are incorrect.
9. Option D is correct.

   The ratio of copper and zinc = 13:7

   The quantity of Zinc = $\frac{7}{\cancel{20}} \times \cancel{600}^{30} = 210$gm

   Options A, B, and C are incorrect.
10. Option C is correct.

    There is an inverse variation between the number of men and time taken.

    Time taken by 3 men = $\frac{2 \times 6}{3}$

    Options A, B, and D are incorrect.

6 FINANCIAL ARITHMETIC:

Exercise 6A

1.

Helpful Hint:

Use the following formula to solve the questions.

$P = SP - CP$; $P\% = \frac{P}{CP} \times 100\%$

$L = CP - SP$; $L\% = \frac{L}{CP} \times 100\%$

- $P = SP - CP$
  $= 276 - 200$
  $= 76$

  $P = \text{Rs } 76$

  $P\% = \frac{\cancel{76}^{38}}{\cancel{200}} \times \cancel{100}\%$

  $P\% = 38\%$

- $L = CP - SP$
  $= 3060 - 3000$

  Loss = Rs 60

  $L\% = \frac{\cancel{60}^{1}}{\cancel{3060}_{51}} \times 100\%$

  $= \frac{100}{51}\%$

  $= 1.96\ \%$

- CP = Rs 850
  P% = 20%
  P = 170
  Profit = Rs 170
  SP = 850 + 170
  = 1020
  Selling Price = Rs 1020
  P = SP – CP:
  = 560 – 500

- P = Rs 60

  $P\% = \frac{\cancel{60}^{12}}{\cancel{500}} \times \cancel{100}\%$

  $= 12\%$

- If CP = Rs 100, L = 5%, then
  SP = Rs 95

CP	SP
100	95
	855

  $95 \times = 855 \times 100$

  $= \frac{\cancel{855}^{9} \times 100}{\cancel{95}}$

  $= 900$

  CP = Rs 900
  L = 900 – 855
  = Rs 45

2. The cost price of 12 pens for Rs 25 each = 12×25 = Rs 300

   The selling price of 12 pens for Rs 28 each = 12×28 = Rs 336

   Profit (P) = SP – CP
   = 336 – 300
   = RS 36

   $P\% = \frac{P}{CP} \times 100\%$

   $= \frac{\cancel{36}^{12}}{\cancel{300}_{\cancel{3}_1}} \times \cancel{100}^{1}\%$

   $= 12\%$

   ∴ P = Rs 36 and % P = 12%

3. Cost price of 12 eggs = Rs 9.60

   Selling price of 12 eggs $= \frac{\cancel{18}^{9} \times 12}{\cancel{20}_{10}}$

   $= \frac{108}{10}$ = Rs 10.80

   Gain per dozen = Rs 10.80 – Rs 9.60

   = Rs 1.20

Gain % $= \frac{P}{CP} \times 100\%$

$= \frac{1.20}{9.60} \times 100\%$ (cancelled: 100^{25}, 8_2)

$= \frac{25}{2}\%$

Gain % = 12.5%

4. Cost price of the plot = Rs 108,000

Profit % = 20%

Profit % $= \frac{\text{Profit}}{CP} \times 100\%$

$20 = \frac{P}{108000} \times 100$

P = 1080 × 20

= Rs 21600

SP = CP + P

= Rs 108000 + 21600

= Rs 129,600

Selling price of the plate

= Rs 1296

5. SP = Rs 10.68

Loss% = 11%

Let the CP be Rs y.

Loss% $= \frac{\text{Loss}}{CP} \times 100\%$

$11\% = \frac{(y - 10.68)}{y} \times 100\%$

$11y = 100y - 1068$

$89y = 1068$

$y = \frac{1068^{12}}{89_1}$

y = Rs 12

∴ CP = Rs 12

To yield a profit of 10%

P% $= \frac{P}{CP} \times 100\%$

$10\% = \frac{P}{12} \times 100\%$

100P = 120

$P = \frac{120}{100}$ = Rs 1.20

SP = CP + P

= 12 + 1.20

= Rs. 13.20

CP = Rs 12 ; SP at 10% profit = Rs 13.20

6. SP = Rs 48 per kg

P% = 20%

Total gain = Rs 90

P% $= \frac{P}{CP} \times 100\%$

$20\% = \frac{90}{CP} \times 100\%$

$CP = \frac{90 \times 100^5}{20_1}$

CP = Rs 450; cost of total quantity of tea.

SP = P + CP

= 90 + 450 = Rs 540

Now, Rs 48 is SP of 1kg

Rs 540 is SP of $\frac{540}{48}$ kg

= 11.25 kg

Hence; 11.25 kg tea was sold.

7. Let CP = Rs

SP = Rs 1475

Loss% $= \frac{\text{Loss}}{CP} \times 100\%$

Loss% = 13%

∴ $13\% = \frac{x - 1475}{x} \times 100\%$

$13 = \frac{x - 1475}{x} \times 100$

13 = 100 × – 147500

87 = 147500

= 147500 ÷ 87

= Rs 1695.40

∴ CP = Rs 1695.40

New SP = Rs 1615

Loss = 1695.40 – 1615

= Rs 80.40

Hence, there will be a loss of Rs 80.40

Exercise 6B

1. (i) D = MP – SP

= 650 – 520

= Rs 130

D% $= \frac{D}{MP} \times 100\%$

$= \frac{\cancel{130}}{\cancel{650}} \times \cancel{100}^{20}\%$

$= 20\%$

∴ Discount = Rs 130; Discount % = 20%

(ii). Discount of 15% means,

if SP is Rs 85, MP = Rs 100

if SP in Rs 170, MP = Rs $\frac{100}{\cancel{85}} \times \cancel{170}^{2}$

∴ MP = Rs 200

D = MP – SP

= 200 – 170

= Rs 30

MP = Rs 200, D = Rs 30

Hence, Marked price = Rs 200

Discount = Rs 30

(iii)

Helpful Hint:

$D\% = \frac{D}{MP} \times 100\%$

$10\% = \frac{D}{840} \times 100\%$

$10 = \frac{D}{840} \times 100$

$D = \frac{10 \times 840}{100}$

D = Rs 84

D = MP – SP

84 = 840 – SP

SP = 840 – 84

= Rs 756

∴Discount = Rs 89, Selling Price = Rs 756

(iv) SP = MP – D

= 5600 – 1400

= Rs 4200

$D\% = \frac{D}{MP} \times 100\%$

$= \frac{\cancel{1400}^{25}}{\cancel{5600}} \times \cancel{100}\%$

= 25%

Hence Marked price = Rs 4200,

2. MP = Rs 400

D% = 10%

$D\% = \frac{D}{MP} \times 100\%$

$10 = \frac{D}{\cancel{400}} \times \cancel{100}$

D = Rs 40

= MP – D

SP = 400 – 40

= Rs 360

Hence net selling price of the article = Rs 360

3. Marked Price = Rs 1000 (Marked price is same as list price)

selling Price = Rs 900.

Discount = MP – SP

= 1000 – 900 = Rs 100

$D\% = \frac{100}{\cancel{1000}} \times \cancel{100} = 10\%$

Hence, the discount per cent = 10%

4. SP = Rs 450

D% = 10%

Let marked Price (MP) = Rs

$D\% = \frac{(x - 450)}{x} \times 100\%$

$10 = \frac{(x - 450)}{x} \times 100$

10 = 100 – 45000

90 = 45000

$= \frac{\cancel{45000}^{500}}{\cancel{90}} = 500$

∴Marked Price = Rs 500 or list price = Rs 500

5. When CP = Rs 100

MP = Rs (100 + 30)

= Rs 130

Discount = 10% of MP

$= \frac{10}{100} \times 130$

= Rs 13

Net selling price = Rs (130 – 13)

= Rs 117

Profit = Rs 117 – 100

= Rs 17

Profit % = $\frac{17}{100} \times 100\% = 17\%$

∴ Profit % = 17%

6. When CP = Rs 100

Price with 20% discount = Rs(100–20) Rs 80

Discount = Rs 80 (New cost price)

Goods are sold at a profit of 25%

$25\% = \frac{P}{100} \times 100\%$

P = Rs 25

MP = 100 + 25 = Rs 125

When marked price is Rs 125, cost price is Rs 80

If marked price is Rs 2000, cost price

$= \frac{80 \times \overset{16}{\cancel{2000}}}{\cancel{125}_5}$

= Rs 1280

Hence, cost price of goods is Rs 1280.

Exercise 6C

1. (i) Taxable Income
   (ii) agricultural assets
   (iii) Rs 20000
   (iv) Value added tax
   (v) Rs 300000
   (vi) Marked price free
2. (i) True : Free income is not taxable.
   (ii) True : By Islamic law.
   (iii) False : Sale tax is paid by buyer on the purchase.
   (iv) False : The agent who makes the deal gets the commission.
   (v) True : Value added tax in paid by the buyer to the seller.
   (vi) False : MP = CP + D
   (vii) True
   The discount on Rs 200 (marked price) at the rate of 10% will be Rs 20. The selling price will be Rs 180.
   (viii) True : By Islamic law.
3. Samera's monthly income = Rs 35000
   Yearly salary = Rs 35000 × 12
   = Rs 420000
   Income tax rate = 5%
   She pays 42000 × $\frac{5}{100}$ as income tax
   = Rs 21000
   ∴ Samera pays Rs 21 000 income tax in a year.
4. Jawaid monthly salary = Rs 40000
   Annual salary of Jawaid = Rs 40000 × 12
   = RS 480000
   Taxable salary = total salary – exempted salary
   = Rs 480000 – Rs 100000
   = Rs 380000
   Amount of income tax paid by Jawaid
   $= 3800\cancel{00} \times \frac{4}{1\cancel{00}}$
   = RS 15200
   ∴ Amount of income tax paid = Rs 15200
5. Annual income of Saad = Rs 5000000
   Income tax paid by him = Annual income × tax rate
   Income tax% = Income tax paid ÷ Annual income
   $= \frac{\overset{15}{\cancel{750000}}}{\underset{\cancel{5}}{\cancel{5000000}}} \times \cancel{100}\%$
   = 15%
   ∴ Income tax rate = 15%
6. Value of the factory = Rs 200 000 000.
   Property tax = 2%
   Property tax = $\frac{2}{1\cancel{00}} \times 200\,000\,0\cancel{00}$
   = Rs 4 000 000
   ∴ Haider should pay Rs 4 000 000 as property tax.

7. Property tax rate = 2%

Property tax paid = Rs 15,000

Rs 15,000 = 2% × value of the property

Value of the property (two plots) = $\dfrac{15,000 \times \frac{\overset{50}{\cancel{100}}}{}}{\cancel{2}}$

= Rs 750,000

Value of each plot = Rs 750,000 ÷ 2

= Rs 375,000

Hence, the value of each plot is Rs 375,000

8. Old price of Pizza = Rs 800

New Price of Pizza after applying GST = Rs 900

Amount of GST = 900 – 800

= Rs 100

GST% = $\dfrac{\cancel{100}^{25}}{\cancel{800}_{\cancel{200}_{2}}} \times \cancel{100}\%$

= $\dfrac{25}{2}\%$

= 12.5%

Hence general sales tax% = 12.5%

9. List price of radio set = Rs 1200

Rate of sales tax = 7%

Amount of sales tax = $\dfrac{7}{1\cancel{00}} \times 12\cancel{00}$

= Rs 84

Cost of radio set including = 1200 + 84

Sale tax = Rs 1284

Hence amount of sales tax = Rs 84

Cost of radio set = Rs 1284

10. Rate of commission = 25%

Sale price of the car = Rs 1495000

Total amount of commission = Rate × cost of car.

= $\dfrac{25}{1\cancel{00}} \times 14950\cancel{00}$

= Rs 373750

∴ The car dealer earns a commission of Rs 373750.

11. The cost of shirt without VAT

= Rs 750

Rate of VAT = 12.5%

The amount of VAT paid = Rs 750 × 12.5%

= $75\cancel{0} \times \dfrac{125}{100 \times 1\cancel{0}}$

= $\dfrac{9375}{100}$

= Rs 93.75

The price of shirt including VAT

= Rs 750 + Rs 93.75

= Rs 843.75

12. Amount charged by the builder = Rs 57000

(value added tax) VAT = 20%

Amount of VAT paid by builder

= $570\cancel{00} \times \dfrac{20}{1\cancel{00}}$

= Rs 11400

Total bill including VAT = 57000 + 11400

= 68400

∴ VAT = Rs 11400

Total bill = Rs 68400

13. Cost of item = Rs 7500

VAT (value-added tax) = 15%

Amount of VAT = $75\cancel{00} \times \dfrac{15}{1\cancel{00}}$

= Rs 1125

Total amount of item inclusive VAT

= 7500 + 1125

= Rs 8625

VAT = Rs 1125, cost of item inclusive VAT

= Rs 8625

14. Cost of jewellery = Rs 127750

Rate of commission = 4%

Amount of commission Aamir receives

= $\overset{5110}{\cancel{127750}} \times \dfrac{\cancel{4}}{\cancel{100}_{25}}$

= Rs 5110

Amount of commission received by Aamir

= Rs 5110

15. Rate of zakat = $2\frac{1}{2}\%$

yearly savings = Rs 400,000

Zakat paid $= 2\frac{1}{2}\% \times 400,000$

$= \frac{5 \times \cancel{400000}^{2000}}{{}_1\cancel{2} \times \cancel{100}}$

= Rs 10,000

Hence, the zakat paid is Rs 10,000.

16. Rate of zakat = $2\frac{1}{2}\% = \frac{5}{2}\%$

Yearly savings = Rs 93,800

Amount of zakat = $\frac{5}{2}\% \times 93,800$

$= \frac{5 \times \cancel{93800}^{469}}{{}_1\cancel{2} \times \cancel{100}}$

= Rs 2345

Hence, the amount of zakat should be paid is Rs 2345

17. Zakat paid = Rs 1125

Rate of zakat = $2\frac{1}{2}\% = \frac{5}{2}\%$

Yearly saving = $1125 \div \frac{5}{2}\%$

$= \frac{\cancel{1125}^{225} \times 2 \times 100}{\cancel{5}}$

= Rs 45,000

Hence the yearly saving is Rs 45,000.

Multiple Choice Questions 6

Helpful Hint:

Wealth tax is paid on assets, which may be in the form of money, gold, silver or even animals, someone keep to earn money.

Income tax is paid on annual income of a person. Agricultural tax is known as Ushr and is applied on agricultural assets.

Property tax is applied on all kind of properties owned by a person.

1. Option A is correct
2. Option C is correct.
3. Option A is correct.
4. Option C is correct.

   Since, profit = $\frac{15\cancel{000}}{\cancel{100}} \times 10$ = Rs 1500
5. Option B is correct.
6. Option D is correct.
7. Option A is correct

2 Revision 2: Arithmetic

1. (i) Inverse
   (ii) Direct
   (iii) Direct
   (iv) Direct
   (v) Inverse
   (vi) Inverse

2. Cost of 2 tables = Rs 2500

   Cost of 1 table = $\frac{2500}{2}$

   Cost of 3 table = $\frac{\cancel{2500}^{1250}}{\cancel{2}} \times 3$ = Rs 3750

   Cost of 5 chairs = Rs 2500

   Cost of 1 chair = $\frac{2500}{5}$ = Rs 500

   Cost of 6 chairs = Rs 500 × 6 = Rs 3,000

   Cost of 3 tables and 6 chairs
   = Rs 3750 + Rs 3000
   = Rs 6,750

3. Cost of 1 article = Rs 80

   Cost of 20 articles = Rs 80 × 20 = Rs 1600

   Price of each article increased by 25%

   Increase in price of each article

   $= \frac{\cancel{25}^{1}}{\cancel{100}_{4}} \times \cancel{80}^{20}$

   = Rs 20

   Net price of an article = 80 + 20 = Rs 100

   Number of articles can be bought
   = Rs 1600 ÷ Rs 100
   = Rs 16

   Hence, the retailer can buy 16 articles.

4. (i) If number of persons is increased, number of days will decrease, so there is an inverse proportion

   Now, we proceed as follows.

Persons	Days
6	8
8	x (let x be the required number of days)

   $\therefore \frac{6}{8} = \frac{x}{8}$ (Inversely proportioned)

   $x = \frac{6 \times 8}{8}$

   = 6 days

   (ii) Let the original price = Rs 100

   Then reduced price = 100 – 8 = Rs 92

   Let x be the required original price, we proceed as fallows:

Original price	Reduced price
100	92
x	230

   $\therefore \frac{100}{x} = \frac{92}{230}$ (direct variation)

   $92 \times x = 230 \times 100$

   $x = \frac{\cancel{230}^{10} \times \cancel{100}^{25}}{\cancel{92}_{4}}$

   = 250

   ∴ Original price = Rs 250

5. Let x be the required distance. Now,

Distance (m)	Time (sec)
80	$(2)^2$
x	$(5)^2$

   Distance varies directly as square of time.

   $\frac{80}{x} = \frac{16}{25}$

   $x = \frac{\cancel{80}^{5} \times 25}{\cancel{16}}$

   $x = 125$

   ∴The required distance is 125 m.

6. Let x be the number of workers to finish the work in 18 days. There is an inverse proportion.

Now,	Workers		Days
	24		30
	x		18
	$\frac{x}{24}$	=	$\frac{30}{18}$
	x	=	$\frac{\cancel{30}^{10} \times \cancel{24}^{4}}{\cancel{18}_{\cancel{6}_1}}$
		=	40

$\therefore$ 40 workers will finish the construction in 18 days.

40 – 24 = 16 more workers will be required.

7. First we find the cost price of the TV set. If Rs 100 in the cost price, selling price will be Rs 80.

Now, for selling on 10% gain, we proceed as

CP	SP
100	120
4500	x

$x = \frac{45\cancel{00} \times 110}{1\cancel{00}}$

$x = 4950$

$\therefore$ the selling price must be Rs 4950.

8. The cost price of 400 comics = Rs 1500

The selling price of 300 comics = 300 × 4.50
= 1350.00
= Rs 1350

The selling price of 100 comics
= 100 × 4.00
= 400 = Rs 400

The selling price of 400 comics
= Rs 1350 + Rs 400
= Rs 1750

Profit = SP – CP
= 1750 – 1500
= Rs 250

$P\% = \frac{P}{CP} \times 100\%$

$= \frac{\cancel{250}^{50}}{_{3}\cancel{1500}} \times 100\%$

$= \frac{50}{3}\ \% = 16\frac{2}{3}\ \%$

9. (i) MP = Rs 900

SP = Rs 810

D = 900 – 810

D = Rs 90

$D\% = \frac{\cancel{90}^{10}}{\cancel{900}} \times 1\cancel{00}\%$

= 10%

(ii) $D\% = \frac{D}{MP} \times 100\%$

$12\% = \frac{180}{MP} \times 100\%$

$12 = \frac{180}{MP} \times 100$

$MP = \frac{\cancel{180}^{15} \times 100}{1 \quad \cancel{12}}$

$\therefore$ Marked price is Rs 1500

SP = MP – D
= 1500 – 180
= Rs 1320

$\therefore$ selling price is Rs 1320

(iii) $D\% = \frac{\cancel{90}^{15}}{\cancel{600}} \times 100\%$

= 15%

$\therefore$ discount% is 15%

SP = MP – P
= 600 – 90
= Rs 510

$\therefore$ selling price is Rs 510

(iv) $18\% = \frac{27}{MP} \times 100\%$

$MP = \frac{\cancel{27}^{3} \times \cancel{100}^{50}}{\cancel{18}_{2}}$

= 150

$\therefore$ Marked price is Rs 150.

SP = MP – D
= 150 – 27

$= 123$

$\therefore$ selling price is Rs 123

(v) $8\% = \frac{D}{9600} \times 100\%$

$DP = \frac{8 \times 9600}{100}$

$= 768$

$\therefore$ Actual discount is Rs 768.

$SP = MP - D$

$= 9600 - 768$

$= 8832$

$\therefore$ Selling price is Rs 8832.

10. Horse — Days

4 — 35

7 — x (There is a inverse variation)

$\frac{4}{7} = \frac{x}{35}$

$x = \frac{4 \times \cancel{35}}{\cancel{7}_1}$

$= 20$

$\therefore$ The amount of grain will last for 20 days.

11. Discount (km) — Time (hours)

$\frac{75}{8}$ — $\frac{5}{2}$

5 — x (There is a direct variation)

$\frac{x \times 2}{5} = \frac{5 \times 8}{75}$

$x = \frac{\cancel{5}^1 \times \cancel{8}^4}{\cancel{75}_{\cancel{15}_3}} \times \frac{\cancel{5}}{\cancel{2}}$

$= \frac{4}{3}$

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

She will take 1 hour 20 minutes

7 Algebraic Polynomials

Exercise 7A

1. (i) n^{th} term $= 3n + 2$
$n_1 = 3 \times 1 + 2 = 5$
$n_2 = 3 \times 2 + 2 = 8$
$n_3 = 3 \times 3 + 2 = 11$
$n_4 = 3 \times 4 + 2 = 14$
$n_5 = 3 \times 6 + 2 = 17$

(ii) n^{th} term $= 5n - 2$
$n_1 = 5 \times 1 - 2 = 3$
$n_2 = 5 \times 2 - 2 = 8$
$n_3 = 5 \times 3 - 2 = 13$
$n_4 = 5 \times 4 - 2 = 18$
$n_5 = 5 \times 5 - 2 = 23$

(iii) n^{th} term $= 10 - n$
$n_1 = 10 - 1 = 9$
$n_2 = 10 - 2 = 8$
$n_3 = 10 - 3 = 7$
$n_4 = 10 - 4 = 6$
$n_5 = 10 - 5 = 5$

(iv) n^{th} term $= n + 8$
$n_1 = 1 + 8 = 9$
$n_2 = 2 + 8 = 10$
$n_3 = 3 + 8 = 11$
$n_4 = 4 + 8 = 12$
$n_5 = 5 + 8 = 13$

(v) n^{th} term $= 2n + 5$
$n_1 = 2 \times 1 + 5 = 7$
$n_2 = 2 \times 2 + 5 = 9$
$n_3 = 2 \times 3 + 5 = 11$
$n_4 = 2 \times 4 + 5 = 13$
$n_5 = 2 \times 5 + 5 = 15$

(vi) n^{th} term $= 7 - 3n$
$n_1 = 7 - 3 \times 1 = 4$
$n_2 = 7 - 3 \times 2 = -1$
$n_3 = 7 - 3 \times 3 = -2$
$n_4 = 7 - 3 \times 4 = -5$
$n_5 = 7 - 3 \times 5 = -8$

2. (i) n^{th} term $= 6n - 5$
13^{th} term $= 6 \times 13 - 5$
$= 78 - 5$
$= 73$
$\therefore 13^{th}$ term $= 73$

(ii) n^{th} term $= 12n + 4$
21^{st} term $= 12 \times 21 + 4$
$= 252 + 4$
$= 256$
$\therefore 21^{st}$ term $= 256$

(iii) n^{th} term $= 5n + 2$
15^{th} term $= 5 \times 15 + 2$
$= 75 + 2$
$= 77$
$\therefore 15^{th}$ term $= 77$

(iv) n^{th} term $= n + 8$
19^{th} term $= 19 + 8$
$= 27$
$\therefore 19^{th}$ term $= 27$

3.

Helpful Hint: Inequalities are the mathematical expression in which two sides are not equal.

(i), (ii), (iii), (v), (vi), (viii), (ix) and (x) are Inequalities.

4.

Helpful Hint: Add the algebraic polynomials by placing the similar terms one below another.

Add

(i)
$$\begin{array}{r} 2a + 3b \\ 4a + 7b \\ \hline 6a + 10b \\ \hline \end{array}$$

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

(iii)
$$\begin{array}{r} 3a + 6b \\ a - 7b \\ \hline 4a - b \\ \hline \end{array}$$

(iv)
$$\begin{array}{r} x^2 + 5y \\ -3x^2 - 2y \\ \hline -2x^2 + 3y \\ \hline \end{array}$$

(v)
$$\begin{array}{r} -3a^2 - 5ab + 2b^2 \\ 7a^2 + 2ab - b^2 \\ \hline 4a^2 - 3ab + b^2 \\ \hline \end{array}$$

(vi)
$$\begin{array}{r} 4xy - 8 \\ xy + 6 \\ \hline 5xy - 2 \\ \hline \end{array}$$

(vii) Writing the expressions vertically
$$\begin{array}{r} 4x^2 - 5xy - 6y^2 \\ -6x^2 + 10xy + 3y^2 \\ -4x^2 + 2xy + 3y^2 \\ \hline -6x^2 + 7xy \\ \hline \end{array}$$

(viii)
$$\begin{array}{r} x^2 - 2xy + y^2 \\ x^2 + 2xy + y^2 \\ 4x^2 - xy + y^2 \\ x^2 \qquad - y^2 \\ \hline 7x^2 - xy + 2y^2 \\ \hline \end{array}$$

5. A = $2x - 3y + 4z$
B = $5x - 6y + 7z$
C = $-x - y + z$

Arranging the terms horizontally we get,
A + B + C = $(2x - 3y + 4z) + (5x - 6y + 7z) + (-x - y + z)$
= $2x - 3y + 4z + 5x - 6y + 7z - x - y + z$
Arranging the same terms together,
= $(2x + 5x - x) + (-3y - 6y - y) + (4z + 7z + z)$
= $6x - 10y + 12z$
Hence A + B + C = $6x - 10y + 12z$

6. X = $2x^2 - 3xy + 4y^2$
Y = $x^2 + 2xy - 3y^2$
Z = $-4x^2 + 5xy + y^2$

Arranging the same terms together,
X + Y + Z = $(2x^2 + x^2 - 4x^2) + (-3xy + 2xy + 5xy) + (4y^2 - 3y^2 + y^2)$
= $-x^2 + 4xy + 2y^2$
Hence X + Y + Z = $-x^2 + 4xy + 2y^2$

7. Subtract:

Helpful Hint: Change the signs of the second expression.

(i) $a - b + c$ from $2a + b - c$
$$\begin{array}{r} 2a + b - c \\ a - b + c \\ - \quad + \quad - \\ \hline a + 2b - 2c \\ \hline \end{array}$$

(ii) $3a - 2b - 4c$ from $2a + 3b + c$
$$\begin{array}{r} 2a + 3b + c \\ 3a - 2b - 4c \\ - \quad + \quad + \\ \hline -a + 5b + 5c \\ \hline \end{array}$$

(iii) $7a^2 - 8ab - b^2$ from $-2a^2 + 3ab - 2b^2$

$$\begin{array}{r} -2a^2 + 3ab - 2b^2 \\ 7a^2 - 8ab - b^2 \\ - \quad + \quad + \\ \hline -9a^2 + 11ab - b^2 \\ \hline \end{array}$$

(iv) $x^2 - y^2 + z^2 + 2yz$ from $x^2 + y^2 + z^2 + 2yz$

$$\begin{array}{r} x^2 + y^2 + z^2 + 2yz \\ x^2 - y^2 + z^2 + 2yz \\ - \quad + \quad - \quad - \\ \hline 2y^2 \\ \hline \end{array}$$

(v) $p^4 - 2p^3 - 3p^2 - 4p - 5$ form

$-p^4 + 5p^3 + 4p^2 + 3p + 2$

$$\begin{array}{r} -p^4 + 5p^3 + 4p^2 + 3p + 2 \\ p^4 - 2p^3 - 3p^2 - 4p - 5 \\ - \quad + \quad + \quad + \quad + \\ \hline -2p^4 + 7p^3 + 7p^2 + 7p + 7 \\ \hline \end{array}$$

(vi) $2x^2 + 3$ from $x^2 + 3x - 2$

$$\begin{array}{r} x^2 + 3x - 2 \\ 2x^2 \quad + 3 \\ - \quad\quad - \\ \hline -x^2 + 3x - 5 \\ \hline \end{array}$$

8. The sum of two quantities = $4ax + 3by + 2cz$
One of the term is $5ax + by - cz$
Subtract one term from the sum.

$$\begin{array}{r} 4ax + 3by + 2cz \\ 5ax + by - cz \\ - \quad - \quad + \\ \hline -ax + 2by + 3cz \\ \hline \end{array}$$

Hence, the other term is $-ax + 2by + 3cz$

9. To obtain the required result, we will subtract 4 from $4a^3 + 3a^2 - a - 5$

$(4a^3 + 3a^2 - a - 5) - (4)$

$= 4a^3 + 3a^2 - a - 5 - 4$

$= 4a^3 + 3a^2 - a - 9$

Hence, the required result is $4a^3 + 3a^2 - a - 9$

10. Creating the sequence of the arrival times we get

9:00 am 9:30 am 10:am 10:30 am 11 am

The 5th bus arrives at 11:00 am

Exercise 7B

1. Arrange the following expressions in ascending and descending order of the variable indicated.

(i) $7x - 4 + 5x^2 - 3x^3$ (x)

Descending order:

$-3x^3 + 5x^2 + 7x - 4$

Ascending order:

$-4 + 7x + 5x^2 - 3x^3$

(ii) $2x^2 + 7 - 3x$ (x)

Descending order:

$2x^2 - 3x + 7$

Ascending order:

$7 - 3x + 2x^2$

(iii) $4b^3 - ab^2 + a^3 - a^2b^2$ (a)

Descending order:

$a^3 - a^2b^2 - ab^2 + 4b^3$

Ascending order

$4b^3 - ab^2 - a^2b^2 + a^3$

(iv) $6x^2 + xy + 2x - 2y^2 - y$ (y)

Descending order:

$-2y^2 + xy - y + 2x + 6x^2$

Ascending order:

$6x^2 + 2x - y + xy - 2y^2$

2. Simplify:

Helpful Hint:
When we multiple numbers with same base, powers are added.

(i) $(x^4)^2$

$= x^4 \times x^4$

$= x^8$

(ii) $(y^5)^3$

$= y^5 \times y^5 \times y^5 = y^{5+5+5}$

$= y^{15}$

(iii) $(-3a^3)^2$

$= (-3a^3) \times (-3a^3)$

$= -3a^3 \times -3a^3$

$= 9a^6$

(iv) $(-5a^4)^2$

$= -5a^4 \times -5a^4$

$= -5 \times -5 \times a^4 \times a^4$

$= 25a^8$

(v) $(2a^2 b^2)^3$

$= 2a^2 b^2 \times 2a^2 b^2 \times 2a^2 b^2$

$= 8 \times a^2 \times a^2 \times a^2 \times b^2 \times b^2 \times b^2$

$= 8a^6 b^6$

(vi) $\left(\frac{1}{2} x^2\right)^3$

$= \frac{1}{2} x^2 \times \frac{1}{2} x^2 \times \frac{1}{2} x^2$

$= \frac{1}{8} \times x^2 \times x^2 \times x^2 = \frac{1}{8} x^6$

3. Simplify:

(i) $(2a^2)^2 \times (2a)^3$

$= 2a \times 2a \times 2a \times 2a \times 2a$

$= 32\ a^5$

Hence, $(2a)^2 \times (2a)^3 = 32a^5$

(ii) $(10x)^2 \times (10x)^3$

$(10x)^5 = 10 \times 10 \times 10 \times 10 \times 10 \times x^5$

$= 100\ 000\ x^5$

Hence, $(10x)^2 \times (10x)^3 = 100{,}000\ x^5$

(iii) $(-2x^6)^3 = -8x^{6\times3}$

$= -8x^{18}$

Helpful Hint:
To find the power of a power, we multiply the exponents.

Hence, $(-2x^6)^3 = -8x^{18}$

(iv) $(-4ab^2)^2 \times (2a^2b)^3$

$= (-4ab^2 \times -4ab^2) \times (2a^2b \times 2a^2b \times 2a^2b)$

$= 16a^2b^4 \times 8a^6b^3$

$= 128a^{2+6}b^{4+3}$

$= 128a^8b^7$

Hence, $(-4ab^2)^2 \times (2a^2b)^3 = 128a^8b^7$

4. Simplify:

(i) $2\ (x + 3)$

$= 2 \times x + 2 \times 3$

$= 2x + 6$

(ii) $a(2 - a)$

$= 2 \times a - a \times a$

$= 2a - a^2$

(iii) $x(y + z)$

$= x \times y + x \times z$

$= xy + xz$

(iv) $3a\ (a^2 - 3a)$

$= 2a \times a^2 - 3a \times 3a$

$= 3a^{2+1} - 9a^{1+1}$

$= 3a^3 - 9a^2$

(v) $5a\ (4a^2 - 7a - 8)$

$= 5a \times 4a^2 - 7a \times 5a - 8 \times 5a$

$= 20a^3 - 35a^2 - 40a$

5. Multiply:

(i) $a^2 - b^2,\ ab$

$ab\ (a^2 - b^2)$

$= ab \times a^2 - ab \times b^2$

$= a^3b - ab^3$

(ii) $bc + ca - ab,\ -2abc$

$= -2abc\ (bc + ca - ab)$

$= (-2abc) \times (bc) + (-2abc) \times (ca)$
$+ (-2abc) \times (-ab)$

$= -2ab^2c^2 - 2a^2bc^2 + 2a^2b^2c$

(iii) $2pq^2 - 3pq^3 + 4q^4,\ -2pqr$

$= (-2pqr)\ (2p^2q^2 - 3pq^3 + 4q^4)$

$= (-2pqr) \times (2p^2q^2) + (-2pqr)\ (-3pq^3)$
$+ (-2pqr)\ (4q^4)$

$= -4p^3q^3r + 6p^2q^4r - 8pq^5r$

(iv) $-3/8\ x^5y^3z,\ 16xyz$

$(16xyz) \times (-\frac{3}{8} x^5y^3z)$

$= (16^{2}) \times (-\frac{3}{8_1})\ x^{5+1}y^{3+1}z^{1+1}$

$= -6\ x^6y^4z^2$

6. Simplify:

(i) $ab\ (3a - 5b)$

$= (ab)\ (3a) - (ab)\ (5b)$

$= 3a^2b - 5ab^2$

(ii) $6mn\ (3m - 3n)$

$= (6mn)\ (2m) - (3n)\ (6mn)$

$= 12m^2n - 18mn^2$

(iii) $(x^2 - 5x - 6)\ (x - 4)$

$= x\ (x^2 - 5x - 6) - (4\ x^2 - 5x - 6)$

$= (x^3 - 5x^2 - 6x) - 4\ (x^2 - 20x - 24)$

$= x^3 - 5x^2 - 6x - 4x^2 + 20x + 24$

$= x^3 - 9x^2 + 14x + 24$

(iv) $(a^2 - ab + b^2)\ (a + b)$

$= a(a^2 - ab + b^2) + b(a^2 - ab + b^2)$

$= a^3 - a^2b + ab^2 + a^2b - ab^2 + b^3$

$= a^3 + b^3$

(v) $(3a + 2b)\ (5a - 7b)$

$= 3a\ (5a - 7b) + 2b\ (5a - 7b)$

$= 15a^2 - 21ab + 10ab - 14b^2$

$= 15a^2 - 11ab - 14b^2$

7. Simplify:

(i) $3(x - 4) + 4\ (x - 3) + 5\ (x - 2)$

$= 3x - 12 + 4x - 12 + 5x - 10$

$= 3x + 4x + 5x - 12 - 12 - 10$

$= 12x - 34$

(ii) $x(a - x) + 2x\ (2a + x) + 3x\ (3a - x)$

$= ax - x^2 + 4a\ x + 2x^2 + 9ax - 3x^2$

$= -x^2 + 2x^2 - 3x^2 + ax + 4ax + 9ax$

$= -2x^2 + 14a\ x$

(iii) $x^2\ (x^2 + ax + a^2) - ax\ (x^2 - ax - a^2) +$
$a^2\ (x^2 + 2ax + 2a^2)$

$= x^4 + ax^3 + a^2x^2 - ax^3 + a^2x^2 + a^3x +$
$a^2x^2 + 2a^3x + 2a^4$

$= x^4 + a^2x^2 + a^2x^2 + a^2x^2 + a^3x + 2a^3x + 2a^4$

$= x^4 + 3a^2x^2 + 3a^3x + 2a^4$

(iv) $a(b - c) + b(c - a) + c(a - b)$

$= ab - ac + bc - ab + ac - bc$

$= 0$

(v) $z^2\ (x^2 - y^2) + x^2\ (y^2 - z^2) + y^2\ (z^2 - x^2)$

$= x^2z^2 - y^2z^2 + x^2y^2 - x^2z^2 + y^2z^2 - x^2y^2$

$= 0$

(vi) $a^2\ (a^2 + b^2 + c^2) - b^2(a^2 + b^2 + c^2)$
$- c^2\ (a^2 + b^2 + c^2)$

$= a^4 + a^2b^2 + a^2c^2 - a^2b^2 - b^4 - b^2c^2 - a^2c^2$
$- b^2c^2 - c^4$

$= a^4 - b^4 - 2b^2c^2 - c^4$

8. Simplify:

Helpful Hint: When we divide numbers with same base, the powers are subtracted.

(i) $\frac{3\ x}{x}$

$= 3x^{1-1}$

$= 3\ x^0$

$= 3$

(ii) $\frac{8a^2}{-2a}$

$= -4a^{2-1}$

$= -4a$

(iii) $\frac{3c^3d^5}{cd}$

$= 3c^{3-1}\ d^{5-1}$

$= 3c^2d^4$

(iv) $\frac{5\ 22}{10}$

$= \frac{1}{2}\ x^{2-1}y^{2-1}$

$= \frac{1}{2}\ xy$

$= \frac{xy}{2}$

(v) $\frac{-18x^3y^5}{12\ x\ y^2}$

$= -\frac{3}{2}\ x^{3-1}y^{5-2}$

$= -\frac{3}{2}\ x^2y^3$

$= -\frac{3^{23}}{2}$

9. Simplify:

(i) $(9x - 6y) \div 3$

$= \frac{9x}{3} - \frac{6y}{3}$

$= 3x - 2y$

(ii) $(6c - 18) \div 6$

$= \frac{6}{6} - \frac{18}{6}$

$= c - 3$

(iii) $(4a^3 - 10a^2 + 6a) \div 2a$

$= \frac{4a^3}{2a} - \frac{10a^2}{2a} \quad \frac{6a}{2a}$

$= 2a^{3-1} - 5a^{2-1} + 3a^{1-1}$

$= 2a^2 - 5a + 3a^o$

$= 2a^2 - 5a + 3 \qquad (a^o = 1)$

(iv) $= (6x^2y - 4xy^2) \div 2xy$

$\frac{6x^2y}{2xy} - \frac{4xy^2}{2xy}$

$= 3x^{2-1}y^{1-1} - 2x^{1-1}\, y^{\,2-1}$

$= 3xy^o - 2x^oy$

$= 3x - 2y \; (\therefore\; y^o = 1;\; x^o = 1)$

10. Divide the first term by the second term.

(i) $-64abxy,\; 4abx$

$= \frac{-64}{4}$

$= -16a^{1-1}\, b^{1-1}\, x^{1-1}\, y$

$= -16a^o\, b^o\, x^o\, y$

$= -16y$

(ii) $= -20ab^2c,\; 5abc$

$= \frac{-20ab^2c}{5abc}$

$= -4\, a^{1-1}\, b^{2-1}\, c^{1-1}$

$= -4\, a^ob\, c^o$

$= -4b$

(iii) $a^4b^3,\; -a^2b$

$= \frac{a^4b^3}{-a^2b}$

$= -a^{4-2}\, b^{3-1}$

$= -a^2\, b^2$

(iv) $4ab^2c^3,\; -2abc$

$= \frac{4ab^2c^3}{-2abc}$

$= -2a^{1-1}\, b^{2-1}\, c^{3-1}$

$= -2a^o\, bc^2$

$= -2bc^2$

(v) $3\, x^2y - 2xy^2,\; xy$

$= \frac{3x^2y - 2xy^2}{xy}$

$= \frac{3x^2y}{xy} - \frac{2xy^2}{xy}$

$= 3x^{2-1}\, y^{1-1} - 2x^{1-1}\, y^{2-1}$

$= 3xy^o - 2x^oy$

$= 3x - 2y$

(vi) $-15a^2 - 25b^2,\; -5ab$

$= \frac{-15a^2 - 25b^2}{-5ab}$

$\frac{-15a^2}{-5ab} - \frac{25b^2}{-5ab}$

$\frac{3a^{2-1}}{b} + \frac{5b^{2-1}}{a}$

$\frac{3a}{b} + \frac{5b}{a}$

(vii) $-24\, a^2b^2c - 3a^2bc^3 + 6ab^2c,\; -3ab$

$= \frac{-24\, a^2b^2c - 3a^2bc^3 + 6ab^2c}{-3ab}$

$= -\frac{24a^2b^2c}{-3ab} - \frac{3a^2bc^3}{-3ab} + \frac{6ab^2c}{-3ab}$

$= 8a^{2-1}\, b^{2-1}\, c + a^{2-1}\, b^{1-1}\, c^3 - 2a^{1-1}\, b^{2-1}\, c$

$= 8\, abc + ab^oc^3 - 2a^obc$

$= 8abc + ac^3 - 2bc$

(viii) $18a^3b^2c - 24a^2bc^3 + 12a^2b^2c^2 - 6a^3bc^2,\; 6a^2b$

$= \frac{18\, a^3b^2c - 24a^2bc^3 + 12a^2b^2c^2 - 6a^3bc^2}{6a^2b}$

$= \frac{18a^3b^2c}{6a^2b} - \frac{24a^2bc^3}{6a^2b} + \frac{12a^2b^2c^2}{6a^2b} - \frac{6a^3bc^2}{6a^2b}$

$= 3a^{3-2}b^{2-1}c - 4a^{2-2}\, b^{1-1}c^3 + 2a^{2-2}\, b^{2-1}\, c^2 - a^{3-2}\, b^{1-1}\, c^2$

$= 3abc - 4a^o\, b^oc^3 + 2a^obc^2 - ab^oc$

$= 3abc - 4c^3 + 2bc^2 - ac^2$

11. Simplify:

(i) $\frac{^2 - \ + \ ^2}{} + \frac{^2 - \ + \ ^2}{} +$

$\frac{c^2 - ca + ca^2}{c}$

Taking common variable;

$= \frac{\cancel{a}\,(a - b + b^2)}{\cancel{a}} + \frac{\cancel{b}\,(b - c + c^2)}{\cancel{b}}$

$+ \frac{\cancel{c}\,(c - a + a^2)}{\cancel{c}}$

$= \cancel{a} - \cancel{b} + b^2 + \cancel{b} - \cancel{c} + c^2 + \cancel{c} - \cancel{a} + a^2$

$= a^2 + b^2 + c^2$

(ii) $\frac{a^2 \ 1 \ 2ab + 3ab^2}{a} + \frac{b^2 \ 1 \ 4bc + 5bc^2}{b}$

$+ \frac{5^2 \ 1}{}$

$= \frac{\cancel{a}\,(a - 2b + 3b^2)}{\cancel{a}} + \frac{\cancel{b}\,(b - 4c + 5c^2)}{\cancel{b}}$

$+ \frac{\cancel{c}\,(5\ c – a)}{\cancel{c}}$

$= \cancel{a} - 2b + 3b^2 + b - 4c + 5c^2 + 5c - \cancel{a}$

$= 3b^2 + 5c^2 - b + c$

Multiple Choice Questions 7

1. Option C is correct.
2. Option D is correct.
   When same base are multiplied powers are added.
3. Option B is correct.
   The sum of the expression is $x^4 + x^3 + 4y^2 - y - 3xy$.
   The largest exponent, the variable has in a polynomial with one variable or for more than one variable is called the degree of the expression. In thin case it is 4.
4. Option B is correct by subtracting $2x^2 - 10$ from $x^2 + y^2$
5. Option C is correct.
   The area of rectangle $= (x + 3) \times (x - 5)$
   $= x^2 - 2x - 15$

Helpful Hint:
n^{th} term $= a_1 + (n - 1)d$

6. Option B is correct. By using the laws of inequality.
7. Option A is correct.

8 Algebraic Identities

Exercise 8

1. Find the squares of he following:

(i) $2a + 1$

$(2a + 1)^2 = (2a)^2 + 2(2a) + (1)^2$ (using the identity $(a+b)^2 = a^2 + 2ab + b^2$)

$(2a + 1)^2 = 4a^2 + 4a + 1$

(ii) $3b + 2c$

$(3b + 2c)^2 = (3b)^2 + 2(3b)(2c) + (2c)^2$

$= 9b^2 + 12bc + 4c^2$

(iii) $2p^2 + 3q^2$

$(2p^2 + 3q^2)^2 = (2p^2)^2 + 2(2p^2)(3q^2) + (3q^2)^2$

$= 4p^4 + 12p^2q^2 + 9q^4$

2 Simplify:

Helpful Hint:
All the sums have been solved by applying the identity $(a+b)^2 = a^2 + 2ab + b^2$.

(i) $9p^2 + 12pq + 4q^2$

$= (3p)^2 + 2(3p)(2q) + (2q)^2$

$= (3p + 2q)^2$

$= (3p + 2q)(3p + q)$

(ii) $4x^2 + 4xy + y^2$

$= (2x)^2 + 2(2x)(y) + (y)^2$

$= (2x + y)^2$

$= (2x + y)(2x + y)$

(iii) $25p^2 + 10pq + q^2$

$= (5p)^2 + 2(5p)(q) + (q)^2$

$= (5p + q)^2$

$= (5p + q)(5p + q)$

(iv) $36x^2 + 24xy + 4y^2$

$= (6x)^2 + 2(6x)(2y) + (2y)^2$

$= (6x + 2y)^2$

$= (6x + 2y)(6x + 2y)$

(v) $x^2 + 2xy + y^2$

$= (x)^2 + 2(x)(y) + (y)^2$

$= (x + y)^2$

$= (x + y)(x + y)$

3. Evaluate:

(i) $16a^2 + 24ab + 9b^2$, When $a = 4$, $b = 3$

$= (4a)^2 + 2(4a)(3b) + (3b)^2$

$= (4a + 3b)^2$ (using formula $a^2 + 2ab + b^2 = (a + b)^2$)

$= (4 \times 4 + 3 \times 3)^2$ (substituting $a = 4$ and $b = 3$)

$= (16 + 9)^2$

$= (25)^2$

$= 625$

(ii) $4m^4 + 12m^2n^2 + 9n^4$, When $m = \frac{1}{2}$ and $n = \frac{1}{3}$

$= 4m^4 + 12m^2n^2 + 9n^4$

$= (2m^2)^2 + 2(2m^2)(3n^2) + (3n^2)^2$ (using formula)

$= (2m^2 + 3n^2)^2$

(Substitute $m = \frac{1}{2}$, $n = \frac{1}{3}$)

$= \left(2 \times (\frac{1}{2})^2 + 3 \times (\frac{1}{3})^2\right)^2$

$= (2 \times \frac{1}{4} + 3 \times \frac{1}{9})^2$

$= (\frac{1}{2} + \frac{1}{3})^2$

$= \left(\frac{3 + 2}{6}\right)^2$

$= \left(\frac{5}{6}\right)^2$

$= \frac{25}{36}$

4. $p + \frac{1}{—} = 5$

Squaring both the sides,

$\left(+ \frac{1}{p} \right)^2 = (5)^2$

$(p^2) + 2 \times p \times \frac{1}{—} + (\frac{1}{p})^2 = 25$

$p^2 + 2 + \frac{1}{2} = 25$

$p^2 + \frac{1}{p^2} = 25 - 2$

$p^2 + \frac{1}{2} = 23$

Hence, the required result is proved.

5. Given that

$a + b = 5$ and $ab = 4$

Squaring both the sides

$(a + b)^2 = (5)^2$

$a^2 + 2ab + b^2 = 25$ (using formula)

$a^2 + 2 \times 4 + b^2 = 25$

$a^2 + b^2 = 25 - 8$

$a^2 + b^2 = 17$

$(a^2 + b^2)^2 = (17)^2$

Squaring both the sides

$a^4 + 2a^2b^2 + b^4 = 289$ (using formula)

$a^4 + 2 \times (4)^2 + b^4 = 289$

$a^4 + 32 \times b^4 = 289$

$a^4 + b^4 = 289 - 32 = 257$

Hence, $a^2 + b^2 = 17$ and $a^4 + b^4 = 257$

6. Given that

$2ab + 5cd = 5$ and $abcd = 1$

$2ab + 5cd = 5$

Squaring both the sides

$(2ab + 5cd)^2 = (5)^2$

$(2ab)^2 + 2\,(2ab)\,(5cd) + (5cd)^2 = 25,$

$4a^2b^2 + 20abcd + 25c^2d^2 = 25$

$4a^2b^2 + 25c^2d^2 = 25 - 20abcd$

$4a^2b^2 + 25c^2d^2 = 25 - 20 \times 1$

$4a^2b^2 + 25c^2d^2 = 5$

7. (i) 503×503

$= (503)^2$

$= (500 + 3)^2$

$= (500)^2 + 2(500)(3) + (3)^2$

(using identity $(a + b)^2$

$= 250000 + 3000 + 9$

$= 253009$

(ii) 1005×1005

$= (1005)^2$

$= (1000 + 5)^2$

$= (1000)^2 + 2(1000)(5) + (5)^2$

$= 1000000 + 10000 + 25$

$= 1010025$

(iii) 904×904

$= (904)^2$

$= (900 + 4)^2$

$= (900)^2 + 2(900)(4) + (4)^2$

$= 810000 + 7200 + 16$

$= 817216$

8. Simplify:

Helpful Hint:
Use identity $a^2 - 2ab + b^2 = (a - b)^2$.

(i) $9x^2 - 12xy + 4y^2$

$= (3x)^2 - 2 \times 3x \times 2y + (2y)^2$

$= (3x - 2y)^2$

(ii) $36a^2 - 24a + 4$

$= (6a)^2 - 2 \times 6a \times 2 + (2)^2$

$= (6a - 2)^2$

(iii) $16x^2 - 8xy + y^2$

$= (4x)^2 - 2 \times 4x \times y + (y)^2$

$= (4x - y)^2$

(iv) $4a^2 - 20ab + 25b^2$

$= (2a)^2 - 2 \times 2a \times 5b + (5b)^2$

$= (2a - 5b)^2$

(v) $x^2 - 6xy + 9y^2$

$= (x)^2 - 2 \times x \times 3y + (3y)^2$

$= (x - 3y)^2$

9. (i) $25a^2 - 10a + 1$, When $a = \frac{1}{5}$

$25a^2 - 10a + 1 = (5a)^2 - 2(5a)(1) + (1)^2$

$= (5a - 1)^2$ (using formula)

$= \left(5 \times \frac{1}{5} - 1\right)^2$ (putting $a = \frac{1}{5}$

$= (1 - 1)^2 = 0$

(ii) $4(a + b)^2 - 20(a + b) + 25$ when $a = 2, b = 1$

$= \{2(a + b)\}^2 - 2 \times 2(a + b) \times 5 + (5)^2$

$= \{2(a + b) - 5\}^2$

Substitute a = 2, $b = 1$

$= \{6 - 5\}^2 = 1$

(iii) $36(l + m)^2 - 48n(l + m) + 16n^2$,

When $l = \frac{1}{2}$, $m = \frac{1}{3}$ and $n = \frac{1}{4}$

$36(l + m)^2 - 48n(l + m) + 16n^2$

$= \{6(l + m)\}^2 - 2 \times 6(l + m) \times 4n + (4n)^2$

$= \{6(l + m) - 4n\}^2$ (using formula)

$= \{6 \times (\frac{1}{2} + \frac{1}{3}) - 4 \times \frac{1}{4}\}^2$

$= \{6 \times \frac{5}{6} - 4 \times \frac{1}{4}\}^2$

$= (5 - 1)^2$

$= (4)^2$

$= 16$

10. Evaluate:

Helpful Hint:
Use identity $(a - b)^2 = a^2 - 2ab + b^2$

(i) 57×57

$= (60 - 3)(60 - 3)$

$= (60 - 3)^2$

(applying formula)

$= (60)^2 - 2 \times 60 \times 3 + (3)^2$

$= 3600 - 360 + 9$

$= 3249$

(ii) 994×994

$= (1000 - 6)(1000 - 6)$

$= (1000 - 6)^2$

$= (1000)^2 - 2 \times 1000 \times 6 + (6)^2$

$= 1000000 - 12000 + 36$

$= 988036$

(iii) 9997×9997

$= (10000 - 3)(10000 - 3)$

$= (10000 - 3)^2$

$= (10000)^2 - 2(10000)(3) + (3)^2$

$= 100000000 - 60000 + 9$

$= 99940009$

11. Given $a - \frac{1}{a} = 2$ then show that

(i) $a^2 + \frac{1}{a^2} = 6$

$a - \frac{1}{a} = 2$

$\left(- \frac{1}{a} \right)^2 = (2)^2$ (squaring both the sides)

$a^2 - 2 \times a \times \frac{1}{a} + \frac{1}{a^2} = 4$

$a^2 + \frac{1}{a^2} = 4 + 2$

$a^2 + \frac{1}{a^2} = 6$

Hence proved.

(ii) $a^4 + \frac{1}{a^4} = 34$

$a - \frac{1}{a} = 2$

(squaring both the sides)

$\left(a - \frac{1}{a}\right)^2 = 4$

$a^2 + \frac{1}{a^2} = 6$

(squaring both the sides)

$\left(a^2 + \frac{1}{a^2}\right)^2 = (6)^2$

$a^4 + 2 + \frac{1}{a^4} = 36$

$a^4 + \frac{1}{a^4} = 36 - 2 = 34$

Hence, proved.

(iii) $\left(a + \frac{1}{a}\right)^2 = 8$

we have

$\left(a - \frac{1}{}\right) = 2$

(squaring both the sides)

$a^2 - 2 + \frac{1}{2} = 4$

$a^2 - 2 + \frac{1}{a^2} + 4 = 4 + 4$

(adding 4 on both the sides)

$a^2 + 2 + \frac{1}{a^2} = 8$

$\left(a + \frac{1}{a}\right)^2 = 8$

Hence, proved.

12.

Helpful Hint:
Use the identity $(a + b)(a - b) = a^2 - b^2$

(i) $(a + 1)(a - 1)(a^2 + 1)$

$= \{(a)^2 - (1)^2\}(a^2 + 1)$ (using identity)

$= (a^2 - 1)(a^2 + 1)$

$= (a^2)^2 - (1)^2$

$= a^4 - 1$

(ii) $(a + b)(a - b)(a^2 + b^2)(a^4 + b^4)$

$= (a^2 - b^2)(a^2 + b^2)(a^4 + b^4)$

$= (a^4 - b^4)(a^4 + b^4)$ (using identity)

$= a^8 - b^8$

(iii) $(2p + 3q)(2p - 3q)(4p^2 + 9q^2)(16p^4 + 81q^4)$

$= (4p^2 - 9q^2)(4p^2 + 9q^2)(16p^4 + 81q^4)$

$= (16p^4 - 81q^4)(16p^4 + 81q^4)$

$= 256p^8 - 6561q^8$

13. $81p^2 - 49q^2$

$81p^2 - 49q^2 = (9p - 7q)(9p + 7q)$

using identity $a^2 - b^2 = (a - b)(a + b)$

14. (i) $(3a + b)(3a - b)$

$= (3a)^2 - (b)^2$

$= 9a^2 - b^2$

(ii) $(5a + 3b)(5a - 3b)$

$= (5a)^2 - (3b)^2$

$= 25a^2 - 9b^2$

(iii) $(2x + 3y)(2x - 3y)$

$= (2x)^2 - (3y)^2$

$= 4x^2 - 9y^2$

Multiple Choice Questions 8

1. Option D is correct.

   Using the identity $(a - b)(a + b) = a^2 - b^2$

2. Option A is correct.

   Using the formula for $(a - b)^2$ and $(a + b)^2$

3. Option D is correct. By multiplying the two expressions.

4. Option A is correct. By substituting the values in the expression.

5. Option B is correct.

   Using identity $a^2 - 2ab + b^2 = (a - b)^2$

   $x^2y^2 - \frac{xy}{z} + \frac{1}{4z^2} = \left(xy - \frac{1}{2z}\right)^2$

9 Factorisation of Algebraic Expressions

Exercise 9A

Resolve into Factors:

1. $p^2q + pq^2$
   $= \quad pq\,(p + q)$
   Taking out common factors.

2. $3x^3 - 15x^2y$
   $= \quad 3(x^3 - 5x^2y)$
   $= \quad 3x^2\,(x - 5y)$

3. $45y^4 - 9xy^3$
   $= \quad 9(5y^4 - xy^3)$
   $= \quad 9y^3\,(5y - x)$

4. $6\,p^2q + 12pq^2$
   $= \quad 6\,(p^2q + 2pq^2)$
   $= \quad 6pq\,(p + 2q)$

5. $5\,a^4b^2 + 15a^2b^4$
   $= \quad 5\,(a^4b^2 + 3a^2b^4)$
   $= \quad 5\,a^2b^2\,(a^2 + 3b^2)$

6. $xy + x + y + 1$
   $= \quad (xy + x) + (y + 1)$

Helpful Hint:
Grouping the terms

   $= \quad x(y + 1) + (y + 1)$
   $= \quad (x + 1)\,(y + 1)$

7. $am^3 - am^2 - m + 1$
   $= \quad am^2\,(m - 1) - (m - 1)$
   $= \quad (m - 1)\,(am^2 - 1)$

8. $4a^2 + 12ab + 9b^2$

Helpful Hint:
Using formula $a^2 + 2ab + b^2 = (a + b)^2$

   $= \quad (2a)^2 + 2\,(2a)\,(3b) + (3b)^2$
   $= \quad (2a + 3b)^2$
   $= \quad (2a + 3b)\,(2a + 3b)$

9. $x^2 - (p + q)x + pq$
   $= \quad x^2 - px - qx + pq$
   $= \quad x\,(x - p) - q\,(x - p)$
   $= \quad (x - p)\,(x - q)$

10. $abc - ab - c + 1$

Helpful Hint:
Taking ab common, from first two terms

   $= \quad ab\,(c - 1) - (c - 1)$
   Taking $(c - 1)$ common,
   $= \quad (c - 1)\,(ab - 1)$

11. $(a + b)\,(p + q + r) + (b + c)\,(p + q + r) + (c + a)\,(p + q + r)$
   Taking $(p + q + r)$ common, we get
   $= \quad (p + q + r)\,(a + b + b + c + c + a)$
   $= \quad (p + q + r)\,(2a + 2b + 2c)$
   $= \quad 2\,(a + b + c)\,(p + q + r)$

Exercise 9B

Resolve into factors:

1. $x^2 + yz + xy + xz$
   By regrouping,
   $= \quad (x^2 + xz) + (xy + yz)$
   Taking the common factor
   $= \quad x\,(x + z) + y(x + z)$
   $= \quad (x + z)\,(x + y)$

2. $5x^2 + 3y^2 + 3x^2 + 5y^2$
   By regrouping,
   $= \quad (5x^2 + 5y^2) + (3x^2 + 3y^2)$
   $= \quad 5(x^2 + y^2) + 3(x^2 + y^2)$
   $= \quad (5 + 3)\,(x^2 + y^2)$
   $= \quad 8\,(x^2 + y^2)$

3. $ab - ad + db - ac$

By regrouping,

$= (ab + db) - (ac + cd)$

Taking the common factor,

$= b(a + d) - c(a + d)$

$= (a + d)(b - c)$

4. $ab(x^2 + y^2) + xy(a^2 + b^2)$

$= abx^2 + aby^2 + a^2xy + b^2xy$

By regrouping,

$= (abx^2 + a^2xy) + (aby^2 + b^2xy)$

Taking the common factor,

$= ax(bx + ay) + by(ay + bx)$

$= (bx + ay)(ax + by)$

$= (ax + by)(bx + ay)$

5. $a^2 + ab + 8a + 8b$

$= (a^2 + ab) + (8a + 8b)$

$= a(a + b) + 8(a + b)$

$= (a + 8)(a + b)$

6. $kl - mn - nl + km$

By regrouping,

$= (kl + km) - (nl + mn)$

$= k(l + m) - n(l + m)$

$= (k - n)(l + m)$

7. $5x^2 - 25xz - 7xy + 35yz$

By taking common factor,

$= 5x(x - 5z) - 7y(x - 5z)$

$= (x - 5z)(5x - 7y)$

8. $a^2b - 2a(1 - b) - 4$

$= a^2b - 2a + 2ab - 4$

Taking common factors,

$= a(ab - 2) + 2(ab - 2)$

$= (a + 2)(ab - 2)$

9. $x^2 + 13x + 30$

Helpful Hint:
Factorise by breaking the middle terms.

Finding the factors of 30 that add up to 13,

Factors	Sum
10 x 3 = 30	10 + 3 = 13

$= x^2 + (10 + 3)x + 30$

$= x^2 + 10x + 3x + 30$

$= x(x + 10) + 3(x + 10)$

$= (x + 10)(x + 3)$

10. $x^2 - 20x + 36$

Finding the factors of 36 that add up to – 20,

Factors	Sum
–2 * –18 = 36	– 2 – 18 = – 20

$= x^2 - 2x - 18x + 36$

$= x^2(x - 2) - 18(x - 2)$

$= (x - 2)(x - 18)$

11. $x^2 - (a + b)x + ab$

Expanding the middle term,

$= x^2 - ax - bx + ab$

Taking common factors,

$= x(x - a) - b(x - a)$

$= (x - a)(x - b)$

12. $x^2 - 19x + 60$

Finding the factors of 60 that add up to – 19,

Factors	Sum
–15 * –4 = 60	– 15 – 4 = – 19

$= x^2 - 15x - 4x + 60$

$= x(x - 15) - 4(x - 15)$

$= (x - 15)(x - 4)$

13. $x^2 + 2x - 15$

Finding the factors of –15 that add up to + 2,

Factors	Sum
5 * – 3 = – 15	5 – 3 = 2

$= x^2 + 5x - 3x - 15$

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

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

14. $x^2 + 5x - 176$

Finding the factors of –176 that add up to 5

Factors	Sum
16 * – 11 = – 176	16 – 11 = 5

= $x^2 + 16x - 11x - 176$

= $x(x + 16) - 11(x + 16)$

= $(x + 16)(x - 11)$

15. $a^2 - 24a - 81$

Finding the factors of –81 that add up to – 24

Factors	Sum
– 27 * 3 = – 81	–27 + 3 = – 24

= $a^2 - 27a + 3a - 81$

= $a(a - 27) + 3(a - 27)$

= $(a - 27)(a + 3)$

16. $px^2 + (pq - 1)x - q$

= $px^2 + pqx - x - q$

Taking common factors,

= $px(x + q) - 1(x + q)$

= $(x + q)(px - 1)$

17. $3a^2 - 19a + 20$

Multiplying the coefficient of a^2 and 20,

3 * 20 = 60

Finding the factors of 60 that add up to –19,

Factors	Sum
– 15 * – 4 = 60	–15 – 4 = – 19

= $3a^2 - 15a - 4a + 20$

= $3a(a - 5) - 4(a - 5)$

= $(a - 5)(3a - 4)$

18. $6p^2 + p - 2$

Multiplying the coefficient of p^2 and the constant term 6 * – 2 = – 12

Finding the factors of –`12 that add up to 1,

Factors	Sum
4 * – 3 = – 12	4 – 3 = 1

= $6p^2 + 4p - 3p - 2$

= $2p(3p + 2) - 1(3p + 2)$

= $(3p + 2)(2p - 1)$

19. $a^2 + 7p - 144$

Finding the factors of – 144 that add up to 7,

Factors	Sum
16 * – 9 = – 144	16 – 9 = 7

= $a^2 + 16a - 9a - 144$

= $a(a + 16) - 9(a + 16)$

= $(a + 16)(a - 9)$

20. $x^2 + x - 72$

Finding the factors of – 72 that add up to 1,

Factors	Sum
9 * – 8 = – 72	9 – 8 = 1

= $x^2 + 9x - 8x - 72$

= $x(x + 9) - 8(x + 9)$

= $(x + 9)(x - 8)$

Multiple Choice Questions 9

1. Option A is correct. (By taking common)
2. Option C is correct. (By grouping)
3. Option D is correct.
4. Option B is correct. (By breaking middle term)
5. Option C is correct. (By taking common)

10 Linear Equations

Exercise 10A

1. $2x + 5 = 19$

$2x = 19 - 5$ (by transposition)

$2x = 14$

$x = \frac{14}{2}$

$x = 7$

2. $-7x + 2 = 23$

$-7x = 23 - 2$ (by transposition of 2)

$-7x = 21$

$x = -\frac{21}{7}$

$x = -3$

3. $8x - 3 = 3 \times + 17$

$8x - 3x - 3 = 17$ (by transposition of $3x$)

$8x - 3x = 17 + 3$ (by transposition of 3)

$5x = 20$

$x = \frac{20}{5}$

$x = 4$

4. $9x + 4 = 7x + 12$

$9x - 7x + 4 = 12$ (by transposition)

$9x - 7x = 12 - 4$ (by transposition)

$2x = 8$

$x = 4$

5. $3(6 - 2x) + 4(5x - 1) = 0$

$18 - 6x + 20x - 4 = 0$

$-6x + 20x = 4 - 18$ (by transposition)

$14x = -14$

$x = \frac{-14}{14}$

$x = -1$

6. $3(x - 5) = -2(4 - x)$

$3x - 15 = -8 + 2x$

$3x - 2x = 15 - 8$ (by transposition)

$x = 7$

7. $-\frac{6x}{5} + \frac{2x}{15} = -4$

$\frac{-3 \times 6x + 2x}{15} = -4$

$\frac{-18 + 2}{15} = -4$

$\frac{-16}{15} = -4$

By cross multiplying

$-16x = -4 \times 15$

$-x = \frac{-\cancel{4}^{1} \times 15}{\cancel{16}_{4}}$

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

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

8. $\frac{x}{2} - 6 = 8 - \frac{2}{3}$

$\frac{}{2} + \frac{2x}{3} = 8 + 6$ (by transposition)

$\frac{3x + 4x}{6} = 14$

$\frac{7}{6} = 14$

$7x = 14 \times 6$

$x = \frac{{}^{2}\cancel{14} \times 6}{\cancel{7}_{1}}$

$x = 12$

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

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

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

$$\frac{4-8-\ +5}{6} = \frac{3+2-12}{4}$$

$$\frac{3x-3}{6} = \frac{3x-10}{4}$$

$$6\,(3x-10) = 4\,(3x-3)$$

$$18x-60 = 12x-12$$

$$18x-12x = 60-12$$

$$6x = 48$$

$$x = \frac{48}{6}$$

$$x = 8$$

10. $$\frac{x-2}{3} + \frac{-5}{4} = \frac{-5}{6} + \frac{-7}{8}$$

$$\frac{-2}{3} - \frac{-5}{6} = \frac{-7}{8} -$$

$$\frac{2x-4-x+5}{6} = \frac{x-7-2x+10}{8}$$

$$\frac{x+1}{6} = \frac{-x+3}{8}$$

By cross multiplying,

$$8(x+1) = 6\,(-x+3)$$

$$8x+8 = -6x+18$$

$$8x+6x = -8+18$$

$$14x = 10$$

$$x = \frac{\cancel{10}^{5}}{\cancel{14}_{7}}$$

$$x = \frac{5}{7}$$

11. $$\frac{\quad}{\quad} + \frac{x}{b} = \frac{a^2-b^2}{ab}$$

$$\frac{\quad + \quad}{\quad} = \frac{a^2-b^2}{ab}$$

$$(bx+ax) = (a^2-b^2$$

$$bx+ax = a^2-b^2$$

$$x\,(a+b) = a^2-b^2$$

$$x = \frac{\cancel{(a+b)}\,(a-b)}{\cancel{(a+b)}}$$

$$x = a-b$$

12. $$8\,(\frac{\quad}{2} - 5) = 7x+2$$

$$\cancel{8}^{4} \times \frac{\quad}{\cancel{2}} - 8 \times 5 = 7x+2$$

$$4x-40 = 7x+2$$

$$4x-7x = 2+40$$

$$-3x = 42$$

$$-x = \frac{\cancel{42}^{14}}{\cancel{3}}$$

$$-x = 14$$

$$x = -14$$

13. $$3\,(2x+5)-2x = 3\,(x+6)$$

$$6x+15-2x = 3x+18$$

$$4x+15 = 3x+18$$

$$4x-3x = 18-15$$

$$x = 3$$

14. $$5x+2\,(2x-1) = 3x-14$$

$$5x+4x-2 = 3x-14$$

$$9x-2 = 3x-14$$

$$9x-3x = -14+2$$

$$6x = -12$$

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

$$x = -2$$

15. $$3\,(x+4)+5\,(x+3) = 2x-27$$

$$3x+12+5x+15 = 2x-27$$

$$8x+27 = 2x-27$$

$$8x-2x = -27-27$$

$$6x = -54$$

$$x = \frac{-54}{6}$$

$$x = -9$$

16. $$ax + \frac{b}{c} = cx + \frac{b}{a}$$

$$ax-cx = \frac{\quad}{\quad} - \frac{b}{c}$$

$$x\,(a-c) = \frac{bc-ab}{ac}$$

$$x = \frac{b\,(c-a)}{ac\,(a-c)}$$

$$x = \frac{-b(\cancel{a-c})}{ac\,(\cancel{a-c})}$$

$$x = -\frac{b}{ac}$$

17. $$\frac{-}{\quad} + \frac{\quad}{\quad} = \frac{al + bm}{lm}$$

$$\frac{(\ -\ ) + (\ -\ )}{\quad} = \frac{al + bm}{lm}$$

$$\frac{mx - am + lx - bl}{lm} = \frac{+}{\quad}$$

$$mx - am + lx - bl = \frac{\cancel{\ }(+\mathrm{b})}{\quad}$$

$$(mx + lx) - (am + bl) = al + \cancel{b}m$$

$$x\,(m + l) - (am + bl) = al + bm$$

$$x\,(m + l) = al + bm + (am + bl)$$

$$= al + bm + am + bl$$

$$x = \frac{l\,(a + b) + m\,(a + b)}{l + m}$$

$$x = \frac{(+)\,(\cancel{+})}{(\cancel{+})}$$

$$x = a + b$$

18. $$\frac{4 + 3}{9} + \frac{2x}{5} = \frac{3x + 2}{15}$$

$$\frac{5(4x + 3) + 9\,(2x)}{45} = \frac{3 + 2}{15}$$

$$\frac{20 + 15 + 18}{45} = \frac{3 + 2}{15}$$

By cross multiplying,

$$15\,(38x + 15) = 45\,(3x + 2)$$

$$570x + 225 = 135x + 90$$

$$435x = -135$$

$$x = -\frac{\cancel{135}^{\cancel{27}^{9}}}{\cancel{435}_{\cancel{87}_{29}}}$$

$$x = -\frac{9}{29}$$

19. $$\frac{2}{3} - \frac{x}{4} = \frac{x}{5} - \frac{x}{6} + 23$$

$$\frac{8-3}{12} = \frac{6-5}{30} + 23$$

$$\frac{5x}{12} = \frac{x}{30} + 23$$

$$\frac{5x}{12} - \frac{x}{30} = 23$$

$$\frac{25-2}{60} = 23$$

$$\frac{23x}{60} = 23$$

$$23x = 23 \times 60$$

$$x = \frac{\cancel{23} \times 60}{\cancel{23}}$$

$$x = \frac{\cancel{23} \times 60}{\cancel{23}}$$

$$x = 60$$

20. $$\frac{x}{a} + \frac{\quad}{\quad} + \frac{x}{c} = \frac{ab + bc + ca}{abc}$$

$$\frac{bcx + acx + abx}{abc} = \frac{ab + bc + ac}{abc}$$

$$bcx + acx + abx = \frac{+\ +}{\quad} \times \cancel{abc}$$

$$x\,(ab + bc + ac) = ab + bc + ca$$

$$x = \frac{\cancel{ab + bc + ca}}{\cancel{ab + bc + ca}}$$

$$x = 1$$

21. $$6 - \frac{x - 1}{2} - \frac{x - 2}{3} = \frac{3 -}{4}$$

$$\frac{3 - x}{4} + \frac{x - 1}{2} + \frac{x - 2}{3} = 6$$

$$\frac{3(3 -) + 6(- 1) + 4(- 2)}{12} = 6$$

$$\frac{9 - 3x + 6x - 6 + 4x - 8}{12} = 6$$

$$\frac{6x + 4x - 3x + 9 - 6 - 8}{12} = 6$$

$$\frac{7x-5}{12} = 6$$

$7x - 5 = 6 \times 12$

$7x = 72 + 5$

$x = \frac{77}{7}$

$x = 11$

22. $\frac{}{4} - \frac{5x+8}{6} = \frac{2-9}{3}$

$\frac{3x-2(5x+8)}{12} = \frac{2-9}{3}$

$\frac{-7x-16}{12} = \frac{2x-9}{3}$

$3(-7x-16) = 12(2x-9)$

$-21x - 48 = 24x - 108$

$-21x - 24x = -108 + 48$

$-45x = -60$

$x = \frac{\cancel{60}^{4}}{\cancel{45}_{3}}$

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

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

23. $13 - \frac{9-}{11} = \frac{3x}{22} + 12\frac{1}{2}$

$13 - \frac{9-}{11} = \frac{3x}{22} + \frac{25}{2}$

$\frac{3x}{22} + \frac{9-x}{11} = 13 - \frac{25}{2}$

$\frac{3+2(9-)}{22} = \frac{26-25}{2}$

$\frac{3x+18-2x}{22} = \frac{1}{2}$

$3x - 2x + 18 = 22 \times \frac{1}{2}$

$x + 18 = 11$

$x = -18 + 11$

$x = -7$

24. $2.25x - 0.125 = 3x + 3.175$

$2.25x - 3x = 3.175 + 0.125$

$-0.75x = 3.300$

$-x = \frac{3.300}{0.75}$

$x = -4.4$

Exercise 10B

1. Let x be the number.

 7 times of x = $7x$

 $7x + 3 = 31$

 $7x = 31 - 3$

 $7x = 28$

 $x = \frac{28}{7}$

 $x = 4$

2. Let the number be x

 Three quarter of x = $\frac{3}{4}$

 Three fifth of x = $\frac{3}{5}$

 $\frac{3}{4} - \frac{3}{5} = 9$

 $\frac{15x-12x}{20} = 9$

 $3x = 9 \times 20$

 $3x = 180$

 $x = 60$

3. Suppose Hena gets Rs x.

 3 times of Rsx = Rs $3x$

 Rina gets Rs $(3x - 100)$

 $x + 3x - 100 = 300$

 $4x = 300 + 100$

 $4x = 400$

 x = Rs 100

Hence, Hena gets Rs 100 and Rina gets Rs 200.

4. Let each boy get Rs x

 Each girl gets Rs $3x$

 Share of 2 boys = Rs $2x$

 Share of 3 girls = $3x \times 3$ = Rs $9x$

 $\therefore$ $2x + 9x = 528$

 $11x = 528$

 $x = 48$

 Each boy will get Rs 48.

5. Let the number be x

$$(x-3)\times 13 = 91$$
$$13x - 39 = 91$$
$$13x = 91 + 39$$
$$13x = 130$$
$$x = \frac{\cancel{130}^{10}}{\cancel{13}}$$
$$= 10$$

6. Let the lager number be x

Smaller number will be $(120 - x)$

Helpful Hint:
larger number + smaller number = 120

$$2x = 3(120 - x)$$
$$2x = 360 - 3x$$
$$2x + 3x = 360$$
$$5x = 360$$
$$x = 72$$

$\therefore$ $120 - x = 120 - 72 = 48$

Hence, larger number is 72 and smaller number is 48.

7. Let three consecutive positive integers be x, $x + 1$, and $x + 2$

$$x + x + 1 + x + 2 = 315$$
$$3x + 3 = 315$$
$$3x = 315 - 3$$
$$3x = 312$$
$$\therefore \quad x = 104$$
$$x + 1 = 104 + 1 = 105$$
$$x + 2 = 104 + 2 = 106$$

$\therefore$ The numbers are 104, 105, 106

8. Let the number be x

7 times the number = $7x$

$$630 - 7x = 3x$$
$$10x = 630$$
$$x = 63$$

9. Let Meena's present age = x years

Shaheena's present age = $(40 - x)$ year

After 10 years;

Meena's age = $(x + 10)$ years

Shaheena's age = $(40 - x + 10)$ years

= $(50 - x)$ year

$$\therefore \quad x + 10 = 2(50 - x)$$
$$x + 10 = 100 - 2x$$
$$x + 2x = 100 - 10$$
$$3x = 90$$
$$x = 30$$

$\therefore$ Meena's present age is 30 years

Shaheena's present age is 40 – 30 = 10 years

10. Let the two consecutive odd integers be x and $x + 2$, where x is smaller integer and x + 2 is larger integer.

$$\frac{x}{3} = \frac{x+2}{7} + 6$$
$$\frac{3}{} = \frac{+ 2 + 42}{7}$$
$$\frac{3}{} = \frac{x + 44}{7}$$
$$7x = 3(x + 44)$$
$$7x = 3x + 132$$
$$4x = 132$$
$$x = \frac{132}{4} = 33$$
$$x + 2 = 33 + 2 = 35$$

$\therefore$ The numbers are 33 and 35.

11. Let larger number be x.

Smaller number will be $x - 6$

Now,

$$\frac{x}{3} + 2 = \frac{-2}{3}(x - 6)$$
$$\frac{+6}{3} = \frac{2}{3}x - \frac{2}{\cancel{3}_1} \times \cancel{6}^2$$
$$\frac{x+6}{3} = \frac{2}{3}x - 4$$
$$\frac{x+6}{3} = \frac{2 - 12}{3}$$
$$x + 6 = 2x - 12$$
$$2x - x = 6 + 12$$
$$x = 18$$

Hence,larger number is 18 and smaller number is 12.

12. Let the number be x

$4x = x + 42$

$4x - x = 42$

$3x = 42$

$x = \frac{42^{14}}{3}$

$x = 14$

Hence, the required number is 14.

13. Let the three consecutive multiples of 11 be

$x, x + 11, x + 22$

$x + (x + 11) + (x + 22) = 297$

$3x + 33 = 297$

$3x = 297 - 33$

$x = \frac{264}{3}$

$= 88$

Hence, the required consecutive numbers are 88, 99, and 110.

14. Let the cost of the TV set = Rs x

Cost of the DVD player = Rs $(2x - 1600)$

Now, $2x - 1600 + x = 27800$

$3x - 1600 = 27800$

$3x = 27800 + 1600$

$= 29400$

$x = \frac{29400}{3}$

$=$ Rs 9 800

$\therefore$ The cost of TV set = Rs 9800

The cost of DVD player $= 2x - 1600$

$= 2 \times 9800 - 1600$

$= 19600 - 1600$

$=$ Rs 18,000

15. Let the breadth of the rectangle be x cm

The length of the rectangle is $x + 3$ cm

Perimeter of a rectangle = $2(l + b)$

$30 = 2(x + 3 + x)$

$30 = 2(2x + 3)$

$30 = 4x + 6$

$4x = 30 - 6$

$4x = 24$

$x = 6$ cm

$\therefore$ Breadth of the rectangle = 6 cm
length of the rectangle = 6 + 3 = 9 cm

16. Let the present age of the boy be x years.

age after 4 years $= x + 4$

age 6 years ago $= x - 6$

$\therefore \quad x + 4 = 2(x - 6)$

$x + 4 = 2x - 12$

$2x - x = 12 + 4$

$x = 16$

Hence the boy's present age is 16 years.

Exercise 10C

1. (i) Let the number be x.

Twice of the number = $2x$

Subtracting 13 from twice of the number, we get, the required equation

$\therefore 2x - 13 = 3$

(ii) Five times a number = $5x$

Increased by 9 = $5x + 9$

The required equation is

$5x + 9 = 39$

(iii) A number subtracted from 5 = $5 - x$

Four times the original number = $4x$

The required equation is

$5 - x = 4x$

(iv) One-fourth of a number = $\frac{x}{4}$

$\therefore \frac{x}{4} = 2 \times 5$

The required equation is

$\frac{x}{4} = 10$

(v) twice of number = $2x$.

The required equation is

$2x + 12 = 24$

(vi) Six times of a number= $6x$.

10 more than the number itself = $x + 10$

$6x = x + 10$

2. (i) $2x - 7 = 0$

$2x - 7 + 7 = 0 + 7$

$2x = 7$

$x = \frac{7}{7}$

$\therefore x = 3\frac{1}{2}$

(ii) $8x - 7 = 5 + 5x$

$8x - 7 + 7 = 5 + 5x + 7$

$8x = 5x + 12$

$8x - 5x = 12$

$3x = 14$

$\therefore x = 4$

(iii) $4(x - 1) - (2x - 5)$

$4x - 4 - 2x + 5 = 4$

$2x + 1 = 4$

$2x = 4 - 1$

$2x = 3$

$\therefore x = \frac{3}{2}$

or $x = 1\frac{1}{2}$

(iv) $2(x - 1) + 2 = 12$

$2x - \cancel{2} + \cancel{2} = 12$

$2x = 12$

$\therefore x = 6$

(v) $\frac{x}{9} + \frac{x}{3} = 4$

$\frac{x}{9} + \frac{4 + x}{3 * 3} = 4$

$\frac{x}{9} + \frac{3x}{9} = 4$

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

$x = \cancel{4} * \frac{9}{\cancel{2}}$

$\therefore x = 9$

3. (i) $x - 5 < 1$

$x - \cancel{5} + \cancel{5} < 1 + 5$

$x < 6$

Now,

$4x < 8$

$\frac{1}{\cancel{4}} * \cancel{4}\, x > \cancel{8}^2 * \frac{1}{\cancel{4}}$

$x > 2$

$\therefore 2 < x < 6$

(ii) $2x + 5 < 15$

$2x + \cancel{5} - \cancel{5} < 15 - 5$

$2x < 10$

$\frac{1}{\cancel{2}} * \cancel{2} * x < \frac{1}{2} * 10$

$x < 5$

Now, $3x - 2 > -5$

$3x - 2 + 2 > -5 + 2$

$3x > -3$

$\frac{1}{\cancel{3}} * \cancel{3}x > \frac{1}{\cancel{3}} * (-\cancel{3})$

$x > -1$

$-1 < x < 5$

(iii) $7x + 4 > 11$

$7x > 11 - 4$

$7x > 7$

$x > 1$

Now, $3x \leqslant 9$

$x \leqslant 3$

$\therefore 3 \geqslant x > 1$

4. (i) $5 - x < -2$

$-x + \cancel{5} - \cancel{5} < 2 - 2$

$-x < -7$

$-(-x) > -(-7)$

$x > 7$

Now, $3 - x \geq -2$

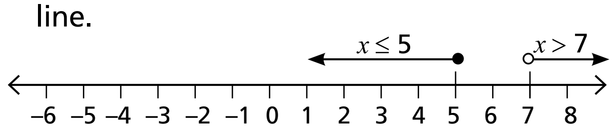
$3x - 2 + 2 > -5 + 2$

$-x + -\cancel{3} - \cancel{3} \geq -2 - 3$

$-x \geq -5$

$x \leq 5$

Now, presenting the solution on a number line.



(ii) $3x - 15 \geq -12$

$3x + \cancel{15} - \cancel{15} \geq -12 + 15$

$3x \geq 3$

$x \geq 1$

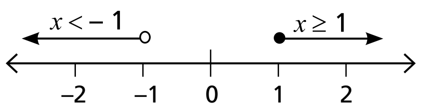
Now, $5x - 3 < -8$

$5x - \cancel{3} + \cancel{3} < -8 + 3$

$5x < -5$

$\frac{1}{\cancel{5}} * \cancel{5}x < \frac{1}{\cancel{5}} * (-5)$

$x < -1$



(iii) $5x - 3 < 3x + 1$

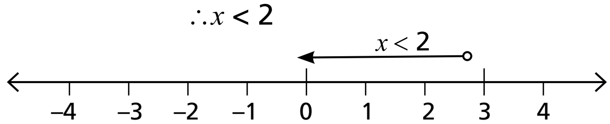
$5x + \cancel{3} + \cancel{3} < 3x + 1 + 3$

$5x < 3x + 4$

$5x - 3x < \cancel{3x} + 4 - \cancel{3x}$

$3x < 4$

$\therefore x < 2$



(iv) $2(2x + 3) - 10 \le 6\,(x - 2)$

$4x + 6 - 10 \le 6x - 12$

$4x - 4 \le 6x - 12$

$4x - \cancel{4} + \cancel{4} \le 6x - 12 + 4$

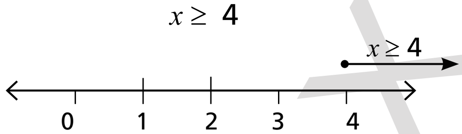
$4x - 6x \le 6x - 8$

$4x - 6x \le \cancel{6x} - 8 - \cancel{6x}$

$-2x \le -8$

$-x \le -4$

$x \ge 4$



Exercise 10D

1. (i) $2x + 5y = 24$ ________ (1)

$4x + 3y = 20$ ________ (2)

Multiply (1) by 2: $4x + 10y = 48$ ___ (3)

$4x + 3\,y = 20$ ________ (4)

Subtracting (4) from (3)

$7y = 28$

$y = 4$

Substituting $y = 4$ in (1), we get,

$2x + 20 = 24$

$2x = 4$

$x = 2$

$\therefore$ the solution set is $x = 2$, $y = 4$

(ii) $3x + y = 11$ ________ (1)

$9x + 2y = 28$ ________ (2)

Multiply (1) by 3

$9x + 3y = 33$ ________ (3)

$9x + 2y = 28$ ________ (4)

Subtracting (3) and (4), we get,

$y = 5$

Substituting $y = 5$ in (1), we get,

$3x + 5 = 11$

$3x = 6$

$x = 2$

$\therefore$ the solution set is $x = 2$, $y = 5$

(iii) $x + 2y = 17$ ________ ((1)

$8x + 3y = 45$ ________ (2)

Multiply (1) by 8

$8\,x + 16y = 136$ ________ (3)

$8x + 3y = 45$ ________ (4)

Subtracting (3) and (4), we get,

$13y = 91$

$y = 7$

Substituting $y = 7$ in (2), we get,

$8x + 21 = 45$

$8x = 24$

$x = 3$

$\therefore$ the solution set is $x = 3$, $y = 7$

(iv) $2x + 3y = 11$ ________ ((1)

$3x + 4y = 15$ ________ (2)

Multiply (1) by 3

$6x + 9y = 33$ ________ (3)

Multiply (1) by 2

$6x + 8y = 30$ ________ (4)

Subtracting (3) and (4), we get,

$y = 3$

Substituting $y = 3$ in (1), we get,

$2x + 9 = 11$

$2x = 2$

$x = 1$

$\therefore$ the solution set is $x = 1$, $y = 3$

(v) $x + 2y = -4$ ______ (1)

$3x - y = 9$ ______ (2)

$x + 2y = -4$ ______ (3)

Multiply (2) by 2

$6x - 2y = 18$ ______ (4)

Adding (3) and (4), we get,

$7x = 14$

$x = 2$

Substituting $x = 2$ in (1), we get,

$2 + 2y = -4$

$2y = -6$

$y = -3$

$\therefore$ the solution set is $x = 2, y = -3$

2. (i) $3x + y = 10$ ______(1)

$x - y = 2$ ______(2)

Write y in terms of x from (1)

$y = 10 - 3x$

Substitute in (2), we get,

$x - (10 - 3x) = 2$

$x - 10 + 3x = 2$

$4x = 12$

$x = 3$

Substituting in (1), we get,

$y = 10 - 9$

$y = 1$

$\therefore$ the solution set is $x = 3, y = 1$

(ii) $x + 2y = 8$ ______1)

$2x + 3y = 14$ ______ (2)

Write x in terms of y from (1)

$x = 8 - 2y$

Substitute in (2), we get,

$2(8 - 2y) + 3y = 14$

$16 - 4y + 3y = 14$

$16 - y = 14$

$y = 2$

Substituting in (1), we get,

$x + 4 = 8$

$x = 4$

$\therefore$ the solution set is $x = 4, y = 2$

(iii) $7x + 2y = 19$ ______ (1)

$x - y = 4$ ______ (2)

Write x in terms of y from (2)

$x = 4 + y$

Substituting in (1), we get,

$7(4 + y) + 2y = 19$

$28 + 7y + 2y = 19$

$9y = -9$

$y = -1$

Substituting in (2), we get,

$x - (-1) = 4$

$x = 3$

$\therefore$ the solution set is $x = 3, y = -1$

(iv) $2x + y = 13$ ______ (1)

$5x + 4y = 13$ ______ (2)

Write y in terms of x from (1)

$y = 13 - 2x$

Substituting in (2), we get,

$5x + 52 - 8x = 13$

$-3x = 13 - 52$

$-3x = -39$

$x = 13$

Substituting in (1), we get,

$y = 13 - 26$

$y = -13$

$\therefore$ the solution set is $x = 13, y = -13$

Multiple Choice Questions 10

1. Option B is correct.
2. Option D is correct.

Helpful Hint:
$x + (x + 9) + (x + 18) = 81$

3. Option B is correct.

Helpful Hint:
Hint: $x - 15 = \frac{3}{4}x$

4. Option B is correct.
5. Option C is correct.
   Gradient of $y = mx + c$ is m = $\frac{3}{4}$
6. Option C is correct. $P = 2(l + 7)$

3 Revision 3: Algebra

1. Given $a = 2$, $b = 1$ and $c = -\frac{1}{2}$

   (i) $(2\,ab^2c)\,(3a^2bc)$

   $= 6a^3\,b^3\,c^2$

   (substituting the values)

   $= 6 \times (2)^3 \times (1)^3 \times (-\frac{1}{2})^2$

   $= 6 \times \cancel{8}^{2} \times 1 \times \frac{1}{\cancel{4}_1}$

   Hence, product $= 6\,a^3b^3c^2$

   Numerical value $= 12$

   (ii) $(-\,2a^2bc)\,(-\,\frac{4}{5}\,abc^2)\,(\frac{5}{16}\,ab^2c)$

   $= -\,\cancel{2}^1 \times -\,\frac{\cancel{4}^1}{\cancel{5}} \times \frac{\cancel{5}}{\cancel{16}\,\cancel{4}^2} \times a^4 \times b^4 \times c^4$

   $= \frac{1}{2}\,a^4\,b^4\,c^4$

   $= \frac{1}{2}\,(2)^4\,(1)^4\,(-\,\frac{1}{2})^4$

   $= \frac{1}{2} \times \cancel{16} \times 1 \times \frac{1}{\cancel{16}} \quad = \frac{1}{2}$

   Hence, product $= \frac{1}{2}\,a^4b^4c^4$

   numerical value $= \frac{1}{2}$

2. Simplify:

   (i) $2a^3\,(a^3 - a^2 + 4) + 2a^5\,(a^2 + 5a + 1)$

   $= 2a^3 \times a^3 - 2a^3 \times a^2 + 4 \times 2a^3 + 2a^5 \times a^2$
   $+ 2a^5 \times 5a + 2a^5$

   $= 2a^6 - \cancel{2a^5} + 8a^3 + 2a^7 + 10a^6 + \cancel{2a^5}$

   $= 2a^7 + 12a^6 + 8a^3$

   (ii) $x^3\,(x + 3) + x^2\,(x^2 + 2) - x\,(2x^3 - 1)$

   $= x^4 + 3x^3 + x^4 + 2x^2 - 2x^4 + x$

   $= \cancel{2x^4} + 3x^3 + 2x^2 + x - \cancel{2x^4}$

   $= 3x^3 + 2x^2 + x$

   (iii) $(a - 1)\,(a^2 + a + 1) - (a + 1)\,(a^2 - a + 1)$

   $= a(a^2 + a + 1) - 1\,(a^2 + a + 1)$
   $-\,a(a^2 - a + 1) - 1(a^2 - a + 1)$

   $= \cancel{a^3} + \cancel{a^2} + \cancel{a} - \cancel{a^2} - \cancel{a} - 1 - \cancel{a^3} + \cancel{a^2} - \cancel{a} - \cancel{a^2} + \cancel{a} - 1$

   $= -\,1 - 1 = -\,2$

3. Multiply:

   (i) $(3x + 2)$ and $(x - 1)$

   $(3x + 2)\,(x - 1)$

   $= 3x\,(x - 1) + 2(x - 1)$

   $= 3x^2 - 3x + 2x - 2$

   $= 3x^2 - x - 2$

   (ii) $(5x - 7)$ and $(3x + 5)$

   $= (5x - 7)\,(3x + 5)$

   $= 5x(3x + 5) - 7\,(3x + 5)$

   $= 15x^2 + 25x - 21x - 35$

   $15x^2 + 4x - 35$

   (iii) $(2x - 5y)$ and $(7x + 3y)$

   $= (2x - 5y)\,(7x + 3y)$

   $= 2x(7x + 3y) - 5y\,(7x + 3y)$

   $= 14x^2 + 6xy - 35xy - 15y^2$

   $= 14x^2 - 29xy - 15y^2$

   (iv) $(x + ab)$ and $(2x - 7ab)$

   $= (x + ab)\,(2x - 7ab)$

   $= x(2x - 7ab) + ab\,(2x - 7ab)$

   $= 2x^2 - 7abx + 2ab\,x - 7a^2b^2$

   $= 2x^2 - 5abx - 7a^2b^2$

   (v) $(\frac{a^3}{3} - \frac{ab}{2})$ and $(a + b)$

   $= (\frac{a^3}{3} - \frac{ab}{2})\,(a + b)$

   $= \frac{a^3}{3}\,(a + b) - \frac{ab}{2}\,(a + b)$

   $= \frac{a^4}{3} + \frac{a^3b}{3} - \frac{a^2b}{2} - \frac{ab^2}{2}$

   (vi) $(3a^2 - 4)$ and $(4a^2 + 1)$

   $= (3a^2 - 4)\,(4a^2 + 1)$

$= 3a^2 (4a^2 + 1) – 4(4a^2 + 1)$

$= 12a^4 + 3a^2 – 16a^2 – 4$

$= 12a^4 – 13a^2 – 4$

4. $(x + a)(x + b) = x^2 + (a + b)x + ab$

By applying the above formula,we get,

$(m + 4)(m – 3) = m^2 + (4 – 3)m + (4)(– 3)$

$= m^2 + m – 12$

$= (–2)^2 + (–2) – 12$, when $m = – 2$

$= 4 – 2 – 12 = – 10$

Hence $(m + 4)(m – 3) = m^2 + m – 12$

Numerical value = – 10

5. Given:

$(x + a)(x + b)(x + c) = x^3 + (a + b + c)x^2 + (ab + bc + ca)x + abc$

$(p + 1) p – 2) (P + 3) = p^3 + (1 – 2 + 3) p^2 + (– 2 – 6 + 3) p + (– 6)$

$= p^3 + 2p^2 – 5p – 6$

Numerical value when $p = – 1$

$= (– 1)^3 + 2(– 1)^2 – 5(– 1) – 6$

$= – 1 + 2 + 5 – 6$

$= – 7 + 7 = 0$

6. For the following sums, use the rule

$(a + b)(a – b) = a^2 – b^2$

(i) $(3a + 2)(3a – 2)$

$= (3a)^2 – (2)^2$

$= 9a^2 – 4$

(ii) $(4x + 5)(4x – 5)$

$= (4x)^2 – (5)^2$

$= 16x^2 – 25$

(iii) $\left(\frac{1}{3}x + \frac{1}{2}y\right)\left(\frac{1}{3}x – \frac{1}{2}y\right)$

$= (\frac{1}{3}x)^2 – (\frac{1}{2}y)^2$

$= \frac{1}{9}x^2 – \frac{1}{4}y^2$

(iv) $(2a^2 + 3b^2)(2a^2 – 3b^2)$

$= (2a^2)^2 – (3b^2)^2$

$= 4a^4 – 9b^4$

7. (i) $(3a – 5b)^2$

Using identity $(a – b)^2 = a^2 – 2ab + b^2$

$(3a – 5b)^2 = (3a)^2 – 2(3a)(5b) + (5b)^2$

$= 9a^2 – 30ab + 25b^2$

(ii) $(abc – 2)^2 = (abc)^2 – 2(abc)(2) + (2)^2$

$= a^2b^2bc^2 – 4abc + 4$

(iii) $(2a + 3b – c)^2$

let $2a + 3b = x$

Then, $(x – c)^2 = x^2 – 2xc + c^2$

Putting $x = 2a + 3b$

$= (2a + 3b)^2 – 2(2a + 3b)c + c^2$

$= (4a^2 + 12ab + 9b^2) – (4a + 6b)c + c^2$

$= 4a^2 + 12ab + 9b^2 – 4ac – 6bc + c^2$

$= 4a^2 + 9b^2 + c^2 + 12ab – 6bc – 4ac$

(iv) $(x –2y + 3z)^2$

Let $x – 2y = a$

$(a + 3z)^2 = a^2 + 6az + 9z^2$

Put $a = x – 2y$

$= (x – 2y)^2 6(x – 2y)z + 9z^2$

$= x^2 – 4xy + 4y^2 + 6xz – 12yz + 9z^2$

$= x^2 + 4y^2 + 9z^2 – 4xy – 12yz + 6xz$

8. Length of the room = $(3x + 1)$

breath of the room = $(2x – 1)$

height of the room = $(x + 3)$

(i) Area of the floor = $(3x + 1)(2x – 1)$

$= 6x^2 – 3x + 2x – 1$

$= (6x^2 – x – 1)$ sq. units

(ii) Total area of the four walls

Helpful Hint:

Dimension of opposite walls will be the same.

Length and breadth of the walls change, while height will remain same.

Area of two opposite walls = 2 (length × height)

$= 2(3x + 1)(x + 3)$

$= 2(3x^2 + 9x + x + 3)$

$= 2(3x^2 + 10x + 3)$

$= (6x^2 + 20x + 6)$ sq. units

Area of other opposite walls

$= 2(x + 3)(2x –1)$

$= 2(2x^2 + 6x – x – 3)$

$= (4x^2 + 12x – 2x – 6)$

$= (4x^2 + 10x – 6)$ sq. units

Total area of 4 walls

$= 6x^2 + 20x + 6 + 4x^2 + 10x - 6$

$= (10x^2 + 30x)$ sq. units

(iii) Volume of the room $= l \times b \times h$

$= (3x + 1)(2x - 1)(x + 3)$

$= (3x + 1)(2x^2 + 5x - 3)$

$= 6x^3 + 15x^2 - 9x + 2x^2 + 5x - 3$

$= (6x^3 + 17x^2 - 4x - 3)$ cubic units

(iv) In part (iv) we have calculated the surface area of four walls. Now, we will calculate the surface area of floor and ceiling.

Total surface area of 4 walls $= (10x^2 + 30x)$ sq. units

Surface area of floor $= (3x + 1)(2x - 1)$

$= (6x^2 - 3x + 2x - 1)$

$= (6x^2 - x - 1)$ sq. units

Area of ceiling is same as area of floor

$\therefore$ Area of ceiling $= (6x^2 - x - 1)$ sq. units

$\therefore$ Total surface area of room = Area of four walls + Area of ceiling + area of floor

$= (10x^2 + 30x) + (6x^2 - x - 1) + (6x^2 - x - 1)$

$= 10x^2 + 30x + 6x^2 - x - 1 + 6x^2 - x - 1$

$= (22x^2 + 28x - 2)$ sq. units

9. (i) 51×51

$(50 + 1)(50 + 1)$

$= (50 + 1)^2$

using identity $(a + b)^2 = a^2 + 2ab + b^2$

$(50 + 1) = (50)^2 + 2(50)(1) + (1)^2$

$= 2500 + 100 + 1 = 2601$

(ii) $102 + 102$

$= (100 + 2)(100 + 2)$

$= (100 + 2)^2$

$= (100)^2 + 2(100)(2) + (2)^2$

using $(a + b)^2 = a^2 + 2ab + b^2$

$= 10000 + 400 + 4 = 10404$

(iii) 97×97

$= (100 - 3)(100 - 3)$

using $(a - b)^2 = a^2 - 2ab + b^2$

$= (100)^2 - 2(100) + (3)^2$

$= 10000 - 600 + 9 = 9409$

(iv) 1004×1004

$= (1000 + 4)(1000 + 4)$

$= (1000 + 4)^2$

$= (1000)^2 + 2(1000)(4) + (4)^2$

$= 1000000 + 8000 + 16$

$= 1008016$

(v) 103×97

$= (100 + 3)(100 - 3)$

$= (100)^2 - (3)^2$

using $(a + b)(a - b) = a^2 - b^2$

$= 10000 - 9 = 9991$

(vi) $(71)^2 - (29)^2$

$= (71 + 29)(71 - 29)$

$= (100)(42) = 4200$

(vii) $(142)^2 - (58)^2$

$= (142 + 58)(142 - 58)$

$= (200)(84) = 16800$

10. (i) $\frac{x + 2}{3} = \frac{2x + 3}{4}$

Cross multiplying

$4(x + 2) = 3(2x + 3)$

$4x + 8 = 6x + 9$

$2x = -1$

$x = -\frac{1}{2}$

(ii) $\frac{x}{2} + 3 = \frac{x}{3} + 4$

$\frac{x}{2} - \frac{x}{3} = 4 - 3$

$\frac{3x - 2x}{6} = 1$

$\frac{x}{6} = 1$

$x = 6$

(iii) $0.3x + 4 = 0.7x + 8$

$0.7x - 0.3x = 4 - 8$

$0.4x = -4$

$\frac{4x}{10} = -4$

$4x = -40$

$x = -10$

11. Let the number be x

$5x - 27 = 13$

$5x = 13 + 27$

$5x = 40$

$x = 8$

12. (i) $(78 - 72)(78 + 72) = 12x$

$x = \frac{6 \times 150}{12}$

$x = 75$

$\therefore$ Option B is correct

(ii) $(p + \frac{1}{p})^2 = 2^2$

$p^2 + 2 + \frac{1}{p^2} = 4$

$p^2 + \frac{1}{p^2} = 2$

Option C is correct.

(iii) $(m - \frac{1}{m})^2 = n^2$

$m^2 - 2 + \frac{1}{m^2} = n^2$

$m^2 + \frac{1}{m^2} = n^2 + 2$

Option A is correct.

(iv) $(m - \frac{1}{m})^2 = 2^2$

$m^2 - 2 + \frac{1}{m^2} = 4$

$m^2 + 2 + \frac{1}{m^2} - 4 = 4$

$\left(m + \frac{1}{m}\right)^2 = 4 + 4 = 8$

Option D is correct.

(v) $(x + y)^2 = x^2 + 2xy + y^2$

$= x^2 + y^2 + 2xy$

Substituting the values, we get

$(x + y)^2 = 14 + 2 \times 1$

$(x + y)^2 = 16$

$\therefore (x + y) = 4$

Option C is correct.

13. (i) $a^2 (a^2 + a + 1) - a^2 (a^2 - a + 1)$

$= \cancel{a^4} + a^3 + \cancel{a^2} - \cancel{a^4} + a^3 - \cancel{a^2}$

$= 2a^3$

(ii) $(2x + 7)(3x - 1)$

Multiply the expressions.

$= 2x(3x - 1) + 7(3x - 1)$

$= 6x^2 - 2x + 21x - 7$

$= 6x^2 + 19x - 7$

(iii) Area of a square = (side)^2

$= (3a + bc)(3a + bc)$

$= (3a + bc)^2$

Applying the identify,

$= (3x)^2 + 2(3a) + (bc)^2$

$= 9a^2 + 6abc + b^2c^2$

$\therefore$ Area = $(9a^2 + 6abc + b^2c^2)$ sq. units

(iv) Dimensions of the room are

$(x + 1)$, $(x - 1)_1$ and x units

let length $= (x + 1)$ unit

breadth $= (x + 1)$ unit

height $= x$ unit

Let W_1 and W_2 be pair of opposite walls. Similarly, W_3 and W_4 be another pair of opposite walls.

Area of $W_1 = x(x + 1)$

$= x(x^2 + x)$sq. units

Also, area of $W_2 = (x^2 + x)$sq. units

Area of $W_3 = x(x - 1)$

$= (x^2 - x)$sq. units

Also, area of $W_4 = (x^2 - x)$sq. units

Total area of 4 walls

$= (x^2 + x) + (x^2 + x) + (x^2 - x) + (x^2 + x)$

$= 4x^2 + \cancel{2x} - \cancel{2x}$

$= 4x^2$ sq. units

(v) $\left(\frac{1}{2}x + \frac{2}{3}y\right)\left(\frac{1}{2}x - \frac{2}{3}y\right)$

Helpful Hint:
Use the identity $(a + b)(a - b) = a^2 - b^2$

$\therefore \left(\frac{1}{2}x + \frac{2}{3}y\right)\left(\frac{1}{2} - \frac{2}{3}y\right)$

$= \left(\frac{1}{2}x\right)^2 - \left(\frac{2}{3}y\right)^2$

$= \frac{1}{4}x^2 - \frac{4}{9}y^2$

14. (i)

Helpful Hint:
Use the identity $(a + b)^2 = a^2 + 2a + b^2$

$(91)^2 = (90 + 1)^2$
$= (90)^2 + (1)(90) + (1)^2$
$= 8100 + 180 + 1$
$= 8281$

(ii)

Helpful Hint:
Use the identity $(a + b)^2 = a^2 - 2ab + b^2$

$199 * 199 = (200 - 1)(200 - 1)$
$= (200 - 1)^2$
$= (200)^2 - 2(200)(1) + 1$
$= 40000 - 400 + 1$
$= 39601$

(iii)

Helpful Hint:
Use the identity $(a + b)(a - b) = a^2 - b^2$

$507 * 493 = (500 + 7)(500 - 7)$
$= (500)^2 - (7)^2$
$= 250000 - 49$
$= 249951$

15. Let the denominator be x

numerator will be $x - 5$

Now, $\frac{x - 5}{x - 1} = \frac{1}{3}$

$3(x - 5) = (x - 1)$ by cross multiplying

$3x - 15 = x - 1$

$2x = 14$

$x = 7$

Hence, denominator = 7

numerators = 7 – 5 = 2

$\therefore$ Required fraction is $\frac{2}{7}$

16. Let the positive number be x

Twice of number = $2x$

One-third of the number = $\frac{x}{3}$

Now,

$2x = \frac{x}{3} + 25$

$2x - \frac{x}{3} = 25$

$\frac{6x - x}{3} = 25$

$5x = 25 * 3$

$x = \frac{\overset{5}{\cancel{25}} * 3}{\cancel{5}}$

$\therefore x = 15$

17. (i) $5pq\,(-3p^2qr^3)\left(-\frac{2}{15}q^2\right)$

Reducing the given polynomial in monomial,

$= \cancel{5} * (-\cancel{3})\left(-\frac{2}{\underset{3}{\cancel{15}}}\right)p^3q^4r^4$

$= 2\,p^3q^4r^4$

Now, substituting $p = -1$, $q = 1$ and $r = 2$

$= 2\,(-1)^3\,(1)^4\,(2)^4$

$= 2 * (-1) * 1 * 16$

$= -32$

(ii) $4x^2 - 3x(x - 2) - x\,(x + 2)$

$= 4x^2 - 3x^2 + 6x - x^2 - 2x$

$= \cancel{4x^2} - \cancel{4x^2} + 6x - 2x$

$= 4x$

18. (i) $(3a - 2b)^2$

Using identity $(a - b)^2 - 2ab + b^2$

$= (3a)^2 - 2(3a)\ \ (2b) + (2b)^2$

$= 9a^2 - 12ab + 4b^2$

(ii) $(5a^2 - 3b^3)^2$

$= (5a^2)^2 - 2(5a^2)\,(3b^2) + (3b^3)^2$

$= 25a^4 - 30a^2b^3 + 9b^6$

19. (i) $(196)^2$

$= (200 - 4)^2$

$= (200)^2 - 2(200)(4) + (4)^2$

$= 40000 - 1600 + 16$

$= 38416$

(ii) $(405)^2$

$= (400 + 5)^2$

$= (400)^2 + 2(400)(5) + (5)^2$

$= 160000 + 4000 + 25$

$= 164025$

(iii) $103 * 97$

Using the identity $(a + b)(a - b) = a^2 - b^2$

$\therefore 103 * 97$

$= (100 + 3)(100 - 3)$

$= (100)^2 - (3)^2$

$= 10000 - 9$

$= 9991$

20. (i) $16x^2 - 24x + 10$

Substituting $x = \frac{3}{4}$,

$= 16 * \frac{3}{4} * \frac{3}{4} - 24 * \frac{3}{4} + 10$

$= 9 - 18 + 10$

$= 1$

(ii) $(87)^2 - (63)^2 = 15x$

Using identify $a^2 - b^2 = (a + b)(a - b)$,

RHS becomes,

$(87 + 63)(87 - 63) = 15x$

$15x = 150 * 24$

$15x = 3600$

$x = \frac{3600}{15}$ (240 / 1)

$\therefore x = 240$

21. $x - \frac{1}{x} = 3$

Taking square of both the sides,

$\left(x - \frac{1}{x}\right)^2 = (3)^2$

$x^2 - 2(x)\left(\frac{1}{x}\right) + \left(\frac{1}{x}\right)^2 = 9$

$x^2 + \frac{1}{x^2} = 9 + 2$

$x^2 + \frac{1}{x^2} = 11$

22. Taking the square of $x - y$

$(x - y)^2 = x^2 - 2xy + y^2$

$= x^2 + y^2 - 2xy$

By substituting $x^2 + y^2 = 27$ and $xy = 1$

$(x - y)^2 = 27 - 2 * 1$

$= 27 - 2$

$= 25$

$\therefore x - y = \sqrt{25}$

$= \pm 5$

23. For a square field, the two dimension should be equal.

So, $2x + 3 = 3x - 7$

$3x - 2x = 3 + 7$

$x = 10$

For $x = 10$, units the field will be a square.

24. $\frac{2x - 1}{3} + 4 = \frac{3x + 1}{4}$

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

$\frac{2x + 11}{3} = \frac{3x + 1}{4}$

By cross multiplying,

$4(2x + 11) = 3(3x + 1)$

$8x + 44 = 9x + 3$

$9x - 8x = 44 - 3$

$x = 41$

25. Let Shazia's present age be 'x' years

Four years ago Shazia's age = $x - 4$ years

Four years ago Nadra's age was $2(x - 4)$ years

Now, $2(x - 4) - (x - 4) = 11$ years

$x - 4 = 11$ years

$x = 15$ years

$\therefore$ Shazia's present age is 15 years

26. (i) Option A is correct because the variable in linear equation has power 1.

(ii) Option B is correct.

27. The sequence is 120, 135, 150, ...

Given $a_1 = 120$, $a_2 = 135$, $a_3 = 150$

$d = 15$

Compartment	1st	2nd	3rd	...	13th
Passengers	120	135	150		?

$a_n = a_1 + (n - 1)\, d$

$a_{13} = 120 + (13 - 1) * 15$

$= 120 + 12 * 15$

$= 120 + 180$

$= 300$

∴ 300 passengers will travel in 13th compartment.

28. The sequence is 250, 270, 290, ...

Given $a_1 = 250$, $a_2 = 270$, $a_3 = 290$

$d = 20$

Minute	1st	2nd	3rd	...	7th
Distance (m)	250	270	290	...	?

$a_n = a_1 + (n - 1)\, d$

$a_2 = 250 + (7 - 1) * 20$

$= 250 + 6 * 20$

$= 250 + 120$

$= 370$ m

∴ The car will travel 370 m in 7th minute.

29. The sequence is 500, 545, 590

Given $a_1 = 500$, $a_2 = 545$, $a_3 = 590$

$d = 45$

Week	1st	2nd	3rd	...	8th	...	10th
Earning (Rs)	500	545	590	...	?	....	?

$a_n = a_1 + (n-1)\, d$

$a_8 = 500 + (8 - 1) * 45$

$= 500 + 7 * 45$

$= 500 + 315$

= Rs 815

$a_{10} = 500 + (10 - 1) * 45$

$= 500 + 9 * 45$

$= 500 + 405$

= Rs 905

∴ He will earn Rs 815 in 8th week and Rs 905 in 10th week.

30. The sequence is 32, 40, 48, ...

Given $a_1 = 32$, $a_2 = 40$, $a_3 = 48$

$d = 8$

Rows	1st	2nd	3rd	...	9th
Seats	32	40	48	...	?

$a_n = a_1 + (n-1)\, d$

$a_9 = 32 + (9 - 1) * 8$

$= 32 + 8 * 8$

$= 32 + 64$

= 96 seats

∴ there will be 96 seats in 9th row.

31. The sequence is 53, 60, 67

Given $a_1 = 53$, $a_2 = 60$, $a_3 = 67$

$d = 7$

Floor	1st	2nd	3rd	...	15th
People	53	60	67	...	?

$a_n = a_1 + (n-1)\, d$

$a_{15} = 53 + (15 - 1) * 7$

$= 53 + 14 * 7$

$= 53 + 98$

$= 151$

∴ 151 people will be living on 15th floor.

11 Polygons

Exercise 11

Helpful Hint:

Each interior angle $= \frac{(n-2) * 180°}{n}$

Sum of interior angle $= (n-2) * 180°$

Each exterior angle $= \frac{360°}{n}$

Where n is the number of sides of a polygon.

1. (i) 360°
   (ii) One
   (iii) 360°
   (iv) 7-sided
   (v) equal

2. (i) False
   Sum of interior angles of a triangle is 180°.
   (ii) True (Triangle property)
   (iii) True
   (iv) True
   (v) False
   (iii)–(v): Use the formula from given hints.
   Each interior angle of an octagon is 135°

3.

Helpful Hint:
Sum of the angles of a triangle is 180°.
$\angle A + \angle B + \angle C = 180°$

(i) $45° + 58° + x° = 180°$
$103° + x° = 180°$
$x° = 180° - 103°$
$\therefore x° = 77°$

(ii) $98° + 30° + x° = 180°$
$128° + x° = 180°$
$x° = 180° - 128°$
$\therefore x° = 52°$

(iii) $90° + 60° + x° = 180°$
$x° + 150° = 180°$
$x° = 180° - 150°$
$\therefore x° = 30°$

4.

Helpful Hint:
An exterior angle of a triangle is equal to the sum of two opposite interior angles.

(i) In the given triangle, we will first find the angle $x°$ the triangle.
So, $x° + 45° + 55° = 180°$
$x° + 100 = 180°$
$x° = 180° - 100°$
$\therefore x° = 80°$
Now, $\angle CAD$ is an exterior, therefore
$y° = 45° + 55°$
$\therefore y° = 100°$
Hence, $x° = 80°$ and $y° = 100°$

(ii) $x° = 40° + 35°$
$= 75°$
$\therefore$ Exterior angle $x° = 75°$

(iii) In Δ ABC,
$\angle BAC = 180° - 100°$
$= 80°$ (supplementary angles on a line).
Now,using the property of a triangle,
Exterior angle = Sum of two opposite interior angles
$100° = x° + 45°$
$x° = 100° - 45°$
$\therefore x° = 55°$

(iv) Using the property of the triangle, we write,

$x° = 70° + 50°$

$\therefore x° = 120°$

(v) Using the property of the triangle,

$4y° + (7y° + 6) = 116°$

$4y° + 7y° + 6 = 116$

$11y° = 116 – 6$

$11y° = 110$

$y° = 10$

$\therefore y = 10°$

5. The sum of interior angles of a pentagon is 540°

$\therefore x° + 150° + 95° + 2x° + 145° = 540°$

$3x° + 390° = 540°$

$3x° = 540 – 390°$

$3x° = 150°$

$x° = 150° \div 3$

$\therefore x° = 50°$

6. (i) Heptagon has 7 sides, so $n = 7$

$\therefore$ Sum of interior angles of a heptagon

$= (n – 2) * 180°$

$= (7 – 2) * 180°$

$= 5 * 180°$

$= 900°$

(ii) Sum of interior angles of a 15-sided polygon

$= (15 – 2) * 180°$

$= 13 * 180°$

$= 2340°$

(iii) Sum of interior angles of a 20-sided polygon

$= (20 – 2) * 180°$

$= 18 * 180°$

$= 3240°$

7. (i) A decagon has 10 sides.
Each interior angle of a decagon

$= \frac{(10 – 2) * 180°}{3}$

$= \frac{8 * 180°}{10}$

$= 144°$

(ii) Each interior angle of 18-sided polygon

$= \frac{(18 – 2) * 180°}{3}$

$= \frac{16 * 180°}{18}$

$= 16 * 10$

$= 160°$

(iii) Each interior angle of 16-sided polygon

$= \frac{(16 – 2) * 180°}{16}$

$= \frac{\cancel{14}^{7} * 180°}{\cancel{16}_{8}}$

$= \frac{7 * \cancel{180}^{45}}{\cancel{8}_{2}}$

$= \frac{315}{2}$

$= 157.5°$

8. Each exterior angle of a polygon = $360° \div n$

(i) A nonagon has 9-sides, therefore,

each exterior angle = $360 \div 9$

$= 40°$

(ii) Each exterior angle of a 12-sided polygon

$= 360 \div 12$

$= 30°$

(iii) Each exterior angle of a 45-sided polygon

$= 360 \div 45$

$= 8°$

Multiple Choice Questions 11

1. Option C is correct, since an exterior angle of a triangle is equal to the sum of two opposite interior angles.
2. Option D is correct, because the number of sides of the given polygon is 6.
3. Option C is correct.

   The given shape is 6-sided, so sum of interior angles will be $(n - 2) * 180°$
4. Option C is correct

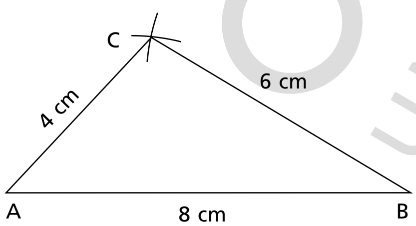
12 Practical Geometry

Exercise 12A

1. (i) 70°
   (ii) hypotenuse
   (iii) scalene
   (iv) obtuse
   (v) scalene
2. (i) True: Properties of triangle
   (ii) True: Properties of triangle
   (iii) True because the two opposite sides of an isosceles triangle are equal.
   (iv) False: It can be right-angled, obtuse-angled, or acute-angled triangle.
   (v) False, One angle in a right-angled triangle is 90°. The other two angles should sum to 90°.
3.

Helpful Hint:
(i), (ii) and (iii) follow the same steps of construction.

(i) $m\overline{AB}$ = 8 cm, $m\overline{BC}$ = 6 cm, $\overline{CA}$ = 4 cm



Steps of construction:

Step 1: Draw $m\overline{AB}$ = 8 cm.

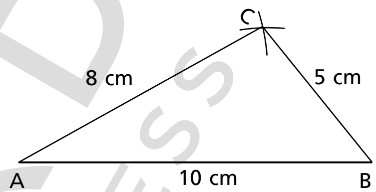
Step 2: With B as centre draw an arc with radius 6 cm.

Step 3: With A as centre, draw an arc with radius 4 cm.

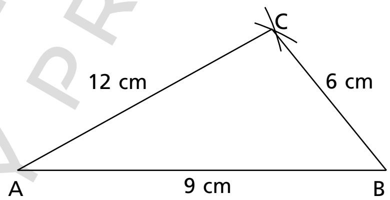
Step 4: Join C to A and B

Δ ABC is the required triangle.

(ii) $m\overline{AB}$ = 10 cm, $m\overline{BC}$ = 5 cm, m $\overline{CA}$ = 8 cm.

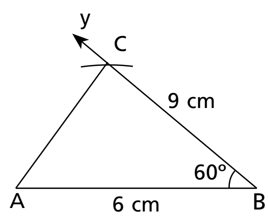


(iii) $m\overline{AB}$ = 9 cm, $m\overline{BC}$ = 6 cm, $m\overline{CA}$ = 12 cm



Helpful Hint:
(iv), (v) and (vi) follow the same steps of construction.

(iv) $m\overline{AB}$ = 6 cm, $m\overline{BC}$ = 9 cm, $m\angle B = 60°$



Steps of construction:

Steps 1: Draw $m\overline{AB}$ = 6 cm

Steps 2: At point B, draw $m\angle ABC = 60°$

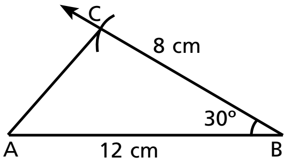
Step 3: With B as center, draw an arc of radius 9 cm to cut $\overline{BY}$ at C.

Step 4: Join A to C.

Δ ABC is the required triangle.

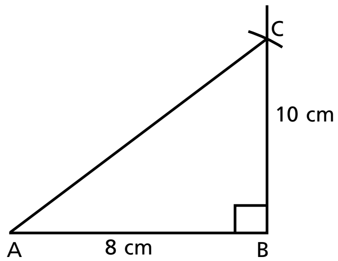
(v) $m\,\overline{AB}$ = 12 cm, $m\,\overline{BC}$ = 8 cm

$m\angle B = 30°$



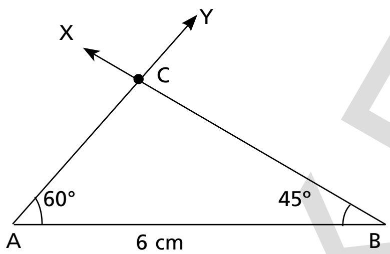
(vi) $m\,\overline{AB}$ = 8 cm, $m\,\overline{BC}$ = 10 cm,

$m\angle B = 90°$



Helpful Hint:
(vii) and (viii) follow the same steps of construction.

(vii) $m\,\overline{AB}$ = 6 cm, $m\angle A = 60°$, $m\angle B = 45°$



Steps of construction:

Step 1: Draw $m\,\overline{AB}$ = 6 cm BAY

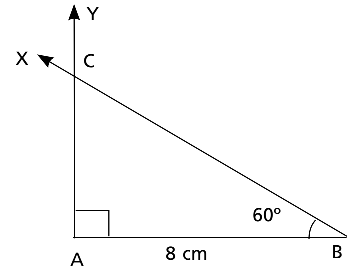
Step 2: At point A, draw $m\angle BAY = 60°$

Step 3: At point B, draw $m\angle ABX = 45°$

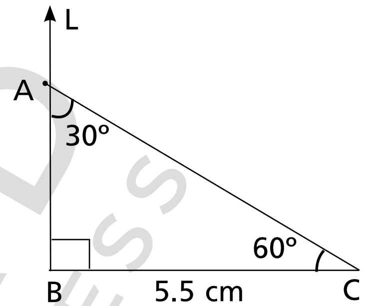
Step 4: Mark point C at the intersection of $\overline{AY}$ and $\overline{BX}$.

Δ ABC is the required triangle.

(viii) $m\,\overline{AB}$ = 8 cm, $m\angle A = 90°$, $m\angle B = 60°$



(ix) $m\,\overline{BC}$ = 5.5 cm, $m\angle A = 30°$, $m\angle B = 90°$



Steps of construction:

Step 1: Draw $\overline{BC}$ = 5.5 cm

Step 2: Construct an angle of 90° at B.

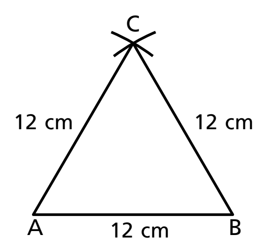
Step 3: Since sum of the angles in a triangle is 180°, i.e $\angle B + \angle A + \angle C = 180°$, Make angle of 60° at C meeting $\overline{BL}$ at A.

Step 4: Measure $\angle$ A. It will be 30°.

Δ ABC is the required triangle.

4. Construct the following equilateral triangles:

(i) $m\,\overline{AB}$ = 12 cm



Steps of construction:

Step 1: Draw $m\,\overline{AB}$ = 12 cm

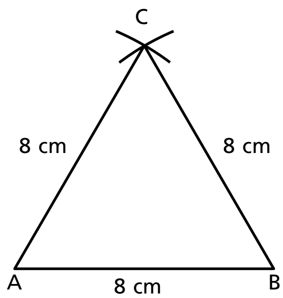
Step 2: With A as centre, draw an arc with radius 12 cm.

Step 3: With B as centre, draw another arc with radius 12 cm. So that it intersects the previous arc at C.

Step 4: Join C to A and B.

Δ ABC is the required triangle.

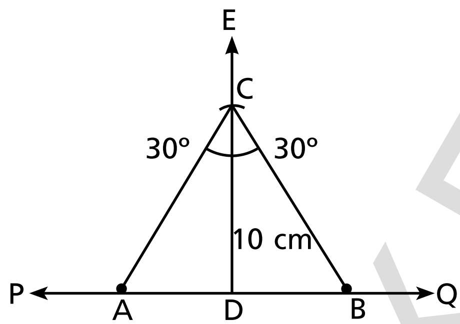
(ii) $m\,\overline{AB} = 8$ cm



Steps of construction:

Follow the same steps as given in Q4 (i)

(iii) altitude $\overline{CD} = 10$ cm



Steps of construction:

Step 1: Draw $m\,\overline{PQ} = 10$ cm

Step 2: Mark a point D at the centre $\overline{AB}$.

Step 3: Draw a perpendicular $\overline{DE}$ on $\overline{AB}$.

Step 4: With D as centre, draw an arc with radius 10 cm intersecting the perpendicular at C.

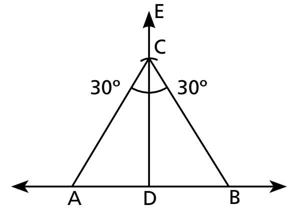
Step 5 At C draw two angles of 30° on either side of CD. $m\angle$ BCD and

$m\angle$ ACD = 30°

Step 6: Mark point A and B, where the arms of the angles interest $\overline{PQ}$.

Δ ABC is the required equilateral triangle.

(iv) altitude $\overline{CD} = 15$ cm



Steps of construction:

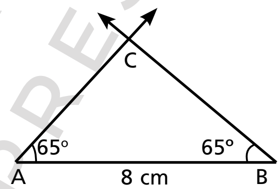
Follow the same steps as given in Q4 (iii).

5. Construct the following isosceles triangles.

Helpful Hint:

In an isosceles triangle base angles are equal, therefore, $\angle$ B = 65°

(i) $m\,\overline{AB} = 8$ cm, $m\angle A = 65°$



Steps of construction:

Step 1: Draw m AB = 8 cm

Step 2: Construct $m\angle$ BAC = 65°

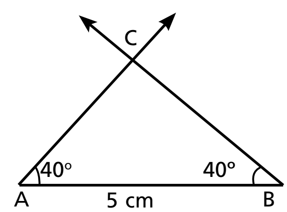
Step 3: Construct $m\angle$ ABC = 65°

Step 4: Extend the arms of the angles, so that they meet each other at point C.

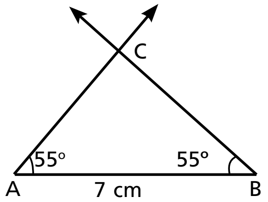
Δ ABC is the required triangle.

Follow the steps of construction given in Q5 (i), for (ii), (iii), (iv).

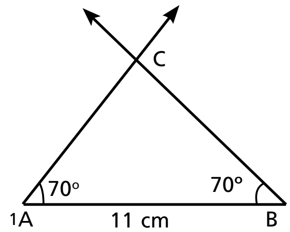
(ii) $m\,\overline{AB} = 5$ cm, $m\angle A = 40°$



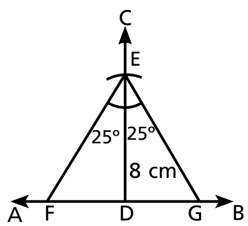
(iii) $m\,\overline{AB} = 7$ cm, $m\angle A = 70°$



(iv) $m\ \overline{AB}$ = 11 cm, $m\angle$ A = 70°



(v) altitude = 8 cm vertical angle = 50°



Steps of construction:

Steps 1: Draw $\overline{AB}$ of any length and mark a point D on it.

Step 2: Draw $\overline{CD}$ perpendicular to $\overline{AB}$.

Step 3: With D as centre draw an arc of radius 8 cm, intersecting $\overline{CD}$ at E.

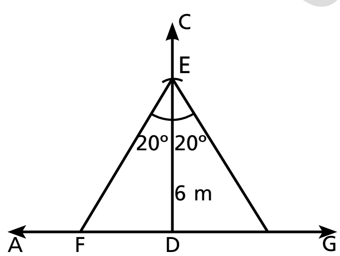
Step 4: construct $m\angle$ DEF = 25°

$m\angle$ DEG = 25°

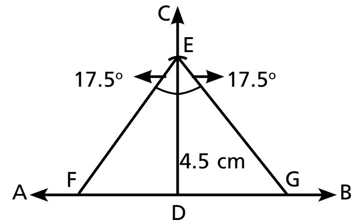
Δ EFG is the required isosceles triangle.

(vi) altitude = 6 cm, vertical angle = 40°

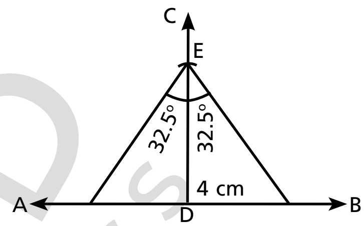
Follow the same steps of construction as given in Q5 (v), for (vi), (vii), and (viii).



(vii) altitude = 9.5 cm, vertical angle = 35°



(viii) altitude = 4 cm, vertical angle = 65°



(ix) altitude = 5 cm, base angle = 45°

Helpful Hint:

- $\angle$ FEG is vertical angle
- Sum of the angles of a triangle is 180°, therefore $\angle$ FEG = 90°

Steps of construction:

Step 1: Draw $\overline{AB}$ of any length and mark a point D on it.

Step 2: Draw $\overline{CD}$ perpendicular to $\overline{AB}$.

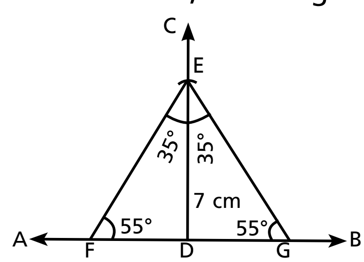
Step 3: With D is as centre, draw an arc of radius 5 cm, intersecting $\overline{CD}$ at E.

Step 4: Construct $\angle$ DEF = 45° and

$\angle$ DEG = 45°

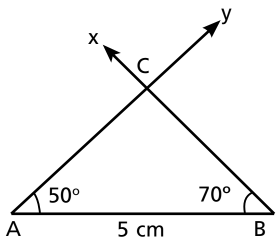
Δ EFG is the required triangle.

(x) altitude = 7 cm, base angle = 55°



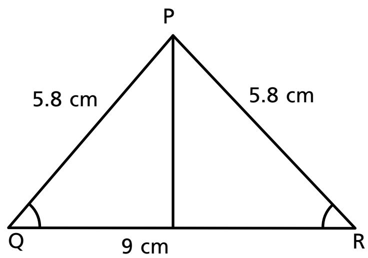
Follow the same steps of construction given in Q5 (ix).

6.



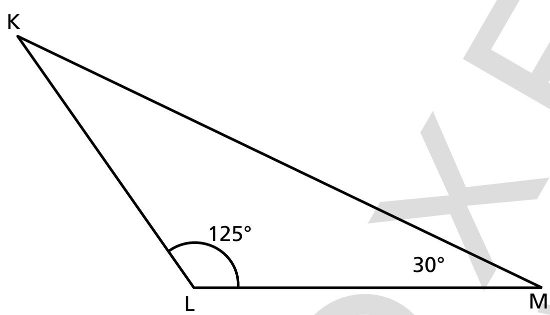
Follow the same steps of construction as given in Q 3 (vii). The given triangle is an acute – angled triangle.

7.



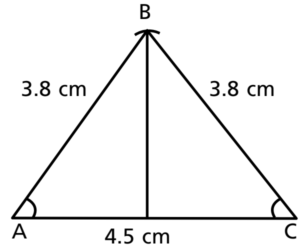
Follow the same steps of construction as given in Q3 (i). The given triangle is an isosceles triangle because two side are equal.

8.



Follow the same steps of construction as given in Q3 (vii). The given triangle is an Obtuse angle – angled triangle.

9.



Steps of construction:

Step 1: Draw $\overline{AC}$ = 4.5 cm

Step 2: With centre C and radius 3.8 cm draw an arc above $\overline{AC}$.

Step 3: with centre A, draw another arc with the same radius, intersecting the previous arc with at point B.

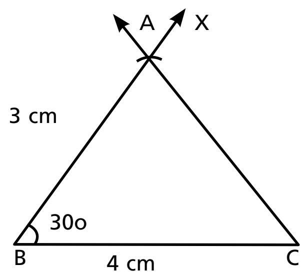
Step 4: Join A and B. Join B and C.

∆ ABC is the required triangle.

Since, ∆ ABC is an isosceles triangle, its base angle are equal.

∴ ∠ BAC = ∠ ACB

10.



Steps of construction:

Step 1: Draw $\overline{BC}$ = 4 cm

Step 2: At point B, draw m ∠ ABC = 30°

Step 3: With B as centre, draw an arc with radius 3 cm to cut $\overline{BX}$ at A.

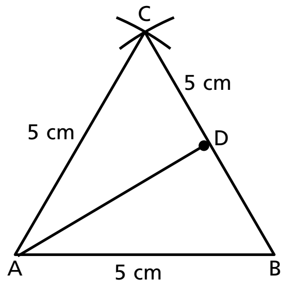
Step 4: Join A to C.

Δ ABC is the required triangle.

11. Follow the steps of construction as in Q4(i) taking each side = 5 cm

Δ ABC is an equilateral triangle.

Now, Take D as the centre of $\overline{BC}$.

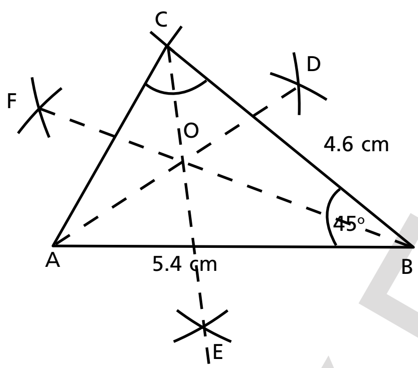


Join A and D.

Measure $\angle$ ADB.

$m \angle ADB = 90^\circ$

12.



Steps of construction:

Step 1: Draw $\overline{AB}$ = 5.4 cm

Step 2: Make an angle of 45° at point B.

Helpful Hint:
Using compass and ruler construct an angle of 90° and bisect it to get 45°.

Step 3: Using a compass cut $\overline{BC}$ = 4.6 cm.

Step 4: Join A and C.

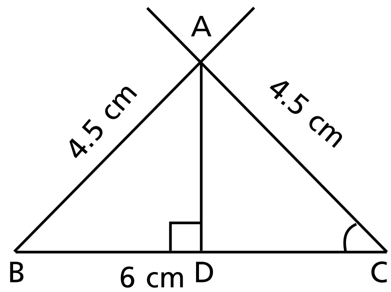
Δ ABC is the required triangle.

Step 5: Using a pair of compasses draw the angle bisectors at $\angle$ A, $\angle$ B, and $\angle$ C.

Step 6: Join A and D, B and F, C and E.

Angle bisectors $\overline{AD}$, $\overline{BF}$, and $\overline{CE}$ pass through the same point O.

13.



Steps of construction:

Step 1: Draw $\overline{BC}$ = 6 cm.

Step 2: With B as centre and radius 4.5 cm draw an arc above $\overline{BC}$.

Step 3: With C as centre and radius 4.5 cm draw another arc, intersecting the previous arc at point A.

Step 4: Join A to B and A to C.

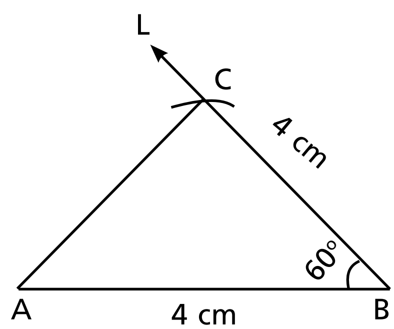
Δ ABC is the required triangle.

Step 5: Mark a point D in the centre of $\overline{BC}$.

Step 6: Join A and D. Measure $\angle$ ADB.

$\angle ADB = 90^\circ$

14.



Step of construction:

Step 1: Draw $\overline{AB}$ = 4 cm.

Step 2: Draw $\angle$ ABL = 60° at point B.

Step 3: With centre B and radius 4 cm draw an aare on $\overline{BL}$ at C.

$\angle ABC = 60^\circ$

Step 4: Join A to C.

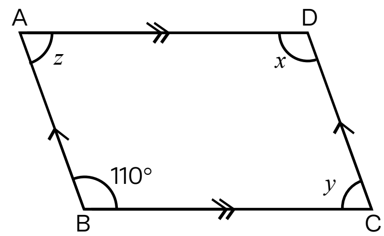
∆ ABC is the required triangle.

Exercise 12B

1. (i) diagonal
   (ii) 360°
   (iii) kite
   (iv) equal
   (v) equal
2. (i) False

   In a trapezoid only one pair of opposite sides are parallel.

   (ii) True: Property of a parallelogram
   (iii) True: It has four sides.
   (iv) True: Parallelograms are four sided figures.
   (v) False: In a rectangle, length has a different measurement than breadth, and only opposite sides are equal.
3. (i) Rhombus; all the sides are equal, and opposite angles are equal.
   (ii) Trapezium; has a set of two parallel sides, but other two sides are not parallel.
   (iii) Kite; the two pairs of adjacent sides are equal but opposite sids are not parallel.
4. (i) True: a parallelogram may have all angles equal i.e. to 90°
   (ii) False: a rectangle must have all the angles equal.
   (iii) True;: all parallelograms may have all the sides, as well as all angles equal.
   (iv) True: all quadrilaterals having four equal sides are rhombuses.
   (v) False: a square must have all the angles equal to 90°.
   (vi) False: a rhombus must have all the sides equal.
   (vii) False: in a kite opposite sides are generally not parallel.
5. (i) In a parallelogram, opposite angels are equal.



In a parallelogram, adjacent angles sum up to 180°.

In the given figure,

$m\angle B$ = 110°

$m\angle D$ = $m\angle B$ = 110° (opposite angles)

$\therefore$ $m\angle D$ = 110°

and $m\angle A + m\angle D$ = 180° (adjacent angles)

$m\angle A$ + 110° = 180°

$m\angle A$ = 70°

$m\angle C$ = $m\angle A$ = 70°

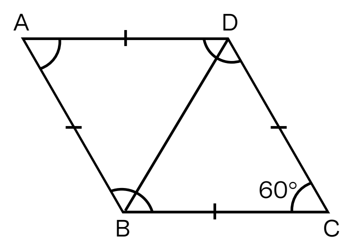
$m\angle C$ = 70°

Hence $m\angle A$ = 70°

$m\angle C$ = 70

$m\angle D$ = 110°

(ii)



Opposite angles in a parallelogram are equal.

$\therefore$ ∠ BCD = ∠ BAD = 60°

Adjacent angles sum up to 180°

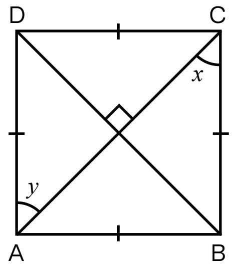
∠ BCD + ∠ CDA = 180°

60° + ∠ CDA= 180°

∠ CDA = 120°

∠ CDA = ∠ ABC = 120°

(iii)



In the given figure ABCD, Δ COB is an isosceles triangle

$\therefore \overline{OC} = \overline{OB}$

and $\angle$ OCB = $\angle$ OBC

$\angle$ COB = 90° (diagonal of a square cut each other at 90°).

According to triangle property

$\angle$ OCB + $\angle$ OBC + $\angle$ COB = 180°

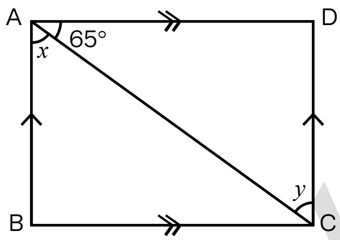
$x + x + 90° = 180°$

$2x = 90°$

$x = 45°$

Similarly, taking Δ AOD, we can prove that $\angle y = 45°$

(iv)



ABCD is a rectangle (given)

$\angle$ BAD = x + 65° = 90° (all the four angles in a rectangle are 90°)

$x + 65° = 90°$

$x = 90° - 65° = 25°$

Now $\overline{AD} \parallel \overline{BC}$

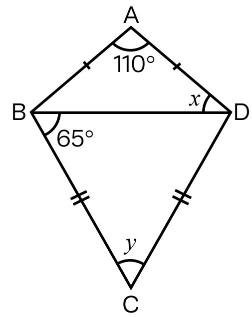
$\overline{AC}$ is the transversal.

$\angle$ DAC = $\angle$ ACB = 65° (alternate $\angle$s)

$y = 90° - 65°$

$= 25°$

(v)



Δ ABD is on isosceles triangle

$\angle$ ABD = x

Now $\angle$ ABD + $\angle$ BDA + $\angle$ BAD = 180°

$x + x + 110° = 180°$

$2x = 180° - 110° = 70°$

$x = 35°$

Similarly Δ BCD is an isosceles triangle

$\angle$ BDC = 65° (lease angle)

$\therefore$ 65° + $\angle$ BDC + y = 180°

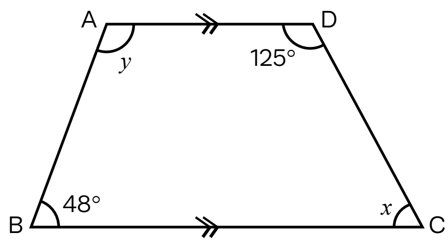
$65° + 65° + y = 180°$

$130° + y = 180°$

$y = 180° - 130°$

$y = 50°$

(vi)



$\overline{AD} \parallel \overline{BC}$

$\angle$ BAD = 180° 48° (interior angles in $\parallel$ lines)

=132°

$y = 132°$

$\angle$ BCD = 180° – 125° (interior angles in $\parallel$ lines)

$\therefore x = 55°$

Note: For Questions 6-11, use the steps of construction from the book.

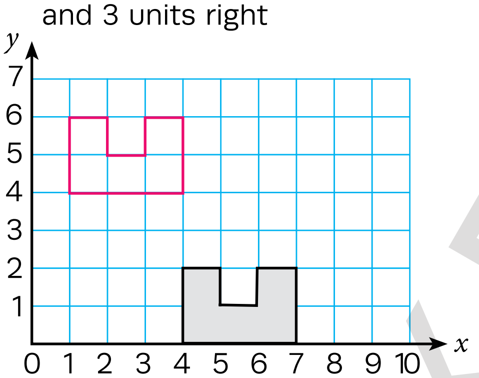
12.

Helpful Hint:
The order of rotational symmetry of a shape can be defined as the number of times it appears the same during a 360° rotation.

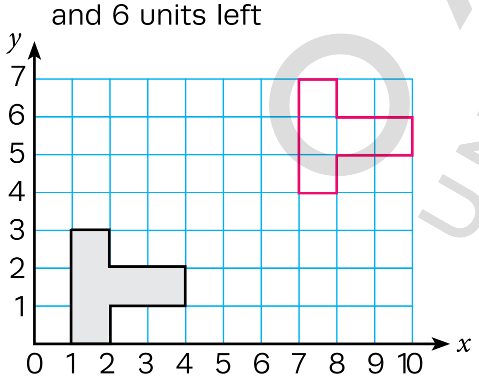
- An equilateral triangle has a rotational symmetry of order 3.
- An arrow has a rotational symmetry of order 1.
- A trapezium has a rotational symmetry of order 1.
- A rectangle has a rotational symmetry of order 2.
- A hexagon has a rotational symmetry of order 6.

13. Translate each shape using the translation give.

(i) move over 4 units down and 3 units right



(ii) move over 4 units down and 6 units left



Multiple Choice Questions 12

1. Option B is correct.

   Reason:

   Length of all the sides of an equilateral triangle is equal.
2. Option A is correct.

   Reason:

   In a right–angled triangle, one angle is always 90°.
3. Option B is correct.

   Reason:

   In a scalene triangle all the sides have different measurement of length.
4. Option A is correct.

   Reason:

   In an equilateral triangle the length of all the sides are equal. Therefore, the other two sides will have same length as the length of the base.
5. Option C is correct.

   Shapes in other option do not have 4 sides.
6. Option D is correct.

   A parallelogram has two pairs of ll lines, while trapezoid has only one pair of ll lines.
7. Option D is correct.

   Rhombus is a quadrilateral. The sum of the angles of a quadrilateral is 360°.
8. Option A is correct.
9. Option B is correct.
10. Option A is correct.

    Opposite angles of a parallelogram are equal.
11. Option D is correct because the given figure coincides four times on its original shape.
12. Option B is correct because translation involve only the movement of the shape from one place to other place.

13 Circles

Exercise 13A

1. (i) diameter
   (ii) circumference
   (iii) segment
   (iv) interior
   (v) chord

2. (i) True

   The centre of a circle is a fixed point which is equidistant from all points on the circle.

   (ii) False

   A diameter of a circle is a line segment passing through the centre of the circle and its end points lie on the circle. There can be many lines passing through the centre and its end points touching the boundary of the circle.

   (iii) False

   A radius is a straight line from the centre to the circumference of a circle, while the chord is straight line whose end points lie on the circle.

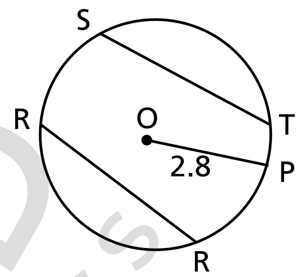
   (iv) True

   diameter = 2 × radius

   (v) True

   Since the arc subtends an angle of 210° which is greater than 180°, it is called major arc.

3.



Steps of construction:

Step 1: Using a compass, draw a circle of radius 2.8 cm.

Step 2: O is the centre of the circle.

Step 3: Take points S and T on the boundary of the circle. Join S and T. $\overline{ST}$ is a chord.

Step 4: Take points Q and R on the boundary of the circle. Join Q and R $\overline{QR}$ is another chord.

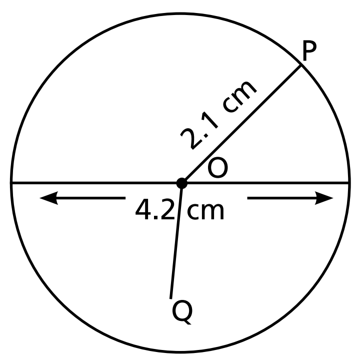
∴ $\overline{ST}$ and $\overline{QR}$ are two chords not passing through the centre.

4.

Diameter of the circle = 4.2 cm

Radius of the circle = $\frac{4.2}{2}$ cm

= 2.1 cm



Steps of construction:

Step 1: Draw a circle of radius 2.1 cm with the help of a compass.

Step 2: O is the centre of the circle. Take a point P on the circle. Measure $\overline{OP}$.

$m\,\overline{OP}$ = 2.1 cm (radius of the circle).

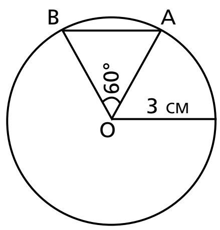
Step 3: Take a point Q inside the circle.

Step 4: Measure $\overline{OQ}$.

$m\,\overline{OQ}$ = 1.8 cm

Hence, $m\,\overline{OP} > m\,\overline{OQ}$.

5.



Steps of construction:

Step 1: Draw a circle of radius 3 cm with centre O.

Step 2: Take a point A on the Circle and join O and A.

Step 3: Draw an angle of 60° on $\overline{OA}$ at point O such that $m\angle AOB = 60°$.

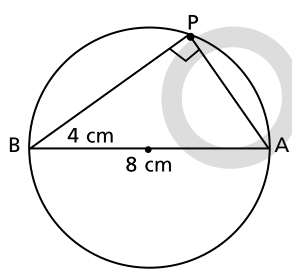
Step 4: Join A to B.

Step 5: Measure $\overline{OA}$, $\overline{OB}$, and $\overline{AB}$.

$m\,\overline{OA} = m\,OB = m\,AB = 3$ cm.

Since, $m\,\overline{OA}$, $m\,\overline{OB}$, and $m\,\overline{AB}$ are equal, Δ AOB is an equilateral triangle.

6.



Steps of construction:

Step 1: Draw a circle of diameter 8 cm or radius 4 cm.

Step 2: Draw the diameter $\overline{AB}$ of the circle.

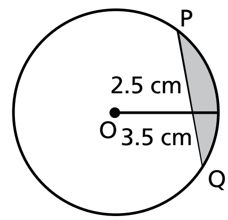
Step 3: Take another point P on the circle

Step 4: Join A to P and B to P.

Step 5: Measure $\angle$ APB m

$\angle APB = 90°$

7.



Steps of construction:

Step 1: Draw a circle with radius 3.5 cm.

Step 2: Draw the chord $\overline{PQ}$ of length 2.5 cm touching the circle at P and Q.

Step 3: Shade the minor segment PQ.

PQ is the required segment.

8. Points A, C, G, and D are interior points.

Points F and B are exterior points.

Points E and H are on the circle.

9. (i) $\overline{AB}$, $\overline{BC}$, $\overline{AC}$ are three chords

(ii) $\overline{AC}$ is the diameter

(iii) Δ AOB and Δ BOC are two triangles

(iv) $\overline{OA}$, $\overline{OB}$, and $\overline{OC}$ are equal line segments.

10.

(i) Draw a circle of suitable radius. With the same radius, mark six point on the circumference, and draw arcs leaving one point.

(ii) Draw a circle and mark six points on the circumference. Join alternate points with overlapping triangles.

(iii) Draw a circle. Taking the radius of the circle as diameters of small circles draw four circle overlapping each other inside the bigger circle.

(iv) Draw a circle of suitable radius. With the same radius draw two half circles facing up and down, taking centre on the circumference. Draw two small half circles taking diameter equal to the radius of bagger circle, on both sides.

Exercise 13B

1. Given:

   In a circle with centre O, $\overline{PQ}$ is a chord and R is the mid–point of $\overline{PQ}$.

   $\overline{PR} = \overline{RQ}$, $\overline{OR}$ is perpendicular to $\overline{PQ}$.

   $m\angle ROP = 42^\circ$

   In Δ OPR

   $m\angle ORP + m\angle POR + m\angle OPR = 180^\circ$

   Helpful Hint:
   sum of the angles of a triangle = 180°.

   $90^\circ + 42^\circ + m\angle OPR = 180^\circ$

   $132^\circ + m\angle OPR = 180^\circ$

   $m\angle OPR = 180^\circ - 132^\circ = 48^\circ$

2. Given:

   $\overline{AB}$ is a chord of the circle with centre O.

   $\overline{OC} \perp \overline{AB}$

   $m\overline{AC} = 4$ cm

   We know that a perpendicular, from the centre f a circle to a chord, bisects the chord (Property 2)

   $\therefore\ m\overline{AC} = m\overline{CB} = 4$ cm

   $m\overline{AB} = m\overline{AC} + m\overline{CB}$

   $= 4 + 4$

   $= 8$ cm

3. Given:

   $\overline{AB}$ is a chord of the circle with centre O.

   $\overline{OE} \perp \overline{AB}$

   $m\overline{AB} = 8$ cm

   $m\overline{CE} = 2.5$ cm

Now,

   $m\overline{CE} = m\overline{ED} = 2.5$ cm (Property 2 of the circle from page 181)

   $m\overline{CD} = 5$ cm

Now, $m\overline{AE} = m\overline{EB}$ (property 2 of the circle)

$= 4$ cm

$\therefore\ m\overline{AC} = m\overline{AE} - m\overline{CE}$

$= 4$ cm $- 2.5$ cm $= 1.5$ cm

Similarly,

$m\overline{BD} = 1.5$ cm

Therefore,

$m\overline{AC} = 1.5$ cm, $m\overline{DB} = 1.5$ cm, and $m\overline{CD} = 5$ cm.

4. Given:

   In the given circle with centre O, $\overline{AB}$ and $\overline{CD}$ are chords to the circle.

   $\overline{OM} \perp \overline{AB}$, $\overline{ON} \perp \overline{CD}$

   $m\overline{OM} = m\overline{ON} = 3$ cm

   $m\overline{AM} = 3.2$ cm

Now, $m\overline{AM} = m\overline{BM} = 3.2$ cm

   ($\therefore$ OM AB, it bisects $\overline{AB}$)

   m $\overline{AB} = m\overline{AM} + m\overline{MB}$

   $= 3.2$ cm $+ 3.2$ cm $= 6.4$ cm

   It is given that $m\overline{OM} = m\overline{ON}$

   $\therefore\ \overline{AB}$ and $\overline{CD}$ are equidistant from the circle.

   Hence in $\overline{AB} = m\overline{CD} = 6.4$ cm

   Helpful Hint:
   Chords of a circle equidistant from the centre are equal. Converse of Property 1, page 180)

5. Given:

   $m\angle AOB = m\angle BOC = 60^\circ$

   $m\overline{AB} = 4$ cm

Now,

   $m\overline{OA} = m\overline{OB} = m\overline{OC}$ (radii of the circle)

   Since the angles subtended by $\overline{AB}$ and $\overline{BC}$ at the centre are equal, then the chords are equal.

   $\therefore\ m\overline{AB} = m\overline{BC} = 4$ cm

   Δ AOB is an isosceles triangle with vertex angle = 60°

∴ $\angle OAB = \angle OBA$

$2\angle OAB = 180° - 60° = 120°$

$\angle OAB = 60°$

∴ ΔOAB is an equilateral triangle Thus $m\overline{AB} = m\overline{OA} = 4$ cm

∴ $m\overline{OC} = 4$ cm

$\angle ABC = \angle ABO + \angle OBC = 60° + 60° = 120°$

Multiple Choice Questions 13

1. Option A is correct

   Diameter of a circle is double of its radius.

2. Option B is correct

   The diameter of a circle is a line with maximum length, touching the two ends of the circle.

3. Option C is correct.

   The chords which are equidistant from the centre are equal.

4. Option D is correct.
5. Option B is correct

4 Revision 4: Geometry

Helpful Hint:
(sum of the angles of a triangle = 180°)

1. $m\angle x + 105° = 180°$ (angles on a straight line)

$m\angle x = 180° - 105°$

$m\angle x = 75°$

$\angle x = 75°$

Now $\angle x + \angle y + 35° = 180°$

$75° + \angle y + 35° = 180°$

$\angle y + 110° = 180°$

$\angle y = 180° - 110°$

$= 70°$

Hence $x = 75°$, $y = 70°$

2. In the Δ BCD

$\angle$ B = 54°, $\angle$ D = 90°

$\angle$ BCD = 180° – 144°

$\angle$ BCD = 36°

Now, in Δ ACD, let $\angle$ ACD = $x°$ then $\angle$ CAD = $3x$ and $\angle$ ADC= 90°

Taking sum of the angles of a triangle, we write $x + 3x + 90 = 180$

$4x = 90°$

$x = \frac{90}{4} = 22.5°$

$\therefore$ $\angle$ ACD = 22.5°

3. (i) The base angles of an isosceles triangle are equal. Suppose the base angles of the given isosceles triangles are $x°$, then

$x° + x° + 76° = 180°$

$2x° = 180 - 76$

$2x° = 104°$

$x° = 52°$

Hence, the required base angle is 52°.

(ii) One of the angles of a right angled triangle is 90°.

let one of the acute angles be $x°$

then $x° + 36° = 90°$

$x° = 90° - 36°$

Hence, the size of the other acute angle is 54°

(iii)

Let the side of the third angle = $x°$

$x° + 42° + 68° = 180°$

$x° + 110° = 180°$

$x° = 180° - 110°$

$x° = 70°$

Hence, the size of the third angle is 70°.

(iv) The ratio of the interior angles of a triangle is 3: 4: 5

Sum of the ratio = 3 + 4 + 5 = 12

Sum of the angles of a Δ = 180°

size of largest angle

$= \frac{5}{12} \times 180° = 75°$ (12 and 180° cancelled: 180/12 = 15)

4. There are 8 triangles in the given figure.

5. (i) In the Δ ACD

$\angle$ ACD + $\angle$ CDA + $\angle$ CAD = 180°

50° + 90° + $\angle$ CAD = 180°

$\angle$ CAD = 180 – 140

$\angle$ CAD = 40°

(ii) In Δ ABD

$\angle$ ABD + $\angle$ DAB + $\angle$ BDA= 180°

$\angle$ ABD + 48° + 90° = 180°

$\angle$ BD = 180° – 138

$\angle$ ABD = 42°

(iii) In Δ ABC,

∠ BAC = BAD + ∠ DAC

= 48° + 40° (∵ ∠ DAC = 40°)

∠ BAD = 88°

6. (i) ∠ DAB and ∠ DCB; ∠ADC and ∠ ABC

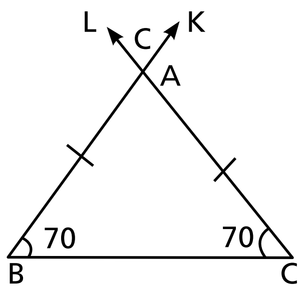
(ii) ∠ DAB and ∠ ABC; ∠ABC and ∠BCD; ∠ BCD and ∠ CDA; ∠ CDA and ∠ DAB

(iii) $\overline{AB}$ and $\overline{CD}$; $\overline{AD}$ and $\overline{BC}$

(iv) $\overline{AB}$ and $\overline{BC}$; $\overline{BC}$ and $\overline{CD}$; $\overline{CD}$ and $\overline{DA}$; $\overline{DA}$ and $\overline{BA}$

7. (iii), (iv), and (vi) are correct statements.

8.



Helpful Hint:
Opposite sides of equal angle are equal.

Steps of construction:

Step 1: Draw a line $\overline{BC}$ of suitable length.

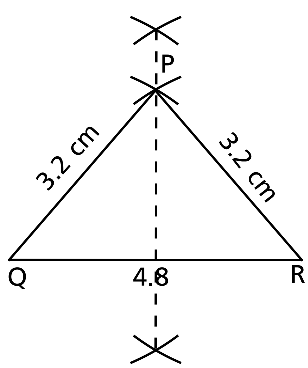
Step 2: With the help of protractor, construct an angle of 70° at point B and C.

Step 3; Join B and K. Join c and L. $\overline{BK}$ and $\overline{CL}$ intersect each other at point A.

$m\ \overline{AC} = m\ \overline{AB}$

Δ ABC is an isosceles triangle.

9.



Steps of construction:

Step 1: Draw $\overline{QR}$ = 4.8 cm.

Step 2: Taking Q as centre and radius 3.2 cm, draw an arc above $\overline{QR}$.

Step 3: With the same radius, take R as centre, draw another arc cutting the previous arc at P.

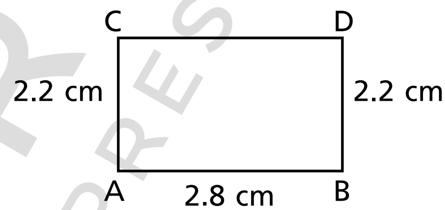
Step 4: Join P and Q. Join P and R

Hence Δ PQR is the required triangle.

Step 5: Draw the perpendicular bisector of QR, with the help of a compass.

We observe that the perpendicular bisector passes through P.

10.



Steps of construction:

Step 1: Draw a line segment $\overline{AB}$ = 2.8 cm

Step 2: With the help of set square make a perpendicular at point A.

Step 3: Similarly, draw a perpendicular on point B.

Step 4: With the help of compass, taking radius of 2.2 cm mark two arcs at C and D.

Step 5: Join point C to point D.

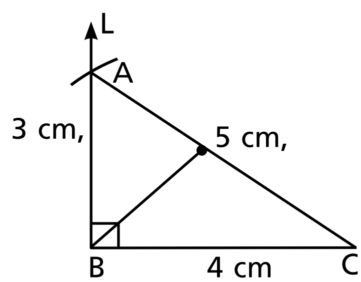
$\overline{CD}$ is parallel to $\overline{AB}$ and is at a distance of 2.2 cm from it.

11. Draw a Δ ABC, where

$m\ \angle ABC = 90°$

$m\ \overline{BC}$ = 4 cm

$m\ \overline{AC}$ = 3 cm



Steps of construction:

Take C as centre, draw on arc of 5 cm cutting $\overline{BL}$ at A.

Join points A and C.

$m\ \overline{AC}$ = 5 cm

Measure $\overline{AB}$ with a ruler.

$m\ \overline{AB}$ = 3 cm

Take M as the mid point of $\overline{AC}$.

Measure $\overline{BM}$ and $\overline{CM}$.

$m\ \overline{BM}$ = m $\overline{MC}$ = 2.5 cm

12. Draw Δ ACB, such that

$m\ \overline{BC}$ = 3.2 cm,

$m \angle$ ABC = 30°

$m \angle$ ACB = 60°

Extend $\overline{AC}$ to D.

Measure $\angle$ BAD with a protractor.

$\angle$ BAD = 90°

13. Exterior angle of a triangle is equal to the sum of two opposite interior angle.

$\therefore x° = 25° + 40$

$= 65°$

Now sum of the interior angles of a triangles is 180°

$\therefore 35° + y° + 65° = 180°$

$y° + 100° = 180°$

$y° = 80°$

14. (i) $\angle$ ($\overline{OD}$ 1 $\overline{AB}$, not touching the circumference)

(ii) = (both are radii of the circle)

(iii) $\angle$ ($\overline{OD}$ $\angle$ radius)

(iv) = (both are radii)

(v) $\angle$ ($\overline{OA}$ is radius)

15. In Δ PQR,

$m\ \overline{PQ} = m\ \overline{PR}$ (given)

Hence, $m \angle$ PQR = $\angle$ PRQ (opposite angles of equal sides)

$m \angle$ QPR = 72° (given)

Therefore, $m \angle$ PQR + $m \angle$ PRQ + 72° = 180° (sum of the angles of a triangle)

$m \angle$ PQR + $m \angle$ PRQ = 180° – 72°

= 108°

$\therefore m \angle$ PQR = $m \angle$ PRQ = 54°

(i) $m \angle$ OQR = $\frac{1}{2}$ of 54° = 27°

$\therefore \overline{QO}$ is the besctor of $\angle$ OQR

Similarly

(ii) $m \angle$ ORQ = $\frac{1}{2}$ of 54° = 27°

(iii) $m \angle$ QOR = 180° – (27° + 27°)

= 180° – 54°

= 126°

Q16 and 17 (Answers not required)

18. (i) The given parallelogram is a rhombus, therefore all the sides are equal.

$\overline{AB} = \overline{BC} = \overline{CD} = \overline{AD}$ = 2.5 cm

(ii) ABCD is a square,the opposite sides of a square are equal.

$\overline{AB}$ = AD = 3 cm

$\overline{DC} \parallel$ AB (apposite sides of a parallelogram)

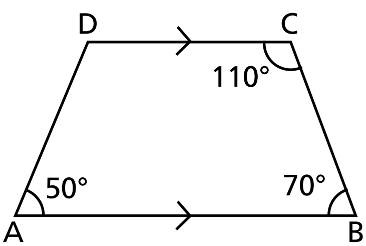
$\angle$ CDB = $\angle$ CBD = 45° (alternate angles)

$\therefore\ \overline{AD} = \overline{BC}$ = 3 cm

Hence $\overline{AD} = \overline{DC} = \overline{CB}$ = 3 cm

Q19 (Answer not required).

20.



ABCD is a trapezium AB || CD

21. (i) Correct (Both are radii if the same chords).

(ii) Not correct ($\angle$ACO and $\angle$ AEB are not subtended by the same chords).

(iii) Not correct (same reason as above).

(iv) Correct (angles substandard by the same chords).

(v) Correct (equal chord subtend equal angles).

(vi) Not correct ($\overline{AB}$ is a diameter and $\overline{AE}$ is a segment).

(vii) Correct ($\overline{CD}$ is radius of the circle and is the longest distance between two points on the circumference).

14 Perimeter and Area

Exercise 14A

1. (i) Perimeter
   (ii) 1600 mm^2
   (iii) A of trapeziums = $\frac{1}{2}$ $(a + b)h$
   (iv) Area of rhombus = $\frac{1}{2}$ xd, xd
   (v) 22.30

2. (i) True: A = 12 × 12 = 144 m^2
   (ii) False In an isosceles triangle, two side are equal
   The three sides of the triangle sum up to 15 m
   (iii) False: An equilateral triangle
   Perimeter = sum of length of all sides
   = 16 + 16 + 16 = 48 cm
   (iv) False: Area of a rhombus = Product of the diagonals ÷ 2.
   (v) True:
   Area of a triangle = $\frac{\text{base} \times \text{height}}{2}$

3. In 1 hour she travels 40 Km
   In 3 hours, she travels 40 × 3
   = 120 Km
   ∴ the girl travels 120 km in 3 hours.

4. Distance between the cities = 165 Km
   Time taken by Yasir to travel = 3 hr
   Speed = $\frac{\text{Distance}}{\text{Time}}$
   = $\frac{165}{3}$
   = 55 Km / hr
   ∴ Yasir travels with the speed of 55 Km/ hr

5. In 1 second, the whale travels 8 m
   In 1 minute, the whale travels 8 × 60 m
   In 2 minutes, the whale travels
   8 × 60 × 2 = 960 m
   ∴ the whale travels 960 m in 2 minutes.

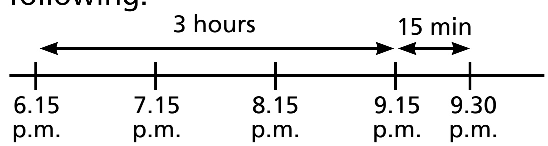
6. 84 km is travelled in 1 hour
   1 Km is travelled in $\frac{1}{84}$ hr
   672 Km is travelled in = $\frac{1 \times 672}{84}$ hr
   = 8 hr
   ∴ It takes 8 hours to travel 672 m at 84 Km/ hr.

7. Ahmed left home at 4.30 p.m.
   He spent 2 hours 25 minutes with his friend.

	hr	min
	4	30
+	2	25
	6	55

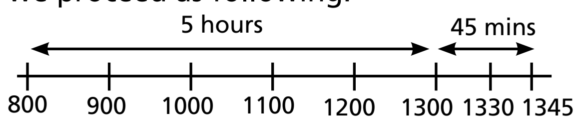
   ∴ He came back at 6.55 p.m.

8. The circus show started at 6. 15 p.m.
   The circus show ended at 9.30 p.m.
   To find the time duration, we proceed as following:



   ∴ the duration of the show is 3 hr 15 min
   = 195 minutes

9. To find the duration of the school time, we proceed as following:



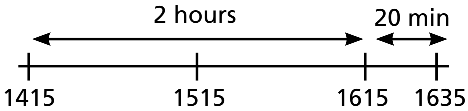
   ∴ the school works for 5 hours + 45 min
   = 5hr 45 min

10. Marium started her work at 2.15 p.m.
    = 14. 15 hours

(Converting into 24- hour time).

She completed her work at 16. 35 hours.

Time taken by Marium is calculated as following:



$\therefore$ time taken by Marium

= 2 hr + 15 min + 5 min

= 2 hr 20 min

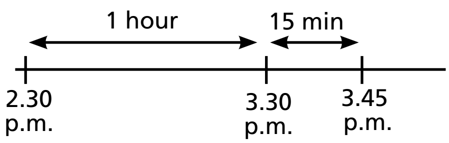
11. At first, Bazil watched the match for the following: time duration.

$\therefore$ He watched the match for

45 min + 50 min = 95 min

= 1 hr 35 min

Then, he watched the match again for the following time duration.



He watched the match again for 1 hr 15 min.

$\therefore$ The total time for which he watched the match is 1 hr 35 min + 1 hr 15 min

= 2hr 25 min

12. Let the breadth of rectangle be x cm

then, length = $2x$ cm

12 = $2x$

x = 6 cm

Perimeter = $2(l + b)$

= 2(12 + 6)

= 36 cm

13. Perimeter of rectangular land = $2(l + b)$

= 2(8 + 5)

= 26 m

The length of wire needed to fence the field once = 26 m

The length of wire for fencing 4 lines

= 26×4

= 104 m

14. The perimeter of rectangular garden

= $2(l + b)$

= 2(105 + 75)

= 2 + 180

= 360 m

Now, 360 m will make 1 round

3600 m will make 10 rounds.

15. (i) Area of the big square = 15×15

= 225 m^2

Area of the small square = $9 \times 9 = 81$ m^2

Area of the shaded part = Area of the big square – Area of the small square

= 225 – 81

= 144 sq. metres

(ii) Area of shaded parts = Area of larger rectangle + area of triangle.

Rectangle:

Length = 8 m + 4 m = 12 m

breadth = 5 m

Area = $5 \times 12 = 60$ m^2

Triangle:

Base = 8 m

height = 5 m

Area = $\frac{8 \times 5}{2} = 20$ m^2

Area of shaded part

= 60 + 20

= 80 sq. metres

(iii) Area of rhombus = $\frac{1}{2} \times d_1 \times d_2$; where d_1 and d_2 are the diagonals of the rhombus.

A = $\frac{1}{2} \times 10 \times 12$

= 60 sq. metres

Area of $\frac{1}{4}$ of the rhombus = $60 \div 4$

= 15 sq. metres

16. Area covered by 1 tile = 20 sq. centimeter

$\frac{20}{10000}$ = 0. 0 0 2 m

Area covered by 1050 tiles = 0.002 × 1050

= 2.100 sq. metres

= 2.1 sq. metres

17. Area of the floor = length × breadth

= 12 × 9

= 108 sq. metres

Cost of tiling 1 sq. metre of the floor = Rs 50

Cost of tiling 108 sq. metres of the floor

= 108 × 50

= Rs 5400

18. The area of the rectangular wall = 5 m × 7 m

= 35 m^2

The area of the door = 2 m × 0.9 m

= 1.8 m^2

The remaining area of the wall = Area of the wall – area of the door

= 35 m^2 – 1.8 m^2

= 33.2 m^2

∴ the remaining area of the wall = 33.2 m^2

19. The area of the field = 2.5 × 1.5

= 3.75 Km

The area of the field used for growing potatoes

= 3.75 – 1.25

= 2.50 km^2

∴ the area for growing potatoes = 2.5 Km^2

Exercise 14B

1. Area of a circle = πr^2; π = 3.142

Area = $3.142 \times (3.5)^2$

= 3.142×12.25

= 38.4895 cm^2

2. Area of the circular garden = πr^2

= $3.142 \times (42)^2$

= 5542.488 m^2

3. Area of the circle = πr^2

Given:

Area = 616 cm^2

$\pi = \frac{22}{7}$

∴ $616 = \frac{22}{7} \times r^2$

$r^2 = \frac{\overset{28}{\cancel{56}}\ \cancel{616} \times 7}{\underset{2}{\cancel{22}}}$

$r^2 = 196$

r $\sqrt{196}$

$= \sqrt{14 \times 14}$

= 14 cm

4. Internal radius of the ring = 3 cm

External radius of the ring = 10 cm

Area of the circle = πr^2

Area of the internal circle = $3.142 \times (3)^2$

= 3.142 × 9

= 28.278 cm^2

Area of the external circle = $3.142 \times (10)^2$

= 3.142 × 100

= 314.2 cm^2

Area of the circular ring = 314.200 – 28.278

= 285.922 cm^2

5. Diameter of first circle = 4 cm

∴ Radius r_1 = 2 cm

Diameter of second circle = 6 cm

Radius r_2 = 3 cm

Area A_1 = $\pi (r_1)^2$

= $3.142 \times (2)^2$

= 3.142 × 4

= 12.568 cm^2 = 13 cm^2

(rounding off to whole number)

Area A_2 = $\pi (r_2)^2$

= $3.14 \times (3)^2$

= 3.142 × 9

= 28.278 cm^2 = 28 sq. cm^2

(rounding off to nearest whole number)

$A_1 : A_2$ = 13 : 28

6. Radius of the circular park = 12 m

width of the road = 4 m

Area of circular park = $\frac{22}{7} \times (12)^2$

$= \frac{22 \times 144}{7}$

$= 452.57\ m^2$

Area of the circular park including 4 m wide road around it

$= \frac{22}{7} \times (12 + 4)^2$

$= \frac{22}{7} \times (16)^2$

$= \frac{22}{7} \times 16 \times 16$

$= 8\ 0\ 4.57\ m^2$

Area of the circular road = 804.57 – 452.57

$= 352\ m^2$

Cost of metalling the road = 352 × 600

= Rs 211,200

7. The diameter of the wheel = 44 cm

The radius of the wheel = 44 ÷ 2

= 22 cm

= 0.22 m

Circumference of the wheel = $2 \times \pi \times r$

= 2 × 3.142 × 0.22

= 1.382 m

In one revolution wheel covers

= 1.382 m

In 450 revolution it covers = 1.382 × 450

= 621.9 m

= 622 m

8. Radius of the bus wheel = 50 cm

$= \frac{50}{100} = 0.5$ m

$= \frac{0.5}{1000}$ km

= 0.0005 km

Circumference of the bus wheel = $2\ \pi \times r$

= 2 × 3.142 × .0005

= 0.00314 km

Now, 0.00314 km is covered in 1 revolution
3 km is covered in 955 revolutions

9. The area of the rectangular field = 14.5 × 22

= 319 sq. metres

The goat can graze in a circular field with radius 2.5 m.

The area of circular field = $2 \times 3.142 \times (2.5)^2$

$= 39.275\ m^2$

The surface of the field on which the goat can not graze = 319 – 39.275

$= 279.5\ m^2$

Multiple Choice Questions 14

1. Option A is correct.

   Area of a triangle = $\frac{b \times h}{2}$

2. Option C is correct.

   Area of a rhombus = $\frac{d_1 \times d_2}{2}$

3. Option B is correct.

   length = 30 cm breadth = 15 + 5 = 20 cm

   Area of rectangles = $l \times b$

4. Option C is correct.

   Perimeter = sum of length of all the sides. The unit should be cm

5. Option D is correct.

   A trapezium cannot be divide into two squares or rectangles, because its two sides are non-parallel.

   Area of trapezium = $\frac{d_1 \times d_2}{2}$

6. Option A is correct.

   Radium = Diameter/2

7. Option B is correct.

8. Option C is correct.

9. Option C is correct.

   First we find the speed partner, then convert the speed in m/s.

10. Option A is correct.

    Convert 105 minutes into hours and minute.

    By adding both the times we get answer.

15 Volume and Surface Area

Exercise 15

1. (i) $(\frac{1}{2} bh) \times l$
   (ii) $2\pi r (h + h)$
   (iii) two
   (iv) $\pi r^2 h$
   (v) $2\pi r$

2. (i) true
   The circumference defines the length of the boundary of the circle.
   (ii) True
   A cylinder is formed by stacking circles of negligible thickness, upon each other. By stacking, the circles we get cylinder with height 'h'. A circle has two dimensions and 'h' is the third dimension. Therefore, the cylinder is a 3D object.
   (iii) False
   The surface area of a cylinder consists of one rectangle and two circles.
   (iv) False
   The volume of a cylinder has three dimension.
   (v) True

3. l = 2 m, b = 80 cm, and h = 60 cm
   Volume of a cuboid $= l \times b \times h$
   $= 200 \times 80$ x 60

Helpful Hint:
2 m = 200 cm

$= 960000$ cm^3
$= 960000 \div 1000000$
$= 0.96$ m^3

Surface Area of a cuboid
$= 2(lb + bh + hl)$
$= 2(200 \times 80 + 80 \times 60 + 60 \times 200)$
$= 2(16000 + 4800 + 12000)$
$= 2 \times 32800$
$= 65,600$ cm^2
$= 65600 \div 10000$
$= 6.56$ m^2

4. Volume of a cube $= l^3$, where l is the length of each side
   Volume $= 1.5 \times 1.5 \times 1.5$
   $= 3.375$ m^3
   Surface Area $= 6l^2$
   $= 6 \times 1.5 \times 1.5$
   $= 13.5$ cm^2

5. The edge of the cube = 80 cm
   Volume $= 80 \times 80 \times 80$
   $= 512000$ cm^3
   Surface Area $= 6 \times 80 \times 80$
   $= 38400$ cm^2
   If edge is decreased by 10%
   decrease $= \frac{\overset{1}{\cancel{10}}}{\underset{\cancel{10}}{\cancel{100}}} \times \overset{8}{\cancel{80}} = 8$ cm
   New length of edge $= 80 - 8 = 72$ cm
   Decreased volume $= 72 \times 72 \times 72$
   $= 373248$ cm^3
   Actual decrease in volume $= 512000 - 373248$
   $= 138752$ cm^3
   % decrease in volume $= \frac{138752}{512000} \times 100\%$
   $= 27.1\%$
   Now, decreased surface area $= 6 \times 72 \times 72$
   $= 31104$ cm^2

Actual decrease in surface area

$= 38400 - 31104$

$= 7296 \text{ cm}^2$

% decrease in surface area

$= \frac{7296}{38400} \times 100\%$

$= 19\%$

Hence, volume is decreased by 27.1% or 138752 cm^3

Surface area is decreased by 19% or 7296 cm^2

6. Length of the wall = 30 m

Height of the wall = 2.5 m

Thickness of the wall = 50 cm = 0.5 m

Volume of the wall $= 30 \times 2.5 \times 0.5$

$= 37.5 \text{ m}^3$

Length of the brick = 20 cm

Width of the brick = 10 cm

Thickness of the brick = 7.5 cm

Volume of the brick $= 20 \times 10 \times 7.5$

$= 1500 \text{ cm}^3 = 0.0015 \text{ m}^3$

Number of bricks required to build the wall

$= \frac{37.5}{.0015}$

$= \frac{\overset{25}{\cancel{375}}\ \overset{1000}{\cancel{10000}}}{\cancel{15}_1\ \cancel{10}_1}$

$= 25\,000$

7. The volume of cube 1 $= 3 \times 3 \times 3 = 27 \text{ cm}^3$

The volume of cube 2 $= 4 \times 4 \times 4 = 64 \text{ cm}^3$

The volume of cube 3 $= 5 \times 5 \times 5 = 125 \text{ cm}^3$

Total volume of melted metal

$= 27 + 64 + 125 = 216 \text{ cm}^3$

Hence, the volume of new cube $= 216 \text{ cm}^3$

One edge of the new cube $= \sqrt[3]{216 \text{ cm}^3}$

$= \sqrt[3]{6 \times 6 \times 6}$

$= 6$ cm

the surface area of new cube $= 6l^2$

$= 6 \times 6 \times 6$

$= 216 \text{ cm}^2$

$\therefore$ (i) the volume of the new cube $= 216 \text{ cm}^3$

(ii) the surface area of the new cube $= 216 \text{ cm}^2$

8. Volume of a cylinder $= \pi r^2 h$

Surface Area of a cylinder $= 2 \pi r (h + r)$

Radius = 7 cm

Height = 30 cm

Volume $= \pi r^2 h$

$= \frac{22}{7} \times (7)^2 \times (30)$

$= \frac{22}{\cancel{7}} \times 7 \times 7 \times 30$

4620 cm^3

Surface Area $= 2 \pi r (h + r)$

$= 2 \times \frac{22}{7} \times 7(30 + 7)$

$= 2 \times \frac{22}{\cancel{7}} \times \cancel{7} \times 37$

$= 1628 \text{ cm}^2$

9. Circumference of a circle $= 2 \pi r$

$44 = 2 \times \frac{22}{7} \times r$

$r = \frac{\overset{2}{\cancel{44}} \times 7}{\cancel{2} \times \cancel{22}}$

$= 7$ cm

Volume of a cylinder $= \pi r^2 h$

$= \frac{22}{7} \times (7)^2 \times 10$

$= \frac{22}{\cancel{7}} \times \cancel{7} \times 7 \times 10$

$= 1540 \text{ cm}^3$

10. Let the height of the cylinder be $\times$ cm.

Radius of the cylinder $= \frac{x}{7}$ cm

Area of curved surface of a cylinder $= 2 \pi r h$

$176 = 2 \times \frac{22}{7} \times \frac{x}{7} \times x$

$$x^2 = \frac{\cancel{176}^{\cancel{8}^{4}} \times 7 \times 7}{\cancel{2} \times \cancel{22}}$$

x^2 = 196 cm^2

x = 14 cm

$\therefore$ Height of the cylinder = h = 14 cm

Radius of the cylinder = r = $\frac{14}{7}$ = 2 cm

Volume of the cylinder = $\pi r^2 h$

$= \frac{22}{\cancel{7}} \times 2 \times 2 \times \cancel{14}$

= 176 cm^2

11. Diameter of the pillar = 1.4 m

Radius of the pillar = 0.7 m

Height of the pillar = 6 m

Area of curved surface of one pillar = $2 \pi r h$

= 2 × 3.142 × 0.7 × 6

= 26.39 m^2

Area of curved surface of 4 pillar

= 26.39 × 4

= 105.56 m^2

Cost of painting one square metre = Rs 10

Cost of painting 105.56 m^2 = 10 × 105.56

= 1055.60

= Rs 1056

12. Volume of the prism = $(b \times h) \times l$

Where $\frac{1}{2}$ bh is the base area and l is height of prism

Volume of the prism = 87.5 cm^3

87.5 = $\frac{1}{2}$ $(x \times 5) \times 10$

$= \frac{5x}{\cancel{2}} \times \cancel{10}^{5}$

= 25x

$\therefore$ 25x = 87.5

x = 87.5 ÷ 25

= 3.5 cm

13.

Helpful Hint:

Surface area of a triangular prism.
= $(5_1 + 5_2 + 5_3) = l + bh$
Where 5_1, 5_2, and 5_3 are the edges of the base triangle, b is the bottom edge of the base triangle, and l is the length of prism

(i) 5_1 = 7 cm 5_2 = 7 cm

5_3 = 9 cm b = 9 cm

h = 5 cm l = 11 cm

Surface are of triangular prism

= 23 × 11 + 45

= 253 + 45

= 298 cm^2

(ii) (3 + 4 + 5) × 9 + 4 × 3

= 12 × 9 + 12

= 108 + 12

= 120 cm^2

(iii) (6 + 6 + 7) × 13 + 7 × 8

= 19 × 13 + 56

= 303 cm^2

Multiple Choice Questions 15

1. Option C is correct.

Volume of a cuboid = $l \times b \times h$

= 6 × 5 × 12 = 360 cm^3

2. Option C is correct.

Volume of the prism $(\frac{1}{2}\ b \times h) \times l$

3. Option A is correct.

Volume of cylinder = $\pi r^2 h$

$= \frac{22}{7} \times 2 \times 2 \times 12$

= 150.85 cm^3

4. Option B is correct.

500 ÷1000000

$= .0005 \text{ m}^3$

5. Option B is correct.

   Volume of cylinder = $\pi r^2 h$

   $$4224 = \frac{22}{7} \times 8 \times 8 \times h$$

   $$\frac{\cancel{4224}^{\cancel{528}^{\cancel{66}^{3}}} \times 7}{\cancel{22} \times \cancel{8} \times \cancel{8}} = 21 \text{ cm}$$

Revision 5: Mensuration

1. (i) Area of the bigger rectangle:

$l = 30$ m; $b = 24$ m

Area $= l \times b$

$= 30 \times 24$

$= 720$ m^2

Area of the smaller rectangle:

$l = 30 - 12 = 18$ m

$b = 24 - 8 = 16$ m

Area $= l \times b$

$= 18 \times 16$

$= 288$ m^2

Area of the shaded part

= Area of bigger rectangle – Area of smaller rectangle

$= 720 - 288 = 432$ m^2

(ii) Area of the rectangle $= l \times b$

$= 12 \times 8$

$= 96$ m^2

Area of the triangle $= \frac{1}{2} \times b \times h$

$= \frac{1}{\cancel{2}} \times \cancel{12}^{6} \times 8$

$= 48$ m^2

Area of shaded part = Area of rectangle – Area of triangle

$= 96$ m^2 – 48 m^2

$= 48$ m^2

(iii) In the given rhombus:

$d_1 = 10$m; $d_2 = 16$m

Area of rhombus $= \frac{1}{2} \times d_1 \times d_2$

$= \frac{1}{\cancel{2}} \times 10 \times 16$

$= 80$ m^2

Area of unshaded triangle $= \frac{1}{2} \times b \times h$

$\frac{1}{2} \times \cancel{10}^{10} \times 8$

$= 40$m^2

Area of shaded part = Area of rhombus – Area of unshaded part

$= 80$ m^2 – 40 m^2

$= 40$ m^2

(iv) We see two triangles in shaded part.

One triangle is with base 12 cm and height 12 cm

Area $= \frac{b \times h}{2} = \frac{12 \times 12}{2} = 72$ cm^2

The other triangle is with base 8 cm and height 12 cm.

Area $= \frac{b \times h}{2} = \frac{8 \times 12}{2} = 48$ cm^2

Total area of shaded part $= 72$ cm^2 + 48 cm^2

$= 120$ cm^2

2. Length of the rectangle = 16 m

Perimeter of the rectangle = 52 m

P = $2(l + b)$

52 = $2(16 + b)$

52 = $32 + 2b$

$2b$ = $52 - 32$

$2b$ = 20

b = 10 m

∴ breadth of the rectangle = 10 m

Area of the rectangle $= l \times b$

$= 16 \times 10$

$= 160$ m^2

3. One side of a square field is 12 m

Area of the square field = l^2

= 12×12

= $144\ m^2$

Cost of levelling $1\ m^2$ = Rs 2.50

Cost of levelling $144\ m^2$ = 144×2.50

= Rs 360

4. Area of the rectangular hall

= 12×20 = $240\ m^2$

Area of the square slab = 40×40

= 1600 cm = $0.16\ m^2$

Number of slabs required to cover the floor

= $240 \div 0.16 = 1500$

Cost of single slab = Rs 15

Cost of 1500 slabs = 15×1500

= Rs 22500

5. Area of a rectangular region = $840\ m^2$

Breadth of the rectangular region = 15 m

Area of a rectangular region = $l \times b$

$\therefore$ Length = $\dfrac{\text{Area}}{\text{breadth}}$

Length of rectangular region = $\dfrac{840}{15}$ = 56 m

Perimeter of a rectangular region = $2\ (l + b)$

= $2(56 + 15)$

= 2×71

= 142 m

6. Area of parallelogram field = base x height

= 15×8

= $120\ m^2$

Cost of watering $1\ m^2$ = Rs 20

Cost of watering $120\ m^2$ = 120×20

= Rs 2400

7. Area of a rhombus = $80\ m^2$

Perimeter of the rhombus = 40 m

$\therefore$ One side of the rhombus = 10 m

Divide the rhombus into two triangles

Area of each triangle = $40\ m^2$

Area of triangle = $\dfrac{1}{2} \times b \times h$

Base of the triangle = 10 m

$40 = \dfrac{1}{2} \times 10 \times h$

h = 8 m

Height = 8 m

8. Base of the triangle = 12 cm

Altitude of the triangle = 8 cm

Area of the triangle = $\dfrac{1}{2} \times b \times h$

= $\dfrac{12 \times 8}{2}$

= $48\ cm^2$

9. Perimeter of square plot = 15×4

= 60 m

Perimeter of the square plot = Perimeter of the rectangular plot = 60 m

$\therefore$ 60 = $2\ (l + b)$

60 = $2\ (18 + b)$

60 = $36 + 2b$

$2b$ = $60 - 36$

$2b$ = 24

b = 12 m

Now,

Area of square plot = $l \times b$

= 15×15 = $225\ m^2$

Area of rectangular plot = $l \times b$

= $18 \times 12 = 216\ m^2$

Square plot has greater area.

$225 - 216 = 9\ m^2$

$\therefore$ Square plot has greater area by $9\ m^2$.

10. Area of the rectangular lawn

= $l \times b$

= $20 \times 16 = 320\ m^2$

After surrounding by 2 m wide path,

$l = 20 + 2 + 2 = 24$ m

$b = 16 + 2 + 2 = 20$ m

Area of the lawn including surrounded path

= 24×20

= $480\ m^2$

Area of the path = Area of the lawn including path – Area of the lawn without path

= 480 m^2 – 320 m^2

= 160 m^2

Cost of levelling 1 m^2 = Rs 12

Cost of levelling 160 m^2 = 160 × 12

= Rs 1920

11. Area of a parallelogram = $b \times h$; where b is the base and h is altitude or height of the parallelogram.

base = 20 cm = .20 m

3.20 m^2 = 0.20 × h

$h = \frac{3.20}{0.20}$

= 16 m

12. The dimensions of the pit are

l = 4.8 m

b = 2.5 m

h = 2 m

The volume of earth removed from the pit

= 4.8 × 2.5 × 2

= 24 m^3

13. The dimensions of the cuboid are:

l = 4 m

b = 3 m

h = 2 m

Surface Are of a cuboid = 2($lb + bh + lh$)

= 2 (4 × 3 + 3 × 2 + 4 × 2)

= 2 (12 + 6 + 8)

= 2 (26)

= 52 m^2

14. The area of 4 walls = 2 (12 × 8) + 2 (4 × 12)

= 2 × 96 + 2 × 48

= 192 + 96

= 288 m^2

15. (i) Area of square = $l \times b = l^2$

Perimeter of square = 2 ($l + l$) = 4l

80 = 4l

l = 20 cm

Area of square = 20 × 20

= 400 cm^2

(ii) Area of square = 16 × 16

= 256 cm^2

Area of rectangle = 20 × 13

= 260 cm^2

Area of rectangle is larger by 4 cm^2

16. Area of rectangle = 3 × 4 = 12 cm^2

3 times the over = 12 × 3 = 36 m^2

Area of square = l^2

l^2 = 36 m^2

l = 6 m

17. Area of the garden = 40 × 30 = 1200 m^2

dimensions of garden after making path are

l = 40 + 3 + 3 = 46 m   b = 30 + 3 + 3 = 36 m

Area of garden with path = 46 × 36 = 1566

Area of path = 1656 – 1200

= 456 m^2

18. Surface are of a cylinder = 2πr (h + r)

r = 14 cm + h = 12 cm

Surface area = $2 \times \frac{12}{\pi} \times \cancel{14}^{2}$ (12 + 14)

= 88 × 26

= 2288 cm^2

19. Area of the square ABCD = 16 × 16 = 256 cm^2

Area of triangle ADF = $\frac{16 \times 8}{2}$ = 64 cm^2

Area of triangle CFF = $\frac{8 \times 8}{2}$ = 32 cm^2

Area of shaded part = Area of square – area of unshaded region

= 256 cm^2 – 96 cm^2

= 160 cm^2

20. (i) Surface area of triangular prism

= $(s_1 + s_2 + s_3) \times l + bh$

= (5 + 5 + 6) x 12 + 4 × 6

= 16 × 12 + 24

= 192 + 24

= 216 cm^2

(ii) Surface area of the cube = $6l^2$

$6l^2 = 96 \text{ cm}^2$

$l^2 = 16 \text{ cm}^2$

$l = 4$ cm

Volume of the cube = l^3

$= 4 \times 4 \times 4$

$= 64 \text{ cm}^3$

21. The perimeter of the floor = 64 m

Total length of the four walls = 64 m

Height of the hall = 5 m

Area of all 4 walls = 64×5

$= 320 \text{ m}^2$

Cost of painting per sq.m = Rs 8

Cost of painting $320 \text{ m}^2 = 320 \times 8$

= Rs 2560

22. Area of Δ ABC = $\frac{1}{2} \times \text{base} \times \text{height}$

$= \frac{1}{2} \times 16 \times 6$

$= 48 \text{ cm}^2$

Area of Δ ACD = $\frac{1}{2} \times 16 \times 4$

$= 32 \text{ cm}^2$

Area of ABCD = Area of Δ ABC + Area of Δ ACD

$= 48 + 32$

$= 80 \text{ cm}^2$

23. Volume of a cylinder = $\pi r^2 h$

$2310 = \frac{22}{\cancel{7}} \times \cancel{7} \times 7 \times h$

$2310 = 154\,h$

$h = 2310 \div 154$

$h = 15$ cm

24. (i) Area of rectangle = $l \times b$

$= 20 \times 14 = 280 \text{ cm}^2$

The four unshaded triangles are equal.

Total area = $4\left(\frac{b \times h}{2}\right)$

where $b = 10$, $h = 7$

$= 4 \times \left(\frac{10 \times 7}{2}\right)$

$= \frac{4 \times \overset{5}{\cancel{10}} \times 7}{\cancel{2}} = 140 \text{ cm}^2$

Area of shaded region = 280 – 140

$= 140 \text{ cm}^2$

Therefore, option B is correct.

(ii) Area of parallelogram = base $\times$ height

$210 = \text{base} \times 14$

$\text{base} = 210 \div 14$

= 15 cm

= 0.15 m

Therefore, option D is correct.

25. Volume of the triangular prism

= Base area $\times$ height

$= 280 \times 35$

$= 9800 \text{ cm}^3$

$= 9800 \div 1000000$

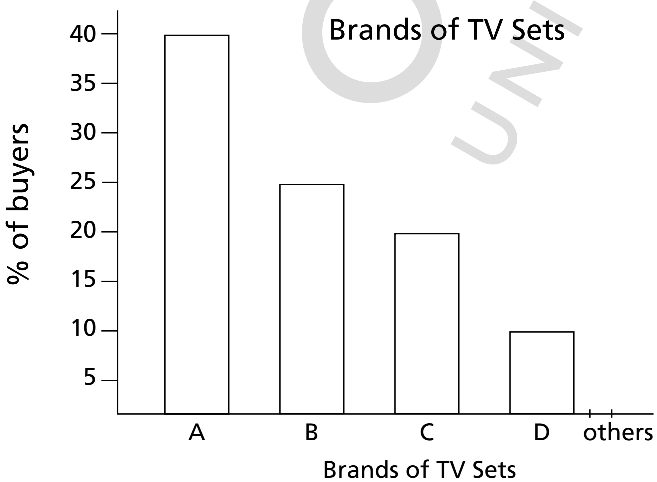
$= 0.0098 \text{ m}^3$

16 DATA HANDLING

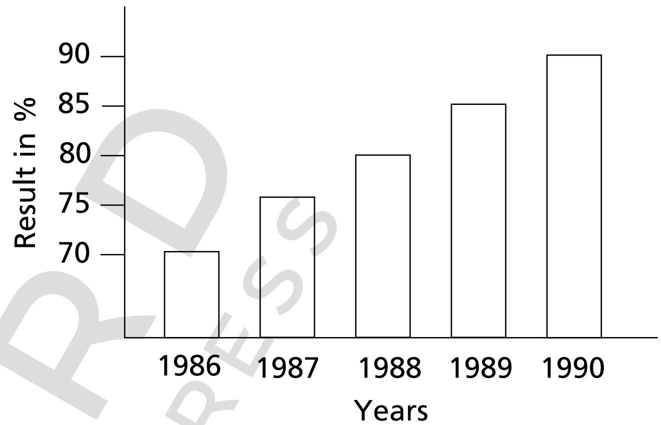
Exercise 16A

1. (i) raw
   (ii) class interval
   (iii) frequency
   (iv) height
   (v) 360°
2. (i) True
   (ii) True
   Range is the number which tells the difference between smallest and greatest data values.
   (iii) True
   Data value is represented by the height of the bar, i.e. y-axis
   (iv) True
   Pie chart is a circular chart and it interprets the data by measuring the sizes of different sectors.
   (v) True
   Class frequencies tell about how many times a data occurs, therefor, sum of class frequencies is same as number of data items.

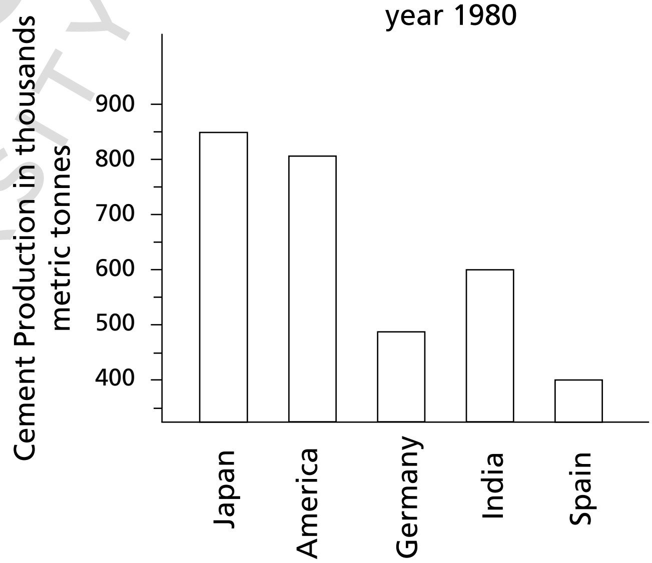
3. Market Position of Different Brands of TV Sets



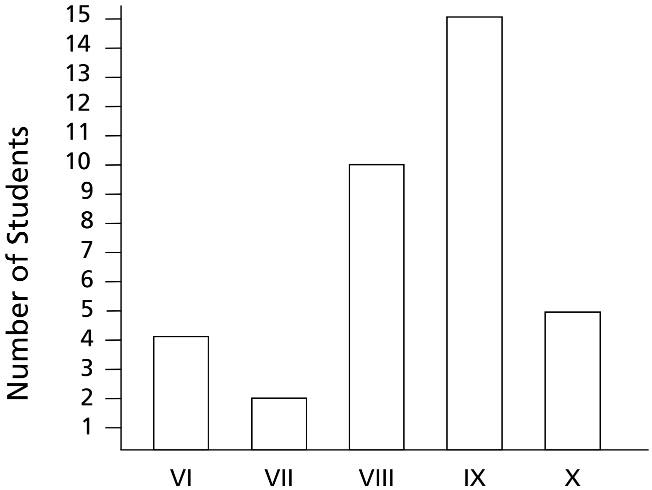
4. Class X result for the last five years



5. Cement Production during year 1980

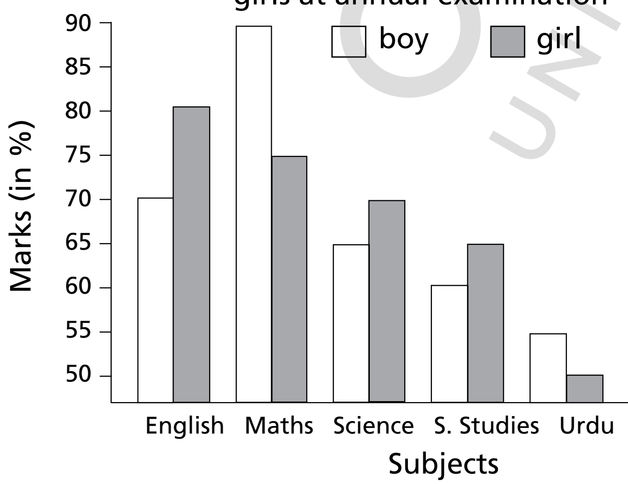


6. Number of students who like to play cricket



7. Number of applicants registered with the Employment Exchange (1985–1989)

8. Comparative score of boys and girls at annual examination



9. (i) 90°

(ii) Sum of the angles of the sectors of:

Banana + Mango + Apple + Peach = 360°

90° + 80° + 160° + Peach = 360°

330° + Peach = 360°

∴ Angle of sector of Peach = 360° – 330°

= 30°

(iii) Sector area of 30° represents 3 students.

10° represents I student

Hence, 90° represents $\frac{90}{10}$ = 9 students

Number of students like banana = 9

Number of students like mango

$= \frac{80}{10} = 8$

Number of students like apple

$= \frac{160}{10} = 16$

Number of students like peach

$= \frac{30}{10} = 3$

Total number of students = 9 + 8 16 + 3

= 36 students

(iv) % of students like bananas

$= \frac{\cancel{90}}{\cancel{360}_4} \times \cancel{100}^{25}\ \%$

= 25%

10. Total number of people

= 240 + 180 + 60 + 120 = 600

Cricket:

Percentage = $\frac{\cancel{240}^{40}}{\cancel{600}} \times \cancel{100}\% = 40\%$

Angle of sector = $\frac{\cancel{240}^4}{\cancel{600}_{\cancel{10}}} \times \cancel{360°}^{36} = 144°$

Hockey:

Percentage = $\frac{\cancel{180}^3}{\cancel{600}_{\cancel{6}_1}} \times \cancel{100}\% = 30\%$

Angle of sector = $\frac{\cancel{180}^3}{\cancel{600}_{\cancel{10}_1}} \times \cancel{360}^{36} = 108°$

Tennis:

Percentage = $\frac{\cancel{60}^{10}}{\cancel{600}_{\cancel{6}\,1}} \times \cancel{100} = 10\%$

Angle of sector = $\frac{\overset{1}{\cancel{60}}}{\cancel{600}_{\cancel{10}\,1}} \times \overset{36}{\cancel{360^\circ}} = 36^\circ$

Basket ball:

Percentage = $\frac{\cancel{120}}{\cancel{600}_{\cancel{100}\,1}} \times \overset{1}{100} = 20\%$

Angle of sector = $\frac{\cancel{120}^{2}}{\cancel{600}_{\cancel{10}}} \times \overset{36}{\cancel{360^\circ}} = 72^\circ$

11. (i) In week 2 he sold 10 candies.
   (ii) In the first 4 weeks he sold 100 candies.
   (iii) In week 2 he sold 10 less candies then week 1.
   (iv) He sold 150 candies altogether in six weeks.
   (v) The average number of candies

$= \frac{\text{Total number of candies}}{\text{number of week}}$

$= \frac{150}{6}$

$= 25$

$\therefore$ He sold 25 candies as average of per week.

Exercise 16 B

1. (i) Central tendencies
   (ii) Mean
   (iii) Mode

   Mode is the value which occur most in the data.

   (iv) $\frac{\Sigma Wx}{\Sigma W}$

   Weighted mean is the mean of the data having different weights assigned to the values.

   (v) $\frac{\Sigma x}{n}$; where Σx is the sum of values and n is the number of values.

2. (i) True (by definition)
   (ii) True: Mode of data can be found by simply counting the values. However, for bigger data, making tally chart or arranging in descending order is more helpful.
   (iii) True: the median and mode are the average values of the data which define central tendencies.
   (iv) True
   (v) True: There may be some values is the data which occur equal numbers of time, so a data can have more than one mode.

3. The mean of the data = $\frac{\Sigma x}{n}$

$= \frac{5 + 11 + 6 + 17 + 2 + 7}{6}$

$= \frac{48}{6}$

$\therefore$ Mean = 8

To find median, we arrange the data is ascending order

2, 5, (6, 7) 11,17

The two middle values are 6 and 7.

The mean of 6 and 7 is $\frac{6 + 7}{2} = \frac{13}{2} = 6.5$

$\therefore$ Median = 6.5

Mode is the most occurring value of the data. The given data has no mode.

4. Range of the data = highest value – lowest value

-= 111 – 81 = 30

We can take class width of 5 to make 6 intervals. so, class width $= \frac{30}{6} = 5$

Number of class intervals = 6

Class intervals	Tally	Frequencies
80 – 85	卌	5
86 – 91	卌 I	6
92 – 97	卌 I	6
98 – 103	卌 I	6
104 – 109	卌 I	6

110 – 115	I	1

5. First 15 natural numbers = 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 11, 12, 13, 14, 15

Sum of numbers = 115

Number of values = 15

Mean = $\frac{\sum x}{n}$

= $\frac{115}{15}$ = 7.66

6. First eight even natural numbers are 2, 4, 6, 8, 10, 12, 14, 16

Sum of the first eight natural numbers

=72

Mean of the first eight natural numbers

= 72 ÷ 8

= 9

7. Average salary of 25 workers = Rs 2500

Total salary of 25 workers = 2500 * 25

= Rs 62500

The salary of the manager = Rs 35000

Total salary of 26 employees

= 62500 + 35000

= Rs 97500

Average salary of 26 employees

= 97500 ÷ 26

= Rs 3750

8.

x	11	13	15	18	19	20	21	22
f	4	3	7	16	4	3	2	1
$\sum x$	44	39	105	288	76	60	42	22

$\sum fx$ = 506

$\sum f$ = 40

Mean = $\frac{\sum fx}{\sum f}$

Mean = $\frac{676}{40}$

= 16.9

9. Mean = $\frac{\sum x}{n}$

$\sum x$ = 20 + 50 + 30 + 34+ 45 + 27 + 40 + 10 + 50 + 50 + 48 + 52

= 456

n = 12

Mean = $\frac{456}{12}$ = 38

Exercise 16 B

Q10. a. Mean = $\frac{\sum x}{x}$

= 16 +16 + 12 + 14 + 13 + 15 + 13 + 13 + 16 + 12 + 15 + 10/12

= 13.75

b. Median:

Arrange the numbers in ascending order:
10, 12, 12, 13, 13, 13, 14, 15, 15, 16, 16, 16

middle values are 13 and 14, so:

13 + $\frac{14}{2}$

= 13.5

c. Mode:

Arrange the numbers in ascending order:
10, 12, 12, 13, 13, 13, 14, 15, 15, 16, 16, 16

13 and 16 are the most common values. So mode = 13 and 16.

Exercise 16 C

1. (i) Certain; because it is a fact that Wednesday comes before Thursday.

(ii) Possible; because number of dots on a dice are 1, 2 3, 4, 5, and 6.

Hence, it is possible that we get a 5 by throwing a single dice.

(iii) Impossible; it is a fact that sun does not show because at 9.00 it is night time.

2. Total number of letters in PHOTOSYNTHESIS = 14

Number of S in the word = 3

Probability of choosing a S is P(S).

P(S) = $\frac{\text{Number of favourable outcomes}}{\text{1 Total number of outcomes}}$

Probability of choosing S = $\frac{3}{14}$

3. (iii), (iv), and (vi) can not be a probability, because their values are greater than 1.

(iv) can not be a probability, because probability can not be a negative number.

4. Total number of outcomes

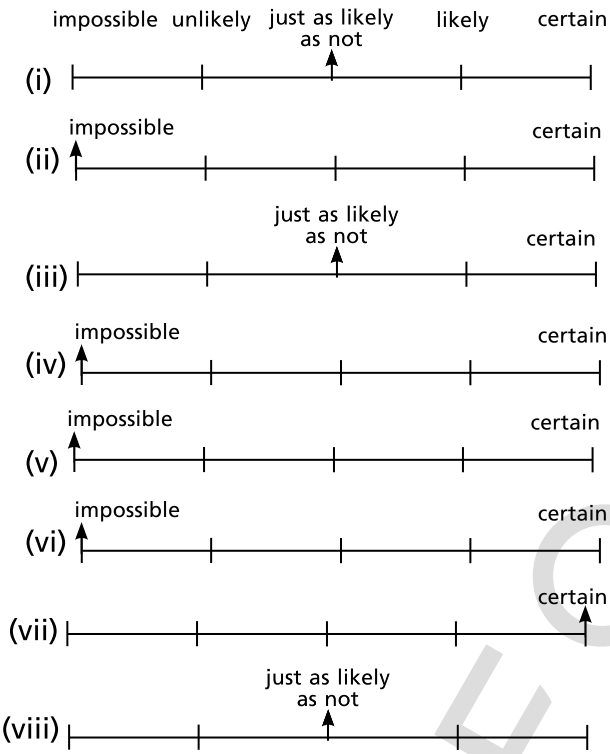
= 13 yellow balls + 17 blue balls

= 30 balls

Number of favourable outcomes i.e. yellow balls = 13

Probability of choosing a yellow ball = $\frac{13}{30}$

5.



6. Probability (P)

$$= \frac{\text{Number of favourable outcomes}}{\text{Total number of outcomes}}$$

(i) Number of green balls = 3

Total number of outcomes = 13

P (green balls) = $\frac{3}{13}$

(ii) Number of yellow balls = 6

Total number of outcomes = 13

P (green balls) = $\frac{6}{13}$

(iii) Number of red balls = 4

Total number of outcomes = 13

P (red balls) = $\frac{4}{13}$

7. There are 52 weeks in a year.

$\therefore$ there will be 52 Mondays.

The total numbers of outcomes = 52

P (one Monday to be a holiday) = $\frac{1}{52}$

8. Probability of selecting a white ribbon = $\frac{1}{7}$

P (white ribbon) = $\frac{1}{7}$

P (not a white ribbon) = $1 - \frac{1}{7}$

$= \frac{6}{7}$

9. Total number of outcomes = 8

(i) P (spinning a 5) = $\frac{2}{8}$

(ii) P (spinning a 3) = $\frac{2}{8}$

P (not spinning a 3)= $1 - \frac{2}{8}$

$= \frac{6}{8}$

(iii) P (spinning a 6) = 0

Since, there is no 6 on the spinner.

(iv) P (not spinning a 6) = 1

$\therefore$ there is no option of spinning 6.

So it is a certain event having a probability equal to 1.

Multiple Choice Questions 16

1. Option A is correct, because the event which is going to happen is a possible event.
2. Option D is correct, because 1 – 0.3 = 0.7
3. Option A is correct. There are three even numbers out of total six numbers.
4. Option D is correct, because throw of a coin can give only one possible event. Head and tail can not happen together.
5. Option B is correct.
6. Option A is correct, 8 is central value of data arranged in ascending order.
7. Option B is correct, using Mean = $\frac{\sum x}{n}$
8. Option B is correct, because 10 is occurring two times, while all the other values are occurring once.
9. Option D is correct.
10. Option A is correct, secondary data are generated by government institutions, government publications, or censuses etc.

Teacher's Note