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Mathematics Practice Book

CLASS 10

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> Uses a graded approach to generate, build and retain interest in concepts and their applications

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CLASS

10

Pearson IIT Foundation Series

Mathematics Practice Book

First Edition

Trishna Knowledge Systems

Pearson

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Head Office: 15th Floor, Tower-B, World Trade Tower, Plot No. 1, Block-C, Sector 16, Noida 201 301, Uttar Pradesh, India.
Registered Office: 4th Floor, Software Block, Elnet Software City, TS 140, Block 2 & 9, Rajiv Gandhi Salai, Taramani, Chennai - 600 113, Tamil Nadu, India.
Fax: 080-30461003, Phone: 080-30461060
www.pearson.co.in, Email: companysecretary.india@pearson.com

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Preface

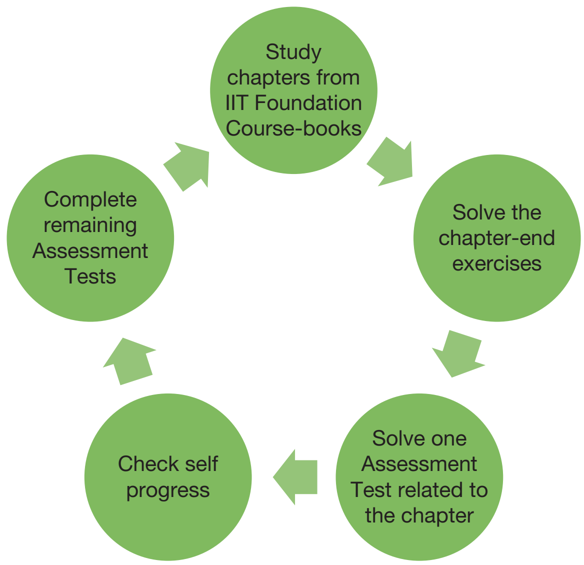
Pearson IIT Foundation Practice Book Series is designed to accompany the course-books available in this series. Developed by a team of experienced faculties, this workbook series connects the subjective knowledge to its real world applications through various text and chapter level problems. Each chapter has a set of assessment tests which are mapped to chapters covered in the course-book. These worksheets will guide students step-by-step towards understanding the central concept of that particular chapter. These tests are recommended as after class material for further practice.

Any suggestions for added or updated additional readings would also be welcome. Students can share their feedback at reachus@pearson.com.

How to Use the Practice Book

Many times, students face significant challenges in answering application level questions in Physics, Chemistry and Mathematics. These Practice Books will enhance their problem-solving skill which will definitely lead to a strong subject foundation. The entire practice book series are recommended to be used alongside IIT Foundation course-books.

Students can refer the following steps while using the practice books:



While preparing for Foundation courses, students need to learn the fundamental concepts with utmost clarity. In order to successfully complete the IIT Foundation course, one must prepare profoundly. Consistent hard work, practice and perseverance are needed throughout the year.

During any competitive examination, one must exercise clinical precision with speed since the average time available to respond to a question is hardly a minute. The aspirants should be conceptually excellent in the subject owing to the negative marking in the examination. A better practice to solve the paper would be to go for the easiest questions first and then gradually progress to the more complicated ones.

Regular practice of MCQs will assist the aspirants in preparing for the examination. In a nutshell, hard work, conceptual clarity and self-assessment are the essential ingredients to achieve success in competitive examinations. IIT Foundation course-books play an important role in understanding the concepts. Student need to read-up on all concepts/theories in a regular and systematic manner.

Course-book Chapter Flow

Class 7

1. Number Systems
2. Expressions and Special Products
3. Ratio and Its Applications
4. Indices
5. Geometry
6. Mensuration
7. Equations and their Applications
8. Formulae
9. Statistics
10. Set Theory

Class 9

1. Number Systems
2. Logarithms
3. Polynomials and Square Roots of Algebraic Expressions
4. Linear Equations and Inequations
5. Quadratic Expressions and Equations
6. Sets and Relations
7. Matrices
8. Significant Figures
9. Statistics
10. Probability
11. Banking and Computing
12. Geometry
13. Mensuration
14. Coordinate Geometry
15. Locus
16. Trigonometry
17. Percentages, Profit and Loss, Discount, and Partnership
18. Sales Tax and Cost of Living Index
19. Simple Interest and Compound Interest
20. Ratio, Proportion and Variation
21. Shares and Dividends
22. Time and Work
23. Time and Distance

Class 8

1. Real Numbers and LCM and HCF
2. Squares and Square Roots and Cubes and Cube Roots
3. Indices
4. Polynomials, LCM and HCF of Polynomials
5. Formulae
6. Ratio, Proportion and Variation
7. Percentages
8. Profit and Loss, Discount and Partnership
9. Simple Interest and Compound Interest
10. Time and Work, Pipes and Cisterns
11. Time and Distance
12. Linear Equations and Inequations
13. Sets
14. Statistics
15. Matrices
16. Geometry
17. Mensuration

Class 10

1. Number Systems
2. Polynomials and Rational Expressions
3. Linear Equations in Two Variables
4. Quadratic Equations and Inequalities
5. Statements
6. Sets, Relations and Functions
7. Progressions
8. Trigonometry
9. Limits
10. Matrices
11. Remainder and Factor Theorems
12. Statistics
13. Geometry
14. Mensuration
15. Coordinate Geometry
16. Mathematical Induction and Binomial Theorem
17. Modular Arithmetic
18. Linear Programming
19. Computing
20. Permutations and Combinations
21. Probability
22. Banking
23. Taxation
24. Instalments
25. Shares and Dividends
26. Partial Fractions
27. Logarithms

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Geometry 1

Reference: *Coursebook - IIT Foundation Mathematics Class 10; Chapter - Geometry; pp. 13.1–13.49*

Assessment Test I

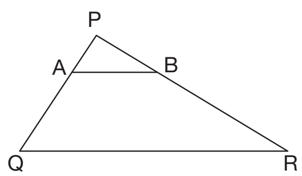
Time: 30 min.

Direction for questions 1 to 11: Select the correct answer from the given options.

Space for rough work

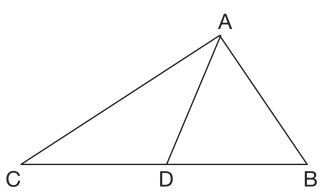
1. The following are the steps involved in proving that an angle in a semicircle is 90°. Arrange them in sequential order.
   (A) Find the value of ∠AOB.
   (B) Find the relation between ∠AOB and ∠APB.
   (C) Let AOB be a diameter of the circle and P be any point on the circle.
   (D) Find the value of ∠APB.
   (a) CADB (b) CBAD (c) CABD (d) CDBA

2. In the given figure (not to scale), PA:AQ = 1:3 and $\overline{AB} \| \overline{QR}$. If QR = 10 cm, then find the length of AB (in cm).



   (a) 2.5 (b) $\bar{3}$ (c) 3.5 (d) 4

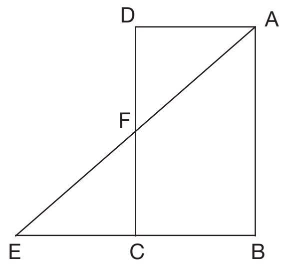
3. In the given figure (not to scale), AD is the bisector of ∠A. If AB = 9 cm, AC = 12 cm, and BC = 14 cm, then find the length of CD (in cm).



   (a) 7 (b) 6 (c) 8 (d) 9

4. In ΔABC, D is a point on AC such that BD ⊥ AC. If ∠ABC = 90°, AB = 15 cm, and BD = 12 cm, then find the length of BC (in cm).
   (a) 20 (b) 18 (c) 16 (d) 25

5. In the following figure (not to scale), ABCD is rectangle, if AB = 20 cm, BC = 12 cm, and AF:FE = 3:2, then find the length of FE (in cm).



(a) $12\sqrt{2}$ (b) $9\sqrt{2}$ (c) $8\sqrt{2}$ (d) $6\sqrt{2}$

6. In ΔABC, P and Q are on AB and AC, respectively, such that PQ||BC. If AP = $3x - 2$, PB = $2x + 7$ and AQ:QC = 2:3, then the value of x is _______.

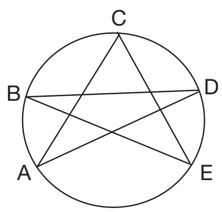
(a) 16 (b) 3 (c) 6 (d) 4

7. Incircle of a triangle touches the sides $\overline{AB}$ at P, $\overline{BC}$ at Q, and $\overline{CA}$ at R. If AB = 5 cm and CR = 3 cm, then the perimeter of ΔABC (in cm) is _______.

(a) 16 (b) 12

(c) 8 (d) 20

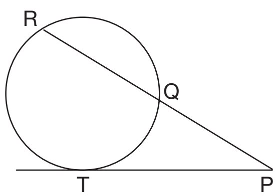
8. In the given figure (not to scale), A, B, C, D, and E are concyclic points. If ∠ACE = 50° and ∠ABD = 85°, then find the measure of ∠AED.



(a) 85° (b) 95°

(c) 135° (d) 90°

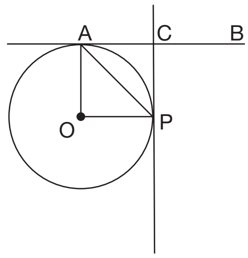
9. In the given figure (not to scale), PT is a tangent to the circle at T. PQR is a straight line. If PT = 12 cm and QR = 7 cm, then find the length of PQ (in cm).



(a) 8 (b) 9 (c) 10 (d) 16

10. In the given figure (not to scale), 'O' is the centre of the circle, and AB and PC are the tangents to the circle at A and P, respectively. If ∠PAB = 40°, then find the measure of ∠PCA.

Space for rough work



(a) 100° (b) 80°

(c) 60° (d) 70°

11. The distance between the centres of two circles with radii 4 cm and 5 cm is 10 cm. The length of their direct common tangent is ______ (in cm).

(a) $\sqrt{11}$ (b) $2\sqrt{11}$

(c) $3\sqrt{11}$ (d) $4\sqrt{11}$

Direction for questions 12 to 15: Match the values of Column A with those of Column B.

Column A (Distance between Centres of Two Distinct Circles is d and Radii are R, r (in cm))	Column B (Two Circles are)
12. $d = 5$, $R = 6$, and $r = 3$	(a) Non-overlapping
13. $d = 7$, $R = 4$, and $r = 3$	(b) Touching externally
14. $d = 5$, $R = 8$, and $r = 3$	(c) Touching internally
15. $d = 7$, $R = 3$, and $r = 3$	(d) Intersecting

Assessment Test II

Time: 30 min.

Space for rough work

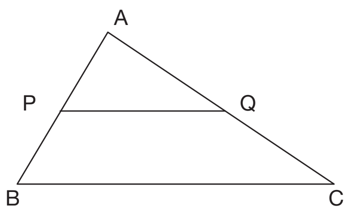
Direction for questions 1 to 11: Select the correct answer from the given options.

1. The following are the steps involved in proving that point A is on the perpendicular bisector of BC in ΔABC, where AB = AC. Arrange them in sequential order.

   (A) Write relation between BD and CD.
   (B) Draw $\overline{AD} \perp \overline{BC}$, where D is a point on BC.
   (C) Find the relation between ΔABD and ΔACD.
   (D) Find the relation among the corresponding sides or angles of ΔABD and ΔACD.

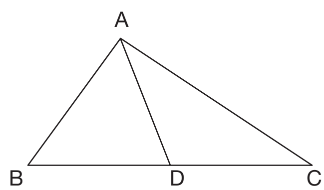
   (a) BCDA (b) DBAC (c) BDCA (d) DBCA

2. In the given figure (not to scale), PQ || BC and AQ:QC = 3:2. If PQ = 15 cm, then find the length of BC (in cm).



   (a) 25 (b) 20 (c) 18 (d) 30

3. In the given figure (not to scale), AD is the bisector of ∠A. If AB:AC = 3:4 and BC = 21 cm, then find the length of BD (in cm).



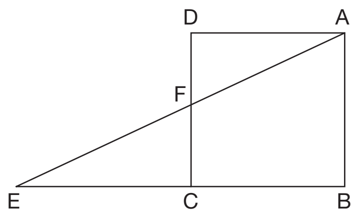
   (a) 7 (b) 9 (c) 12 (d) 15

4. In ΔABC, D is a point on AC such that BD ⊥ AC. If ∠ABC = 90°, AB = 15 cm and BC = 36 cm, then find the length of BD (in cm).

   (a) $\frac{160}{13}$ (b) $\frac{168}{13}$ (c) $\frac{175}{13}$ (d) $\frac{180}{13}$

5. In the given figure (not to scale), ABCD is a square of side 10 cm. If CE = 15 cm, then find the length of FE (in cm).

Space for rough work

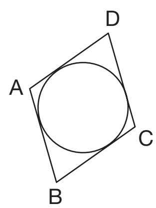


(a) $2\sqrt{29}$ (b) $3\sqrt{21}$ (c) $3\sqrt{29}$ (d) $2\sqrt{21}$

6. In ΔPQR, A and B are two points on PQ and PR, respectively, such that $AB \| QR$. If $PA = 2x + 3$, $AQ = 6x - 16$ and PB:BR = 3:4, then what will be the value of x?

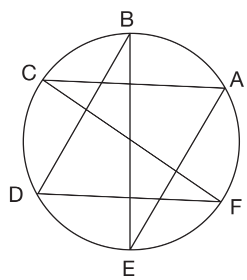
(a) 10 (b) 9 (c) 14 (d) 6

7. In the given figure (not to scale), AB = 3 cm and CD = 4 cm. The perimeter of the quadrilateral ABCD (in cm) is ________.



(a) 10 (b) 9 (c) 14 (d) 12

8. In the given figure (not to scale), A, B, C, D, E and F are concyclic points. If $\angle ACF = 35°$ and $\angle BDF = 60°$, then find $\angle BEA$.

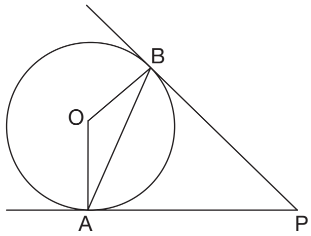


(a) 25° (b) 30° (c) 35° (d) 40°

9. The chords RQ and TS of a circle are produced to meet at P. If PQ = 6 cm, QR = 9 cm, and PS = 5 cm, then find the length of ST (in cm).

(a) 15 (b) 13 (c) 11 (d) 9

10. In the given figure (not to scale), 'O' is the centre of the circle. PA and PB are the tangents to the circle at A and B, respectively. If $\angle OAB = 25°$, then find the measure of $\angle APB$.



(a) 60° (b) 55° (c) 50° (d) 45°

11. The distance between the centres of two circles with radii 3 cm and 5 cm is 8 cm. The length of their transverse common tangent is _______ cm.

(a) $2\sqrt{2}$ (b) $3\sqrt{2}$
(c) $4\sqrt{2}$ (d) 0

Direction for questions 12 to 15: Match the values of Column A with those of Column B.

Column A (Two Circles)	Column B (Number of Common Tangents)
12. Distance between the centres of the two circles is 5 cm and radii are 2 cm and 4 cm.	(a) 0
13. Distance between the centres of the two circles is 7 cm and radii are 5 cm and 2 cm.	(b) 1
14. Distance between the centres of the two circles is 5 cm and radii are 7 cm and 2 cm.	(c) 2
15. Distance between the centres of the two circles is 7 cm and radii are 4 cm and 2 cm.	(d) 3
	(e) 4
	(f) 5

Assessment Test III

Time: 30 min.

Space for rough work

Direction for questions 1 to 14: Select the correct answer from the given options.

1. The following are the steps involved in proving the basic proportionality theorem for a ΔABC in which $\overline{DE} \| \overline{BC}$. Arrange them in a sequential order.

   (A) Draw $EP \perp AB$ and $DF \perp AC$ and join $\overline{DC}$, $\overline{BE}$.

   (B) In ΔABC, $\overline{DE} \| \overline{BC}$.

   (C) $\dfrac{AD}{DB} = \dfrac{AE}{EC}$ is required to prove.

   (D) Consider the ratio of area of ΔADE, ΔBDE and that of ΔADE, ΔCDE.

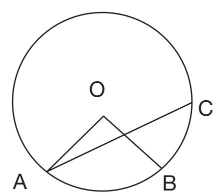
   (E) Area of triangles BDE and CDE are equal.

   (a) ABCDE (b) BCADE
   (c) CBAED (d) BEACD

2. In ΔABC, D is a point on BC such that AD is a median. Which of the following is true?

   (a) $AB^2 + AC^2 = AD^2 + BC^2$ (b) $AB^2 + BC^2 = 2AD^2 + 2AC^2$
   (c) $AB^2 + AC^2 = 2AD^2 + 2BD^2$ (d) $AB^2 + BC^2 = AC^2 + CD^2$

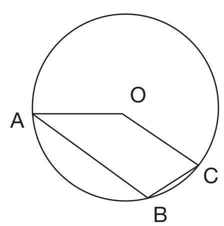
3. In the following figure, 'O' is the centre of the circle.



   If $\angle AOB = 100°$ and $\angle CAB = 30°$, then find the measure of $\angle ABC$.

   (a) 100° (b) 50° (c) 90° (d) 70°

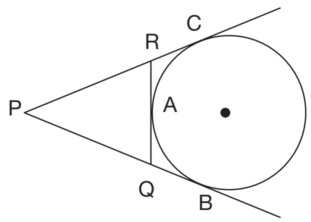
4. In the given figure, 'O' is the centre of the circle. If $\angle OAB = 50°$ and $\angle OCB = 70°$, then find the measure of $\angle AOC$.



   (a) 60° (b) 30° (c) 120° (d) 140°

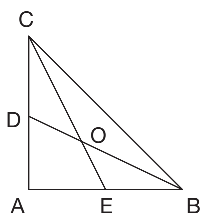
Space for rough work

5. In the given figure PB, PC, and QR are tangents to the circle at B, C, and A, respectively. If PB = 12 cm, then find the perimeter of the triangle PQR.



(a) 16 cm (b) 30 cm (c) 24 cm (d) 36 cm

6. In the given figure, $\angle CAB = 80°$. BD and CE are angle bisectors of $\angle ABC$ and $\angle ACB$, respectively. Find the measure of $\angle BOC$.



(a) 130° (b) 110° (c) 100° (d) 140°

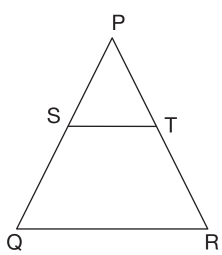
7. In a ΔPQR, M lies on PR and between P and R such that QR = QM = PM. If $\angle MQR = 50°$, then find $\angle P$.

(a) $32\frac{1}{2}^{\circ}$ (b) $37\frac{1}{2}^{\circ}$ (c) $42\frac{1}{2}^{\circ}$ (d) $47\frac{1}{2}^{\circ}$

8. Diagonal AC of a rectangle ABCD is produced to the point E such that AC:CE = 1:2. If AB = 8 cm and BC = 6 cm, find the length of DE.

(a) $12\sqrt{5}$cm (b) $10\sqrt{5}$ cm
(c) $8\sqrt{5}$cm (d) $15\sqrt{5}$cm

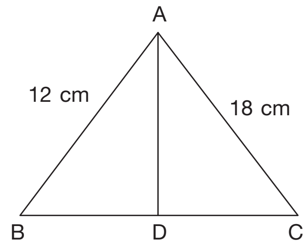
9. In the given figure, if $\overline{ST} || \overline{QR}$ and PS:PQ = 2:5 and TR = 21 cm, then the length of PT is _____.



(a) 15 cm (b) 14 cm (c) 16 cm (d) 18 cm

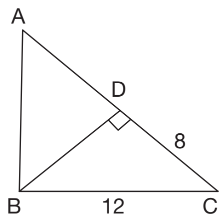
Space for rough work

10. In the given figure, if BC = 25 cm and ∠BAD = ∠CAD, then what will be the length of BD?



(a) 8 cm (b) 10 cm (c) 6 cm (d) 9 cm

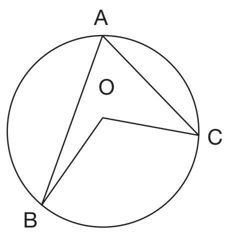
11. In the given figure, if ∠ABC = 90°, BC = 12 cm, and CD = 8 cm, then the length of AD is ______.



(a) 10 cm (b) 12 cm (c) 9 cm (d) 6 cm

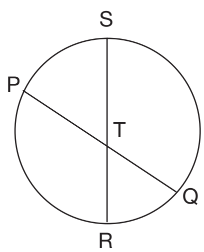
12. In a circle, angle made by a minor arc in the major segment is 70°. Then, the angle made by the same arc in the minor segment is _______.
(a) 100° (b) 70° (c) 110° (d) 120°

13. In the figure, 'O' is the centre of the circle. If ∠ABO = 30° and ∠ACO = 50°, then find the measure of ∠OCB.



(a) 10° (b) 20° (c) 30° (d) 15°

14. In the given figure, PT = 6 cm, ST = 8 cm, and TQ = 4 cm, then RT = ______.



(a) 3 cm (b) 2 cm (c) 5 cm (d) 6 cm

Direction for question 15: r_1 and r_2 are radii and d is the distance between the centres of two circles. Match the values of Column A with those of Column B.

Space for rough work

15.

Column A	Column B
(i) $r_1 - r_2 < d < r_1 + r_2$	(A) Circles touch externally.
(ii) $r_1 + r_2 = d$	(B) Circles touch internally.
(iii) $d = r_1 - r_2$	(C) Circles intersect each other.
(iv) $d > r_1 + r_2$	(D) Circles are apart from each other.

(a) (i) $\to$ (A); (ii) $\to$ (B); (iii) $\to$ (D); (iv) $\to$ (C)
(b) (i) $\to$ (C); (ii) $\to$ (A); (iii) $\to$ (D); (iv) $\to$ (B)
(c) (i) $\to$ (C); (ii) $\to$ (A); (iii) $\to$ (B); (iv) $\to$ (D)
(d) (i) $\to$ (B); (ii) $\to$ (A); (iii) $\to$ (C); (iv) $\to$ (D)

Assessment Test IV

Time: 30 min.

Space for rough work

Direction for questions 1 to 14: Select the correct answer from the given options.

1. The following are the steps involved in proving vertical angle bisector theorem for ΔABC in which AD is the bisector of $\angle BAC$. Arrange them in sequential order.

   (A) $\angle DAC = \angle ACP$ (alternate angles and $\overline{AD} \| \overline{CP}$) also $\angle BAD = \angle APC$ (corresponding angles and $\overline{AD} \| \overline{CP}$)

   (B) In ΔABC, AD is the bisector of $\angle A$.

   (C) Draw $\overline{CP} \| \overline{AD}$ to meet BA produced at P.

   (D) In ΔAPC, $AC = AP$ (sides opposite to equal angles are equal).

   (E) In ΔBCD $\dfrac{BD}{DC} = \dfrac{AB}{AP}$ (by basic proportionality theorem).

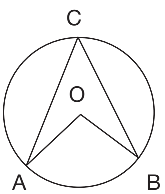
   (F) $\dfrac{BD}{DC} = \dfrac{AB}{AC}$ is required to prove.

   (a) BFACDE (b) BFCADE
   (c) CBFADE (d) EDABCF

2. In ΔABC, $\angle ABC = 90°$, $\overline{BD} \perp \overline{AC}$. Which of the following is true?

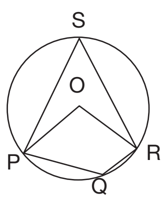
   (a) $AB^2 + AC^2 = BC^2$ (b) $AB^2 + BD^2 = AC^2$
   (c) $AB + BC = AC$ (d) $AD \times DC = BD^2$

3. In the following figure, 'O' is the centre of the circle and $AC = BC$. If $\angle ACB = 40°$, then find the measure of $\angle OAC$.



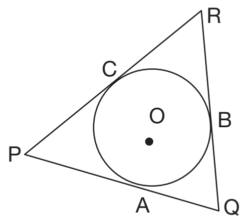
   (a) 50° (b) 20° (c) 40° (d) 60°

4. In the given figure, 'O' is the centre of the circle. If $\angle OPQ = 60°$ and $\angle ORQ = 70°$, then find the measure of $\angle PSR$.



   (a) 50° (b) 60° (c) 20° (d) 40°

Space for rough work

5. 

In the given figure, PQ, PR and QR are the tangents to the circle with centre O. A, B and C are points of contact. If PQ = 12 cm, PR = 10 cm, and CR = 2 cm, then find the perimeter of the ΔPQR.

(a) 24 cm (b) 28 cm (c) 32 cm (d) 26 cm

6. In triangle PQR, QO and RO are the bisectors of $\angle PQR$ and $\angle PRQ$, respectively. Find the measurement of $\angle QPR$, if $\angle QOR = 140°$.

(a) 100° (b) 70° (c) 80° (d) 110°

7. In ΔABC, P lies on AC, between A and C such that BC = BP = AP. If ∠BCP = 70°, then find ∠A.

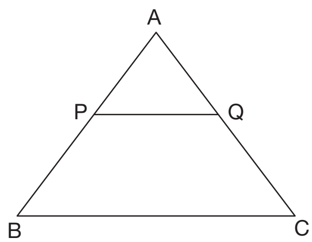
(a) 45° (b) 55° (c) 35° (d) 65°

8. Diagonal AC of a rectangle ABCD is produced to point P such that AC:CP = 1:1, AB = 8 cm, and BC = 6 cm. Find the length of DP.

(a) $2\sqrt{73}$ cm (b) $3\sqrt{73}$ cm

(c) $2\sqrt{63}$ cm (d) $\sqrt{63}$ cm

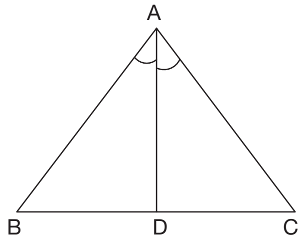
9. In the given figure, if $\overline{PQ} \parallel \overline{BC}$ and AP:PB = 2:3 and QC = 12 cm, then the length of AQ = ____.



(a) 8 cm (b) 10 cm (c) 6 cm (d) 9 cm

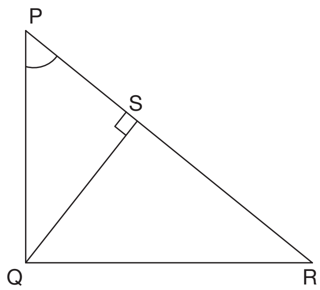
10. In the given figure, if BD:CD = 3:4, ∠BAD = ∠CAD, and AB = 12 cm, then find the length of AC.

Space for rough work



(a) 12cm (b) 15cm (c) 16cm (d) 10cm

11. In the given figure, $\angle PQR = 90°$, $QS = 10$ cm, and $PS = 8$ cm. If $PS \perp PR$, then find the length of RS.

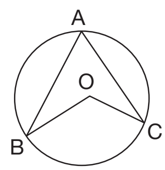


(a) 12 cm (b) 8 cm (c) 9.5 cm (d) 12.5 cm

12. If an angle made by a minor arc in the corresponding minor segment is 132°, then the angle made by the same arc at the centre of the circle is ________.

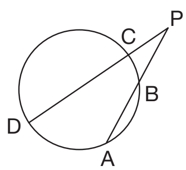
(a) 66° (b) 58° (c) 96° (d) 118°

13. In the figure, 'O' is the centre of the circle. $\angle ABO = 40°$ and $\angle ACO = 20°$. Find the measure of the $\angle OCB$.



(a) 25° (b) 30° (c) 35° (d) 40°

14. In the given figure, AB and DC are two chords of a circle produced to meet at P. If $PA = 8$ cm, $PB = 4$ cm, and $PD = 16$ cm, then $PC =$ _______.



(a) 2 cm (b) 3 cm (c) 4 cm (d) 6 cm

Direction for question 15: (r_1 and r_2 are radii and d is the distance between the centres of two circles). Match the values of Column A with those of Column B.

Space for rough work

15.

Column A (Two Circles)	Column B (Number of Common Tangents)
(i) $r_1 = 6$ cm, $r_2 = 4$ cm, and $d = 7$ cm	(A) 4
(ii) $r_1 = 4$ cm, $r_2 = 3$ cm, and $d = 8$ cm	(B) 2
(iii) $r_1 = 5$ cm, $r_2 = 2$ cm, and $d = 3$ cm	(C) 1
(iv) $r_1 = 9$ cm, $r_2 = 5$ cm, and $d = 3$ cm	(D) 0

(a) (i) → (A); (ii) → (B); (iii) → (D); (iv) → (C)
(b) (i) → (B); (ii) → (A); (iii) → (D); (iv) → (C)
(c) (i) → (D); (ii) → (B); (iii) → (C); (iv) → (A)
(d) (i) → (B); (ii) → (A); (iii) → (C); (iv) → (D)

Answer Keys

Assessment Test I

1. (c) **2.** (a) **3.** (c) **4.** (a) **5.** (c) **6.** (d) **7.** (a) **8.** (b) **9.** (b) **10.** (a)
11. (c) **12.** (d) **13.** (b) **14.** (c) **15.** (a)

Assessment Test II

1. (c) **2.** (a) **3.** (b) **4.** (d) **5.** (c) **6.** (d) **7.** (c) **8.** (a) **9.** (b) **10.** (c)
11. (d) **12.** (c) **13.** (d) **14.** (b) **15.** (e)

Assessment Test III

1. (b) **2.** (c) **3.** (a) **4.** (c) **5.** (a) **6.** (a) **7.** (a) **8.** (a) **9.** (b) **10.** (b)
11. (a) **12.** (c) **13.** (a) **14.** (a) **15.** (c)

Assessment Test IV

1. (b) **2.** (d) **3.** (b) **4.** (a) **5.** (b) **6.** (a) **7.** (c) **8.** (a) **9.** (a) **10.** (c)
11. (d) **12.** (c) **13.** (b) **14.** (a) **15.** (d)

Linear Equations and Inequations; Quadratic Equations 2

Reference: *Coursebook - IIT Foundation Mathematics Class 10; Chapters - Linear Equations in Two Variables; Quadratic Equations and Inequations; pp. 3.1–3.17; 4.1–4.19*

Assessment Test I

Time: 30 min.

Direction for questions 1 to 11: Select the correct answer from the given options.

Space for rough work

1. The following steps are involved in finding a number, if the positive number is less than its square by 30. Arrange them in sequential order.

   (A) $x^2 - x - 30 = 0$ (B) $x = 6$
   (C) $x^2 - x = 30$ (D) $(x + 5)(x - 6) = 0$
   (a) CADB (b) DCBA
   (c) DCAB (d) CDAB

2. If $x + 2y + 3z = 21$ and $3x + 2y + z = 43$, then find the value of $x + y + z$.

   (a) 10 (b) 11 (c) 14 (d) 16

3. For what value of k do the system of equations $2x + 3ky = 4$ and $6x + 27y = 12$ has infinite solutions?

   (a) 1 (b) 2 (c) 3 (d) 4

4. If $7x + 8y = 21$ and $8x + 7y = 20$, then find the value of $x - y$.

   (a) 0 (b) 1 (c) –1 (d) 2

5. If one of the roots of a quadratic equation having rational coefficients is $3+\sqrt{2}$, then the quadratic equation is ______.

   (a) $x^2 - 3\sqrt{2}x + 6 = 0$ (b) $x^2 - 6x + 7 = 0$
   (c) $x^2 + 3\sqrt{2}x + 6 = 0$ (d) $x^2 + 6x + 7 = 0$

6. If α and β are the roots of $x^2 - 5x + 7 = 0$, then find $\alpha^2 + \beta^2$.

   (a) 11 (b) 14 (c) 18 (d) 20

7. If $|x+4| < 2$, then find the number of integer values of x.

   (a) 1 (b) 2 (c) 3 (d) 4

8. The present age of a father is three times that of his son. Seven years ago, the father's age was five times the son's age. What will be the sum of their present ages (in years)?

   (a) 50 (b) 56 (c) 61 (d) 64

Space for rough work

9. Ajit rowed a boat 30 km downstream from a point P and returned to P in 8 h. If the speed of his boat in still water is 8 km/h, find the speed of the stream (in km/h).

(a) 1.5 (b) 2 (c) 2.5 (d) 3

10. Find the number of solutions of the equation $|x|^2 - 5|x| + 6 = 0$.

(a) 0 (b) 2
(c) 3 (d) 4

11. Find the value of $\sqrt{240+\sqrt{240+\sqrt{240+\ldots\infty}}}$.

(a) –15 (b) 16
(c) 15 (d) –16

Direction for questions 12 to 15: Match the statements of Column A with the values of Column B.

Column A	Column B
12. The maximum value of $-3x^2 + 12x + 8$ is attained at $x =$	(a) 2
13. One of the roots of the quadratic equation $x^2 - 6x + 9 = 0$ is	(b) 3
14. If $5x + ky = 22$ and $kx + 5y = 23$ are inconsistent, then k can be	(c) 4
15. The sum of the roots of $\frac{5}{3}x^2 - 10x + 2 = 0$ is	(d) 5
	(e) 6

Assessment Test II

Time: 30 min.

Space for rough work

Direction for questions 1 to 11: Select the correct answer from the given options.

1. If the sum of the roots of the equations $kx^2 - 3x + 6 = 0$ is $\frac{1}{5}$, then find the product of the roots of that equation.

   The following steps are involved in solving the above mentioned problem. Arrange them in sequential order.

   (A) Given, $\frac{3}{k} = \frac{1}{5}$

   (B) The product of the roots $= \frac{6}{k}$

   (C) The sum of the roots of the equation $= \frac{3}{k}$

   (D) As $k = 15$, $\frac{6}{k} = \frac{6}{15} = \frac{2}{5}$

   (a) CADB (b) ACBD
   (c) CABD (d) CBDA

2. If $2x + y + 3z = 12$ and $x + 3y - z = 16$, then find the value of $x + y + z$.

   (a) 6 (b) 8 (c) 10 (d) 12

3. For what value of k do the system of equations $5x - 2ky = 10$ and $6x + 8y = 21$ has no solution?

   (a) $\frac{-5}{3}$ (b) $\frac{10}{9}$
   (c) $\frac{5}{9}$ (d) $\frac{-10}{3}$

4. If $15x + 11y = 41$ and $11x + 15y = 37$, then find the value of $x + y$.

   (a) 3 (b) 4 (c) 5 (d) 6

5. If one of the roots of a quadratic equation having rational coefficients is $5 - \sqrt{3}$, then the quadratic equation is____.

   (a) $x^2 - 10x + 22 = 0$ (b) $x^2 - 2\sqrt{3}x + 11 = 0$
   (c) $x^2 + 10x - 22 = 0$ (d) $x^2 + 2\sqrt{3}x - 11 = 0$

6. If α and β are the roots of $x^2 + 2x - 3 = 0$, then find the value of $\frac{\alpha}{\beta} + \frac{\beta}{\alpha}$.

   (a) $-\frac{5}{3}$ (b) $-\frac{10}{3}$
   (c) $\frac{5}{4}$ (d) $-\frac{7}{4}$

7. If $|x-1| \le 5$, then find the number of integer values of x.

   (a) 10 (b) 11 (c) 9 (d) 12

Space for rough work

8. A two-digit number is 9 more than the sum of its digits. The difference between the digits is k. Find the number of possible values of k.

(a) 10 (b) 9 (c) 7 (d) 8

9. Ramesh rowed a boat 24 km upstream from point A and returned to A in 10 h. If the speed of his boat in still water is 5 kmph, find the speed of the stream (in kmph).

(a) 1 (b) 1.5 (c) 2 (d) 2.5

10. Find the number of roots of the equation $|x|^2 + 7|x| + 12 = 0$.

(a) 0 (b) 2 (c) 3 (d) 4

11. Find the value of $\sqrt{132 - \sqrt{132 - \sqrt{132 - \ldots\infty}}}$.

(a) -11 (b) 12
(c) -12 (d) 11

Direction for questions 12 to 15: Match the statements of Column A with the values of Column B.

	Column A	Column B
12.	The minimum value of $2x^2 - 5x + 11$ is attained at $x =$	(a) $-\frac{10}{3}$
13.	One of the roots of the quadratic equation $4x^2 - 9 = 0$ is	(b) $\frac{5}{4}$
14.	If $kx - 2y = 11$ and $5x + 3y = 23$ are inconsistent, then the value of k can be	(c) $-\frac{5}{3}$
15.	The product of the roots of the equation $3x^2 - 2x - 5 = 0$ is	(d) $\frac{2}{3}$
		(e) $\frac{3}{2}$

Assessment Test III

Time: 30 min.

Space for rough work

Direction for questions 1 to 14: Select the correct answer from the given options.

1. Find the solution of $\sqrt{x+1}-\sqrt{x-1}=\sqrt{4x-1}$. The following are the steps involved in solving the above mentioned problem. Arrange them in sequential order.

   (A) $\sqrt{\frac{5}{4}+1}-\sqrt{\frac{5}{4}-1}=\sqrt{4\left(\frac{5}{4}\right)-1}\Rightarrow 1\neq 2$, which is not possible.

   $\therefore$ There is no solution for the equation.

   (B) $-2\sqrt{x^2-1}=2x-1$

   (C) $(x+1)+(x-1)-2(\sqrt{x+1})(\sqrt{x-1})=4x-1$

   $2x-2\sqrt{x^2-1}=4x-1$

   (D) $4(x^2-1)=4x^2+1-4x\Rightarrow x=\frac{5}{4}$

   (E) $(\sqrt{x+1}-\sqrt{x-1})^2=(\sqrt{4x-1})^2$

   (a) BECAD (b) BEACD
   (c) EBCDA (d) ECBDA

2. The number of common solution(s) for the system of linear equations $2x+3y+5=0$ and $4x+6y-10=0$ is _______.

   (a) 0 (b) 1
   (c) 2 (d) infinite

3. If $a{:}b=5{:}2$ and $a+b=28$, then $a=$ _______.

   (a) 10 (b) 15 (c) 20 (d) 25

4. The total cost of 18 erasers and 27 pencils is ₹228 and the total cost of 20 erasers and k pencils is ₹256. Which of the following cannot be the value of k?

   (a) 25 (b) 30 (c) 32 (d) 35

5. The roots of $(x-3)(x+2)=0$ are ________ and ________.

   (a) $-2, 3$ (b) $2, 3$ (c) $-2, -3$ (d) $2, -3$

6. If α and β are the roots of the equation $x^2-3x+2=0$, then $\frac{1}{\alpha}+\frac{1}{\beta}=$ _______.

   (a) $\frac{1}{2}$ (b) $\frac{3}{2}$ (c) $\frac{5}{2}$ (d) $\frac{2}{3}$

7. The discriminant of $2x^2-8x+p=0$ is -64. The number of values that exist for p is ________.

   (a) 0 (b) 1 (c) 2 (d) 3

8. Find the nature of the roots of $x^2-x+1=0$.

   (a) Rational and equal (b) Rational and distinct
   (c) Irrational and distinct (d) Complex conjugates

Space for rough work

9. The maximum or minimum that $3x^2 + 9x + 11$ attains at x = ________.

(a) $\frac{3}{2}$ (b) $\frac{-3}{2}$ (c) $\frac{2}{3}$ (d) $\frac{-2}{3}$

10. Find the maximum/minimum value of the quadratic expression $x^2 + 4x + 8$.

(a) Minimum value is 4. (b) Maximum value is 4.
(c) Minimum value is 14. (d) Maximum value is 14.

11. Find the breadth of a rectangular hall, if its length exceeds its breadth by 18 m and the area of the hall is 243 m^2.

(a) 9 m (b) 27 m (c) 81 m (d) 3 m

12. Find the range of x, if $|x - 3| < 15$.

(a) $-12 < x < 18$ (b) $-18 < x < 12$
(c) $-6 < x < 9$ (d) $-15 < x < 15$

13. For what value of k, will the following system of equations be consistent?

$4x - 5y = 6$ and $16x - 20y = k$

(a) 12 (b) 18 (c) 24 (d) 30

14. Which of the following is true for two linear equations, $2x + 3y + 4z = 42$ and $9x + 13y + 17z = 184$?

(a) $x + y + z = 14$ (b) $x + y + z = 16$
(c) $x + y + z = 18$ (d) $x + y + z = 20$

Direction for questions 12 to 15: Match the values of Column A with those of Column B.

15.

Column A ($ax^2 + bx + c = 0$)	Column B (Nature of Roots)
(i) $b^2 - 4ac = 0$	(A) Irrational and unequal
(ii) $b^2 - 4ac < 0$	(B) Rational and equal
(iii) $b^2 - 4ac > 0$ and perfect square	(C) Complex conjugates
(iv) $b^2 - 4ac > 0$ and not perfect square	(D) Rational and unequal

(a) (i) → (D); (ii) → (C); (iii) → (B); (iv) → (A)
(b) (i) → (A); (ii) → (D); (iii) → (B); (iv) → (C)
(c) (i) → (B); (ii) → (C); (iii) → (A); (iv) → (D)
(d) (i) → (B); (ii) → (C); (iii) → (D); (iv) → (A)

Assessment Test IV

Time: 30 min.

Space for rough work

Direction for questions 1 to 14: Select the correct answer from the given options.

1. Find the value of x, when $4(4^{2x+1}) - 2(4^{x+1}) + 1 = 0$.

   The following steps are involved in solving the above mentioned problem. Arrange them in sequential order.

   (A) $4^{2x+2} - 2.4^{x+1} + 1 = 0$ (B) Let $4^{x+1} = y$
   (C) $x = -1$ (D) $y = 1$
   (E) $y^2 - 2y + 1 = 0$
   (a) ABECD (b) ABEDC
   (c) ABCED (d) ABDEC

2. The number of common solutions of $2x + 3y + 4 = 0$ and $4x + 6y + 8 = 0$ is _______.

   (a) 0 (b) 1
   (c) 2 (d) infinite

3. If $x{:}y = 2{:}7$ and $x + y = 81$, then $y =$ _______.

   (a) 18 (b) 63 (c) 72 (d) 54

4. Six years hence, the age of a father will be thrice the age of his son. Three years ago, the father's age was p times his son's age. Which of the following cannot be the value of p?

   (a) 5 (b) 4
   (c) 3 (d) 6

5. The roots of $(x + \sqrt{2})\ (x - \sqrt{3}) = 0$ are _________.

   (a) $\sqrt{2}, \sqrt{3}$ (b) $-\sqrt{2}, -\sqrt{3}$
   (c) $-\sqrt{2}, \sqrt{3}$ (d) $\sqrt{2}, -\sqrt{3}$

6. If α and $\beta\,(> \alpha)$ are the roots of the equation $x^2 + 7x + 12 = 0$, then $\dfrac{1}{\alpha} - \dfrac{1}{\beta} =$ _______.

   (a) $\dfrac{5}{12}$ (b) $\dfrac{7}{12}$ (c) $\dfrac{1}{12}$ (d) $\dfrac{11}{12}$

7. The discriminant of $3x^2 - kx - 12 = 0$ is 169. Find the number of values exist for k.

   (a) 0 (b) 1
   (c) 2 (d) More than 2

8. Find the nature of the roots of $5x^2 - 2x - 1 = 0$.

   (a) Rational and equal (b) Rational and distinct
   (c) Irrational and distinct (d) Complex conjugate

9. For what value of x, $7x^2 - 6x + 4$ has minimum value?

(a) $\frac{6}{7}$ (b) $\frac{4}{7}$ (c) $\frac{3}{7}$ (d) $\frac{1}{7}$

10. Find the maximum/minimum value of the quadratic expression $-4x^2 + 8x + 3$.

(a) Minimum value is 7. (b) Maximum value is –7.
(c) Minimum value is –7. (d) Maximum value is 7.

11. A rational number is less than its square by 20. How many such numbers exist?

(a) 0 (b) 1
(c) 2 (d) More than 3

12. Find the range of values of x, if $|x - 2| > 6$.

(a) $x > 8$ or $x < -4$ (b) $x > 8$ or $x > 4$
(c) $x < 8$ or $x > 4$ (d) $x > -8$ or $x > 4$

13. For what value of k, will the following pair of linear equations have no solution?

$3x + 4y = 5$ and $(3k + 1)x + 8y = k + 2$

(a) $\frac{5}{3}$ (b) $\frac{5}{13}$ (c) $\frac{2}{3}$ (d) $\frac{4}{3}$

14. Which of the following is true for two linear equations $2x + 5y + 6z = 84$ and $7x + 4y + 3z = 96$?

(a) $x + y + z = 6$ (b) $x + y + z = 8$
(c) $x + y + z = 10$ (d) $x + y + z = 20$

Direction for question 15: Match the values of Column A with those of Column B.

15.

Column A ($a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$)	Column B (Number of Solutions)
(i) $\frac{a_1}{a_2} = \frac{b_1}{b_2}$	(A) Infinite
(ii) $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$	(B) Unique
(iii) $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$	(C) Zero
(iv) $\frac{a_1}{b_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$	(D) Cannot be determined

(a) (i) → (C); (ii) → (B); (iii) → (A); (iv) → (D)
(b) (i) → (D); (ii) → (B); (iii) → (A); (iv) → (C)
(c) (i) → (B); (ii) → (D); (iii) → (C); (iv) → (A)
(d) (i) → (D); (ii) → (B); (iii) → (C); (iv) → (A)

Space for rough work

Answer Keys

Assessment Test I

1. (a)	**2.** (d)	**3.** (c)	**4.** (c)	**5.** (b)	**6.** (a)	**7.** (c)	**8.** (b)	**9.** (b)	**10.** (d)
11. (b)	**12.** (a)	**13.** (b)	**14.** (d)	**15.** (e)					

Assessment Test II

1. (c)	**2.** (b)	**3.** (d)	**4.** (a)	**5.** (a)	**6.** (b)	**7.** (b)	**8.** (b)	**9.** (a)	**10.** (a)
11. (d)	**12.** (b)	**13.** (e)	**14.** (a)	**15.** (c)					

Assessment Test III

1. (d)	**2.** (a)	**3.** (c)	**4.** (b)	**5.** (a)	**6.** (b)	**7.** (b)	**8.** (d)	**9.** (b)	**10.** (a)
11. (a)	**12.** (a)	**13.** (c)	**14.** (b)	**15.** (d)					

Assessment Test IV

1. (b)	**2.** (d)	**3.** (b)	**4.** (c)	**5.** (c)	**6.** (c)	**7.** (c)	**8.** (c)	**9.** (c)	**10.** (d)
11. (c)	**12.** (a)	**13.** (a)	**14.** (d)	**15.** (b)					

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Matrices; Ratio, Proportion, and Variations; Commercial Mathematics

3

Reference: *Coursebook - IIT Foundation Mathematics Class 10; Chapters - Matrices; Banking; Taxation; Instalments; pp. 10.1–10.18; 22.1–22.11; 23.1–23.9; 24.1–24.5*

Assessment Test I

Time: 30 min.

Direction for questions 1 to 11: Select the correct answer from the given options.

Space for rough work

1. Solve the system of linear equations $5x - 3y = 16$ and $4x + y = 6$ by Cramer's method.

   The following steps are involved in solving the above mentioned problem. Arrange them in sequential order.

   (A) $B_1 = \begin{bmatrix} 16 & -3 \\ 6 & 1 \end{bmatrix}$ and $B_2 = \begin{bmatrix} 5 & 16 \\ 4 & 6 \end{bmatrix}$

   (B) $\begin{bmatrix} 5 & -3 \\ 4 & 1 \end{bmatrix}\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 16 \\ 6 \end{bmatrix} \Rightarrow A \times B$

   (C) $|A| = 17 \neq 0$

   (D) $|B_1| = 34$ and $|B_2| = -34$

   (E) $x = \dfrac{|B_1|}{|A|} = 2,\ y = \dfrac{|B_2|}{|A|} = -2$

   (a) DABCE (b) BCADE
   (c) BCAED (d) DBCAE

2. If $a:b = 3:4$ and $b:c = 3:4$, then find the value of $\sqrt{\dfrac{a^2+b^2}{b^2+c^2}}$.

   (a) $\dfrac{2}{3}$ (b) $\dfrac{4}{5}$ (c) $\dfrac{3}{4}$ (d) 1

3. If $A \times \begin{bmatrix} 4 & -1 & 3 \\ 1 & 0 & 5 \end{bmatrix}\begin{bmatrix} 5 & 1 & 9 \\ 0 & -3 & 6 \\ 1 & 8 & 4 \end{bmatrix}$ is a square matrix, then find the order of A.

   (a) 3×2 (b) 2×3 (c) 3×1 (d) 2×2

4. If A is 2×2 matrix and $\det(5A) = 875$, then find det (A).

   (a) 5 (b) 25 (c) 7 (d) 35

Space for rough work

5. If I is a 2×2 identity matrix, then the matrix $\left[(3\text{I})^{10}\right]^{-1}$ = _____.

(a) 3^{10} I (b) $\frac{1}{3^{20}}$ I (c) 3^{20} I (d) $\frac{1}{3^{10}}$ I

6. If $\frac{\sqrt{5x+7}+\sqrt{5x-7}}{\sqrt{5x+7}-\sqrt{5x-7}} = 2$, then find the value of x.

(a) $\frac{7}{5}$ (b) $\frac{7}{4}$ (c) $\frac{2}{5}$ (d) $\frac{2}{7}$

7. Which of the following is true?
   (a) If A is a symmetric matrix, then A^T need not be a symmetric matrix.
   (b) Matrix inversion method is used to solve simultaneous linear equations in two variables, when Cramer's method is not applicable.
   (c) For any two squares matrices of same order $(A\,B)^{-1} = A^{-1}\,B^{-1}$.
   (d) If A and B are any two squares matrices and $(A + B)^2 = A^2 + 2AB + B^2$, then A and B are commutative.

8. A person invests ₹55,000 in buying 120 shares of a company available at a discount of 10%. If the company pays a dividend of 15%, then find his annual income from the investment.

(a) ₹9000 (b) ₹8000 (c) ₹10,000 (d) ₹7000

9. Find the compound interest on ₹60,000 for 3 years, compounded annually and the rate of interest being 8%, 10%, and 15% for the three successive years, respectively.

(a) ₹19,568 (b) ₹20,786
(c) ₹21,972 (d) ₹22,364

10. Raju deposits ₹2500 per month in a recurring deposit account for 5 years at 8% per annum. Find the amount he receives at the time of maturity.

(a) ₹1,80,500 (b) ₹1,90,750
(c) ₹2,05,250 (d) ₹2,10,500

11. Ajay bought an article for ₹660, which includes a discount of 25% offered on the marked price and 10% sales tax on the remaining amount. Find the marked price of the article.

(a) ₹750 (b) ₹800 (c) ₹850 (d) ₹900

Direction for questions 12 to 15: Match the statements of Column A with the values of Column B.

Column A	Column B
12. If $\dfrac{2x+3y}{2x-3y}=3$, then $x:y$	(a) 5:2
13. If $\dfrac{a^3+3ab^2}{b^3+3a^2b}=\dfrac{185}{158}$, then $a:b$	(b) 3:5
14. If $25\,x^2-30\,x\,y+9\,y^2=0$ then $x:y$	(c) 2:5
15. The compound ratio of 2:7 and 14:5	(d) 4:5
	(e) 3:1

Space for rough work

Assessment Test II

Time: 30 min.

Space for rough work

Direction for questions 1 to 11: Select the correct answer from the given options.

1. Solve the simultaneous linear equations $2x + 5y = 17$ and $7x - 2y = 1$.
   The following steps are involved in solving the above mentioned problem. Arrange them in sequential order.

   (A) $x = A^{-1}B = \begin{bmatrix} 2 & 5 \\ 7 & -2 \end{bmatrix}^{-1} \begin{bmatrix} 17 \\ 1 \end{bmatrix}$

   (B) $\begin{bmatrix} 2 & 5 \\ 7 & -2 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 17 \\ 1 \end{bmatrix}$ or $Ax = B$

   (C) $\begin{bmatrix} x \\ y \end{bmatrix} = -\frac{1}{39} \begin{bmatrix} -39 \\ -117 \end{bmatrix} = \begin{bmatrix} 1 \\ 3 \end{bmatrix}$

   (D) $x = \frac{1}{-4-35} \begin{bmatrix} -2 & -5 \\ -7 & 2 \end{bmatrix} \begin{bmatrix} 17 \\ 1 \end{bmatrix} = -\frac{1}{39} \begin{bmatrix} -39 \\ -117 \end{bmatrix}$

   (a) BCAD (b) CBAD (c) BACD (d) BADC

2. If $\sqrt{\frac{a^2+b^2}{a^2-b^2}} = 3$, then find $a:b$.

   (a) $\sqrt{5}:2$ (b) $2:\sqrt{3}$ (c) $\sqrt{3}:5$ (d) $3:\sqrt{5}$

3. A, B, and C are three matrices. If the order of B is 3×3 and the order of the product A B C is 2×4, then find the order of A.

   (a) 3×2 (b) 2×3
   (c) 2×4 (d) 4×2

4. The order of a matrix A is 2×2. If $\det(A) = 5$ and $\det(kA) = 245$, then find the value of k.

   (a) 7 (b) 8 (c) 4 (d) 5

5. If I is a 2×2 identity matrix, then find the matrix $\left[\left(\frac{1}{5}I\right)^{-1}\right]^{20}$.

   (a) $\frac{1}{5^{20}}I$ (b) $\frac{1}{5^{10}}I$ (c) $5^{20}\,I$ (d) $5^{10}\,I$

6. If $\frac{\sqrt{8x+5}+\sqrt{8x-5}}{\sqrt{8x+5}-\sqrt{8x-5}} = 2$, then find the value of x.

   (a) $\frac{25}{32}$ (b) $\frac{13}{21}$ (c) $\frac{16}{25}$ (d) $\frac{9}{11}$

7. Which of the following is false?

   (a) Matrix multiplication is associative, i.e., $A(BC) = (AB)C$.
   (b) For any two square matrices of same order, $(AB)^T = B^T A^T$.

Space for rough work

(c) For any three matrices A, B, and C, if AB = AC, then it implies that B = C or A = O.

(d) For any matrix A, $A A^{-1} = I$.

8. Ramesh invests ₹68,000 in buying 150 shares of a company available at a premium of ₹20. If the company pays a dividend of 10%, then find the annual income from the investment.

(a) ₹5000 (b) ₹6000 (c) ₹7000 (d) ₹8000

9. Find the compound interest on ₹1,20,000 for 3 years, compounded annually and the rate of interest being 5%, 10%, and 12% for the three successive years, respectively.

(a) ₹28,500 (b) ₹29,356
(c) ₹32,684 (d) ₹35,232

10. A person deposits ₹1800 per month in a recurring deposit account for 10 years at 5% per annum. Find the amount he receives at the time of maturity.

(a) ₹2,15,850 (b) ₹2,40,750
(c) ₹2,70,450 (d) ₹2,85,350

11. The list price of an article is ₹3300 and the sales tax applicable on the article is 10%. If a customer asked the shopkeeper to give a certain discount on its list price such that he pays ₹3300 inclusive of sales tax, then find the discount offered.

(a) ₹300 (b) ₹275 (c) ₹325 (d) ₹350

Direction for questions 12 to 15: Match the statements of Column A with the values of Column B.

	Column A	Column B
12.	If $a:b = 3:2$, then $(5a + 3b):(5a - 3b)$	(a) 4:3
13.	If $\dfrac{x^3 + 3xy^2}{y^3 + 3x^2y} = \dfrac{63}{62}$, then $x:y$	(b) 7:3
14.	If $9x^2 + 16y^2 = 24xy$, then $x:y$	(c) 2:3
15.	The compound ratio of 3:5 and 10:9	(d) 3:2
		(e) 5:2

Assessment Test III

Time: 30 min.

Space for rough work

Direction for questions 1 to 15: Select the correct answer from the given options.

1. Solve the system of linear equations $2x + 5y = 9$ and $3x - 2y = 4$ by inverse matrix method.

   The following steps are involved in solving the above mentioned problem. Arrange them in sequential order.

   (A) $A^{-1}\begin{bmatrix} \frac{2}{19} & \frac{5}{19} \\ \frac{3}{19} & \frac{-2}{19} \end{bmatrix}$

   (B) $2x + 5y = 9$
   $3x - 2y = 4$

   (C) $X = \begin{bmatrix} X \\ Y \end{bmatrix} - \begin{bmatrix} 2 \\ 1 \end{bmatrix}$

   (D) $A = \begin{bmatrix} 2 & 5 \\ 3 & -2 \end{bmatrix}; X = \begin{bmatrix} X \\ Y \end{bmatrix}; B = \begin{bmatrix} 9 \\ 4 \end{bmatrix}$

   (E) $X = \begin{bmatrix} \frac{2}{19} & \frac{5}{19} \\ \frac{3}{19} & \frac{-2}{19} \end{bmatrix}\begin{bmatrix} 9 \\ 4 \end{bmatrix} = \begin{bmatrix} \frac{18}{19} + \frac{20}{19} \\ \frac{27}{19} - \frac{8}{19} \end{bmatrix}$

   (a) BCADE (b) DBAEC
   (c) BDAEC (d) DBEAC

2. If $A = \begin{pmatrix} 3 & 4 \\ 5 & 7 \end{pmatrix}$ then $A + A^{-1} =$ ______.

   (a) 3I (b) 5I (c) 7I (d) 10I

3. If $M = \begin{bmatrix} 3 & 2 \\ 7 & d-4 \end{bmatrix}$ and det. M + 1 = trace of M, then find the value of d.

   (a) 12 (b) 14 (c) 13 (d) 9

4. $A_{2\times 3}$, $B_{4\times 3}$, and $C_{3\times 4}$ are three rectangular matrices. Which of the following products is possible in A, B, and C?

   (a) (AB)C (b) (BC)A (c) (CB)A (d) (AC)B

5. If $(4a + b):(5a - 2b) = 14:11$, then find the ratio $a:b$.

   (a) 4:5 (b) 2:3 (c) 3:2 (d) 2:1

Space for rough work

6. If $\frac{\sqrt{a+bx}}{\sqrt{a-bx}} = \frac{5}{2}$, then find the value of x in terms of a and b.

(a) $\frac{21a}{21b}$ (b) $\frac{23a}{29b}$ (c) $\frac{20a}{23b}$ (d) $\frac{25a}{27b}$

7. If 36 men can complete a piece of work in 12 days, working 8 h/day, then find the number of days required to complete the same work by 48 men working 6 h/day.

(a) 6 (b) 9 (c) 8 (d) 12

8. When a body at rest was pushed, the force applied on it varies directly with the acceleration with which it moves. It moved with an acceleration of 8 m/s^2 as a result of 20 N applied on it. With what acceleration would it have moved if a force of 5 N was applied on it (in m/s^2)?

(a) 4 (b) 2 (c) 3.6 (d) 2.4

9. If the sales of a company in the years 2012, 2013, and 2014 are worth 1.6 crores, 3 crores, and 2.5 crores, respectively, then find the percentage change in the sales of the company over the given period.

(a) 20% decreases (b) 62.5% increase
(c) 62.5% decrease (d) 56.25% increase

10. A sells an article to B at 20% profit. B sells the same article to C at 10% profit. What is the difference between C's cost price and A's cost price, if B makes a profit of ₹66?

(a) ₹150 (b) ₹160 (c) ₹176 (d) ₹136

11. Two articles are sold for ₹13,860 each. There is a loss of 10% on one article and a profit of 10% on the other. What is the overall profit or loss (in ₹)?

(a) ₹0 (b) ₹138.60
(c) ₹280 (d) ₹272.20

12. The difference between the S.I. and the C.I. on a sum of ₹28,000 for 2 years for the same rate of interest is ₹70. Find the rate of interest.

(a) 10% (b) 12% (c) 15% (d) 5%

13. If Mr OP bought 1,00, 240 shares of a particular company at a premium of ₹48 paying 12% dividend, then find Mr OP's rate of returns.

(a) 12% (b) 8% (c) 10% (d) 9%

14. A laptop is offered for ₹30,000 cash or for ₹10,000 down payment followed by two monthly instalments of ₹10,200 each. Calculate the rate of interest under simple interest (approximately).

(a) 16% (b) 20% (c) 18% (d) 22%

Space for rough work

15. Match the values of Column A with those of Column B.

Column A	Column B
(i) $(A^T B)^T$	(A) $B^T A^T$
(ii) $(A B^T)^T$	(B) BA^T
(iii) $(A^T B^T)^T$	(C) BA
(iv) $(AB)^T$	(D) $B^T A$

(a) (i) → (C); (ii) → (D); (iii) → (B); (iv) → (A)
(b) (i) → (C); (ii) → (B); (iii) → (D); (iv) → (A)
(c) (i) → (D); (ii) → (C); (iii) → (B); (iv) → (A)
(d) (i) → (D); (ii) → (B); (iii) → (C); (iv) → (A)

Assessment Test IV

Time: 30 min.

Space for rough work

Direction for questions 1 to 15: Select the correct answer from the given options.

1. Solve the system of linear equations $3x + 5y = 19$ and $4x - 3y = 6$ by Cramer's method. The following steps are involved in solving the problem. Arrange them in a sequential order.

   (A) $x = \left|\frac{B_1}{A}\right|; y = \frac{|B_2|}{|A|}$

   (B) $3x + 5y = 19$
   $4x - 3y = 6$

   (C) $|A| = -9 - 20 = -29 \neq 0$

   (D) $A = \begin{bmatrix} 3 & 5 \\ 4 & -3 \end{bmatrix}; x = \begin{bmatrix} X \\ Y \end{bmatrix}; B = \begin{bmatrix} 19 \\ 6 \end{bmatrix}$

   (E) $B_1 = \begin{bmatrix} 19 & 5 \\ 6 & -3 \end{bmatrix} \Rightarrow |B_1| = -87$

   $B_2 = \begin{bmatrix} 3 & 19 \\ 4 & 6 \end{bmatrix} \Rightarrow |B_2| = -58$

   (a) BCDAE (b) DBECA
   (c) BDCEA (d) BDECA

2. If $P = \begin{pmatrix} 5 & 2 \\ 7 & 3 \end{pmatrix}$, then $P + P^{-1} =$ _______.

   (a) 2I (b) 5I (c) 8I (d) 10I

3. If $N = \begin{bmatrix} 5 & 8 \\ 4 & X-5 \end{bmatrix}$ and det N is 3 more than its trace, then find the value of x.

   (a) 14 (b) 16 (c) 13 (d) 15

4. If $P_{m \times n}$, $Q_{l \times m}$, and $R_{n \times l}$ are three rectangular matrices, then the order of the matrix (QP)R is _______.

   (a) $l \times n$ (b) $m \times l$ (c) $m \times m$ (d) $l \times l$

5. If $(4x - 5y):(3x + 2y) = 3:8$, then find the ratio $x^2:y^2$.

   (a) 1:2 (b) 1:4 (c) 4:1 (d) 2:1

6. If $\frac{\sqrt{3+5x}}{\sqrt{3-5x}} = \frac{7}{2}$, then find the value of x.

   (a) $\frac{10}{53}$ (b) $\frac{27}{53}$ (c) $\frac{18}{53}$ (d) $\frac{17}{53}$

Space for rough work

7. The expenditure of a family of 6 members for 5 months is 1980. Find the expenditure of family of 9 members for 3 months.
(a) 1782 (b) 1972 (c) 1892 (d) 1888

8. In a country 'C', the government collects population tax in such a way that the tax is directly proportional to the square of the number of children. If a family of two children has to pay ₹3144, then find the tax imposed on a family of 3 children.
(a) ₹12,576 (b) ₹7,074 (c) ₹4,666 (d) ₹1,076

9. A student scores 80 marks, 60 marks, and 75 marks in three stages of a test. The maximum marks in each stage is 100. Find the percentage change from the first stage to third stage.
(a) 6.25% increase (b) 20% decrease
(c) 20% increase (d) 6.25% decrease

10. Mr X sells his scooter to Mr P at 20% loss. Mr P sells it to Mr R at 15% loss. What is the difference in the cost prices of Mr X and Mr R, if the loss of Mr P is ₹1050.
(a) ₹2500 (b) ₹2600 (c) ₹2800 (d) ₹2750

11. Mr B sells his two cars for ₹4,20,000 each but one gives him 16% loss, whereas the other gives him 5% profit. Find his profit or loss percentage on the whole.
(a) 10.5% loss (b) 6.66% loss
(c) 8.25% loss (d) 11% profit

12. The difference between the compound interest and the simple interest yielded in two years on a certain sum is ₹2500 at 25% rate of interest. Find the sum (in ₹).
(a) ₹3000 (b) ₹40,000
(c) ₹25,000 (d) ₹55,000

13. Mr A bought 120 shares of a company at a discount of 20. If the company pays a dividend at the rate of 20% per annum and Mr A earns ₹2520 per annum on his investment, find the number of shares purchased.
(a) 100 (b) 105 (c) 125 (d) 120

14. A smart phone is available for ₹20,500 cash down or for ₹500 down payment followed by a monthly payment of ₹10,500 up to 2 months. Find the rate of interest under the instalment plan, approximately.
(a) 17.49% (b) 29.34% (c) 38.26% (d) 40.68%

15. Match the values of Column A with those of Column B.

Column A	Column B (SI)
(i) $P = 1000$, $R = 20\%$, $T = 3$ years	(A) 1800
(ii) $P = 3000$, $R = 20\%$, $T = 3$ years	(B) 600
(iii) $P = 5000$, $R = 10\%$, $T = 2$ years	(C) 1000
(iv) $P = 4000$, $R = 10\%$, $T = 3$ years	(E) 1200

(a) (i) → (D); (ii) → (B); (iii) → (C); (iv) → (A)
(b) (i) → (B); (ii) → (C); (iii) → (D); (iv) → (A)
(c) (i) → (B); (ii) → (D); (iii) → (A); (iv) → (C)
(d) (i) → (B); (ii) → (A); (iii) → (C); (iv) → (D)

Space for rough work

Answer Keys

Assessment Test I

1. (b) **2.** (c) **3.** (a) **4.** (d) **5.** (d) **6.** (b) **7.** (d) **8.** (a) **9.** (c) **10.** (a)
11. (b) **12.** (e) **13.** (a) **14.** (b) **15.** (d)

Assessment Test II

1. (d) **2.** (a) **3.** (b) **4.** (a) **5.** (c) **6.** (a) **7.** (c) **8.** (b) **9.** (d) **10.** (c)
11. (a) **12.** (b) **13.** (d) **14.** (a) **15.** (c)

Assessment Test III

1. (c) **2.** (d) **3.** (a) **4.** (d) **5.** (c) **6.** (a) **7.** (d) **8.** (b) **9.** (d) **10.** (c)
11. (c) **12.** (d) **13.** (c) **14.** (a) **15.** (d)

Assessment Test IV

1. (c) **2.** (c) **3.** (d) **4.** (d) **5.** (c) **6.** (b) **7.** (a) **8.** (b) **9.** (d) **10.** (c)
11. (b) **12.** (b) **13.** (b) **14.** (d) **15.** (d)

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Mensuration 4

Reference: *Coursebook - IIT Foundation Mathematics Class 10; Chapter - Mensuration; pp. 14.1–14.16*

Assessment Test I

Time: 30 min.

Space for rough work

Direction for questions 1 to 11: Select the correct answer from the given options.

1. The following steps are involved in finding the area of a square inscribed in a circle of radius 10 cm.

   Arrange them in sequential order.

   (A) Diagonal of square = $\sqrt{2} \times$ side = 20 cm

   (B) Radius = 10 cm, $\Rightarrow$ Diameter = $2r$ = 20 cm

   (C) Area of square = $(\text{side})^2 = (10\sqrt{2})^2 = 200 \text{ cm}^2$

   (D) Side = $\dfrac{20}{\sqrt{2}} = 10\sqrt{2}$ cm

   (a) BDAC (b) BADC (c) ABDC (d) ABCD

2. The height of an equilateral triangle is 6 cm. Find its area (in cm^2).

   (a) $12\sqrt{3}$ (b) $15\sqrt{3}$ (c) $16\sqrt{3}$ (d) $18\sqrt{3}$

3. If a chord AB of length 8 cm is making 90° at the centre 'O' of a circle, then find the area of ΔAOB (in cm^2).

   (a) 10 (b) 14 (c) 16 (d) 18

4. Two cubes having a face diagonal $5\sqrt{2}$ cm each joined end to end. Find the volume of the resulting cuboid (in cm^3).

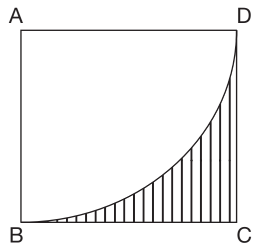
   (a) 175 (b) 225 (c) 250 (d) 275

5. A regular hexagonal pyramid is 15 m high, and the side of the base is 4 m. Find its volume (in m^3).

   (a) $90\sqrt{3}$ (b) $100\sqrt{3}$ (c) $110\sqrt{3}$ (d) $120\sqrt{3}$

6. In the given figure, ABCD is a square of diagonal $14\sqrt{2}$ cm. With A as centre and AB as radius, the arc BD is drawn. Find the area of the shaded region (in cm^2).

Space for rough work



(a) 42 (b) 39 (c) 45 (d) 37

7. Find the volume of a cone whose base radius is 21 cm and angle at its vertex is 90° (in cm^3).

(a) 8746 (b) 8972 (c) 9702 (d) 9494

8. A cylinder is formed by joining the breadths of a rectangular sheet of dimensions 44 cm × 32 cm. Find its curved surface area (in cm^2).

(a) 1467 (b) 1564 (c) 1752 (d) 1408

9. Radius and diameter of a sphere are, respectively, equal to the base radius and height of a cylinder. Find the ratio of their volumes.

(a) 1:2 (b) 2:3 (c) 4:3 (d) 2:1

10. The maximum possible sphere is carved out of a cube of edge 14 cm. Find its surface area (in cm^2).

(a) 576 (b) 592 (c) 616 (d) 634

11. A cylinder of volume 1056 cm^3 is melted and recast into a cone of base radius 6 cm. Find the height of the cone (in cm).

(a) 28 (b) 14 (c) 12 (d) 15

Direction for questions 12 to 15: Match the statements of Column A with the values of Column B.

Column A	Column B
12. The total surface area of a hollow hemisphere, whose inner and outer radii are r and R, respectively.	(a) $2\pi(R + r)^2$
13. The difference between the curved surface area of a sphere of radius R and that of cylinder of base radius r and height $2R$ can be	(b) $\pi(R + r)^2$
14. The curved surface area of a frustum of a cone whose slant height is equal to the sum of radii (R, r) of the circular ends of the frustum.	(c) $\pi(3R^2 + r^2)$
15. The total surface area of a hollow cylinder open at both the ends and whose height is equal to twice its inner radius (r) and outer radius is R.	(d) $4\pi(R^2 - Rr)$

Assessment Test II

Time: 30 min.

Space for rough work

Direction for questions 1 to 11: Select the correct answer from the given options.

1. The following steps are involved in finding the difference between the area of a regular hexagon inscribed in a circle of radius 4 cm and that of the circle.

   Arrange the steps in sequential order.

   (A) Side of the regular hexagon = Radius of the circle

   (B) Area of the hexagon $= 6 \times \frac{\sqrt{3}}{4} r^2$

   (C) $= 24\sqrt{3}\,\text{cm}^2$

   (D) $= \frac{8}{7}(44 - 21\sqrt{3})$

   (E) The required difference $= \pi r^2 - 24\sqrt{3}$

   (a) ADBEC (b) ABDEC
   (c) ABECD (d) ABCED

2. The area of an equilateral triangle is $18\sqrt{3}\,\text{cm}^2$. Find its height (in cm).

   (a) $6\sqrt{2}$ (b) $2\sqrt{6}$ (c) $3\sqrt{6}$ (d) $6\sqrt{3}$

3. If a chord PQ of length 12 cm is making 120° at the centre 'O' of a circle, then find the area of ΔPOQ (in cm^2).

   (a) $9\sqrt{3}$ (b) $10\sqrt{3}$ (c) $12\sqrt{3}$ (d) $14\sqrt{3}$

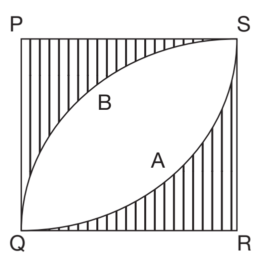
4. Three cubes having a face diagonal $6\sqrt{2}$ cm each are joined end to end. Find the total surface area of the resulting cuboid (in cm^2).

   (a) 516 (b) 504 (c) 652 (d) 696

5. The volume of a square pyramid, 16 m high is 192 m^3. Find the side of its base.

   (a) 5 m (b) 6 m (c) 7 m (d) 8 m

6. In the given figure, PQRS is a square of side $7\sqrt{2}$ cm. With P, R as centres and PQ as radius, the arcs QAS and QBS are drawn, respectively. Find the area of the shaded region (in cm^2).



   (a) 50 (b) 48 (c) 44 (d) 42

Space for rough work

7. Find the curved surface area of a cone whose base radius is 14 cm and angle at its vertex is 60° (in cm^2).

(a) 1196 (b) 1232 (c) 1304 (d) 1424

8. A cylinder is formed by joining the lengths of a rectangular sheet of dimensions 35 cm × 22 cm. Find its volume (in cm^3).

(a) 1347.5 (b) 1472 (c) 1525.5 (d) 1608

9. The radius of a sphere is twice the base radius of a cone. If the height of the cone is twice the radius of the sphere, then find the ratio of the volumes of sphere and cone.

(a) 7:2 (b) 9:1 (c) 10:3 (d) 8:1

10. A cylinder of maximum possible volume is carved out of a cube of edge 7 cm. Find the curved surface area of the cylinder (in cm^2).

(a) 154 (b) 146 (c) 164 (d) 138

11. A cone of base radius 8 cm and height 15 cm is melted and recast into a cylinder of height 10 cm. Find the base radius of the cylinder (in cm).

(a) $3\sqrt{2}$ (b) $\sqrt{2}$ (c) $4\sqrt{2}$ (d) $2\sqrt{2}$

Direction for questions 12 to 15: Match the statements of Column A with the values of Column B.

Column A	Column B
12. The volume of a hollow hemisphere whose thickness is equal to inner radius (r).	(a) $\frac{11r^3}{3}$
13. The volume of a cone whose height is seven times its base radius (r).	(b) $\frac{22r^3}{3}$
14. The radii of ends of a cone frustum are r and $2r$. The volume of the cone frustum of height $\left(2\frac{1}{2}\right)r$.	(c) $\frac{44r^3}{3}$
15. The volume of a hollow cylinder whose outer radius is twice the inner radius and height is $\frac{7}{18}$ times the inner radius (r).	(d) $\frac{55r^3}{3}$

Assessment Test III

Time: 30 min.

Space for rough work

Direction for questions 1 to 15: Select the correct answer from the given options.

1. The area of an equilateral triangle is $9\sqrt{3}$ cm^2. The following steps are involved in calculating the radius of its circumcircle.

   Arrange the steps in a sequential order.

   (A) Altitude $= \dfrac{\sqrt{3}}{2}a = \dfrac{\sqrt{3}}{2}(6)$

   (B) $\dfrac{\sqrt{3}}{4}a^2 = 9\sqrt{3}$

   (C) $r = \dfrac{2}{3}(3\sqrt{3})$

   (D) Height of the equilateral triangle $= 3\sqrt{3}$ cm

   (a) BCAD (b) BDAC (c) ABDC (d) BADC

2. The inradius of an equilateral triangle whose height is 18 cm is ______.

   (a) 3 cm (b) 4 cm (c) 6 cm (d) 9 cm

3. The area of a regular hexagon which is inscribed in a circle is $54\sqrt{3}$ cm^2. Find the area of the circle (in cm^2).

   (a) 36π (b) 48π (c) 54π (d) 42π

4. The length of the longest diagonal of a cuboid is $5\sqrt{5}$ cm, and the length of one of the longest face diagonals is 10 cm. If the lengths of the edges are integers in cm, then find the volume of the cuboid (in cm^3).

   (a) 120 (b) 200 (c) 240 (d) 180

5. A gold biscuit is in the form of a cuboid. It is melted and drawn into a wire of uniform cross-sectional area. The diameter of the cross-section of the wire is 2 mm. How many gold biscuits of dimensions 7 cm × 5 cm × 1.1 cm are required to obtain a wire of length 245 m.

   (a) 10 (b) 12 (c) 20 (d) 18

6. A company is selling ice-cream in cones. Each cone has an internal depth of 14 cm and internal base radius of 6 cm. How many cones are required to fill 528 l of ice-cream?

   (a) 1000 (b) 500 (c) 800 (d) 1200

7. A sphere of radius 3.5 cm cuts into two hemispheres. Find the total surface area of each of the hemispheres.

   (a) $125\sqrt{3}$ cm^2 (b) 120 cm^2
   (c) 115.5 cm^2 (d) 105.5 cm^2

Space for rough work

8. The outer radius and the inner radius of a hollow hemisphere are 11 cm and 5 cm, respectively. What is the total surface of the hollow hemisphere?
   (a) $300\pi\,cm^2$ (b) $426\pi\,cm^2$
   (c) $388\pi\,cm^2$ (d) $420\pi\,cm^2$

9. Find the curved surface area (in cm^2) of a cone frustum whose slant height is 13 cm and the top and bottom radii are 14 cm and 9 cm, respectively.
   (a) 100π (b) 290π (c) 299π (d) 120π

10. A hexagonal base pyramid is $12\sqrt{3}$ m high. If the side of its base is 6 m, find its slant height (in m).
   (a) $3\sqrt{47}$ (b) $3\sqrt{51}$ (c) $6\sqrt{5}$ (d) $6\sqrt{27}$

11. If the curved surface area of a cone is 23.1 cm^2 and the radius of its base is 2.1 cm, then find its slant height.
   (a) 2.8 cm (b) 4.2 cm (c) 3.5 cm (d) 5.1 cm

12. The heights of two cylinders are in the ratio of 4:9. The volumes of the two cylinders are equal. The ratio of their radii is ________.
   (a) 2:3 (b) 3:2 (c) 4:9 (d) 9:4

13. If the total surface area of a cube is 4092 cm^2, then find its lateral surface area in cm^2.
   (a) 1820 (b) 2706 (c) 2728 (d) 3890

14. A cylindrical pipe of 3500 m length is filled with water. If it contains 17.6 m^3 water, then find the inner radius of the pipe.
   (a) 10 cm (b) 8 cm (c) 4 cm (d) 6 cm

15. Match the statements of Column A with the values of Column B.

Column A	Column B
(i) Volume of a cone whose height is equal to its base radius.	(A) $2\pi r^3$
(ii) Volume of a cylinder whose height is equal to its radius.	(B) $\frac{2}{3}\pi r^3$
(iii) Volume of a cone whose height is equal to 6 times the radius of its base.	(C) $\frac{1}{3}\pi r^3$
(iv) Volume of a cylinder whose height is equal to two-third of its base radius.	(D) πr^3

   (a) (i) → (A); (ii) → (B); (iii) → (C); (iv) → (D)
   (b) (i) → (C); (ii) → (D); (iii) → (B); (iv) → (A)
   (c) (i) → (C); (ii) → (B); (iii) → (A); (iv) → (D)
   (d) (i) → (C); (ii) → (D); (iii) → (A); (iv) → (B)

Assessment Test IV

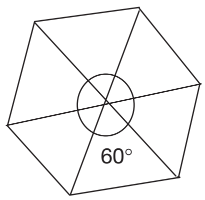
Time: 30 min.

Space for rough work

Direction for questions 1 to 15: Select the correct answer from the given options.

1. The following steps are involved in finding the area of a regular hexagon whose side is a units.

   Arrange them in a sequential order.



(A) Area of an equilateral triangle of side a unit is $\frac{\sqrt{3}a^2}{4}$ sq. units.

(B) The central angle 360° is divided into 6 equal parts, i.e., $\frac{360°}{6} = 60°$.

(C) Area of the hexagon $= \frac{3\sqrt{3}a^2}{2}$ sq. units.

(D) Regular hexagon is divided into six equilateral triangles.

(a) BDAC (b) ABCD (c) ABDC (d) BDCA

2. The circumradius of an equilateral triangle whose height is $15\sqrt{3}$ cm is ______.

(a) $10\sqrt{3}$ cm (b) $6\sqrt{3}$ cm
(c) $5\sqrt{3}$ cm (d) $3\sqrt{3}$ cm

3. Area of a circle is 64π cm^2. If a hexagon is inscribed in that circle, then find the area of the hexagon (in cm^2).

(a) $84\sqrt{3}$ (b) $64\sqrt{3}$ (c) $96\sqrt{3}$ (d) $42\sqrt{3}$

4. The sum of the lengths of all the edges of a cuboid is 120 cm and the length of its longest diagonal is $\sqrt{308}$ cm. Find the total surface area of the cuboid (in cm^2).

(a) 240 (b) 356 (c) 296 (d) 592

5. How many cubes of edge 5 cm should be melted to get a cylinder of base radius 35 cm and the height 35 cm?

(a) 1078 (b) 1312 (c) 1320 (d) 1232

6 A lorry is carrying sand. The carrier is in the shape of a cuboid with internal dimensions $\frac{11}{2}$ m $\times$ 3 m $\times 1\frac{1}{2}$ m. It unloads the sand in the form of conical heaps at different places that are equal in volume and height. If the radius of the heap is $\frac{1}{2}$ m and height $\frac{1}{2}$ m, then find the number of heaps.

(a) 157 (b) 189 (c) 121 (d) 179

Space for rough work

7. The radius of a sphere is 12 cm. Find the surface area of the sphere.

(a) $444\pi\,cm^2$ (b) $360\pi\,cm^2$
(c) $576\pi\,cm^2$ (d) $488\pi\,cm^2$

8. If the thickness of a hemispherical bowl is 12 cm and its outer radius is 54 cm, then find the inner surface area of the hemispherical bowl (in cm^2).

(a) 9944 (b) 10,044
(c) 11,088 (d) 12,066

9. Find the curved surface area of a solid cone frustum (in cm^2) whose radii of the top and bottom ends are 21 cm and 15 cm and its slant height is 10 cm.

(a) 486π (b) 460π (c) 396π (d) 360π

10. The base of a right pyramid is a regular hexagon of side 12 cm. If the slant height of the pyramid is 18 cm, then find its vertical height in cm.

(a) $3\sqrt{2}$ (b) $4\sqrt{6}$ (c) $6\sqrt{6}$ (d) $9\sqrt{2}$

11. If the total surface area of a solid cone is 858 cm^2 and the radius of its base is 6 cm, then find its slant height.

(a) 29 cm (b) 42.5 cm
(c) 39.5 cm (d) 27.5 cm

12. The heights of two cones are in the ratio 3:1. If the volumes are in the ratio 3:4, then find the ratio of their radii.

(a) 1:3 (b) 4:3 (c) 2:1 (d) 1:2

13. If the total surface area of a cube is 864 cm^2. Find the volume of the cube (in cm^3)

(a) 1728 (b) 2744 (c) 512 (d) 216

14. A cylindrical pipe of 4200 cm long and 10 cm of inner radius can hold maximum of x litres of water. Find x.

(a) 1320 (b) 1140 (c) 1560 (d) 1640

15. Match the statements of Column A with the values of Column B.

Column A	Column B
(i) Total surface area of a cylinder whose height is l and base radius is r.	(A) $\frac{\pi rl}{3}$
(ii) Total surface area of a cone whose base radius is (r) with slant height l.	(B) $3\pi rl$
(iii) Curved surface area of a cone frustum whose base radius is equal to twice to the radius of its top (r) and slant height l.	(C) $\pi r(l+r)$
(iv) Curved surface area of a cone whose base radius is r and slant height is $\frac{l}{3}$.	(D) $2\pi r(l+r)$

(a) (i) → (A); (ii) → (C); (iii) → (B); (iv) → (D)
(b) (i) → (D); (ii) → (C); (iii) → (B); (iv) → (A)
(c) (i) → (D); (ii) → (B); (iii) → (A); (iv) → (C)
(d) (i) → (C); (ii) → (B); (iii) → (D); (iv) → (A)

Space for rough work

Answer Keys

Assessment Test I

1. (b)	**2.** (a)	**3.** (c)	**4.** (c)	**5.** (d)	**6.** (a)	**7.** (c)	**8.** (d)	**9.** (b)	**10.** (c)
11. (a)	**12.** (c)	**13.** (d)	**14.** (b)	**15.** (a)					

Assessment Test II

1. (d)	**2.** (c)	**3.** (c)	**4.** (b)	**5.** (b)	**6.** (d)	**7.** (b)	**8.** (a)	**9.** (d)	**10.** (a)
11. (c)	**12.** (c)	**13.** (b)	**14.** (d)	**15.** (a)					

Assessment Test III

1. (d)	**2.** (c)	**3.** (a)	**4.** (c)	**5.** (c)	**6.** (a)	**7.** (c)	**8.** (c)	**9.** (c)	**10.** (b)
11. (c)	**12.** (b)	**13.** (c)	**14.** (c)	**15.** (d)					

Assessment Test IV

1. (a)	**2.** (a)	**3.** (c)	**4.** (d)	**5.** (a)	**6.** (b)	**7.** (c)	**8.** (c)	**9.** (d)	**10.** (c)
11. (c)	**12.** (d)	**13.** (a)	**14.** (a)	**15.** (b)					

Number Systems, Polynomials and Rational Expressions

5

Reference: *Coursebook - IIT Foundation Mathematics Class 10; Chapters - Number Systems; Polynomials and Rational Expressions; pp. 1.1–1.11; 2.1–2.10*

Assessment Test I

Time: 30 min.

Direction for questions 1 to 11: Select the correct answer from the given options.

Space for rough work

1. The following steps are involved in finding the HCF of $x^2 - 5x + 6$ and $x^2 - 4x + 4$. Arrange them in sequential order.

   (A) $f(x) = (x - 2)(x - 3)$ and $g(x) = (x - 2)^2$

   (B) $f(x) = x^2 - 5x + 6$ and $g(x) = x^2 - 4x + 4$

   (C) The HCF of the given polynomials is $x - 2$.

   (D) The common factor with the least exponent is $x - 2$.

   (a) ABCD (b) ABDC (c) BADC (d) BACD

2. $1011_{(2)} + 1101_{(2)} + 1110_{(2)} =$ ______

   (a) $11101_{(2)}$ (b) $101011_{(2)}$
   (c) $10110_{(2)}$ (d) $100110_{(2)}$

3. $11011_{(2)} - 10101_{(2)} =$ ______

   (a) $101_{(2)}$ (b) $1010_{(2)}$ (c) $110_{(2)}$ (d) $1100_{(2)}$

4. The binary number equivalent to 250 is ______.

   (a) $10111011_{(2)}$ (b) $11111010_{(2)}$
   (c) $11001010_{(2)}$ (d) $11111110_{(2)}$

5. If n is a natural number, then $4^n - 3^n$ ends with a digit x. The number of possible values of x is ______.

   (a) 3 (b) 8 (c) 5 (d) 6

6. If the degree of polynomial $f(x).g(x)$ is 15, where $f(x)$, $g(x)$, and $\dfrac{f(x)}{g(x)}$ are polynomials in x, then the degree of $f(x)$ can be _________.

   (a) 5 (b) 7
   (c) 10 (d) 16

7. The multiplicative inverse of the product of the additive inverse of $x + 1$ and the multiplicative inverse of $x^2 - 1$ is ______.

   (a) $x - 1$ (b) $1 - x$
   (c) $1 - x^2$ (d) $x^2 - 1$

Space for rough work

8. If the LCM of two polynomials $8a^2 b^3$ and $12a^3 b^k$ is $24a^3b^3$, then the number of integer values satisfying k is ______.

(a) 3 (b) 4 (c) 2 (d) 5

9. If the HCF of the polynomials $x^2 - ax - 12$ and $(x - 3)(x - b)$ is $x - 4$, then the value of $a + b$ is ______.

(a) 10 (b) 8 (c) 7 (d) 5

10. Three bells toll for every 15 minutes, 30 minutes, and 45 minutes. If they toll together at 9:00 am, then find the probable time at which they can toll together at the earliest.

(a) 10:30 am (b) 10:00 am
(c) 11:00 am (d) 11:30 am

11. The LCM and the HCF of two numbers are 468 and 3, respectively. Find the minimum possible sum of the numbers.

(a) 165 (b) 129 (c) 75 (d) 60

Direction for questions 12 to 15: Match the statements of Column A with the values of Column B.

	Column A	Column B
12.	The HCF of the first 500 even natural numbers.	(a) 0
13.	The degree the constant polynomial 500×502.	(b) 1
14.	The degree of $\dfrac{2x^3 + 7x^2 + x - 10}{2x^2 + 9x + 10}$.	(c) 2
15.	The LCM of 500 and 502.	(d) 500(251)
		(e) 500(502)

Assessment Test II

Time: 30 min.

Space for rough work

Direction for questions 1 to 11: Select the correct answer from the given options.

1. The following steps are involved in finding the LCM of $6(x^2-1)(x-1)$ and $16(x-1)(x^3+1)$. Arrange them in sequential order.
   (A) The LCM of the given polynomials is $48(x-1)^2(x+1)(x^2-x+1)$.
   (B) $f(x) = 6(x^2-1)(x-1)$ and $g(x) = 16(x-1)(x^3+1)$
   (C) The factors (taking only once) with the highest exponents are 2^4, 3, $(x+1)$, $(x-1)^2$, and (x^2-x+1).
   (D) $f(x) = 2 \times 3(x+1)(x-1)(x-1)$ and $g(x) = 2^4(x-1)(x+1)(x^2-x+1)$
   (a) BDAC (b) BDCA (c) CBAD (d) BCDA

2. $101101_{(2)} + 110011_{(2)} =$ _______
   (a) $1100000_{(2)}$ (b) $101011_{(2)}$
   (c) $111110_{(2)}$ (d) $1011011_{(2)}$

3. $10110_{(2)} - 11011_{(2)} + 11001_{(2)} =$ _______
   (a) $10100_{(2)}$ (b) $11000_{(2}$
   (c) $10101_{(2)}$ (d) $10000_{(2)}$

4. The binary number equivalent to 425 is ______.
   (a) $110101001_{(2)}$ (b) $101101110_{(2)}$
   (c) $111101001_{(2)}$ (d) $111010111_{(2)}$

5. If m is a natural number, then $5^m + 9^{2m}$ always ends with ______.
   (a) 6 (b) 1 (c) 4 (d) 3

6. If the degree of polynomial of $\dfrac{f(x)}{g(x)}$ is 10, then the degree of $g(x)$ can be _______.
   (a) 5 (b) 9
   (c) 11 (d) All of these

7. If $f(x) = \dfrac{x^2+1}{x-1}$, then the product of the additive inverse of $f(x)$ and the multiplicative inverse of $f(x)$ is ______.
   (a) 1 (b) $-\left(\dfrac{x^2+1}{x-1}\right)^2$
   (c) $-\left(\dfrac{x^4-1}{x^2+1}\right)$ (d) -1

8. If the HCF of $21x^5y^k$ and $18x^7y^2$ is $3x^5y^k$, then the number of integer values satisfying k is ______.
   (a) 1 (b) 2 (c) 3 (d) 4

Space for rough work

9. If the HCF of the polynomials $(x-2)(x-a)$ and $(x-3)(x-b)$ is $x-a$, then the value of $a-b$ is ______.

(a) 0 (b) 1
(c) 3 (d) Cannot be determined

10. Three persons A, B, and C start running around a circular track simultaneously. If they complete one round in 12 s, 18 s, and 21 s, respectively, then after how much time will they next meet at the starting point and at the earliest (in seconds)?

(a) 252 (b) 126 (c) 420 (d) 504

11. The difference of two numbers is 24 and their LCM is 180. Find the sum of the numbers.

(a) 60 (b) 72 (c) 84 (d) 96

Direction for questions 12 to 15: Match the statements of Column A with the values of Column B.

Column A	Column B
12. $1.\overline{6}+2.\overline{3}$	(a) 1
13. The degree of a linear polynomial	(b) 2
14. The HCF of 159 and 189	(c) 3
15. $\left(\dfrac{2x^2-12x+16}{x^2+3x-10}\right)\times\left(\dfrac{x^2+9x+20}{x^2-16}\right)$	(d) 4
	(e) 159(189)
	(f) $\dfrac{2(x+4)}{x-4}$
	(g) $\dfrac{2(x+5)}{(x+4)}$

Assessment Test III

Time: 30 min.

Space for rough work

Direction for questions 1 to 14: Select the correct answer from the given options.

1. The following steps are involved in proving $5 + \sqrt{3}$ is irrational. Arrange them in sequential order.
   (A) $5+\sqrt{3} = \dfrac{p}{q}$, where p and q are integers.
   (B) $\dfrac{p-5q}{q}$ is rational, but $\sqrt{3}$ is irrational.
   (C) Let us assume that $5+\sqrt{3}$ is rational.
   (D) $\sqrt{3} = \dfrac{p}{q} - 5$
   (E) It contradicts our assumption that $5+\sqrt{3}$ is rational.
   (a) CABDE (b) CADBE
   (c) ECADB (d) EABCD
2. Simplify the value of $11101_{(2)} + 1011_{(2)} - 10011_{(2)}$.
   (a) $11101_{(2)}$ (b) $10110_{(2)}$
   (c) $10101_{(2)}$ (d) $10010_{(2)}$
3. The HCF of the polynomials $(x + 5)^2 (x - 2) (x + 1)^2$ and $(x + 1)^3(x + 5)$ is ___________.
   (a) $(x+5)^2(x+1)^2$ (b) $(x-2)(x+5)(x+1)$
   (c) $(x+5)(x+1)^2$ (d) $(x+1)^2(x-2)(x+5)$
4. The sum of $\dfrac{2x-5}{x^2+x-2}$ and $\dfrac{3x-2}{2x^2+5x+2}$ is _________.
   (a) $\dfrac{7x^2-13x-3}{2x^3+3x^2-3x-2}$ (b) $\dfrac{7x^2-15x-8}{2x^3+3x^2-3x-2}$
   (c) $\dfrac{7x^2-9x-5}{2x^3-3x-2}$ (d) $\dfrac{7x^2-9x-5}{2x^3+3x^2-3x-2}$
5. Express $\dfrac{x^2+x-6}{3x^2+7x+2} \div \dfrac{3x^2-9x}{3x^2+7x+2}$ as rational expression in its lowest terms.
   (a) $\dfrac{x-2}{3x}$ (b) $\dfrac{x+2}{2x}$ (c) $\dfrac{x+2}{3x}$ (d) $\dfrac{x-2}{3x}$
6. Express the denominator of $\dfrac{\sqrt{6}}{\sqrt{18}+\sqrt{12}}$ as rational denominator.
   (a) $\dfrac{\sqrt{3}+\sqrt{2}}{2}$ (b) $\sqrt{3}-\sqrt{2}$
   (c) $\sqrt{6}-\sqrt{3}$ (d) $\dfrac{\sqrt{6}+\sqrt{3}}{2}$

Space for rough work

7. Two bells toll after every 60 minutes and 75 minutes. If they toll together at 8:10 am., then find the number of times at which they can toll together between 8:00 am and 10:00 pm on the same day?

(a) 2 (b) 3 (c) 4 (d) 5

8. The LCM and the HCF of two numbers are 144 and 24, respectively. How many such pairs of numbers are possible?

(a) 2 (b) 1 (c) 3 (d) 0

9. If the LCM of $(x^2 + 3x)(x^2 + 3x + 2)$ and $(x^2 + kx + 8)(x^2 + 5x + 6)$ is $x(x + 1)(x + 2)^2 (x + 3)(x + 4)$, then the value of k is ______.

(a) 5 (b) 6 (c) 8 (d) 7

10. $\dfrac{x-1}{x+1} - \dfrac{x+1}{x-1} - \dfrac{8x}{1+x^2} + \dfrac{12x^3}{x^4-1} = ?$

(a) $\dfrac{12x}{x^2-1}$ (b) $\dfrac{x^2+1}{x^2-1}$

(c) $\dfrac{4x}{x^4-1}$ (d) $\dfrac{x^2-1}{x^4+1}$

11. If $a=\sqrt{11}+\sqrt{3}$, $b = \sqrt{12}+\sqrt{2}$, and $c=\sqrt{9}+\sqrt{5}$, then which of the following is true?

(a) $a^2 < b^2 < c^2$ (b) $b^2 < c^2 < a^2$

(c) $c^2 < b^2 < a^2$ (d) $b^2 < a^2 < c^2$

12. The product of $1.\overline{142857}$ and $0.\overline{63}$ = ______.

(a) $\dfrac{8}{11}$ (b) $\dfrac{7}{11}$ (c) $\dfrac{11}{7}$ (d) $\dfrac{8}{7}$

13. There are 60 boys and 36 girls in a class. These students are arranged in rows for prayer in such a way that each row has either boys or girls, and every row has an equal number of students. Find the minimum number of rows in which all the students can be arranged.

(a) 7 (b) 10 (c) 12 (d) 8

14. $1+\dfrac{1}{3}+\dfrac{1}{6}+\dfrac{1}{10}+\dfrac{1}{15}+\dfrac{1}{21} = ?$

(a) $\dfrac{15}{7}$ (b) $\dfrac{13}{11}$ (c) $\dfrac{15}{8}$ (d) $\dfrac{12}{7}$

Direction for question 15: Match the statements of Column A with the values of Column B.

Column A	Column B
(i) The HCF of 2 consecutive prime numbers	(A) 1
(ii) HCF of the two consecutive even composite numbers	(B) 2
(iii) The HCF of the smallest composite number and the smallest two-digit perfect number	(C) 3
(iv) The smallest odd prime number	(D) 4

(a) (i) $\rightarrow$ (A); (ii) $\rightarrow$ (B); (iii) $\rightarrow$ (D); (iv) $\rightarrow$ (C)
(b) (i) $\rightarrow$ (B); (ii) $\rightarrow$ (A); (iii) $\rightarrow$ (D); (iv) $\rightarrow$ (C)
(c) (i) $\rightarrow$ (A); (ii) $\rightarrow$ (B); (iii) $\rightarrow$ (C); (iv) $\rightarrow$ (D)
(d) (i) $\rightarrow$ (B); (ii) $\rightarrow$ (C); (iii) $\rightarrow$ (B); (iv) $\rightarrow$ (A)

Space for rough work

Assessment Test IV

Time: 30 min.

Space for rough work

Direction for questions 1 to 14: Select the correct answer from the given options.

1. The HCF and the LCM of two polynomials are $(x + 3)$ $(x + 1)$ and $(x^2 - 9)$ $(x^2 - 1)$, respectively. If one of the polynomial is $(x - 3)$ $(x^2 - 1)$, then find the second polynomial. Find the sequential order of steps in solving the above mentioned problem.

   (A) $\dfrac{(x+3)(x+1)(x^2-9)(x^2-1)}{(x-3)(x^2-1)}$

   (B) $q(x) = \dfrac{\text{HCF} \times \text{LCM}}{p(x)}$

   (C) Let the polynomials be $p(x)$ and $q(x)$.

   (D) $q(x) = (x + 3)^2 (x + 1)$

   (a) CBDA (b) DCBA (c) ABCD (d) CBAD

2. $10110_{(2)} + 10101_{(2)} - 1010_{(2)} - 1111_{(2)} =$ ________

   (a) $10100_{(2)}$ (b) $10010_{(2)}$
   (c) $10101_{(2)}$ (d) $11010_{(2)}$

3. The HCF of $(x - 1)$ $(x - 2)^2$ $(x + 4)^3$ and $(x + 1)$ $(x^2 - 4)$ $(x + 4)^2$ is ______.

   (a) $(x - 2)^2 (x + 4)^2$ (b) $(x^2 - 1) (x^2 - 4)$
   (c) $(x - 2)(x + 4)$ (d) $(x - 2)(x + 4)^2$

4. $\dfrac{3x + 5}{x^2 - 3x - 10} - \dfrac{2x - 3}{x^2 + 5x + 6} =$ ________

   (a) $\dfrac{x + 27}{x^2 - 19x - 30}$ (b) $\dfrac{x^2 + 27x}{x^3 - 19x - 30}$

   (c) $\dfrac{x^2 + 27}{x^2 - 19x + 30}$ (d) $\dfrac{x^2 - 27x}{x^2 - 19x^2 + 30}$

5. Express the following as a rational expression in lowest terms:

   $\dfrac{3x^3 - 24}{x^2 + 2x - 8} \div \dfrac{x^2 + 2x + 4}{x + 4}$

   (a) $\dfrac{3(x+4)}{(x-3)}$ (b) $\dfrac{3x}{x-4}$

   (c) $\dfrac{x-4}{x-3}$ (d) 3

6. Express $\dfrac{\sqrt{5}}{\sqrt{15} - \sqrt{10}}$ as a rational denominator:

Space for rough work

(a) $\dfrac{\sqrt{3}+\sqrt{2}}{5}$ (b) $\dfrac{\sqrt{3}-\sqrt{2}}{3}$

(c) $\sqrt{3}+\sqrt{2}$ (d) $\dfrac{\sqrt{3}-\sqrt{2}}{2}$

7. Aloukya and Manoghna walk on a circular track and they take 120 s and 150 s, respectively, to complete one revolution. If they start together at 6:00 am from the same point, then how many times will they meet between 6:05 am and 7:35 am on the same day?

(a) 6 (b) 9 (c) 12 (d) 4

8. Two positive numbers have their HCF as 24 and their sum is 240. Find the number of pairs possible for the numbers.

(a) 2 (b) 1 (c) 3 (d) 4

9. If $f(x) = (x-3)(x^2-x-\mathrm{a})$, $g(x) = (x+3)(x^2+x-\mathrm{b})$, and their HCF is x^2-9, then find $a+b$, where 'a' and 'b' are constants.

(a) 12 (b) 6 (c) 24 (d) 18

10. If $\mathrm{A} = \dfrac{x+1}{2x+1}$, $\mathrm{B} = \dfrac{2x-1}{x+2}$, and $\mathrm{C} = \dfrac{4x-7}{2x^2+5x+2}$, find $4\mathrm{A}-\mathrm{B}-\mathrm{C}$.

(a) $\dfrac{x-2}{2x+1}$ (b) $\dfrac{8}{2x-1}$

(c) $\dfrac{8}{2x+1}$ (d) $\dfrac{2x-1}{x+2}$

11. If $x = \sqrt{12}-\sqrt{9}$, $y = \sqrt{13}-\sqrt{10}$, and $z = \sqrt{11}-\sqrt{8}$, then which of the following is true?

(a) $z > x > y$ (b) $z > y > x$

(c) $y > x > z$ (d) $y > z > x$

12. The value of $1.\overline{285714} \div 1.\overline{714285} =$ _______.

(a) $\dfrac{3}{4}$ (b) $\dfrac{7}{8}$ (c) $\dfrac{7}{12}$ (d) $\dfrac{3}{7}$

13. A trader has 612 Dell soaps and 324 Sell soaps. If he packs them in boxes and each box contains the same number of soaps, then find the number of boxes, such that the number of boxes is the lowest.

(a) 26 (b) 32 (c) 28 (d) 36

14. $\dfrac{1}{3}+\dfrac{1}{15}+\dfrac{1}{35}+\dfrac{1}{63}+\dfrac{1}{99} = ?$

(a) $\dfrac{5}{11}$ (b) $\dfrac{6}{11}$ (c) $\dfrac{7}{11}$ (d) $\dfrac{7}{12}$

Direction for question 15: Match the statements of Column A with the values of Column B.

Space for rough work

Column A	Column B
(i) Additive inverse of $\dfrac{1}{1-x^2}$	(A) $\dfrac{-3}{x^2-1}$
(ii) Multiplicative inverse of $1-x^2$.	(B) $\dfrac{1}{x^2-1}$
(iii) Factor of $\dfrac{1}{x^3-1}$	(C) $\dfrac{1}{x^2+x+x+1}$
(iv) $\dfrac{1}{x+1}-\dfrac{1}{x-1}-\dfrac{1}{x^2-1}$	(D) $\dfrac{1}{1-x^2}$

(a) (i) → (A); (ii) → (B); (iii) → (C); (iv) → (D)
(b) (i) → (B); (ii) → (A); (iii) → (D); (iv) → (C)
(c) (i) → (D); (ii) → (A); (iii) → (C); (iv) → (B)
(d) (i) → (B); (ii) → (D); (iii) → (C); (iv) → (A)

Answer Keys

Assessment Test I

1. (c) **2.** (d) **3.** (c) **4.** (b) **5.** (c) **6.** (c) **7.** (b) **8.** (b) **9.** (d) **10.** (a)
11. (c) **12.** (c) **13.** (a) **14.** (b) **15.** (d)

Assessment Test II

1. (b) **2.** (a) **3.** (a) **4.** (a) **5.** (a) **6.** (d) **7.** (d) **8.** (c) **9.** (d) **10.** (a)
11. (d) **12.** (d) **13.** (a) **14.** (c) **15.** (b)

Assessment Test III

1. (b) **2.** (c) **3.** (c) **4.** (a) **5.** (a) **6.** (b) **7.** (b) **8.** (a) **9.** (b) **10.** (c)
11. (d) **12.** (a) **13.** (d) **14.** (d) **15.** (a)

Assessment Test IV

1. (d) **2.** (b) **3.** (d) **4.** (b) **5.** (d) **6.** (c) **7.** (b) **8.** (a) **9.** (c) **10.** (c)
11. (a) **12.** (a) **13.** (a) **14.** (a) **15.** (d)

Progressions; Remainder and Factor Theorems

6

Reference: ***Coursebook - IIT Foundation Mathematics Class 10; Chapters - Progressions; Remainder; Factor Theorems; pp. 7.2–7.12; 11.1–11.11***

Assessment Test I

Time: 30 min.

Direction for questions 1 to 11: Select the correct answer from the given options.

Space for rough work

1. Find the 15th term of an AP whose first term is 7 and whose 10th term is 61.
   The following steps are involved in solving the above mentioned problem. Arrange them in sequential order.
   (A) Express the tenth term in terms of the common difference.
   (B) Recall the general form of nth term.
   (C) Find the term required.
   (D) Find the value of the common difference.
   (a) DBAC (b) ABDC (c) BADC (d) BDAC

2. If the sum of the first n terms of a sequence is $2n^2 + n$, then find the general term of the sequence.
   (a) $3\text{-}n - 1$ (b) $5\text{-}n - 2$
   (c) $3\text{-}n - 2$ (d) $4\text{-}n - 1$

3. Which term of the AP 5, 11, 17, 23, ... is 125?
   (a) 20 (b) 21 (c) 22 (d) 23

4. Find the sum of the first 50 terms of the sequence 7, 77, 777, …
   (a) $\frac{70}{81}(10^{50}-1)-\frac{350}{9}$ (b) $\frac{70}{81}(10^{51}-1)-\frac{250}{9}$
   (c) $\frac{35}{81}(10^{50}-1)-\frac{175}{9}$ (d) $\frac{35}{81}(10^{51}-1)-\frac{225}{9}$

5. If $\frac{1}{a+b}$, $\frac{1}{b+c}$, and $\frac{1}{c+a}$ are in AP, then which of the following is true?
   (a) a^2, b^2, and c^2 are in AP. (b) a^2, b^2, and c^2 are in GP.
   (c) b^2, a^2, and c^2 are in HP. (d) b^2, a^2, and c^2 are in AP.

6. Find the sum to infinity of the terms of the sequence 5, $10x$, $15x^2$, $20x^3$, ... where $|x| < 1$.
   (a) $\frac{5}{(1-x)^2}$ (b) $\frac{5}{(1+x)^2}$
   (c) $\frac{5}{(x-2)^2}$ (d) $\frac{5}{(x+2)^2}$

Space for rough work

7. If 5 harmonic means are inserted between 2 and 10, then find the 4th harmonic mean inserted.

(a) $\frac{20}{3}$ (b) $\frac{25}{6}$ (c) $\frac{30}{7}$ (d) $\frac{35}{8}$

8. If $x+7$ is a factor of x^2-3x+k, then find the value of k.

(a) –50 (b) –70 (c) 40 (d) 50

9. If ax^3+bx^2+cx+d is exactly divisible by $x+1$ and $x+2$, then which of the following is true?

(a) $3a-4b+d=0$ (b) $8a-b+2d=0$
(c) $5a-2b+3d=0$ (d) $6a-2b+d=0$

10. Find the remainder when x^{100} is divided by x^2-3x+2.

(a) $(2^{100}-2)x+(2^{100}-1)$ (b) $(2^{100}-1)x+(1-2^{100})$
(c) $(2^{100}-1)x+(2-2^{100})$ (d) $(2^{100}-2)x+(2-2^{100})$

11. If $f(x-1)=x^2-5x+7$, then find the remainder when $f(x)$ is divided by $x+3$.

(a) 20 (b) 21 (c) 22 (d) 23

Direction for questions 12 to 15: Match the statements of Column A with the values of Column B.

Column A	Column B
12. General term of an AP whose first term is a and the common difference is r.	(a) $\frac{a}{1-r}$
13. General term of a GP whose first term is a and the common ratio is r.	(b) $\frac{a-r}{n+1}$
14. The sum of infinite terms of a GP whose first term is a and the common ratio is r.	(c) $(n-1)r+a$
15. The common difference of an AP in which there are 'n' AM's between a and r.	(d) ar^{n-1}

Assessment Test II

Time: 30 min.

Space for rough work

Direction for questions 1 to 11: Select the correct answer from the given options.

1. If $x - 2$ is a factor of $x^2 - 5kx + 6$, then find the other factor.

   The following steps are involved in solving the above mentioned problem. Arrange them in sequential order.

   (A) $2^2 - 5\,k\,(2) + 6 = 0$.

   (B) $f(x) = x^2 - 5kx + 6$

   (C) $f(x) = x^2 - 5x + 6 = (x - 2)\,(x - 3)$.

   (D) $x - 2$ is a factor of $f(x)$ $\therefore$ $f(2) = 0$

   (a) CDAB (b) BADC (c) CDBA (d) BDAC

2. If the sum of the first n terms of a sequence is $n\,(3n + 1)$, then find the general term of the sequence.

   (a) $4n - 3$ (b) $6n - 2$ (c) $10n - 6$ (d) $6n - 3$

3. Which term of the AP 7, 3, –1, –5, ... is –153?

   (a) 38 (b) 39 (c) 40 (d) 41

4. The sum of the first 100 terms of the sequence 9, 99, 999, ... is ______.

   (a) $\frac{10}{9}(10^{101} - 90)$ (b) $\frac{10}{9}(10^{100} - 91)$

   (c) $\frac{10}{9}(10^{100} - 90)$ (d) $\frac{10}{9}(10^{99} - 91)$

5. If $\frac{a}{b}$, $\frac{b}{c}$, and $\frac{c}{a}$ are in AP, then which of the following is true?

   (a) ca^2, ab^2, and bc^2 are in AP.

   (b) ab^2, bc^2, and ca^2 are in AP.

   (c) a^2b, b^2c, and c^2a are in AP.

   (d) a, b, and c are in AP.

6. Find the sum of the series $1 + x + 2 - x^2 + 3 - x^3 + \ldots$ where $|x| < 1$.

   (a) $\frac{x^2 + x + 1}{(1 - x)^2}$ (b) $\frac{x^2 + x - 1}{(1 - x)^2}$

   (c) $\frac{x^2 - x + 1}{(1 - x)^2}$ (d) $\frac{x^2 - x - 1}{(1 - x)^2}$

7. If 3 harmonic means are inserted between $\frac{1}{5}$ and $-\frac{1}{12}$, then find the 2nd harmonic mean inserted.

   (a) $\frac{1}{7}$ (b) $\frac{2}{7}$ (c) $-\frac{2}{7}$ (d) $-\frac{1}{7}$

Space for rough work

8. If $2x + 3$ is a factor of $6x^2 - 5x + k$, then find the value of k.
(a) –20 (b) –21 (c) –19 (d) –22

9. If $px^3 + qx^2 + rx + s$ is exactly divisible by $x + 1$ and $x - 3$, respectively, then which of the following is true?
(a) $6p + 3q + s = 0$ (b) $p + 2q + 3s = 0$
(c) $4p + 2q + s = 0$ (d) $3p + 4q + s = 0$

10. Find the remainder when x^{2014} is divided by $x^2 + 5x + 6$.
(a) $(3^{2014} - 2^{2014})x + (2^{2015} - 3^{2015})$
(b) $(2^{2014} - 3^{2014})x + (3.2^{2014} - 2.3^{2014})$
(c) $(3^{2014} - 2^{2014})x + (3.2^{2014} - 2.3^{2014})$
(d) $(2^{2014} - 3^{2014})x + (2^{2015} - 3^{2015})$

11. If $f(x + 4) = x^2 - 7x + 9$, then find the remainder when $f(x)$ is divided by $x + 7$.
(a) 207 (b) 209 (c) 210 (d) 211

Direction for questions 12 to 15: Match the statements of Column A with the values of Column B.

Column A	Column B
12. The sum of the first n terms of an AP whose the first term is a and the common difference is r	(a) $\frac{n}{2}(a+r)$
13. Common ratio of a GP in which there are n geometric means between a and b.	(b) $\frac{n}{2}(2a+nr-r)$
14. The sum of the first 'n' terms of a GP whose first term is a and the common ratio is r.	(c) $\frac{a(r^n-1)}{r-1}$
15. Sum of the first 'n' terms of an AP whose first term is a and the last term is r.	(d) $\left(\frac{b}{a}\right)^{\frac{1}{n+1}}$

Assessment Test III

Time: 30 min.

Space for rough work

Direction for questions 1 to 15: Select the correct answer from the given options.

1. Find the value of a, if $ax^3 - (a + 1)\,x^2 + 3x - 2a$ is divisible by $(x - 3)$.

   The following steps are involved in solving the above mentioned problem. Arrange them in a sequential order.

   (a) $f(3) = 16a = 0$

   (b) $f(x)$ is divisible by $(x - 3)$.

   $\Rightarrow f(3) = 27a - 9a - 9 + 9 - 2a = 0$

   (c) If $f(x)$ is divisible by $(x - a)$, then $f(a) = 0$.

   (d) $f(3)$ to be zero, 'a' must be zero.

   (a) CBDA (b) BCDA (c) CBAD (d) BCAD

2. The remainder when $12x^6 - 4x^3 - 9$ is divided by $(x^3 - 5)$ is _______.

   (a) 27 (b) 271 (c) 183 (d) 281

3. Find the remainder, when $f(x) = x^2 + 6x + 8$ is divided by $2x - 1$.

   (a) $\frac{45}{4}$ (b) $\frac{43}{4}$ (c) 11 (d) $\frac{23}{4}$

4. If the polynomial $x^3 + ax^2 - bx - 30$ is exactly divisible by $x^2 - x - 6$ then, find the third factor.

   (a) $x - 6$ (b) $x + 6$ (c) $x - 5$ (d) $x + 5$

5. The polynomials $f(x) = x^2 + 5x + 6$ and $g(x) = x^2 - 2x + k$ have a common factor. Then the maximum value of k is ______.

   (a) –8 (b) –12 (c) –18 (d) –15

6. What should be added to $3x^3 + 5x^2 - 7x + 5$ to make the sum exactly divisible by $(x - 2)$?

   (a) 35 (b) –35 (c) 25 (d) –25

7. Which of the following is not a factor of $x^4 - 25x^2 + 144$?

   (a) $(x - 4)$ (b) $x^2 - 16$ (c) $x^2 - 9$ (d) $(x - 8)$

8. If there are 5 arithmetic means between 8 and 3, then the 4th arithmetic mean is ______.

   (a) $\frac{7}{6}$ (b) $\frac{10}{3}$ (c) $\frac{17}{6}$ (d) $\frac{14}{3}$

9. An nth term of the sequence 7, 16, 25, 34, 43, is 115. Find n.

   (a) 16 (b) 15 (c) 14 (d) 13

10. The sum of the series $1 + (1 + 3) + (1 + 3 + 5) + \ldots + (1 + 3 + \ldots + 15)$ is ______.

    (a) 202 (b) 203 (c) 204 (d) 205

Space for rough work

11. Find the 9th term of the GP whose first term is 12 and the common ratio is $\frac{3}{2}$.

(a) $\left(\frac{3}{2}\right)^6$ (b) $\left(\frac{3}{4}\right)^6$ (c) $\left(\frac{9}{4}\right)^4$ (d) $\left(\frac{27}{3}\right)^3$

12. Find the geometric mean of the first 33 powers of 2.

(a) 2^{17} (b) 2^{18} (c) 2^{16} (d) 2^{19}

13. The sum of 20 terms of the series 9, 99, 999, 9999, … is ______.

(a) $\frac{10}{9}[10^{20} - 19]$ (b) $\frac{10}{9}[10^{19} - 9]$

(c) $\frac{10}{9}[10^{21} - 1]$ (d) $(10/9)[(10^{19}) - 19]$

14. Find the sum of infinite terms of $\frac{1}{3} + \frac{1}{3^2} + \frac{1}{3^3} +$ ________.

(a) $\frac{1}{2}$ (b) 1 (c) 2 (d) $\frac{2}{3}$

15. Match the values of Column A with those of Column B.

Column A	Column B
(i) $1 + 3 + 5 + \_\_\_\_ + 99$	(A) 50×51
(ii) $2 + 4 + 6 + \_\_\_\_ + 100$	(B) $\frac{50 \times 51}{2}$
(iii) $1 + 2 + 3 + \_\_\_\_ + 50$	(C) 55^2
(iv) $1^3 + 2^3 + 3^3 + \_\_\_\_ + 10^3$	(D) 50^2

(a) (i) → (A); (ii) → (B); (iii) → (D); (iv) → (C)
(b) (i) → (D); (ii) → (A); (iii) → (B); (iv) → (C)
(c) (i) → (D); (ii) → (B); (iii) → (C); (iv) → (A)
(d) (i) → (B); (ii) → (C); (iii) → (C); (iv) → (D)

Assessment Test IV

Time: 30 min.

Space for rough work

Direction for questions 1 to 15: Select the correct answer from the given options.

1. Find the remainder when x^9 is divided by $x^2 - 3x + 2$.

   The following steps are involved in solving the above mentioned problem. Arrange them in a sequential order.

   (a) $x^9 = (x - 2)(x - 1)\,Q(x) + (ax + b)$

   (b) $x^9 = (x^2 - 3x + 2)\,Q(x) + (ax + b)$

   (c) $x^9 = (x^2 - 3x + 2)\,Q(x) + (511x - 510)$

   (d) $1 = a + b$, $2^9 = 2a + b$

   (a) ABCD (b) BCDA (c) BADC (d) BDAC

2. Find the remainder, when $f(x) = x^3 + 6x^2 - 8x + 1$ is divided by $(x - 2)$.

   (a) 17 (b) 18 (c) 19 (d) 20

3. $f(x) = x^3 + bx^2 + ax + 40$ and $g(x) = x^2 - 6x + 8$

   If $g(x)$ is a factor of $f(x)$, then find the third factor.

   (a) $x + 2$ (b) $x - 3$ (c) $x + 5$ (d) $x + 6$

4. If $f(x) = x^2 + 13x + 36$ and $g(x) = 2x^2 - 11x - k$ have a common factor, then find the minimum value of k.

   (a) 14 (b) 76 (c) 137 (d) 261

5. What should be subtracted from $4x^4 - 5x^3 + 6x^2 - 79x + 6$ to make it exactly divisible by $(x - 3)$?

   (a) 0 (b) 6 (c) 12 (d) –12

6. Which of the following cannot be a factor of $x^5 - ax^3 + bx^2 + 200$?

   (a) $(x^3 - 8)$ (b) $(x^2 - 25)$

   (c) $(x + 5)$ (d) $(x + 15)$

7. The remainder when $f(x) = 15x^6 - 7x^3 + 15$ is divided by $(x^3 - 3)$ is ______.

   (a) 129 (b) 121 (c) 124 (d) 120

8. Which of the following is the next term of the series?

   $\frac{5}{16}, \frac{5}{24}, \frac{5}{36}, \frac{5}{54}, \ldots?$

   (a) $\frac{10}{243}$ (b) $\frac{20}{729}$ (c) $\frac{5}{81}$ (d) $\frac{5}{72}$

9. The sum of $1 + (1 + 2) + (1 + 2 + 3) + (1 + 2 + 3 + 4) + \ldots + (1 + 2 + 3 + \ldots 10)$ is ______.

   (a) 220 (b) 215 (c) 210 (d) 205

10. Find the 5th term of a geometric progression whose first term is 8 and the

Space for rough work

common ratio is 5.

(a) 1000 (b) 4000 (c) 5000 (d) 10,000

11. Find the geometric mean of 6, 18, 54, and 162.

(a) $18\sqrt{2}$ (b) 54 (c) $18\sqrt{6}$ (d) $18\sqrt{3}$

12. The sum of the first 15 terms of the sequence 8, 88, 888, 8888, … is ______.

(a) $\frac{8}{9}\left[\frac{1}{9}(10^{15}-1)-15\right]$ (b) $\frac{8}{9}\left[\frac{10}{9}(10^{15}-1)-15\right]$

(c) $\frac{8}{9}\left[(10^{15}-1)-15\right]$ (d) $\frac{8}{9}\left[\frac{10}{9}(10^{15}-1)-9\right]$

13. If there are 7 A.M's between 5 and 8, find the 7th A.M.

(a) $\frac{61}{8}$ (b) $\frac{61}{56}$ (c) $\frac{61}{63}$ (d) $\frac{61}{64}$

14. Find the sum of infinite terms of the series

$1+\frac{1}{2}+\frac{1}{2^2}+\frac{1}{2^3}+\frac{1}{2^4}+\ldots$

(a) $\frac{3}{2}$ (b) 2 (c) $\frac{5}{2}$ (d) 3

15. Match the values of Column A with those of Column B.

Column A	Column B
(i) $\Sigma[n(n-1)]$	(A) $\frac{n^2(n+1)^2}{4}$
(ii) $\Sigma(2n-1)$	(B) $n\,(n+1)$
(iii) $\Sigma(2n)$	(C) n^2
(iv) Σn^3	(D) $\frac{n(n^2-1)}{3}$

(a) (i) → (A); (ii) → (B); (iii) → (C); (iv) → (D)
(b) (i) → (D); (ii) → (C); (iii) → (B); (iv) → (A)
(c) (i) → (A); (ii) → (C); (iii) → (B); (iv) → (D)
(d) (i) → (D); (ii) → (B); (iii) → (C); (iv) → (A)

Answer Keys

Assessment Test I

1. (c)	**2.** (c)	**3.** (b)	**4.** (a)	**5.** (d)	**6.** (a)	**7.** (c)	**8.** (b)	**9.** (d)	**10.** (c)
11. (b)	**12.** (c)	**13.** (d)	**14.** (a)	**15.** (b)					

Assessment Test II

1. (d)	**2.** (b)	**3.** (d)	**4.** (b)	**5.** (a)	**6.** (c)	**7.** (c)	**8.** (b)	**9.** (a)	**10.** (b)
11. (a)	**12.** (b)	**13.** (d)	**14.** (c)	**15.** (a)					

Assessment Test III

1. (c)	**2.** (b)	**3.** (a)	**4.** (d)	**5.** (a)	**6.** (b)	**7.** (d)	**8.** (d)	**9.** (d)	**10.** (c)
11. (d)	**12.** (a)	**13.** (a)	**14.** (a)	**15.** (b)					

Assessment Test IV

1. (c)	**2.** (a)	**3.** (c)	**4.** (b)	**5.** (c)	**6.** (d)	**7.** (a)	**8.** (c)	**9.** (a)	**10.** (c)
11. (d)	**12.** (b)	**13.** (a)	**14.** (b)	**15.** (b)					

Statistics, Counting Techniques, and Probability 7

Reference: *Coursebook - IIT Foundation Mathematics Class 10; Chapters - Statistics; Probability; pp. 12.1–12.28; 21.1–21.7*

Assessment Test I

Time: 30 min.

Direction for questions 1 to 11: Select the correct answer from the given options.

Space for rough work

1. The following steps are involved in finding the quartile deviation of 14, 25, 11, 28, 13, 18, and 21. Arrange them in sequential order.

   (A) $Q_3 = 3\left(\frac{n+1}{4}\right)^{\text{th}}$ observation $= 3\left(\frac{7+1}{4}\right)^{\text{th}} = 6$th observation $= 25$

   (B) The ascending order of the given observations is 11, 13, 14, 18, 21, 25, 28

   (C) Q.D. $= \frac{Q_3 - Q_1}{2} = \frac{25-13}{2} = 6$

   (D) $Q_1 = \left(\frac{n+1}{4}\right)^{\text{th}} = \left(\frac{7+1}{4}\right)^{\text{th}}$ observation, i.e., 2nd observation $= 13$

   (a) BDCA (b) DABC (c) DACB (d) BDAC

2. Find the arithmetic mean of the first 20 terms of the series 2, 4, 8, 16, …

   (a) $\frac{2^{20}-1}{20}$ (b) $\frac{2^{20}-1}{10}$ (c) $\frac{2^{40}-1}{20}$ (d) $\frac{2^{40}-1}{10}$

3. The observations of a certain data are $\frac{x}{3}, \frac{x}{6}, \frac{2x}{7}, \frac{3x}{8}, \frac{x}{4}, \frac{2x}{3}$, and $\frac{x}{7}$ where $x > 0$. If the median of the data is 12, then what will be the value of x?

   (a) 36 (b) 42 (c) 40 (d) 44

4. The mode of the data 5, 4, x, 3, 2, 5, 3, 5, 2, 3, 5, where $x > 3$, is ______.

   (a) 2 (b) 4 (c) 5 (d) 3

5. Calculate standard deviation of the data 2005, 2009, 2008, 2007, and 2011.

   (a) 2 (b) 3 (c) 4 (d) 5

6. From 9 gentlemen and 6 ladies, a committee of 5 members is to be formed. In how many ways this committee consists of at least 3 gentlemen?

   (a) 1834 (b) 1962 (c) 2142 (d) 2206

Space for rough work

7. A password of 4 letters is to be formed with a, b, c, d and e. How many passwords are possible if repetition of letters is not allowed?
(a) 625 (b) 120 (c) 140 (d) 150

8. How many words can be formed by using the letters of the word "TRAPEZIUM" which begin with A and end with Z?
(a) 5040 (b) 720 (c) 2450 (d) 120

9. A four-digit number is formed by using the digits 3, 5, 6, 8 and 9 with repetition. If one number is selected from those numbers, then what is the probability that it will be an odd number?
(a) $\frac{2}{3}$ (b) $\frac{2}{5}$ (c) $\frac{1}{3}$ (d) $\frac{3}{5}$

10. Given l_1 and l_2 are two parallel lines. How many triangles are formed with 10 points taking on l_1 and 8 points on l_2?
(a) 360 (b) 280 (c) 640 (d) 816

11. Of the six faces of a dice, two of the faces are painted white, two of the faces are painted green and the other two faces are painted yellow. Two of such dice are rolled. The probability that both the dice show different colours is ________.
(a) 1/3 (b) 2/9 (c) 2/3 (d) 7/9

Direction for questions 12 to 15: Match the statements of Column A with the values of Column B.

Column A	Column B
12. The probability of getting all heads when three coins are tossed.	(a) $\frac{1}{2}$
13. If two numbers are selected from the set {1, 2, 5, 7}, then the probability that the sum of the numbers is even.	(b) $\frac{1}{8}$
14. The probability that a non-leap year has 53 Sundays.	(c) $\frac{1}{4}$
15. When two dice are rolled, the probability that numbers coming up on both the dice are same.	(d) $\frac{1}{6}$
	(e) $\frac{1}{7}$

Assessment Test II

Time: 30 min.

Space for rough work

Direction for questions 1 to 11: Select the correct answer from the given options.

1. The following steps are involved in finding the value of r from ${}^nP_r = 990$. Arrange them in sequential order.
   (A) ${}^nP_r = \dfrac{11\,!}{8\,!}$
   (B) ${}^nP_r = 990 = 11 \times 10 \times 9$
   (C) ${}^nP_r = {}^{11}P_3 \Rightarrow r = 3$
   (D) ${}^nP_r = \dfrac{11!}{(11-3)!} = {}^{11}P_3$
   (a) ADBC (b) BDAC (c) BADC (d) CABD

2. Find the arithmetic mean of the first 100 terms of the series 2, 6, 10, 14, ….
   (a) 180 (b) 200 (c) 250 (d) 300

3. The observations of a certain data are $\frac{x}{2}, \frac{2x}{3}, \frac{3x}{5}, \frac{4x}{7}, \frac{5x}{12}$, and $\frac{6x}{13}$, where $x > 0$. If the median of the data is 60, then find the value of x.
   (a) 100 (b) 112 (c) 120 (d) 125

4. The mode of the observations 3, 6, 3, 7, 7, 9, 3, 9, 7, 6, 3, 6, 7, x, and 6 cannot be ______.
   (a) 3 (b) 6 (c) 7 (d) 9

5. Calculate the variance of the data 5012, 5013, 5015, 5018, and 5022.
   (a) 13.2 (b) 12.7 (c) 15.5 (d) 16.4

6. From 10 gentlemen and 7 ladies, a committee of 5 members is to be formed. In how many ways, the committee consists of at most 2 ladies?
   (a) 2880 (b) 3990 (c) 2660 (d) 4242

7. A password of 4 letters is to be formed with vowels alone. How many passwords are possible if repetition of letters is allowed?
   (a) 120 (b) 256 (c) 625 (d) 1024

8. How many words by using the letters of the word "MATHS" can be formed that begin with A and do not end with T?
   (a) 18 (b) 21 (c) 24 (d) 27

Space for rough work

9. A four-digit number is formed by using the digits 4, 5, 7, and 8 without repetition. If one number is selected from those numbers, then what is the probability that it is divisible by 3?
(a) 0 (b) 1 (c) $\frac{1}{2}$ (d) $\frac{1}{3}$

10. Given l_1 and l_2 are two parallel lines. How many triangles are formed with 12 points taking on l_1 and 6 points on l_2?
(a) 576 (b) 396 (c) 180 (d) 472

11. Of the six faces of a dice, two of the faces are painted red, two of the faces are painted black, and the other two faces are painted blue. Two such dice are rolled. The probability that both the dice show same colour is ________.
(a) 2/3 (b) 1/3 (c) 1/9 (d) 8/9

Direction for questions 12 to 15: Match the statements of Column A with the values of Column B.

	Column A	Column B
12.	The probability of getting two heads when three coins are tossed.	(a) $\frac{1}{5}$
13.	The probability that a card selected at random from a pack of cards is a numbered card.	(b) $\frac{1}{6}$
14.	Two numbers are chosen from 1 to 10. The probability that they are consecutive.	(c) $\frac{3}{8}$
15.	When two dice are rolled, the probability that the sum of numbers coming up on both the dice will be a multiple of 6.	(d) $\frac{1}{6}$
		(e) $\frac{9}{13}$

Assessment Test III

Time: 30 min.

Space for rough work

Direction for questions 1 to 15: Select the correct answer from the given options.

1. The following steps are involved in finding the mean of a grouped data in deviation method. Arrange them in a sequential order.
   (A) Assume a mid-value of a class as mean (A).
   (B) Calculate $f_{ix}\,\mu_i$ for each class.
   (C) Calculate $\mu_i = \dfrac{x_i - \text{A}}{\text{C}}$.
   (D) Calculate the mid-values of each class (x_i).
   (E) Calculate total frequency (N) and $\Sigma f_i\,\mu_i$.
   (a) BCDEA (b) ACBDE
   (c) DACBE (d) DAEBC

2. Calculate the standard deviation of the following data 12, 15, 18, 16, 9.
   (a) $\sqrt{8}$ (b) $\sqrt{10}$ (c) $\sqrt{12}$ (d) $\sqrt{15}$

3. Find the arithmetic mean of the series 13, 15, 17, 19, 21, … 57.
   (a) 32 (b) 37 (c) 33 (d) 35

4. Find the median of the data 123, 134, 145, 156, … 343.
   (a) 231 (b) 233 (c) 225 (d) 240

5. Find the mode of the following data.

Observation	5	15	25	35	45
Frequency	6	8	12	9	5

   (a) 15 (b) 35 (c) 45 (d) 25

6. Find the number of 3-digit numbers that can be formed using the digits 2, 5, 7, 8, and 9, if every digit can occur at most once in any number.
   (a) 125 (b) 68 (c) 60 (d) 65

7. How many 5-digit odd numbers can be formed using the digits 2, 3, 5, 7, 8, and 9 if every digit can occur at most once in any number?
   (a) 400 (b) 475 (c) 420 (d) 480

8. Fifteen points are marked on a plane so that no three points are collinear except 5 points. How many different lines can be drawn through these points?
   (a) 89 (b) 95 (c) 96 (d) 90

9. If ${}^nP_r = 2730$ and ${}^nC_r = 455$ then, find the value of r.
   (a) 2 (b) 3 (c) 4 (d) 5

Space for rough work

10. A committee of 6 members is to be formed from 8 men and 5 women. Find the number of ways of forming the committee if it has to contain 4 men and 2 women.
(a) 700 (b) 850 (c) 1000 (d) 1100

11. If a card is drawn from a well-shuffled pack of cards, what is the probability that the card being a red king card?
(a) $\frac{1}{13}$ (b) $\frac{1}{26}$ (c) $\frac{2}{13}$ (d) $\frac{3}{26}$

12. Mobile phone numbers of a company network start with 98 and it is a ten-digit number. If no digit repeats, how many customers can it have at the most?
(a) 40,320 (b) 4,03,200
(c) 4,032,000 (d) 4,03,200

13. If a number is selected from the set of four-digit natural numbers, then what is the probability that the digits of the numbers are any 4 consecutive natural numbers in any order?
(a) $\frac{16}{1125}$ (b) $\frac{15}{1024}$ (c) $\frac{1}{1500}$ (d) $\frac{2}{125}$

14. If A = the sum of the first 21 natural numbers, B = the sum of the squares of the first 9 natural numbers, C = the sum of the first 16 odd natural numbers, and D = the sum of the first 15 even natural numbers, then find the average of A, B, C, and D.
(a) 253 (b) 243 (c) 273 (d) 264

15. Match the values of Column A with those of Column B.

Column A	Column B
(i) $^{100}C_0$	(A) 100
(ii) $^{100}C_{99}$	(B) 99
(iii) $^{99}C_{98}$	(C) 98
(iv) $^{98}C_1$	(D) 1

(a) (i) → (C); (ii) → (B); (iii) → (D); (iv) → (A)
(b) (i) → (D); (ii) → (A); (iii) → (B); (iv) → (C)
(c) (i) → (D); (ii) → (B); (iii) → (C); (iv) → (A)
(d) (i) → (D); (ii) → (B); (iii) → (A); (iv) → (C)

Assessment Test IV

Time: 30 min.

Space for rough work

Direction for questions 1 to 15: Select the correct answer from the given options.

1. The following steps are involved in the calculation of mode of a grouped data exclusive class. Arrange them in sequential order.
   (a) Calculate the total frequency (n), the lower boundary (L_1), and the length of the class (c) of the modal class.
   (b) Identify f_1 and f_2.
   (c) Find the modal class of the data.
   (d) Find the highest frequency (f).
   (e) $\text{Mode} = L_1 + \dfrac{(f - f_1)}{(2f - f_1 - f_2)} \times C$

   (a) DABCE (b) DBCAE
   (c) ABCDE (d) DCABE

2. Calculate the variance of the data 4, 8, 9, 11, 13.
   (a) 8.2 (b) 6.4 (c) 9.2 (d) 8.4

3. Find the arithmetic mean of the series 28, 30, 32, 34, … 66.
   (a) 47 (b) 45 (c) 43 (d) 51

4. Find the median of the data 9, 16, 25, 36, … 225.
   (a) 49 (b) 64 (c) 81 (d) 100

5. Find the mode of the following data.

Observation	5	15	25	35	45
Frequency	4	6	10	19	6

   (a) 45 (b) 35 (c) 25 (d) 15

6. Find the number of different codes that can be formed using all the digits 0, 1, 3, 7 without repeating any digit.
   (a) 24 (b) 32 (c) 36 (d) 20

7. How many 4-digit even numbers can be formed using 2, 3, 4, 5, 6, and 7 (without repetition)?
   (a) 160 (b) 175 (c) 180 (d) 200

8. Twenty-six points are marked on a plane with names A, B, C, … X, Y, Z, so that no three points are collinear, but all the points represented by vowels are collinear. Find the number of triangles that can be formed by joining these points.
   (a) 2570 (b) 2590 (c) 2490 (d) 2580

Space for rough work

9. If ${}^nP_r = 5040$ and ${}^nC_r = 210$, then find the value of r.
(a) 7 (b) 6 (c) 5 (d) 4

10. A team of 8 members should be formed from 10 boys and 6 girls. Find the number of ways of forming the team if it has to contain 5 boys and 3 girls.
(a) ${}^{10}C_5 + {}^6C_3$ (b) ${}^{10}C_5 \times {}^6C_3$
(c) ${}^{16}C_5$ (d) ${}^{16}C_5 + {}^{16}C_3$

11. If a card is drawn from a well-shuffled pack of cards, then what is the probability of the card being a queen card?
(a) $\frac{1}{26}$ (b) $\frac{1}{52}$ (c) $\frac{1}{13}$ (d) $\frac{2}{13}$

12. A company wanted to release fancy numbers (starting with 99) and each number is divided into 5 pairs as mentioned in the following table. Each pair should have the same digit but different from the digits of any other pairs. Find the number of such fancy numbers.

I		II		III		IV		V	
9	9								

(a) 3626 (b) 4464 (c) 3024 (d) 4235

13. If a 3-digit natural number is selected at random, then what is the probability that the number has its 10's digit an odd natural number?
(a) $\frac{1}{2}$ (b) $\frac{1}{3}$ (c) $\frac{2}{3}$ (d) $\frac{1}{4}$

14. If $A = 1 + 2 + 3 \ldots + 50$
$B = 1 + 3 + 5 + \ldots + 75$
$C = 2 + 4 + 6 + \ldots + 76$
Find the median of the data A, B, and C.
(a) 1225 (b) 1482 (c) 1275 (d) 1444

15. Match the following about the data 5, 7, 8, 10, 12, 16, 19, 21.

Column A	Column B
(i) First quartile	(A) 4.5
(ii) Second quartile (median)	(B) 7
(iii) Third quartile	(C) 11
(iv) Quartile range	(D) 16

(a) (i) → (B); (ii) → (C); (iii) → (D); (iv) → (A)
(b) (i) → (B); (ii) → (D); (iii) → (C); (iv) → (A)
(c) (i) → (A); (ii) → (C); (iii) → (D); (iv) → (B)
(d) (i) → (C); (ii) → (B); (iii) → (A); (iv) → (D)

Answer Keys

Assessment Test I

1. (d)	**2.** (b)	**3.** (b)	**4.** (c)	**5.** (a)	**6.** (c)	**7.** (b)	**8.** (a)	**9.** (d)	**10.** (c)
11. (c)	**12.** (b)	**13.** (a)	**14.** (e)	**15.** (d)					

Assessment Test II

1. (c)	**2.** (b)	**3.** (b)	**4.** (d)	**5.** (a)	**6.** (d)	**7.** (c)	**8.** (a)	**9.** (b)	**10.** (a)
11. (b)	**12.** (c)	**13.** (e)	**14.** (a)	**15.** (b)					

Assessment Test III

1. (c)	**2.** (b)	**3.** (d)	**4.** (b)	**5.** (d)	**6.** (c)	**7.** (d)	**8.** (c)	**9.** (b)	**10.** (a)
11. (b)	**12.** (a)	**13.** (d)	**14.** (c)	**15.** (b)					

Assessment Test IV

1. (c)	**2.** (c)	**3.** (a)	**4.** (c)	**5.** (b)	**6.** (a)	**7.** (c)	**8.** (b)	**9.** (d)	**10.** (b)
11. (c)	**12.** (c)	**13.** (a)	**14.** (d)	**15.** (a)					

Trigonometry and Coordinate Geometry

8

Reference: *Coursebook - IIT Foundation Mathematics Class 10; Chapters - Trigonometry; Coordinate Geometry; pp. 8.1–8.22; 15.1–15.23*

Assessment Test I

Time: 30 min.

Direction for questions 1 to 11: Select the correct answer from the given options.

Space for rough work

1. The following steps are involved in finding the equation of a line passing through the point (5, –6) and parallel to the line $3x - 5y + 11 = 0$. Arrange the steps in sequential order.

   (A) This line passes through (5, –6).

   (B) $3(5) - 5(-6) + k = 0$

   (C) $3x - 5y + k = 0$

   (D) $3x - 5y - 45 = 0$

   (a) CBAD (b) CABD (c) ACBD (d) CDAB

2. If $\tan A = \dfrac{5}{12}$ and A is not in the first quadrant, then find $\dfrac{\sin A + \cos A}{\sin A - \cos A}$.

   (a) $\dfrac{-12}{5}$ (b) $\dfrac{-17}{7}$ (c) $\dfrac{12}{5}$ (d) $\dfrac{-15}{7}$

3. If $\sec \theta + \operatorname{cosec} \theta = 0$, then $\tan \theta =$ ______.

   (a) 0 (b) 1 (c) –1 (d) –2

4. If $\dfrac{1+\tan A}{1-\tan A} = \tan 75°$, then A = _____.

   (a) 30° (b) 45° (c) 15° (d) 60°

5. Find the relation obtained by eliminating 'θ' from the equations $x = a \sec \theta$ and $y = b \tan \theta$.

   (a) $\dfrac{x^2}{a^2} + \dfrac{y^2}{b^2} = 1$ (b) $a^2 x^2 + b^2 y^2 = 1$

   (c) $a^2 x^2 - b^2 y^2 = 1$ (d) $\dfrac{x^2}{a^2} - \dfrac{y^2}{b^2} = 1$

6. If $5 \cot^2 A = \sin^2 60° + \sec^2 30°$, then what will be the value of $\operatorname{cosec}^2 A$?

   (a) $\dfrac{5}{12}$ (b) $\dfrac{11}{12}$ (c) $\dfrac{17}{12}$ (d) $\dfrac{7}{12}$

7. Find the value of $\cos^2 10° + \cos^2 20° + \cos^2 30° + \ldots + \cos^2 90°$.

   (a) 3 (b) $3\dfrac{1}{2}$ (c) 4 (d) $4\dfrac{1}{2}$

Space for rough work

8. From the top of a tower 150 m high, the angles of depression of the top and bottom of a building are observed to be 45° and 60°, respectively. Find the height of the building (in m).

(a) $100(3-\sqrt{3})$ (b) $50(3-\sqrt{3})$
(c) $75(\sqrt{3}-1)$ (d) $50(\sqrt{3}-1)$

9. Find the area of the triangle formed by the line $5x + 4y - 20 = 0$ with the coordinate axes (in square units).

(a) 10 (b) 12 (c) 15 (d) 20

10. Find the equation of a line passing through (–2, 3) and making x–intercept 5 units.

(a) $3x + 4y - 6 = 0$ (b) $5x + 7y - 11 = 0$
(c) $2x + 5y - 10 = 0$ (d) $3x + 7y - 15 = 0$

11. If C(–3, 6) divides the line segment joining A(–9, –12) and B(0, 15) internally, then find the value of $\frac{AB}{AC}$.

(a) 2 (b) $\frac{3}{2}$ (c) 3 (d) $\frac{5}{2}$

Direction for questions 12 to 15: Match the statements of Column A with the values of Column B.

Column A	Column B
12. Distance between the origin and the midpoint of line segment joining (5, 2) and (1, –10)	(a) $\frac{1}{2}$
13. The slope of the line $\frac{x}{2}-\frac{y}{6}=1$	(b) 0
14. $\sin\frac{\pi^c}{4}\cos\frac{\pi^c}{4}\tan\frac{\pi^c}{4}$	(c) 1
15. Area of the triangle formed by the vertices (1, 2), (2, 3), and (3, 4)	(d) 3
	(e) 5

Assessment Test II

Time: 30 min.

Space for rough work

Direction for questions 1 to 11: Select the correct answer from the given options.

1. The following steps are involved in finding the equation of a line passing through the point (–3, 2) and perpendicular to the line $4x + 7y - 13 = 0$. Arrange them in sequential order.

   (A) $7(-3) - 4(2) + k = 0 \quad k = 29$

   (B) $7x - 4y + k = 0$

   (C) $7x - 4y + 29 = 0$

   (D) The line passes through (–3, 2).

   (a) BADC (b) BCDA (c) DBAC (d) BDAC

2. If $\cos A = \frac{8}{17}$ and A is not in the first quadrant, then find the value of $\frac{\text{cosec } A + \cot A}{\text{cosec } A - \cot A}$.

   (a) $\frac{31}{15}$ (b) $\frac{18}{11}$ (c) $\frac{25}{9}$ (d) $\frac{27}{13}$

3. If cosec θ – cot θ = 0, then what will be the value of sec θ?

   (a) 0 (b) 1 (c) –1 (d) 2

4. If $\frac{1 - \tan\theta}{1 + \tan\theta} = \tan 30°$, then θ = _____.

   (a) 15° (b) 30° (c) 45° (d) 60°

5. Find the relation obtained by eliminating 'θ' from the equations $a = b$ cosec θ and $x = y \tan \theta$.

   (a) $\frac{a^2}{b^2} - \frac{x^2}{y^2} = 1$ (b) $\frac{a^2}{b^2} - \frac{y^2}{x^2} = 1$

   (c) $\frac{b^2}{a^2} - \frac{x^2}{y^2} = 1$ (d) $\frac{b^2}{a^2} - \frac{y^2}{x^2} = 1$

6. If $\sec^2 A = \cot^2 30° + 2\cos^2 45°$, then find the value of $\sin^2 A$.

   (a) $\frac{1}{4}$ (b) $\frac{1}{2}$ (c) $\frac{3}{4}$ (d) 1

7. Find the value of $\sin^2 5° + \sin^2 15° + \sin^2 25° + \ldots + \sin^2 85°$.

   (a) $3\frac{1}{2}$ (b) 4 (c) $4\frac{1}{2}$ (d) 5

8. From the top and the bottom of a building 50 m high, the angles of elevation are 30° and 45°, respectively. Find the height of the tower (in m).

   (a) $50(\sqrt{3} + 3)$ (b) $100(\sqrt{3} - 1)$

   (c) $75(\sqrt{3} + 1)$ (d) $25(\sqrt{3} + 3)$

Space for rough work

9. What will be the area of the triangle formed by the line $8x - 3y - 12 = 0$ with the coordinate axes (in square units)?

(a) 3 (b) 3.5 (c) 4 (d) 4.5

10. Find the equation of a line making y–intercept 3 units and passing through (–3, –5).

(a) $8x - 3y + 9 = 0$ (b) $3x + 5y - 15 = 0$
(c) $2x - 5y - 19 = 0$ (d) $6x + y - 23 = 0$

11. If PQ is a median of a triangle such that $P = (-4, 7)$ and $Q = (3, -5)$, then find the centroid of the triangle (consider P as a vertex of the triangle).

(a) $\left(-2, \frac{4}{3}\right)$ (b) $\left(\frac{1}{3}, \frac{-2}{3}\right)$
(c) $\left(\frac{2}{3}, -1\right)$ (d) $\left(\frac{5}{3}, \frac{-1}{3}\right)$

Direction for questions 12 to 15: Match the statements of Column A with the values of Column B.

Column A	Column B
12. Distance between the origin and the centroid of the triangle formed with the vertices $A(3, 9)$, $B(10, 11)$, and $C(2, 16)$	(a) $\frac{1}{2}$
13. The slope of the line making x–intercept 3 and y–intercept 6	(b) $\frac{4}{3}$
14. $\sec\frac{\pi^c}{3}\,\mathrm{cosec}\frac{\pi^c}{3}\cot\frac{\pi^c}{3}$	(c) 13
15. Area of the triangle formed by the vertices (3, 7), (0, –3), and (–5, 1).	(d) 31
	(e) –2

Assessment Test III

Time: 30 min.

Space for rough work

Direction for questions 1 to 15: Select the correct answer from the given options.

1. The following steps are involved in finding the general formula for the distance between the two points A(x_1, y_1) and B(x_2, y_2). Arrange them in sequential order.

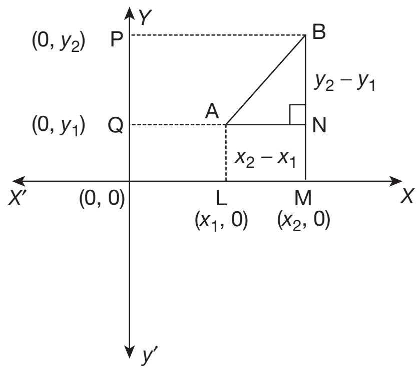
   (A) ABN is a right triangle.

   (B) Join AB and draw perpendiculars on to the coordinate axes from A and B.

   (C) Calculate the lengths of AN and BN.

   (D) Mark A(x_1, y_1) and B(x_2, y_2) on a coordinate plane.

   (E) Apply the Pythagoras theorem for the ΔABN and find AB.



   (a) ABCDE (b) DBEAC

   (c) DCBEA (d) DBACE

2. If $\sin\theta = \frac{11}{61}$, then $\sec\theta - \tan\theta =$ _______.

   (a) $\frac{5}{6}$ (b) $\frac{60}{121}$ (c) $\frac{6}{5}$ (d) $\frac{31}{30}$

3. Solve for: $\sin 75° \times \tan 15°$.

   (a) $\frac{\sqrt{3}+1}{2\sqrt{2}}$ (b) $2-\sqrt{3}$ (c) $\frac{\sqrt{3}-1}{2\sqrt{2}}$ (d) $\sqrt{3}-1$

4. If $x = a\cos\theta + b\sin\theta$ and $y = a\sin\theta - b\cos\theta$, then which of the following relations is correct?

   (a) $x^2 - y^2 = a^2 - b^2$ (b) $x^2 + y^2 = a^2 b^2$

   (c) $x^2 + y^2 = ab$ (d) $x^2 + y^2 = a^2 + b^2$

5. If $\frac{1}{\sqrt{3}}\cos\theta + \sin\theta = \frac{2}{\sqrt{3}}$, then the value of θ in circular measure is _______.

   (a) $\frac{\pi^c}{2}$ (b) $\frac{\pi^c}{3}$ (c) $\frac{\pi^c}{4}$ (d) $\frac{2\pi^c}{5}$

Space for rough work

6. Find the length of a chord which subtends an angle of 100°42′ at the centre of a circle of radius 7 cm.

	0′	….	18′	24′	….	Mean difference				
						1′	2′	3′	4′	5′
sin 50°	0.7660	….	.7694	.7705	….	2	4	6	7	9

(a) 10.78 cm (b) 2.46 cm
(c) 15.7 cm (d) 14.28 cm

7. Mangalam, a Mathematics historian, observes the tip of the hour hand and minute hand of an ancient clock displayed on a pedestal at 6 O′ clock from a point, which is 2 m away from the pedestal. Using a sextant, he found the angles of elevation to be 45° and 60°, respectively. What will be the approximate value of the diameter of the dial in centimetres (use $\sqrt{3} = 1.732$)?

(a) 126.4 (b) 146.4 (c) 73.2 (d) 63.2

8. The angle of elevation of the top of a tower is 45°. On walking 24 m towards the tower along the line joining the foot of the observer and foot of the tower, the angle of elevation is found to be 60°. Find the height of the tower (use = $\sqrt{3} = 1.732$).

(a) 48.96 m (b) 63.454 m
(c) 56.784 m (d) 56.762 m

9. Find the perimeter of the triangle whose vertices are (2, 4), (6, 8), and (2, 8).

(a) $4(\sqrt{2}+1)$ units (b) $4(2+\sqrt{2})$ units
(c) $12\sqrt{2}$units (d) $16\sqrt{2}$ units

10. Find a point on the x–axis which is equidistant from A(3, –6) and (–2, 5).

(a) $\left(\frac{3}{5}, 0\right)$ (b) $\left(\frac{8}{5}, 0\right)$
(c) $\left(\frac{9}{5}, 0\right)$ (d) $\left(\frac{6}{8}, 0\right)$

11. What will be the radius of the circle which passes through (0, 0), (6, 0), and (0, 8)?

(a) 5 units (b) 6 units
(c) 8 units (d) 10 units

12. Find the equation of a line passing through the point $P(2, 3)$ and parallel to $2x + 3y + 5 = 0$.

(a) $2x + 3y + 9 = 0$ (b) $3x + 2y - 13 = 0$
(c) $2x + 3y - 13 = 0$ (d) $2y + 3x + 13 = 0$

13. Calculate the area of a triangle whose vertices are A(1, 2), B(3, 5), and C(–2, 2).

(a) 5.5 (b) 4.5 (c) 6.5 (d) 7.5

Space for rough work

14. What will be the equation of the altitude of a triangle PQR which divides the base PQ in the ratio 2:3 where P(4, 7), and Q(6, 9)?

(a) $5x + 5y = 63$ (b) $2x + 3y = 70$

(c) $4x + 4y = 61$ (d) $5x + 5y = 61$

15. Find the correct match for the following data given in Column A and Column B about a triangle whose vertices are A(0, 0), B(0, 15), and C(20, 0).

Column A	Column B
(i) Centroid	(A) (5, 5)
(ii) Circumcentre	(B) (0, 0)
(iii) Orthocentre	(C) (10, 7.5)
(iv) Incentre	(D) $\left(\frac{20}{3}, 5\right)$

(a) (i) → (A); (ii) → (B); (iii) → (C); (iv) → (D)

(b) (i) → (D); (ii) → (C); (iii) → (B); (iv) → (A)

(c) (i) → (D); (ii) → (A); (iii) → (C); (iv) → (B)

(d) (i) → (D); (ii) → (A); (iii) → (C); (iv) → (B)

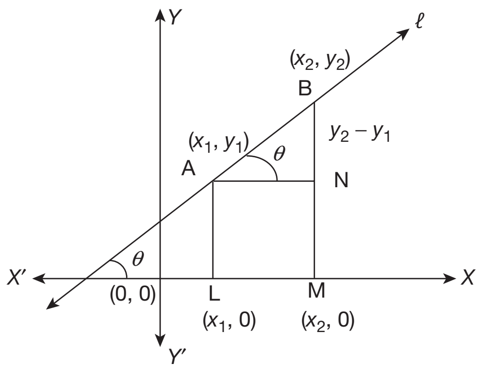
Assessment Test IV

Time: 30 min.

Space for rough work

Direction for questions 1 to 15: Select the correct answer from the given options.

1. The following steps are involved in finding the slope of a line passing through the points (x_1, y_1) and (x_2, y_2). Arrange them in sequential order.
   (A) Draw the perpendicular AL, BM on to the x–axis form A and B, respectively.
   (B) In ΔABN, calculate the lengths AN and BN and hence find $\tan\theta = \dfrac{BN}{AN}$.
   (C) Draw a line 'l', which makes an acute angle 'θ' with the x–axis on a coordinate plane.
   (D) ABN is a right triangle.
   (E) Let A(x_1, y_1) and B(x_2, y_2) be any two points on the line 'l'.



   (a) BACED (b) CEADB
   (c) CEDAB (d) ECADB

2. If $\cos\theta = \dfrac{9}{41}$, then $\operatorname{cosec}\theta - \cot\theta =$ _______.
   (a) $\dfrac{5}{3}$ (b) $\dfrac{4}{5}$ (c) $\dfrac{41}{40}$ (d) $\dfrac{21}{25}$

3. Solve: $\tan 75° \times \sec 15°$.
   (a) $\sqrt{6} + \sqrt{2}$ (b) $\sqrt{6} - \sqrt{2}$
   (c) $\dfrac{\sqrt{3}+1}{2\sqrt{2}}$ (d) $\dfrac{\sqrt{3}-1}{2\sqrt{2}}$

4. If $x = r\sin\theta$, $y = p\cos\theta$, and $z = r\sin^2\theta + p\cos^2\theta$, then which of the following relations is correct?
   (a) $z^2 = x^2 + y^2$ (b) $px^2 + ry^2 = z$
   (c) $px^2 + ry^2 = zrp$ (d) $\dfrac{1}{x^2} + \dfrac{1}{y^2} = \dfrac{1}{z^2}$

Space for rough work

5. If $\cos\theta + \frac{1}{\sqrt{3}}\sin\theta = \frac{2}{\sqrt{3}}$, then find the value of 'θ' in circular measure.

(a) $\frac{\pi^c}{6}$ (b) $\frac{\pi^c}{3}$ (c) $\frac{\pi^c}{4}$ (d) $\frac{\pi^c}{2}$

6. A chord subtends an angle of 103°22′ is 31 cm away from the centre of a circle. Find the radius of the circle.

	0′	6′	....	36′	42′	Mean difference				
						1′	2′	3′	4′	5′
cos 51°	0.6293	0.6280	....	.6211	.6198	2	5	7	9	11

(a) 50 cm (b) 36 cm (c) 42 cm (d) 48 cm

7. There is a plot in the shape of an equilateral triangle. A flagstaff is erected at its centroid. Three ropes are tied to the top of the flagstaff and the other ends are nailed at the three corners of the plot. The angle of elevation of the top of the flagstaff at any vertex is 60°. What will be the height of the flagstaff (in meters), if the side of the plot is 15 m?

(a) $15\sqrt{3}$ (b) $\frac{15}{\sqrt{3}}$ (c) 15 (d) $\frac{15\sqrt{3}}{2}$

8. From a point on the ground which is at a distance of 60 m from the foot of the tower, the angle of elevation to the top of the tower is observed to be 60°. After moving d m away from the tower, the angle of elevation of the top of the tower is decreased to 30°, then find the value of 'd'.

(a) 50 m (b) 100 m (c) 80 m (d) 120 m

9. Find the perimeter of the triangle whose vertices are (1, –1), (–1, 1), and $(\sqrt{3}, \sqrt{3})$.

(a) $4\sqrt{2}$ m (b) $6\sqrt{2}$ m

(c) $8\sqrt{2}$ m (d) $10\sqrt{2}$ m

10. Find the point on the y-axis which is equidistant from the points (3, 5) and (–5, 2).

(a) $\left(0, \frac{3}{5}\right)$ (b) $\left(0, \frac{5}{7}\right)$ (c) $\left(0, \frac{5}{6}\right)$ (d) (0, 7)

11. Find the circumference of a circle, which passes through the origin (0, 12) and (16, 0).

(a) 40π units (b) 10π units

(c) 20π units (d) 15π units

12. What will be the equation of a line passing through (8, 5) and perpendicular to the line $3x - 7y + 5 = 0$?

(a) $3x + 7y - 71 = 0$ (b) $7x + 3y - 16 = 0$

(c) $7x + 3y - 71 = 0$ (d) $3x - 7y + 20 = 0$

Space for rough work

13. If the area of a triangle A(3, 4), B(1, p), and C(2, 3) is 2 square units, then the value of p can be _____.

(a) 4 (b 5 (c) 7 (d) 6

14. In ΔABC, B(2, 1), C(2, 5), AD ⊥ BC, and AD divides BC in the ratio 1:3. Find the equation of AD.

(a) $y = 2$ (b) $x = 2$ (c) $x + y = 3$ (d) $y = 3$

15. Match the values of Column A with those of Column B.

Column A	Column B
(i) Sin 750°	(A) –1
(ii) Cos 750°	(B) $\sqrt{2}$
(iii) Sec 540°	(C) $\frac{\sqrt{3}}{2}$
(iv) Cosec 135°	(D) $\frac{1}{2}$

(a) (i) → (D); (ii) → (B); (iii) → (C); (iv) → (A)
(b) (i) → (A); (ii) → (B); (iii) → (D); (iv) → (B)
(c) (i) → (D); (ii) → (C); (iii) → (A); (iv) → (B)
(d) (i) → (B); (ii) → (A); (iii) → (C); (iv) → (D)

Answer Keys

Assessment Test I

1. (b) **2.** (b) **3.** (c) **4.** (a) **5.** (d) **6.** (c) **7.** (c) **8.** (b) **9.** (a) **10.** (d)
11. (b) **12.** (e) **13.** (d) **14.** (a) **15.** (b)

Assessment Test II

1. (d) **2.** (c) **3.** (b) **4.** (a) **5.** (b) **6.** (c) **7.** (c) **8.** (d) **9.** (a) **10.** (a)
11. (c) **12.** (c) **13.** (e) **14.** (b) **15.** (d)

Assessment Test III

1. (d) **2.** (a) **3.** (c) **4.** (d) **5.** (b) **6.** (a) **7.** (b) **8.** (c) **9.** (b) **10.** (b)
11. (a) **12.** (c) **13.** (b) **14.** (a) **15.** (b)

Assessment Test IV

1. (b) **2.** (b) **3.** (a) **4.** (c) **5.** (a) **6.** (a) **7.** (c) **8.** (d) **9.** (b) **10.** (c)
11. (c) **12.** (c) **13.** (d) **14.** (a) **15.** (c)

Hints and Explanation

CHAPTER 1
Geometry

Assessment Test I

1. The required sequential order is CABD.
   Hence, the correct option is (c).

2. $\Delta PAB \sim \Delta PQR$
   $$\Rightarrow \frac{PA}{PQ} = \frac{AB}{QR} \qquad (1)$$
   Given, PA:AQ = 1:3
   Let $PA = x \Rightarrow AQ = 3x \Rightarrow PQ = PA + AQ = 4x$
   $\therefore$ From Eq. (1), $\frac{x}{4x} = \frac{AB}{10}$ (Given QR = 10 cm)
   $\Rightarrow AB = \frac{5}{2} = 2.5$ cm
   Hence, the correct option is (a).

3. Let $CD = x \Rightarrow BD = 14 - x$ ($\because$ BC = 14)
   We have $\frac{AC}{AB} = \frac{CD}{BD} \Rightarrow \frac{12}{9} = \frac{x}{14-x}$
   $\Rightarrow 168 - 12x = 9x$
   $\Rightarrow 21x = 168 \Rightarrow x = 8$
   Hence, the correct option is (c).

4. In ΔABD, $AD^2 = AB^2 - BD^2$
   $= 15^2 - 12^2 = 81 = 9^2$
   $\Rightarrow AD = 9$ cm
   We have $BD^2 = AD \times CD$
   $\Rightarrow 12^2 = 9 \times CD$
   $\Rightarrow CD = 16$ cm
   In ΔBDC, $BC^2 = BD^2 + CD^2 = 12^2 + 16^2 = 400 = 20^2$
   $\Rightarrow BC = 20$ cm
   Hence, the correct option is (a).

5. We have AB||FC.
   $\therefore \frac{BC}{CE} = \frac{AF}{FE} \Rightarrow \frac{12}{CE} = \frac{3}{2}$
   $\Rightarrow CE = 8$ cm
   Let $AF = 3x$ and $FE = 2x$ ($\because$ AF:FE = 3:2)
   $\Delta FEC \sim \Delta AEB$ ($\because$ AB||FC)
   $\Rightarrow \frac{FE}{AE} = \frac{FC}{AB} \Rightarrow \frac{FE}{AF+FE} = \frac{FC}{20}$
   $\Rightarrow \frac{2x}{3x+2x} = \frac{FC}{20} \Rightarrow FC = 8$ cm
   $\therefore$ In ΔFCE, $FE^2 = FC^2 + CE^2$ ($\because \angle FCE = 90°$)
   $\Rightarrow FE^2 = 8^2 + 8^2 = 128$
   $\Rightarrow FE = \sqrt{128} = 8\sqrt{2}$ cm.
   Hence, the correct option is (c).

6. Option (d): We have $\frac{AP}{PB} = \frac{AQ}{QC}$ ($\because$ By Basic Proportionality Theorem)
   $\Rightarrow \frac{3x-2}{2x+7} = \frac{2}{3}$
   $\Rightarrow 9x - 6 = 4x + 14 \Rightarrow x = 4$
   Hence, the correct option is (d).

7. We have AP = AR, BP = BQ and CR = CQ.
   ($\because$ Lengths of the tangents drawn from an external point are equal.)
   $AB = 5 \Rightarrow AP + BP = 5 \Rightarrow AR + BQ = 5$
   $CR = 3 \Rightarrow CQ = 3$
   $\therefore$ Perimeter of $\Delta ABC = AB + AR + BQ + CQ + CR$
   $= 5 + 5 + 3 + 3 = 16$ cm
   Hence, the correct option is (a).

8. ABDE is a cyclic quadrilateral.
$\therefore$ $\angle AED = 180° - \angle ABD$
$= 180° - 85° = 95°$
Hence, the correct option is (b).

9. Let PQ = x cm
We have $PT^2 = PQ \times PR \Rightarrow PT^2 = PQ \times (PQ + QR)$
$\Rightarrow 12^2 = x(x + 7) \Rightarrow x^2 + 7x - 144 = 0$
$\Rightarrow (x - 9)(x + 16) = 0 \Rightarrow x = 9$ or $x = -16$
$\therefore$ PQ = 9 cm ($\because$ –16 is not possible).
Hence, the correct option is (b).

10. Given, $\angle PAB = 40° \Rightarrow \angle OAP = 90° - 40° = 50°$
($\because$ Radius is perpendicular to the tangent at the point of contact, i.e., $\angle OAC = 90°$.)
$\angle OPA = \angle OAP = 50°$ ($\because$ OA = OP = radius)
In ΔOAP, $\angle AOP = 180° - (50° + 50°) = 80°$
We have $\angle OPC = 90°$
$\therefore$ In quadrilateral OACP
$\angle ACP = 360° - (\angle OAC + \angle AOP + \angle OPC)$
$= 360° - (90° + 80° + 90°) = 100°$
Hence, the correct option is (a).

11. Given $r = 4$ cm, $R = 5$ cm, and $d = 10$ cm
The length of direct common tangent
$= \sqrt{d^2 - (R - r)^2}$
$= \sqrt{10^2 - (5 - 4)^2} = \sqrt{99} = 3\sqrt{11}$ cm
Hence, the correct option is (c).

12. Option (d): $R + r > d > R - r$

13. Option (b): $R + r = d$

14. Option (c): $d = R - r$

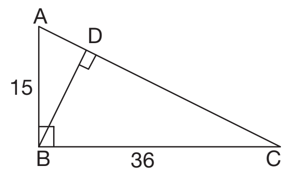
15. Option (a): $R + r < d$

Assessment Test II

1. The required sequential order is BDCA.
Hence, the correct option is (c).

2. We have $\Delta APQ \sim \Delta ABC$
$$\frac{PQ}{BC} = \frac{AQ}{AC} \quad (1)$$
Let AQ = $3x$, QC = $2x$ ($\because$ AQ:QC = 3:2)
$\therefore$ AC = AQ + QC = $5x$
$\therefore$ $\frac{15}{BC} = \frac{3x}{5x}$ [From Eq. (1)]
$\Rightarrow$ BC = 25 cm
Hence, the correct option is (a).

3. Let BD = x cm
$\Rightarrow$ CD = $(21 - x)$ cm ($\because$ BC = 21 cm)
We have $\frac{AB}{AC} = \frac{BD}{CD}$
$\Rightarrow \frac{3}{4} = \frac{x}{21 - x}$
$\Rightarrow 63 - 3x = 4x$
$\Rightarrow x = 9$
Hence, the correct option is (b).

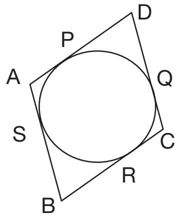
4. 

We have $AC^2 = AB^2 + BC^2$
$= 15^2 + 36^2 = 39^2$
$\Rightarrow$ AC = 39
$\therefore$ $\frac{1}{2} \times 36 \times 15 = \frac{1}{2} \times 39 \times BD$ ($\because$ Area $= \frac{1}{2}$bh)
$\Rightarrow BD = \frac{36 \times 15}{39} = \frac{180}{13}$ cm
Hence, the correct option is (d).

5. $\Delta FEC \sim \Delta AEB$ ($\because$ FC$\|$AB)
$\Rightarrow \frac{FC}{AB} = \frac{EC}{EB} \Rightarrow \frac{FC}{10} = \frac{15}{25}$ ($\because$ EB = BC + CE = 10 + 15 = 25)
$\Rightarrow$ FC = 6 cm
In ΔFCE, $FE^2 = FC^2 + CE^2 = 6^2 + 15^2$
$\Rightarrow FE^2 = 261 \Rightarrow FE = \sqrt{261} = 3\sqrt{29}$ cm
Hence, the correct option is (c).

6. Option (d): We have $\frac{PA}{AQ} = \frac{PB}{BR} \Rightarrow \frac{2x + 3}{6x - 16} = \frac{3}{4}$
$\Rightarrow 8x + 12 = 18x - 48$
$\Rightarrow 10x = 60$
$\Rightarrow x = 6$
Hence, the correct option is (d).

7. AP = AS, BS = BR, CR = CQ, and DQ = DP
($\because$ Tangents drawn from an external point to a circle are equal.)



AB = AS + SB = AP + BR = 3 cm (1)
CD = DQ + QC = DP + CR = 4 cm (2)
Adding Eqs (1) and (2),
(AD + DP) + (BR + CR) = 7 cm
$\Rightarrow$ AD + BC = 7 cm
$\therefore$ The perimeter of ABCD = AB + CD + BC + AD = 3 + 4 + 7 = 14 cm
Hence, the correct option is (c).

8. $\angle ACF = \angle ADF = 35°$
($\because$ Angles in the same segment are equal.)
$\angle BDA = \angle BDF - \angle ADF = 60° - 35° = 25°$
$\therefore \angle BEA = \angle BDA = 25°$
($\because$ Angles in the same segment are equal.)
Hence, the correct option is (a).

9. We have PQ × PR = PS × PT
$\Rightarrow 6 \times (PQ + QR) = 5 \times PT$
$\Rightarrow 6 \times (6 + 9) = 5 \times PT$
$\Rightarrow$ PT = 18 cm
$\therefore$ ST = PT – PS = 18 – 5 = 13 cm
Hence, the correct option is (b).

10. $\angle OAB = \angle OBA = 25°$ ($\because$ OA = OD = radius)
$\angle AOB = 180° - (\angle OAB + \angle OBA) = 180° - (25° + 25°) = 130°$
$\angle OAP = \angle OBP = 90°$
($\because$ Radius is perpendicular to the tangent at the point of contact.)
In quadrilateral OAPB,
$\angle APB = 360° - (\angle OAP + \angle OBP + \angle AOB)$
$= 360° - (90° + 90° + 130°) = 50°$
Hence, the correct option is (c).

11. Given, $r = 3$ cm, $R = 5$ cm, and $d = 8$ cm
The length of the transverse common tangent
$= \sqrt{d^2 - (R+r)^2} = \sqrt{8^2 - (3+5)^2} = 0$
Hence, the correct option is (d).

12. Option (c): $d = 5$, $R = 4$, and $r = 2$
$R + r > d > R - r$
Circles are intersecting at two distinct points.
Number of tangents = 2

13. Option (d): $d = 7$, $R = 5$, and $r = 2$
$d = R + r$
Circles are touching externally.
Number of common tangents is 3.

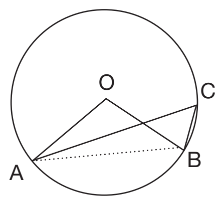
14. Option (b): $d = 5$, $R = 7$, and $r = 2$
$d = R - r$
Circles are touching internally.
Number of common tangents is 1.

15. Option (e): $d = 7$, $R = 4$, and $r = 2$
$d > R + r$
Number of common tangents is 4.

Assessment Test III

1. BCADE is the required sequential order.
Hence, the correct option is (b).

2. By the Apollonius's theorem, $AB^2 + AC^2 = 2AD^2 + 2BD^2$.
Hence, the correct option is (c).

3.


Given, $\angle AOB = 100°$
$\Rightarrow \angle ACB = 50°$
$\angle CAB = 30°$
In ΔABC,
$\angle ABC = 180° - 50° - 30° = 100°$
Hence, the correct option is (a).

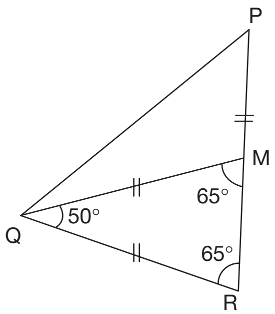
4. $\angle AOC = 360° - (\angle OAB + \angle OBA + \angle OBC + \angle OCB)$
$= 360° - (50° + 50° + 70° + 70°)$
($\therefore \angle OAB = \angle OBA$; $\angle OBC = \angle OCB$)
$= 120°$
Hence, the correct option is (c).

5. PB = 12 cm = PC
PB = PQ + BQ = 12 cm

$PQ + AQ = 12$ ($\therefore$ $AQ = BQ$)
$PC = PR + RC = 12$
$\Rightarrow PR + AR = 12$
$PR + AR + AQ + PQ = 12 + 12$
$PR + RQ + QR = 24$
Perimeter of $\Delta PQR = 24$ cm
Hence, the correct option is (c).

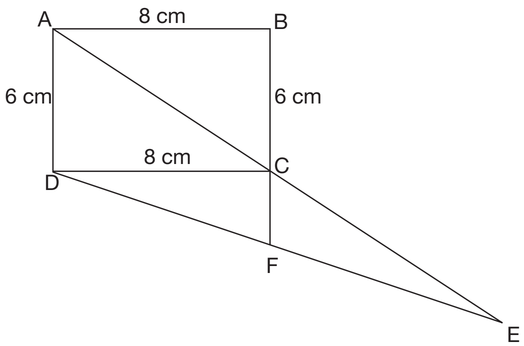
6. $\angle CAB = 80°$
$\therefore$ $\angle ACB + \angle CBA = 100°$
$\therefore$ $\angle DCB + \angle OBC = \dfrac{\angle ACB}{2} + \dfrac{\angle ABC}{2} = 50°$
$\therefore$ $\angle BOC = 180° - (\angle OCB + \angle OBC) = 130°$
Hence, the correct option is (a).

7.



$\angle MQR = 50°$ and $QM = QR$
$\Rightarrow \angle QRM = \angle QMR = \dfrac{180° - 50°}{2} = 65°$
$\angle P = \angle PQM = \dfrac{\angle QMR}{2}$ ($\because$ $PM = MQ$)
$= \dfrac{65°}{2} = 32\dfrac{1}{2}°$
Hence, the correct option is (a).

8.



Given $AB = 8$ cm, $BC = 6$ cm,
$AC:CE = 1:2$ and $AC = 10$ cm, $CE = 20$ cm.
Produce BC to the point F such that D, F, and E are collinear.

$\overline{AD} || \overline{BC}$
$\Rightarrow \overline{AD} || \overline{CF}$
and $AD:CF = AE:CE$
$6:CF = 3:2$
$\dfrac{6}{CF} = \dfrac{3}{2} \Rightarrow CF = 4$ cm
Since $\angle DCF = 90°$
$DF^2 = CD^2 + CF^2$
$= 8^2 + (4)^2 = 64 + 16 = 80$ cm
$DF = \sqrt{80} = 4\sqrt{5}$ cm
Since $DF:FE = AC:CE = 1:2$
$\therefore$ $EF = 2 \times DF$
$= 2 \times 4\sqrt{5} = 8\sqrt{5}$
$\therefore$ $DE = DF + FE$
$= 4\sqrt{5} + 8\sqrt{5} = 12\sqrt{5}$ cm
Hence, the correct option is (a).

9. In ΔPQR, $ST || QR$.
$\Rightarrow \dfrac{PS}{SQ} = \dfrac{PT}{TR}$ (By Basic Proportionality Theorem)
$PS = 2x$, $PR = 5x \Rightarrow SQ = 3x$
$\dfrac{PS}{SQ} = \dfrac{2}{3}$
$\Rightarrow \dfrac{PT}{TR} = \dfrac{2}{3}$
$\Rightarrow \dfrac{2}{3} = \dfrac{PT}{21}$
$PT = \dfrac{2}{3} \times 21$
$\Rightarrow PT = 14$ cm
Hence, the correct option is (b).

10. Since AD is the bisector of $\angle A$,
$\dfrac{AB}{AC} = \dfrac{BD}{DC}$
$\dfrac{12}{18} = \dfrac{BD}{DC}$
$\dfrac{BD}{DC} = \dfrac{2}{3}$
$\Rightarrow BD = 2x$, $DC = 3x$
$\therefore$ $BC = 2x + 3x = 5x$
$BC = 5x = 25 \Rightarrow x = 5$
$\therefore$ $BD = 2x = 2 \times 5 = 10$ cm
Hence, the correct option is (b).

11. In ΔABC and in ΔBDC

$\angle C = \angle C$ (common)

$\angle B = \angle D = 90°$

$\therefore \Delta ABC \sim \Delta BDC$

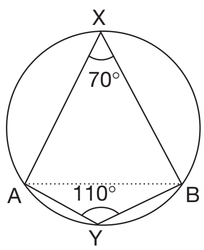
$\therefore \dfrac{AC}{BC} = \dfrac{BC}{DC} \Rightarrow \dfrac{AC}{12} = \dfrac{12}{8} \Rightarrow AC = 18$ cm

$\Rightarrow AD = AC - DC$

$= 18 - 8 = 10$ cm

Hence, the correct option is (a).

12.



Let $\overset{\frown}{AYB}$ be a minor arc.

$\therefore \overset{\frown}{AYB}$ is a major arc.

Now, AYBX is a cyclic quadrilateral.

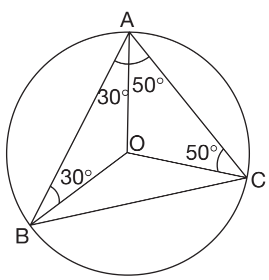
$\Rightarrow \angle AXB + \angle AYB = 180°$ ($\because$ Supplementary angles)

$70° + \angle AYB = 180°$

$\Rightarrow \angle AYB = 180° - 70° = 110°$

Hence, the correct option is (c).

13.



$\angle ABO = \angle BAO = 30°$ and $\angle ACO = \angle CAO = 50°$

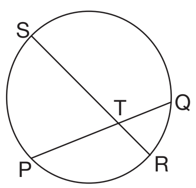
$\Rightarrow \angle BAC = 30° + 50° = 80°$

$\Rightarrow \angle BOC = 160°$

$\angle OCB = \angle OBC = \dfrac{180° - 160°}{2} = 10°$

Hence, the correct option is (a).

14.

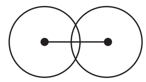


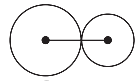
We know that $PT \times TQ = ST \times RT$

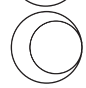
$\Rightarrow 6 \times 4 = 8 \times RT$

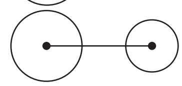
$\Rightarrow RT = 3$ cm

Hence, the correct option is (a).

15. (i) 

(ii) 

(iii) 

(iv) 

(i) $\to$ (C); (ii) $\to$ (A); (iii) $\to$ (B); (iv) $\to$ (D)

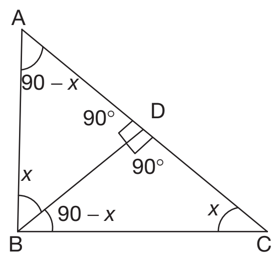
Hence, the correct option is (c).

Assessment Test IV

1. BFCADE is the sequential order.

Hence, the correct option is (b).

2.



In ΔADB and in ΔBDC

$BD = BD$ (common)

$\angle ADB = \angle BDC = 90°$

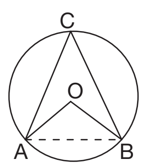
$\angle DBC = \angle DAB = (90 - x)°$

$\therefore \Delta ADB \sim \Delta BDC$

$\dfrac{AD}{DB} = \dfrac{BD}{DC} \Rightarrow BD^2 = AD \times DC$

Hence, the correct option is (d).

3.



$\angle ACB = 40°$

$\Rightarrow \angle AOB = 80°$

$\angle OAB = \angle OBA = \dfrac{180° - 80°}{2} = 50°$

Since AC = BC, $\angle CAB = \angle CBA$

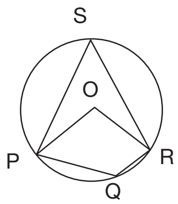
$= \dfrac{180° - 40°}{2} = \dfrac{140°}{2} = 70°$

$\angle CAB = \angle CAO + \angle OAB$

$70° = \angle CAO + \angle 50°$

$\therefore \angle CAO = 70° - 50° = 20°$

Hence, the correct option is (b).

4. 

Let $\angle PSR = x°$

$\Rightarrow \angle POR = 2x°$

And $\angle PQR = 180° - x°$

(Opposite angles of a cyclic quadrilateral)

$\Rightarrow \angle P + \angle Q + \angle R + \angle POR = 360°$

$60 + 180° - x° + 70 + 2x° = 360°$

$310° + x = 360°$

$x = 50°$

$\therefore \angle PSR = 50°$

Hence, the correct option is (a).

5. PQ = PA + AQ = 12 cm

PR = PC + CR = 10 cm

PC + 2 = 10 cm $\Rightarrow$ PC = 8 cm

$\Rightarrow$ PA = 8 cm ($\because$ PA = PC)

$\Rightarrow$ AQ = BQ = 12 – 8 = 4 cm

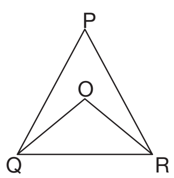
$\therefore$ Perimeter of ΔPQR

= PQ + QR + RP

= PA + AQ + BQ + BR + RC + CP

= 8 + 4 + 4 + 2 + 2 + 8 = 28 cm

Hence, the correct option is (b).

6. 

$\angle QPR + \angle PQR + \angle PRQ$

$= 180°$ (1)

$\angle QOR + \angle OQR + \angle ORQ$

$= 180°$

$\angle QOR + \dfrac{\angle PQR}{2} + \dfrac{\angle PRQ}{2} = 180°$ (2)

$\dfrac{\angle PQR}{2} + \dfrac{\angle PRQ}{2} = 180°$

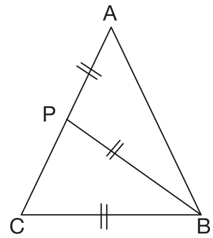
$- QOR = 180° - 140° = 40°$

$= \left[\dfrac{1}{2}(180° - (\angle QPR))\right]$ [from Eq. (1)]

$\Rightarrow 180° - \angle QPR = 80°$

$\Rightarrow \angle QPR = 100°$

Hence, the correct option is (a).

7. 

$\angle$ BCP = 70° and BP = BC

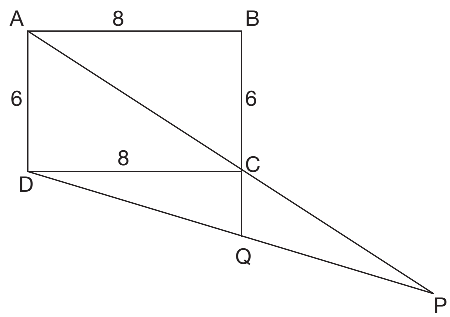
$\Rightarrow \angle BPC = 70°$

$\Rightarrow \angle APB = 180° - 70° = 110°$

Since BP = AP

$\angle A = \dfrac{180° - 110°}{2} = 35°.$

Hence, the correct option is (c).

8. 

AC = 10 cm

AC:CP = 1:1

AP:CP = AD:CQ

$\Rightarrow$ 2:1 = AD:CQ

$\dfrac{6}{CQ} = \dfrac{2}{1}$

$\Rightarrow$ CQ = 3 cm

$DQ = \sqrt{8^2 + 3^2} = \sqrt{64 + 9} = \sqrt{73}$

DQ:QP = 1:1

$\Rightarrow AP = DQ = \sqrt{73}$ cm

$\therefore DP = 2\sqrt{73}$ cm

Hence, the correct option is (a).

9. Given, in ΔABC $\overline{PQ} || \overline{BC}$ and AP:PB = 2:3.

AQ:QC = 2:3

$\frac{AQ}{QC} = \frac{2}{3}$

$\frac{AQ}{12} = \frac{2}{3} \Rightarrow AQ = 8$ cm

Hence, the correct option is (a).

10. In ΔABC, AD is the bisector of $\angle A$.

$\Rightarrow \frac{AB}{AC} = \frac{BD}{DC}$

$\frac{AB}{AC} = \frac{3}{4}$

$\frac{12}{AC} = \frac{3}{4} \Rightarrow AC = 16$ cm

Hence, the correct option is (c).

11. We have $QS^2 = PS \times RS$

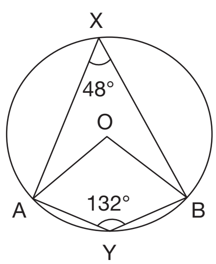
$10^2 = 8 \times RS$

$\frac{100}{8} = RS$

$\Rightarrow RS = 12.5$ cm

Hence, the correct option is (d).

12.



Let $\overset{\frown}{AYB}$ be a minor arc.

and $\overset{\frown}{AYB}$ $\overline{AXB}$ be the major arc.

$\angle AYB = 132°$

$\Rightarrow \angle AXB = 180° - 132° = 48°$

$\angle AOB = 2 \times 48° = 96°$

Hence, the correct option is (c).

13. $\angle ABO = 40° = \angle BAO$

$\Rightarrow \angle ACO = \angle OAC = 20°$

$\angle BAC = 40° + 20° = 60°$

$\angle BOC = 2\ \angle BAC = 2 \times 60° = 120°$

$\Rightarrow \angle OCB = \angle OBC = \frac{180 - 120}{2} = 30°$

Hence, the correct option is (b).

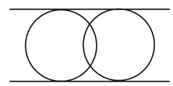
14. We know that $PA \times PB = PC \times PD$.

$\Rightarrow 8 \times 4 = PC \times 16$

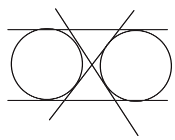
$32 = PC \times 16 \Rightarrow PC = 2$ cm

Hence, the correct option is (a).

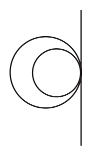
15. (i)



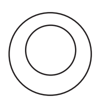
(ii)



(iii)



(iv)



(i) $\rightarrow$ (B); (ii) $\rightarrow$ (A); (iii) $\rightarrow$ (C); (iv) $\rightarrow$ (D)

Hence, the correct option is (d).

CHAPTER 2
Linear Equations and Inequations; Quadratic Equations

Assessment Test I

1. The required sequential order is CADB.
   Hence, the correct option is (a).
2. $x + 2y + 3z = 21 \quad (1)$
   $3x + 2y + z = 43 \quad (2)$
   Adding Eqs (1) and (2), we get
   $4x + 4y + 4z = 64 \Rightarrow x + y + z = 16$
   Hence, the correct option is (d).
3. $2x + 3ky = 4 \quad (1)$
   $6x + 27y = 12 \quad (2)$
   Given Eqs (1) and (2) have infinite common solutions.
   $\frac{2}{6} = \frac{3k}{27} = \frac{4}{12} \Rightarrow \frac{k}{9} = \frac{1}{3} \Rightarrow k = 3.$
   Hence, the correct option is (c).
4. $7x + 8y = 21 \quad (1)$
   $8x + 7y = 20 \quad (2)$
   Subtracting Eq. (1) from Eq. (2), we get
   $x - y = -1$
   Hence, the correct option is (c).
5. Given one root is $3+\sqrt{2}$, The other root will be $3-\sqrt{2}$.
   $\therefore$ The required quadratic equation is
   $x^2-[(3+\sqrt{2})+(3-\sqrt{2})]x + (3+\sqrt{2})(3-\sqrt{2})=0$
   $\Rightarrow x^2 - 6x + 7 = 0$
   Hence, the correct option is (b).
6. $x^2 - 5x + 7 = 0$
   $\alpha+\beta = \frac{-(-5)}{1} = 5$
   $\alpha\beta = \frac{7}{1} = 7$
   $\alpha^2 + \beta^2 = (\alpha+\beta)^2 - 2\alpha\beta$
   $= (5)^2 - 2\times7 = 25 - 14 = 11.$
   Hence, the correct option is (a).
7. $|x+4| < 2 \Rightarrow -2 < x+4 < 2$
   $\Rightarrow -2-4 < x < 2-4 \Rightarrow -6 < x < -2$
   x can take the values –3, –4, and –5.
   $\therefore$ The number of integer values of x is 3.
   Hence, the correct option is (c).
8. Let the present age of the son be x years.
   $\therefore$ Father's present age = $3x$ years.
   Given $3x - 7 = 5(x - 7)$
   $\Rightarrow 3x - 7 = 5x - 35 \Rightarrow 2x = 28 \Rightarrow x = 14$
   $\therefore$ The sum of their present ages = $4x$.
   $= 4(14) = 56$ years
   Hence, the correct option is (b).
9. Let the speed of the stream be x kmph.
   $\therefore$ Downstream speed = $(8 + x)$ kmph
   Upstream speed = $(8 - x)$ kmph
   $\Rightarrow \frac{30}{8+x} + \frac{30}{8-x} = 8$
   $\Rightarrow 30\left(\frac{8-x+8+x}{64-x^2}\right) = 8$
   $\Rightarrow 64 - x^2 = 60 \Rightarrow x^2 = 4 \Rightarrow x = \pm 2$
   $x = -2$ is not possible.
   $\therefore$ The speed of the stream is 2 kmph.
   Hence, the correct option is (b).
10. $|x|^2 - 5|x| + 6 = 0 \Rightarrow |x|^2 - 3|x| - 2|x| + 6 = 0$
    $\Rightarrow (|x|-3)(|x|-2) = 0$
    $\Rightarrow |x| = 3$ or $|x| = 2$
    $x = \pm 3$ or $x = \pm 2$
    $\therefore$ Number of solutions is 4.
    Hence, the correct option is (d).
11. Let $x = \sqrt{240+\sqrt{240+\sqrt{240+\ldots\infty}}}$
    $\Rightarrow x^2 = 240 + \sqrt{240+\sqrt{240+\ldots\infty}}$
    $\Rightarrow x^2 = 240 + x$
    $\Rightarrow x^2 - x - 240 = 0$

$\Rightarrow (x-16)(x+15)=0$

$\Rightarrow x=16$ or $x=-15$ (not possible)

$\therefore\ x=16$

Hence, the correct option is (b).

12. Option (a): Maximum value attains at $x =$

$$-\frac{b}{2a}=\frac{-12}{2(-3)}=2.$$

13. Option (b): $x^2-6x+9=0 \Rightarrow (x-3)^2=0 \Rightarrow x=3$

14. Option (d): $\frac{5}{k}=\frac{k}{5} \Rightarrow k^2=25 \Rightarrow k=\pm 5$

15. Option (e): $\frac{+10}{\left(\frac{5}{3}\right)}=10\times\frac{3}{5}=6$

Assessment Test II

1. The required sequential order is CABD.

Hence, the correct option is (c).

2. $2x+y+3z=12 \quad (1)$

$x+3y-z=16 \quad (2)$

$2\times$ Eq. (1) $\Rightarrow 4x+2y+6z=24 \quad (3)$

Eq. (2) + Eq. (3) $\Rightarrow 5x+5y+5z=40$

$\Rightarrow x+y+z=8$

Hence, the correct option is (b).

3. $5x-2ky=10 \quad (1)$

$6x+8y=21 \quad (2)$

Given Eqs (1) and (2) have no common solution.

$$\frac{5}{6}=-\frac{2k}{8} \Rightarrow k=-\frac{20}{6} \Rightarrow k=-\frac{10}{3}$$

Hence, the correct option is (d).

4. $15x+11y=41 \quad (1)$

$11x+15y=37 \quad (2)$

Adding Eqs (1) and (2), we get

$26x+26y=78 \Rightarrow x+y=3$

Hence, the correct option is (a).

5. Given one root is $5-\sqrt{3}$, the other root is $5+\sqrt{3}$.

The required quadratic equation is

$$x^2-[(5+\sqrt{3})+(5-\sqrt{3})]x+(5+\sqrt{3})(5-\sqrt{3})=0$$

$x^2-10x+22=0$

Hence, the correct option is (a).

6. Given $x^2+2x-3=0$

$$\alpha+\beta=\frac{-2}{1}=-2$$

$$\alpha\beta=\frac{-3}{1}=-3$$

$$\frac{\alpha}{\beta}+\frac{\beta}{\alpha}=\frac{\alpha^2+\beta^2}{\alpha\beta}=\frac{(\alpha+\beta)^2-2\alpha\beta}{\alpha\beta}$$

$$=\frac{(2)^2-2(-3)}{-3}=\frac{4+6}{-3}=\frac{-10}{3}.$$

Hence, the correct option is (b).

7. $|x-1|\le 5 \Rightarrow -5\le x-1\le 5$

$\Rightarrow -4\le x\le 6$

$\therefore\ x$ can take 11 integer values.

Hence, the correct option is (b).

8. Let the two-digit number be $10a+b$.

Given $10a+b=a+b+9$

$\Rightarrow 9a=9 \Rightarrow a=1$

$\therefore$ The required numbers are 10, 11, 12, 13, …, 19.

Difference between digits are 1, 0, 1, 2, 3, 4, 5, 6, 7, 8.

$\therefore$ The number of different values of k is 9.

Hence, the correct option is (b).

9. Let the speed of the stream be x kmph.

The speed of boat upstream = $(5-x)$ kmph

The speed of boat downstream = $(5+x)$ kmph

$$\Rightarrow \frac{24}{5-x}+\frac{24}{5+x}=0$$

$$\Rightarrow 24\left(\frac{5+x+5-x}{25-x^2}\right)=10$$

$\Rightarrow 25-x^2=24 \Rightarrow x^2=1 \Rightarrow x=\pm 1$

$x=-1$ is not possible.

$\therefore\ x=1$

Hence, the correct option is (a).

10. $|x|^2+7|x|+12=0 \Rightarrow (|x|+3)(|x|+4)=0$

$\Rightarrow |x|=-3$ or $|x|=-4$, which are not possible.

No solution for given equation.
Hence, the correct option is (a).

11. Let $y = \sqrt{132 - \sqrt{132 - \sqrt{132 - \ldots \infty}}}$

$y^2 = 132 - \sqrt{132 - \sqrt{132 - \ldots \infty}}$
$y^2 = 132 - y$
$y^2 + y - 132 = 0$
$(y + 12)(y - 11) = 0$
$y = -12$ (not possible) or $y = 11$
$\therefore y = 11$
Hence, the correct option is (d).

12. Option (b): Minimum value attains at $x =$

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

13. Option (e): $4x^2 - 9 = 0 \Rightarrow x^2 = \frac{9}{4} \Rightarrow x = \pm\frac{3}{2}$

14. Option (a): $-\frac{k}{5} = \frac{2}{3} \Rightarrow k = -\frac{10}{3}$.

15. Option (c): Product of the roots $= \frac{c}{a} = -\frac{5}{3}$

Assessment Test III

1. The required sequential order is ECBDA.
Hence, the correct option is (d).

2. Given $2x + 3y + 5 = 0$ and $4x + 6y - 10 = 0$

$\frac{2}{4} = \frac{3}{6} \neq \frac{5}{-10}$

$\Rightarrow \frac{1}{2} = \frac{1}{2} \neq \frac{-1}{2}$

$\therefore$ The pair of equations has no solution.
Hence, the correct option is (a).

3. Given $a{:}b = 5{:}2$

Let $a = 5k$, $b = 2k$
$a + b = 28$ (Given)
$5k + 2k = 28$
$7k = 28$
$k = 4$
$\Rightarrow a = 5k = 5 \times 4 = 20.$
Hence, the correct option is (c).

4. Let e and p be the number of erasers and pencils, respectively.

Given $18e + 27p = 228$
$20\,e + kp = 256$

$\frac{18}{20} \neq \frac{27}{k}$

$k \neq \frac{27}{18} \neq 10 \Rightarrow k \neq 30.$
Hence, the correct option is (b).

5. The roots of $(x - 3)(x + 2) = 0$ are $-2, 3$.

Hence, the correct option is (a).

6. Given α and β are the roots of the equation.

$x^2 - 3x + 2 = 0$

$\Rightarrow \alpha + \beta = \frac{-b}{a} = 3$

$\alpha\beta = \frac{c}{a} = 2$

$\frac{1}{\alpha} + \frac{1}{\beta} = \frac{\alpha + \beta}{\alpha\beta} = \frac{3}{2}$
Hence, the correct option is (b).

7. Given $2x^2 - 8x + p = 0$

Discriminant $(\Delta) = b^2 - 4ac = -64$
$\Rightarrow (-8)^2 - 4(2)(p) = -64$
$\Rightarrow 8p = 128$
$p = 16$
Hence, the correct option is (b).

8. Given $x^2 - x + 1 = 0$

Discriminant $(\Delta) = b^2 - 4ac$
$= (-1)^2 - 4(1)(1)$
$= 1 - 4$
$= -3 < 0$
The roots are complex conjugates.
Hence, the correct option is (d).

9. Given expression is $3x^2 + 9x + 11$, where $a = 3 > 0$.

$\therefore$ The minimum value attains at $\frac{-b}{2a}$, i.e., $\frac{-9}{2(3)}$
$= \frac{-3}{2}$

Hence, the correct option is (b).

10. Given $x^2 + 4x + 8$ which is in the form of $ax^2 + bx + c$.

where $a = 1 > 0$

Minimum value $= \dfrac{4ac - b^2}{4a}$

$= \dfrac{4(1)(8) - 16}{4(1)}$

$= \dfrac{32 - 16}{4} = 4$

Hence, the correct option is (a).

11. Let l and b be the length and breadth of the rectangular hall, respectively.

$l - b = 18$ m (1)

Area $(lb) = 243$ m^2

$(l + b)^2 = (l - b)^2 + 4lb$

$(l + b)^2 = (18)^2 + 4(243)$

$= 324 + 972$

$(l + b)^2 = 1296$

$l + b = 36$ (2)

From Eqs. (1) and (2)

$2b = 18$

$b = 9$

Hence, the correct option is (a).

12. $|x - 3| < 15$

$\Rightarrow -15 < x - 3 < 15$

$\Rightarrow -15 + 3 < x - 3 + 3 < 15 + 3$

$\Rightarrow -12 < x < 18$

Hence, the correct option is (a).

13. Given $4x - 5y = 6$ and $16x - 20y = k$

$\dfrac{4}{16} = \dfrac{5}{-20} = \dfrac{6}{k}$

$\dfrac{1}{4} = \dfrac{1}{4} = \dfrac{6}{k}$

$\dfrac{6}{k} = \dfrac{1}{4}$

$k = 24$

Hence, the correct option is (c).

14. Given $2x + 3y + 4z = 42$ (1)

$9x + 13y + 17z = 184$ (2)

$(1) \times 4 \Rightarrow 8x + 12y + 16z = 168$

$x + y + z = 16$

Hence, the correct option is (b).

15. (i) $b^2 - 4ac = 0 \Leftrightarrow$ The roots are rational and equal.

(ii) $b^2 - 4ac < 0 \Leftrightarrow$ The roots are complex conjugates.

(iii) $b^2 - 4ac > 0$ and perfect square $\Leftrightarrow$ The roots are rational and unequal.

(iv) $b^2 - 4ac > 0$ and not perfect square $\Leftrightarrow$ The roots are irrational and unequal.

Hence, the correct option is (d).

Assessment Test IV

1. ABEDC is the required sequential order.

Hence, the correct option is (b).

2. Given $2x + 3y + 4 = 0$ and $4x + 6y + 8 = 0$

$\dfrac{2}{4} = \dfrac{3}{6} = \dfrac{4}{8}$

$\dfrac{1}{2} = \dfrac{1}{2} = \dfrac{1}{2}$

$\therefore$ The pair of equations has infinite solutions.

Hence, the correct option is (d).

3. Given $x{:}y = 2{:}7$

$x = 2k, y = 7k$

$x + y = 81$ (Given)

$2k + 7k = 81$

$9k = 81$

$k = 9$

$y = 7k = 7 \times 9 = 63$

Hence, the correct option is (b).

4. Let F be the father's age and S be the son's age

Given $F + 6 = 3(S + 6)$ (1)

$F - 3 = p(S - 3)$ (2)

$(1) \Rightarrow F = 3S + 12$ (3)

$(2) \Rightarrow F = pS - 3p + 3$ (4)

$(3) = (4) \Rightarrow 3S + 12 = 4S - 9$

$\dfrac{1}{1} \neq \dfrac{3}{p}$

$\Rightarrow p \neq 3$

Hence, the correct option is (c).

5. The roots of $(x+\sqrt{2})(x-\sqrt{3}) = 0$ are $-\sqrt{2}$ and $\sqrt{3}$.

   Hence, the correct option is (c).

6. Given α and $\beta (> \alpha)$ are the roots of $x^2 + 7x + 12 = 0$.

   $x^2 + 7x + 12 = 0$

   $x^2 + 4x + 3x + 12 = 0$

   $x(x + 4) + 3(x + 4) = 0$

   $(x + 4)(x + 3) = 0$

   $x = -3$ or -4

   $\therefore\ \alpha = -4, \beta = -3 \quad (\because \beta > \alpha)$

   $\frac{1}{\alpha} - \frac{1}{\beta} = \frac{1}{-4} - \frac{1}{(-3)}$

   $= \frac{-1}{4} + \frac{1}{3}$

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

   Hence, the correct option is (c).

7. Given $3x^2 - kx - 12 = 0$

   Discriminant $(\Delta) = b^2 - 4ac$

   $\Rightarrow (-k)^2 + 4(3)(12) = 169$

   $= k^2 + 144 = 169$

   $\Rightarrow k^2 = 25, k = \pm 5$

   Hence, the correct option is (c).

8. Given $5x^2 - 2x - 1 = 0$

   Discriminant $(\Delta) = b^2 - 4ac$

   $= (-2)^2 - 4(5)(-1)$

   $= 4 + 20$

   $= 24 > 0$

   The roots are irrational and distinct.

   Hence, the correct option is (c).

9. Given $7x^2 - 6x + 4$ has a minimum value.

   The minimum value attains at $\frac{-b}{2a}$, i.e., at $\frac{6}{14} = \frac{3}{7}$.

   Hence, the correct option is (c).

10. Given $-4x^2 + 8x + 3$ which is in the form of $ax^2 + bx + c$, where $a = -4 < 0$.

    $\therefore$ Maximum value $= \frac{4ac - b^2}{4a}$

    $= \frac{4(-4)(3)-(8)^2}{4(-4)}$

    $= \frac{4(4)(3)+64}{4(4)}$

    $= 7$

    Hence, the correct option is (d).

11. Let the number be x

    Given $x^2 - x = 20$

    $x^2 - x - 20 = 0$

    $x^2 + 5x - 4x - 20 = 0$

    $x(x + 5) - 4(x + 5) = 0$

    $(x + 5)(x - 4) = 0$

    $x = 4$ or -5

    Option (c) follows.

    Hence, the correct option is (c).

12. Given $|x - 2| > 6$

    $\Rightarrow x - 2 > 6$ or $x - 2 < -6$

    $\Rightarrow x > 8$ or $x < -4$.

    Hence, the correct option is (a).

13. Given $3x + 4y = 5$, $(3k + 1)x + 8y = k + 2$

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

    $\frac{3}{3k+1} = \frac{1}{2}$

    $6 = 3k + 1$

    $3k = 5$

    $k = \frac{5}{3}$

    Hence, the correct option is (a).

14. $2x + 5y + 6z = 84 \quad (1)$

    $7x + 4y + 3z = 96 \quad (2)$

    Adding Eqs (1) and (2), we get

    $\Rightarrow 9x + 9y + 9z = 180$

    $\Rightarrow x + y + z = 20$

    Hence, the correct option is (d).

15. (i) $\frac{a_1}{a_2} = \frac{b_1}{b_2} \Leftrightarrow$ Can't say anything about the number of solutions.

(ii) $\frac{a_1}{a_2} \neq \frac{b_1}{b_2} \Leftrightarrow$ Unique solution

(iii) $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2} \Leftrightarrow$ Infinite solutions

(iv) $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2} \Leftrightarrow$ Unique solution.

Hence, the correct option is (b).

CHAPTER 3
Matrices; Ratio, Proportion, and Variations; Commercial Mathematics

Assessment Test I

1. The required sequential order is BCADE.
   Hence, the correct option is (b).

2. $a:b = 3:4 = 9:2$
   $b:c = 3:4 = 12:16$
   $\Rightarrow a:b:c = 9:12:6$
   Let $a = 9k$, $b = 12k$, and $c = 16k$
   $$\sqrt{\frac{a^2+b^2}{b^2+c^2}} = \sqrt{\frac{(9k)^2+(12k)^2}{(12k)^2+(16k)^2}} = \sqrt{\frac{225k^2}{400k^2}}$$
   $$= \frac{\sqrt{225}}{\sqrt{400}} = \frac{15}{20} = \frac{3}{4}$$
   Hence, the correct option is (c).

3. The order of the product $\begin{bmatrix} 4 & -1 & 3 \\ 1 & 0 & 5 \end{bmatrix}_{2\times 3}$ $\begin{bmatrix} 5 & 1 & 9 \\ 0 & -3 & 6 \\ 1 & 8 & 4 \end{bmatrix}_{3\times 3}$ is 2×3, since the product of matrix A and the matrix of order 2×3 is a square matrix.
   $\therefore$ The order of A must be 3×2.
   Hence, the correct option is (a).

4. If A is a $n \times n$ matrix, then $\det(kA) = K^n \det A$.
   $\therefore \det(5A) = 875 \Rightarrow 5^2 \det A = 875$
   $\det A = 35$
   Hence, the correct option is (d).

5. $I = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$
   $$3I = \begin{bmatrix} 3 & 0 \\ 0 & 3 \end{bmatrix} \Rightarrow (3I)^{10} = \begin{bmatrix} 3^{10} & 0 \\ 0 & 3^{10} \end{bmatrix}$$
   $$[(3I)^{10}]^{-1} = \frac{1}{3^{10}\times 3^{10} - 0\times 0}\begin{bmatrix} 3^{10} & 0 \\ 0 & 3^{10} \end{bmatrix}$$
   $$= \frac{1}{3^{20}} \times 3^{10}\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} = \frac{1}{3^{10}}I.$$
   Hence, the correct option is (d).

6. $$\frac{\sqrt{5x+7}+\sqrt{5x-7}}{\sqrt{5x+7}-\sqrt{5x-7}} = \frac{2}{1}$$
   Using componendo and dividendo, we get
   $$\frac{\left(\sqrt{5x+7}+\sqrt{5x-7}\right)+\left(\sqrt{5x+7}-\sqrt{5x-7}\right)}{\left(\sqrt{5x+7}+\sqrt{5x-7}\right)-\left(\sqrt{5x+7}-\sqrt{5x-7}\right)} = \frac{2+1}{2-1}$$
   $$\Rightarrow \frac{2\sqrt{5x+7}}{2\sqrt{5x-7}} = \frac{3}{1} \Rightarrow \sqrt{\frac{5x+7}{5x-7}} = 3$$
   $$\Rightarrow \frac{5x+7}{5x-7} = 9 \Rightarrow 5x + 7 = 45x - 63$$
   $$\Rightarrow 40x = 70 \Rightarrow x = \frac{7}{4}$$
   Hence, the correct option is (b).

7. If A is symmetric, then A^T must be symmetric. Both Cramer's method and matrix inversion method are not applicable when the linear equations have no solution. For any two squares matrices of same order,
   $(AB)^{-1} = B^{-1}A^{-1}$
   $(A+B)^2 = (A+B)(A+B) = A^2 + AB + BA + B^2$
   $= A^2 + AB + BA + B^2$ ($\because$ A and B are commu -tative.)
   $= A^2 + 2AB + B^2$
   Option (d) follows.
   Hence, the correct option is (d).

8. MV = 120 – 10 = 110
   Number of shares $= \frac{\text{Total Investment}}{\text{MV}}$
   $= \frac{₹55,000}{₹110} = 500$
   Annual income from each share $= \frac{15}{100} \times 120$
   $= 18$
   $\therefore$ Annual income from 500 shares $= 500 \times 18$
   $= 9000$.
   Hence, the correct option is (a).

9. Amount $= 60,000\left(1+\frac{8}{100}\right)\left(1+\frac{10}{100}\right)\left(1+\frac{15}{100}\right)$
   $= 60,000 \times \frac{108}{100} \times \frac{110}{100} \times \frac{115}{100}$
   $= 81,972$

$\therefore$ Compound interest = 81,972 – 60,000
= 21,972.
Hence, the correct option is (c).

10. We have, Interest $= P \times \frac{n(n+1)}{2} \times \frac{1}{12} \times \frac{R}{100}$
Here, $P = 2500$, $n = 5 \times 12$, i.e., 60 months
$R = 8$
$\therefore$ Interest $= 2500 \times \frac{60(60+1)}{2} \times \frac{1}{12} \times \frac{8}{100}$
$= 30{,}500$
$\therefore$ The total amount received = (60×2500) + 30,500 = 1,80,500
Hence, the correct option is (a).

11. Let the marked price be x.
Discount $= \frac{25}{100} \times x = \frac{x}{4}$
The price of the article after discount =
$x - \frac{x}{4} = \frac{3x}{4}$
Sales tax charged = 10% of $\frac{3x}{4} = \frac{10}{100} \times \frac{3x}{4} = \frac{3x}{40}$
The cost of the article inclusive of sales tax
$= \frac{3x}{4} + \frac{3x}{40} = 3x\left(\frac{1}{4} + \frac{1}{40}\right) = 3x\left(\frac{11}{40}\right)$
$= \frac{33x}{40}$
Given, $\frac{33x}{40} = 660$
$\Rightarrow x = 800$
Hence, the correct option is (b).

12. Option (e): $\frac{2x+3y}{2x-3y} = 3$
$\Rightarrow 2x + 3y = 6x - 9y \Rightarrow 4x = 12y$
$\Rightarrow x = 3y \Rightarrow x{:}y = 3{:}1$

13. Options (a): $\frac{a^3 + 3ab^2}{b^3 + 3a^2b} = \frac{185}{158}$
Using componendo and dividendo, we get
$\frac{(a^3 + 3ab^2) + (b^3 + 3a^2b)}{(a^3 + 3ab^2) - (b^3 + 3a^2b)} = \frac{185 + 158}{185 - 158}$
$\Rightarrow \frac{(a+b)^3}{(a-b)^3} = \frac{343}{27} \Rightarrow \left(\frac{a+b}{a-b}\right)^3 = \left(\frac{7}{3}\right)^3$
$\Rightarrow \frac{a+b}{a-b} = \frac{7}{3}$
Again using componendo and dividendo, we get $\frac{2a}{2b} = \frac{10}{4}$.
$\Rightarrow \frac{a}{b} = \frac{5}{2}$

14. Option (b): $25x^2 - 30xy + 9y^2 = 0$
$\Rightarrow (5x - 3y)^2 = 0$
$\Rightarrow 5x - 3y = 0$
$\Rightarrow 5x = 3y$
$\Rightarrow x{:}y = 3{:}5$

15. Option (d): The compound ratio of 2:7 and 14:5
$= 2 \times 14{:}7 \times 5 = 4{:}5$

Assessment Test II

1. The required sequential order is BADC.
Hence, the correct option is (d).

2. $\sqrt{\frac{a^2+b^2}{a^2-b^2}} = 3$
$\Rightarrow \frac{a^2+b^2}{a^2-b^2} = 9$
$\Rightarrow a^2 + b^2 = 9a^2 - 9b^2$
$\Rightarrow 8a^2 = 10b^2 \Rightarrow \frac{a^2}{b^2} = \frac{5}{4}$
$\Rightarrow \left(\frac{a}{b}\right)^2 = \frac{5}{4}$
$\Rightarrow \frac{a}{b} = \frac{\sqrt{5}}{2}$
Hence, the correct option is (a).

3. The order of B is 3×3.
The order of A B C is 2×4.
$\therefore$ Order of C must be 3×4.
$\Rightarrow$ Order of $B_{3\times3}\, C_{3\times4}$ is 3×4.
As $A_{2\times3}\,(B\,C)_{3\times4}$ order is 2×4, order of A must be 2×3.
Hence, the correct option is (b).

4. Let $A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$
det A $= ad - bc = 5$
$ka = \begin{bmatrix} ka & kb \\ kc & kd \end{bmatrix}$

$\det(ka) = k^2ad - k^2bc$

$245 = k^2(ad - bc)$

$245 = k^2(5) \Rightarrow k = 7$

Hence, the correct option is (a).

5. $\frac{1}{5}\mathrm{I} = \frac{1}{5}\begin{bmatrix}1 & 0\\0 & 1\end{bmatrix} = \begin{bmatrix}\frac{1}{5} & 0\\0 & \frac{1}{5}\end{bmatrix}$

$$\left(\frac{1}{5}\mathrm{I}\right)^{-1} = \begin{bmatrix}\frac{1}{5} & 0\\0 & \frac{1}{5}\end{bmatrix}^{-1} = \frac{1}{\frac{1}{5}\times\frac{1}{5} - 0\times 0}\begin{bmatrix}\frac{1}{5} & 0\\0 & \frac{1}{5}\end{bmatrix}$$

$$= 25\begin{bmatrix}\frac{1}{5} & 0\\0 & \frac{1}{5}\end{bmatrix} = 5\begin{bmatrix}1 & 0\\0 & 1\end{bmatrix} \therefore \left[\left(\frac{1}{5}\mathrm{I}\right)^{-1}\right]^{20} = 5^{20}\mathrm{I}$$

Hence, the correct option is (c).

6. $\dfrac{\sqrt{8x+5}+\sqrt{8x-5}}{\sqrt{8x+5}-\sqrt{8x-5}} = \dfrac{2}{1}$

Using componendo and dividendo, we get

$$\frac{\left(\sqrt{8x+5}+\sqrt{8x-5}\right)+\left(\sqrt{8x+5}-\sqrt{8x-5}\right)}{\left(\sqrt{8x+5}+\sqrt{8x-5}\right)-\left(\sqrt{8x+5}-\sqrt{8x-5}\right)} = \frac{2+1}{2-1}$$

$$\Rightarrow \frac{2\sqrt{8x+5}}{2\sqrt{8x-5}} = \frac{3}{1} \Rightarrow \sqrt{\frac{8x+5}{8x-5}} = 3$$

$$\Rightarrow \frac{8x+5}{8x-5} = 9$$

$\Rightarrow 8x + 5 = 72x - 45$

$\Rightarrow 64x = 50$

$\Rightarrow x = \dfrac{25}{32}$

Hence, the correct option is (a).

7. For any three matrices A, B, and C, if A B = AC, then it is not necessarily imply that B = C or A = O.

Hence, the correct option is (c).

8. M V = 150 + 20 = 170

Number of shares $= \dfrac{\text{Total Investment}}{\text{MV}}$

$= \dfrac{₹6800}{₹170} = 400$

Annual income from each share $= \dfrac{10}{100} \times 150$

$= 15$

$\therefore$ Annual income from 400 shares $= 400 \times 15$

$= 6000$

Hence, the correct option is (b).

9. Amount $= 120{,}000\left(1+\dfrac{5}{100}\right)\left(1+\dfrac{10}{100}\right)\left(1+\dfrac{12}{100}\right)$

$= 1{,}20{,}000\left(\dfrac{105}{100}\right)\left(\dfrac{110}{100}\right)\left(\dfrac{112}{199}\right)$

$= 1{,}55{,}232$

$\therefore$ Compound interest $= 1{,}55{,}232 - 1{,}20{,}000$

$= 35{,}232$

Hence, the correct option is (d).

10. We have, Interest $= P \times \dfrac{n(n+1)}{2} \times \dfrac{1}{12} \times \dfrac{R}{100}$

Here, $p = 1800$, $n = 10 \times 12 = 120$ months

$R = 5\%$

$\therefore$ Interest $= 1800 \times \dfrac{120(120+1)}{2} \times \dfrac{1}{12} \times \dfrac{5}{100}$

$= 54{,}450$

$\therefore$ The total amount received $= (120 \times 1800) + 54{,}450$

$= 2{,}70{,}450$

Hence, the correct option is (c).

11. Let the reduced price of the article after discount be x.

Sales tax charged = 10% of $x = \dfrac{10}{100}x = \dfrac{x}{10}$

$\therefore$ Selling price $= x + \dfrac{x}{10} = ₹\dfrac{11x}{10}$

Given, $\dfrac{11x}{10} = 3300$

$\Rightarrow x = 3000$

$\therefore$ Discount offered $= (3300 - 3000) = 300$

Hence, the correct option is (a).

12. Option (b): Let $a = 3K$, $b = 2K$

$\dfrac{5a+3b}{5a-3b} = \dfrac{5(3k)+3(2k)}{5(3k)-3(2k)} = \dfrac{21k}{9k} = \dfrac{7}{3}$

13. Option (d): $\dfrac{x^3+3xy^2}{y^3+3x^2y} = \dfrac{63}{62}$

Using componendo and dividendo, we get

$\dfrac{(x^3+3xy^2)+(y^3+3x^2y)}{(x^3+3xy^2)-(y^3+3x^2y)} = \dfrac{63+62}{63-62}$

$$\Rightarrow \frac{(x+y)^3}{(x-y)^3} = \frac{125}{1} \Rightarrow \left(\frac{x+y}{x-y}\right)^3 = \left(\frac{5}{1}\right)^3$$

$$\Rightarrow \frac{x+y}{x-y} = \frac{5}{1}$$

Again using componendo and dividendo, we get

$$\frac{2x}{2y} = \frac{6}{4}$$

$$\Rightarrow \frac{x}{y} = \frac{3}{2}$$

14. Option (a): $9x^2 + 16y^2 = 24xy \Rightarrow 9x^2 - 24xy + 16y^2 = 0$

$\Rightarrow (3x - 4y)^2 = 0 \Rightarrow 3x - 4y = 0$

$\Rightarrow 3x = 4y \Rightarrow \frac{x}{y} = \frac{4}{3}$.

15. Option (c): The compound ratio of 3:5 and 10:9 $= 3 \times 10 : 5 \times 9 = 2:3$

Assessment Test III

1. BDAEC is the required sequential order.

Hence, the correct option is (c).

2. $A = \begin{pmatrix} 3 & 4 \\ 5 & 7 \end{pmatrix}$

$$A^{-1} = \frac{1}{21-20}\begin{pmatrix} 7 & -4 \\ -5 & 3 \end{pmatrix}$$

$$A^{-1} = \begin{pmatrix} 7 & -4 \\ -5 & 3 \end{pmatrix}$$

$$A + A^{-1} = \begin{pmatrix} 3 & 4 \\ 5 & 7 \end{pmatrix} + \begin{pmatrix} 7 & -4 \\ -5 & 3 \end{pmatrix}$$

$$= \begin{pmatrix} 10 & 0 \\ 0 & 10 \end{pmatrix} = 10\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} = 10I$$

Hence, the correct option is (d).

3. $M = \begin{bmatrix} 3 & 2 \\ 7 & d-4 \end{bmatrix}$

det $M = 3d - 12 - 14$

$= 3d - 26$

Trace of $M = 3 + d - 4$

$= d - 1$

Given that $3d - 26 + 1 = d - 1$

$3d - d = -1 + 25$

$2d = 24$

$d = 12$

Hence, the correct option is (a).

4. Given, $A_{2\times 3}$, $B_{4\times 3}$, and $C_{3\times 4}$.

$A_{2\times 3} \times C_{3\times 4} = (AC)_{2\times 4}$

$(AC)_{2\times 4} \times B_{4\times 3} = [(AC)B]_{2\times 3}$ is possible.

Hence, the correct option is (d).

5. $\frac{4a+b}{5a-2b} = \frac{14}{11}$

$44a + 11b = 70a - 28b$

$28b + 11b = 70a - 44a$

$39b = 26a$

$\frac{39}{26} = \frac{a}{b}$

$\therefore a:b = 3:2$

Hence, the correct option is (c).

6. Given, $\frac{\sqrt{a+bx}}{\sqrt{a-bx}} = \frac{5}{2}$

$$\Rightarrow \frac{a+bx}{a-bx} = \frac{25}{4}$$

$$\Rightarrow \frac{a+bx+(a-bx)}{a-bx-(a-bx)} = \frac{25+4}{25-4}$$

$$\Rightarrow \frac{2a}{2bx} = \frac{29}{21}$$

$$\frac{a}{bx} = \frac{29}{21}$$

$$x = \frac{21a}{29b}$$

Hence, the correct option is (a).

7. The number of men is inversely proportional to the number of days required to do a work.

$M_1D_1H_1 = M_2D_2H_2$

$36 \times 12 \times 8 = 48 \times D_2 \times 6$

$D_2 = 12$

$\therefore$ 48 men can complete the work working at 6 h per day in 12 days.

Hence, the correct option is (d).

8. Let the force applied and the acceleration produced be denoted by F and a, respectively.

F varied directly with a.

$\therefore \dfrac{F}{a} = \text{constant}$

Given that, $F = 20$ N and $a = 8$ m/sec^2

This constant $= \dfrac{20}{8} = \dfrac{5}{2}$.

$\therefore F = \dfrac{5}{2}a$

If instead $F = 5$ N, a would have been $\dfrac{2}{5}(5) =$ 2 m/s^2.

Hence, the correct option is (b).

9. % change $= \dfrac{\text{Difference}}{\text{Initial value}} \times 100$

$= \dfrac{2.5-1.6}{1.6} \times 100 = \dfrac{0.9}{1.6} \times 100 = 56.25\%$

Hence, the correct option is (d).

10. $A \xrightarrow{+20\%} B \xrightarrow{+10\%}$

10% of the cost price for B is 66.

$\Rightarrow$ B's cost price $= \dfrac{₹66 \times 100}{10} = 660$

$\Rightarrow$ B's selling price $= (660 + 66) = 726$

$\therefore$ C's cost price $= 726$

$\therefore$ A's selling price = B's cost price $= 660$

$\Rightarrow$ 120% of B's cost price $= 660$

A's cost price

$= \dfrac{660}{120} \times 100 = 550$

$\therefore$ A's cost price $= 550$

$\therefore$ Required difference $= 726 - 550 = 176$

Hence, the correct option is (c).

11. C.P. of the 1st article

$= \dfrac{13860}{90}(100) = 15{,}400$

C.P. of 2nd article $= \dfrac{13860}{110}(100) = 12{,}600$

Total S.P. $= 13{,}860(2) = 27{,}720$

Total C.P. $= 15{,}400 + 12{,}600 = 28{,}000$

Loss = C.P. – S.P.

$= (28{,}000 - 27{,}720) = 280$

Hence, the correct option is (c).

12. Difference between the compound interest and simple interest for two years $= P\left(\dfrac{R}{100}\right)^2$.

$28000\left(\dfrac{R}{100}\right)^2 = 70$

$\left(\dfrac{R}{100}\right)^2 = \dfrac{1}{400}$

$\left(\dfrac{R}{100}\right)^2 = \left(\dfrac{1}{20}\right)^2$

$\dfrac{R}{100} = \dfrac{1}{20}$

$\Rightarrow R = 5\%$

$\therefore$ Rate of interest $= 5\%$

Hence, the correct option is (d).

13. Cost of 100 shares $= (240 + 48) \times 100$

$= 288 \times 100 = 28{,}800$

The dividend on 100 shares

$= \dfrac{12}{100} \times 240 \times 100$

$= 2{,}880$

Rate of returns $= \dfrac{2880}{28800} \times 100\,\% = 10\%$

Hence, the correct option is (c).

14. Cash price $= 30{,}000$

Down payment $= 10{,}000$

Balance to be paid by instalments $= 30{,}000 - 10{,}000 = 20{,}000$

Let R be the rate of interest per annum

After two months 20,000 will amount to

$20000 + \dfrac{20000 \times R \times 2}{100 \times 12}$

$= 20000 + \dfrac{100R}{3}$

The customer has to pay 10,200 each month.

The first instalment will amount to

$10200 + \dfrac{10200 \times R}{100 \times 12} = 10200 + \dfrac{17R}{2}$.

The second instalment is 10,200.

Total value of the instalments

$= 10{,}200 + \dfrac{17R}{2} + 10{,}200$

$= 20{,}400 + \dfrac{17}{R}$

$\therefore 20000 + \dfrac{100R}{3} = 20{,}400 + \dfrac{17R}{2}$

$$\frac{100R}{3}-\frac{17R}{2}=400$$

$$\frac{149R}{6}=1200$$

$$R=\frac{2400}{146}\approx 16$$

$\therefore$ Rate of interest = 16%

Hence, the correct option is (a).

15. (i) $(A^TB)^T = B^T(A^T)^T = B^TA \to$ (d)

(ii) $(AB^T)^T = (B^T)^TA^T = BA^T \to$ (b)

(iii) $(A^TB^T)^T = (B^T)^T(A^T)^T = BA \to$ (c)

(iv) $(AB)^T = B^TA^T \to$ (a)

(i) $\to$ (D); (ii) $\to$ (B); (iii) $\to$ (C); (iv) $\to$ (A)

Hence, the correct option is (d).

Assessment Test IV

1. BDCEA is the required sequential order.

Hence, the correct option is (c).

2. $P=\begin{pmatrix}5 & 2\\ 7 & 3\end{pmatrix}$

$$P^{-1}=\frac{1}{15-14}\begin{pmatrix}3 & -2\\ -7 & 5\end{pmatrix}$$

$$=\begin{pmatrix}3 & -2\\ -7 & 5\end{pmatrix}$$

$$P+P^{-1}=\begin{pmatrix}5 & 2\\ 7 & 3\end{pmatrix}+\begin{pmatrix}3 & -2\\ -7 & 5\end{pmatrix}$$

$$=\begin{pmatrix}8 & 0\\ 0 & 8\end{pmatrix}$$

$= 8I$

Hence, the correct option is (c).

3. $N=\begin{bmatrix}5 & 8\\ 4 & x-5\end{bmatrix}$

$|N| = 5x - 25 - 32$

$= 5x - 57$

Trace of N $= 5 + x - 5$

$= x$

Given that $5x - 57 = x + 3$

$4x = 60$

$x = 15$

Hence, the correct option is (d).

4. $Q_{l\times m}\times P_{m\times n} = (QP)_{l\times n}$

$(QP)_{l\times n}\times R_{n\times l} = [(QP)R]_{l\times l}$

Hence, the correct option is (d).

5. Given, $(4x - 5y):(3x + 2y) = 3:8$

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

$32x - 40y = 9x + 6y$

$23x = 46y$

$1x = 2y$

$$\frac{x}{y}-\frac{2}{1}$$

$\Rightarrow x:y = 2:1$

$\Rightarrow x^2:y^2 = 4:1$

Hence, the correct option is (c).

6. Given, $\dfrac{\sqrt{3+5x}}{\sqrt{3-5x}}=\dfrac{7}{2}$

$$\frac{3+5x}{3-5x}=\frac{49}{4}$$

$$\frac{3+5x+(3-5x)}{3+5x-(3-5x)}=\frac{49+4}{49-4}$$

$$\Rightarrow \frac{3+5x+3-5x}{3+5x-3+5x}=\frac{53}{45}$$

$$\Rightarrow \frac{6}{10x}=\frac{53}{45}$$

$$x=\frac{27}{53}$$

Hence, the correct option is (b).

7. $\dfrac{M_1\ D_1}{C_1}=\dfrac{M_2\ D_2}{C_2}$

$$\Rightarrow \frac{6\times 5}{1980}=\frac{9\times 3}{C_2}$$

$$C_2=\frac{9\times 3\times 1980}{6\times 5}$$

$= 27 \times 66 = 1782$

Hence, the correct option is (a).

8. Let tax be T and the number of children be C.

$T \propto C^2$

$\Rightarrow T = KC^2$

$C = 2$; $T = 3144$

$\Rightarrow 3144 = K(2)^2$

$\Rightarrow K = 786$

If $C = 3$

$T = KC^2$

$T = 786(3)^2$

$T = 7074.$

Hence, the correct option is (b).

9. Stage I: $\frac{80}{100} \times 100 = 80\%$

Stage II: $\frac{60}{100} \times 100 = 60\%$

Stage III: $\frac{75}{100} \times 100 = 75\%$

Percentage change $= \frac{80-75}{80} \times 100\ \%$

$= \frac{5}{80} \times 100\ \% = 6.25\% = 6.25\%$ decrease

Hence, the correct option is (d).

10. $\text{Mr.X} \xrightarrow{-20\%} \text{Mr.P} \xrightarrow{-15\%} \text{Mr.R}$

Mr P's loss = 15% of P's cost price = ₹1050

$\Rightarrow$ Mr P's cost price = Mr X's selling price

$= \frac{1050}{15} \times 100 =$ ₹7000

80% of Mr X's cost price = ₹7000

Mr X's cost price $= \frac{7000}{80} \times 100$ = ₹8750

$\therefore$ Selling price of Mr P = Cost price of Mr R

= ₹7000 – ₹1050

$\therefore$ C.P. of Mr R = ₹5950

$\therefore$ Difference between the cost prices of Mr X and Mr R

= (₹8750 – ₹5950) = ₹2800

Hence, the correct option is (c).

11. The selling price of the cars = ₹4,20,000

Case I:

16% loss on $CP_1 \Rightarrow$ 84% of CP_1 = ₹4,20,000

$CP_1 = \frac{4,20,000}{84} \times 100$

CP_1 = ₹5,00,000

Case II:

5% profit on $CP_2 \Rightarrow$ 105% of CP_2 = ₹4,20,000

$CP_2 = \frac{4,20,000}{105} \times 100$ = ₹4,00,000

Total CP = $CP_1 + CP_2$

= ₹5,00,000 + ₹4,00,000 = ₹9,00,000

Total SP = $SP_1 + SP_2$

= ₹4,20,000 + ₹4,20,000 = ₹8,40,000

CP > SP

Loss% $= \left(\frac{60,000}{9,00,000} \times 100\right)\% = 6\frac{2}{3}\%$

= 6.66% loss

Hence, the correct option is (b).

12. $P\left(\frac{R}{100}\right)^2 =$ ₹2500

$P\left(\frac{25}{100}\right)^2 =$ ₹2500

P = ₹2500 × 16

P = ₹40,000

Hence, the correct option is (b).

13. Let x number of shares be purchased.

Investment $= (120 - 20) \times x = 100x$

Annual income = (20% of 120)x

$= 24x$

$24x = 2520$

$x = 105$

Hence, the correct option is (b).

14. Cost price = ₹20,500

Down payment = ₹500

Remaining amount = (20,500 – 500) = ₹20,000

Let R be the rate of interest per annum.

Each instalment = 10,500

$\therefore$Interest = 2(10,500) – 20,000 = 1000

Principal for the first month = 20,000.

Principal for the second month = (20,000 – 10,500)

= ₹9500

The sum of monthly payments = (20,000 + 9500)

= ₹29,500

Interest $= \frac{PR}{1200}$

$1000 = \frac{₹29500 \times R}{1200}$

$R = \frac{₹12000}{295} = 40.68\%$

Hence, the correct option is (d).

15. (i) S.I. $= \dfrac{1000\times 20\times 3}{100} = 600 \rightarrow$ (b)

(ii) S.I. $= \dfrac{3000\times 20\times 3}{100} = 1800 \rightarrow$ (a)

(iii) S.I. $= \dfrac{5000\times 10\times 2}{100} = 1000 \rightarrow$ (c)

(iv) S.I. $= \dfrac{4000\times 10\times 3}{100} = 1200 \rightarrow$ (d)

(i) $\rightarrow$ (B); (ii) $\rightarrow$ (A); (iii) $\rightarrow$ (C); (iv) $\rightarrow$ (D)

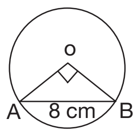
Hence, the correct option is (d).

CHAPTER 4
Mensuration

Assessment Test I

1. The required sequential order is BADC.
   Hence, the correct option is (b).

2. Let the side of the equilateral triangle be a cm.
   Given $\frac{\sqrt{3}}{2}a = 6 \Rightarrow a = \frac{12}{\sqrt{3}} \Rightarrow a = 4\sqrt{3}$
   $\therefore$ Area $= \frac{\sqrt{3}}{4}a^2 = \frac{\sqrt{3}}{4}(4\sqrt{3})^2 = 12\sqrt{3}\,\text{cm}^2$
   Hence, the correct option is (a).

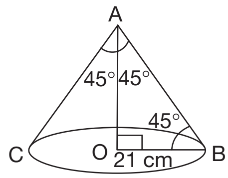
3. 

   Given AB = 8 cm = hypotenuse of ΔOAB.
   Area of a right isosceles triangle =
   $\frac{h^2}{4} = \frac{8^2}{4} = 16\ \text{cm}^2$
   Hence, the correct option is (c).

4. Face diagonal of the cube $= 5\sqrt{2}$ cm
   $\Rightarrow$ Edge of the cube $= \frac{5\sqrt{2}}{\sqrt{2}} = 5$ cm
   $\therefore$ The dimensions of the resulting cuboid are:
   $l = 5 + 5 = 10$ cm, $b = 5$ cm, and $h = 5$ cm.
   $\therefore$ Volume $= lbh$
   $= 10 \times 5 \times 5 = 250\ \text{cm}^3$
   Hence, the correct option is (c).

5. The area of the base of the pyramid (A) = the area of regular hexagon
   $= 6 \times \frac{\sqrt{3}}{4}a^2 = 6 \times \frac{\sqrt{3}}{4} \times 4^2 = 24\sqrt{3}\ \text{cm}^2$
   $\therefore$ Volume $= \frac{1}{3}Ah$
   $= \frac{1}{3} \times 24\sqrt{3} \times 15 = 120\sqrt{3}\ \text{cm}^3$
   Hence, the correct option is (d).

6. Diagonal of the square $= 14\sqrt{2}$ cm
   $\Rightarrow$ Side $= \frac{14\sqrt{2}}{\sqrt{2}} = 14$ cm
   Area of the shaded region = area of the square – area of the sector ABD
   $= 14^2 - \frac{90^\circ}{360^\circ} \times \frac{22}{7} \times (14)^2 = 42\ \text{cm}^2$
   Hence, the correct option is (a).

7. 

   Given $r = 21$ cm and $\angle BAC = 90°$:
   $\angle OAB = \frac{1}{2}\angle BAC = 45°$
   In ΔAOB, OA = OB
   $\Rightarrow$ Height (h) = OA = 21 cm
   $\therefore$ Volume $= \frac{1}{3}\pi r^2 h = \frac{1}{3} \times \frac{22}{7} \times 21^2 \times 21$
   $= 9702\ \text{cm}^3$
   Hence, the correct option is (c).

8. CSA of the cone = Area of the rectangle
   $= 44 \times 32$
   $= 1408\ \text{cm}^2$
   Hence, the correct option is (d).

9. Let the radius of the sphere be r cm.
   $\therefore$ Diameter $= 2r$ cm
   Base radius of the cylinder $= r$ cm
   Height $= 2r$ cm (given)
   $\therefore$ Required ratio $= \frac{\frac{4}{3}\pi r^3}{\pi r^2 (2r)}$ $(\because h = 2r)$
   $= \frac{4}{6} = 2:3$
   Hence, the correct option is (b).

10. Diameter of the sphere = the edge of the cube = 14 cm

$\Rightarrow 2r = 14$ cm $\Rightarrow r = 7$ cm

$\therefore$ Surface area $= 4\pi r^2 = 4 \times \frac{22}{7} \times 7^2$

$= 616$ cm^2

Hence, the correct option is (c).

11. Given $r = 6$ cm

$\frac{1}{3}\pi r^2 h = 1056$ (given)

$\Rightarrow \frac{1}{3} \times \frac{22}{7} \times 6^2 \times h = 1056$

$\Rightarrow h = 28$ cm

Hence, the correct option is (a).

12. Option (c): TSA $= 2\pi R^2 + 2\pi r^2 + \pi R^2 - \pi r^2$

$= \pi(3R^2 + r^2)$

13. Option (d): The required difference

$= 4\pi R^2 - 2\pi(r)(2R)$

$= 4\pi R^2 - 4\pi Rr$

$= 4\pi(R^2 - Rr)$

14. Option (b):

CSA $= \pi l(R + r)$

$= \pi(R + r)^2$ ($\because l = R + r$)

15. Option (a):

TSA $= 2\pi Rh + 2\pi rh + 2\pi(R^2 - r^2)$

$= 2\pi R(2r) + 2\pi r(2r) + 2\pi R^2 - 2\pi r^2$

$= 4\pi Rr + 4\pi r^2 + 2\pi R^2 - 2\pi r^2$

$= 2\pi(R^2 + 2Rr + r^2)$

$= 2\pi(R + r)^2$

Assessment Test II

1. The required sequential order is ABCED.

Hence, the correct option is (d).

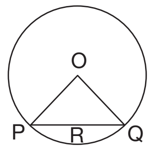
2. Given $\frac{\sqrt{3}}{4}a^2 = 18\sqrt{3}$

$\Rightarrow a^2 = 72 \Rightarrow a = 6\sqrt{2}$ cm

$\therefore$ Height $= \frac{\sqrt{3}}{2}a = \frac{\sqrt{3}}{2} \times 6\sqrt{2} = 3\sqrt{6}$ cm

Hence, the correct option is (c).

3.



OR is the perpendicular bisector of PQ.

$\therefore RQ = \frac{PQ}{2} = \frac{12}{2} = 6$ cm

The angles of ΔORQ are 30°, 60°, and 90°.

$\therefore$ The ratio of its corresponding sides is $1:\sqrt{3}:2$.

$\Rightarrow \frac{OR}{RQ} = \frac{1}{\sqrt{3}} \Rightarrow \frac{OR}{6} = \frac{1}{\sqrt{3}}$

$\Rightarrow OR = 2\sqrt{3}$ cm

$\therefore$ Area of $\Delta POQ = \frac{1}{2} \times PQ \times OR$

$= \frac{1}{2} \times 12 \times 2\sqrt{3} = 12\sqrt{3}$ cm^2

Hence, the correct option is (c).

4. The face diagonal of the cube $= 6\sqrt{2}$ cm

$\Rightarrow$ The edge of the cube $= \frac{6\sqrt{2}}{\sqrt{2}} = 6$ cm

$\therefore$ The dimensions of the resulting cuboid are:

$l = 6 \times 3 = 18$ cm, $b = 6$ cm, and $h = 6$ cm.

$\therefore$ Total surface area of the cuboid

$= 2(lb + bh + lh)$

$= 2(18 \times 6 + 6 \times 6 + 18 \times 6) = 504$ cm^2

Hence, the correct option is (b).

5. Given $\frac{1}{3}Ah = 192$ m^3

$\Rightarrow \frac{1}{3} \times A \times 16 = 192 \Rightarrow A = 36$ m^2

$\Rightarrow$ (side) (side) $= 36 \Rightarrow$ side $= 6$ m

Hence, the correct option is (b).

6. The area of the shaded region QASR.

= The area of square PQRS – the area of sector PQAS

$= (7\sqrt{2})(7\sqrt{2}) - \frac{90^\circ}{360^\circ} \times \frac{22}{7} \times (7\sqrt{2})^2$

$= 98 - 77 = 21$ cm^2

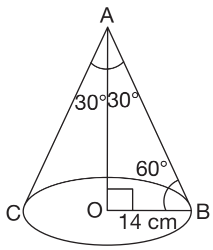
Similarly, the area of the shaded region PQBS $= 21 \text{ cm}^2$.

$\therefore$ The area of the shaded region $= 21 + 21$

$= 42 \text{ cm}^2$

Hence, the correct option is (d).

7.



Given $r = 14$ cm

$\angle BAC = 60° \Rightarrow \angle OAB = \frac{1}{2}\angle BAC = 30°$

In ΔAOB, the angles are 30°, 60°, and 90°.

$\therefore$ The ratio of the corresponding sides is $1{:}\sqrt{3}{:}2$.

$\therefore$ Slant height of the cone $= AB = 2 \times OB = 28$ cm

$\therefore$ Curved surface area of the cone $= \pi rl$

$= \frac{22}{7} \times 14 \times 28 = 1232 \text{ cm}^2$

Hence, the correct option is (b).

8. Here, $2\pi r = 22$ cm

$\Rightarrow 2 \times \frac{22}{7} \times r = 22 \Rightarrow r = 3.5$ cm

h = length = 35 cm

$\therefore$ Volume $= \pi r^2 h = \frac{22}{7} \times (3.5)^2 \times 35$

$= 1347.5 \text{ cm}^3$

Hence, the correct option is (a).

9. Let the radius of the cone be r.

$\therefore$ Radius of the sphere $= 2r$

Height of the cone $= 2\,(2r) = 4r$

$$\frac{\text{Volume of the sphere}}{\text{Volume of the cone}} = \frac{\frac{4}{3}\pi(2r)^3}{\frac{1}{3}\pi r^2(4r)}$$

$= \frac{4 \times 8\pi^3}{4r^3} = 8{:}1$

Hence, the correct option is (d).

10. The base diameter of the cylinder = the edge of the cube

$\therefore 2r = 7 \Rightarrow r = 3.5$ cm

The height of the cylinder = the edge of the cube = 7 cm

The curved surface area $= 2\,\pi rh$

$= 2 \times \frac{22}{7} \times 3.5 \times 7 = 154 \text{ cm}^2$

Hence, the correct option is (a).

11. Let the base radius of the cylinder be r.

Volume of the cylinder = the volume of the cone

$\pi r^2 \times 10 = \frac{1}{3}\pi \times 8^2 \times 15$

$r^2 = \frac{8^2 \times 5}{10} = 32 \Rightarrow r = 4\sqrt{2}$ cm

Hence, the correct option is (c).

12. Option (c):

The volume of hollow hemisphere $\frac{2}{3}\pi(R^3 - r^3)$

$= \frac{2}{3}\pi(8r^3 - r^3)$ ($\therefore R = 2r$)

$= \frac{2}{3} \times \frac{22}{7} \times 7r^3 = \frac{44}{3}r^3$

13. Option (b):

The volume of a cone $= \frac{1}{3}\pi r^2 h$

$= \frac{1}{3} \times \frac{22}{7} \times r^2 \times 7r$

$= \frac{22r^3}{3}$

14. Option (d): The volume of a cone frustum

$= \frac{1}{3}\pi h(R^2 + Rr + r^2)$

$= \frac{1}{3}\pi \times \frac{5}{2}r\,\left[(2r^2) + (2r)r + r^2\right]\left(\therefore\ r = \frac{R}{2}\right)$

$= \frac{\pi \times 5r}{3 \times 2}(7r^2)$

$= \frac{55r^3}{3}$

15. Option (a): The volume of hollow cylinder

$= \pi(R^2 - r^2)h$

$= \frac{22}{7}\left[\left((2r)^2 - r^2\right) \times \frac{7}{18}r\right]$

$= \frac{22}{7} \times 3r^2 \times \frac{7r}{18}$

$= \frac{11r^3}{3}$

Assessment Test III

1. BADC is the required sequential order.

   Hence, the correct option is (d).

2. The given height of an equilateral triangle $= 18$ cm

   $\therefore$ Required inradius $= \frac{1}{3} \times 18 = 6$ cm

   Hence, the correct option is (c).

3. Let r be the radius of the circle.

   $\therefore$ The side of the hexagon $= r$

   The area of the regular hexagon $= 54\sqrt{3}$ cm

   A regular hexagon is equal to

   $6\left(\frac{\sqrt{3}\, r^2}{4}\right) = 54\sqrt{3} \Rightarrow r^2 = 36$

   $r = 6$ cm

   $\therefore$ Area of the circle $= \pi \times 6^2 = 36\pi\,\text{cm}^2$

   Hence, the correct option is (a).

4. Let l, b, and h be the length, breadth, and height of the cuboid, respectively.

   The longest diagonal of the cuboid

   $= \sqrt{l^2 + b^2 + h^2} = 5\sqrt{5}$ cm

   $\Rightarrow l^2 + b^2 + h^2 = 125$

   And $\sqrt{l^2 + b^2} = 10$

   ($\because$ One of the longest face diagonals)

   $\Rightarrow l^2 + b^2 = 100 \Rightarrow l = 8$ and $b = 6$

   ($\because$ The lengths of the edges are integers.)

   $\therefore l^2 + b^2 + h^2 = 125$

   $100 + h^2 = 125$

   $h^2 = 25$

   $h = 5$ cm

   $\therefore$ Volume $= lbh = 8 \times 6 \times 5 = 240\ \text{cm}^3$

   Hence, the correct option is (c).

5. Let n biscuits be required to obtain a wire of length (h) 245 m.

   The volume of the wire $= \pi r^2 h$

   $\Rightarrow n \times 7 \times 5 \times 1.1 = \frac{22}{7} \times \left(\frac{1}{10}\right)^2 \times 24{,}500$

   $\Rightarrow n \times 7 \times 5 \times 1.1 = \frac{22}{7} \times \frac{1}{100} \times 24{,}500$

   $\Rightarrow n = 20$

   Hence, the correct option is (c).

6. Let n be the number of cones required to fill 528 l ice-cream.

   $n \times \frac{1}{3} \times \pi r^2 h = 528\ l$

   $n \times \frac{1}{3} \times \frac{22}{7} \times (6)^2 \times 14 = 528 \times 1000\ \text{cm}^3$

   $n \times 22 \times 12 \times 2 = 528 \times 1000$

   $n = 1000$

   Hence, the correct option is (a).

7. Given $r = 3.5$ cm

   $\therefore$ TSA of the hemisphere

   $= 3\pi r^2 = 3 \times \frac{22}{7} \times (3.5) \times (3.5) = 115.5\ \text{cm}^2$

   Hence, the correct option is (c).

8. Let R and r be the outer and inner radius of the hollow sphere.

   $\Rightarrow R = 11$ and $r = 5$

   The total surface area of the hemisphere

   $= 3\pi R^2 + \pi r^2 = \pi(3 \times 11^2 + 5^2)$

   $= \pi(363 + 25) = 388\pi\,\text{cm}^2$

   Hence, the correct option is (c).

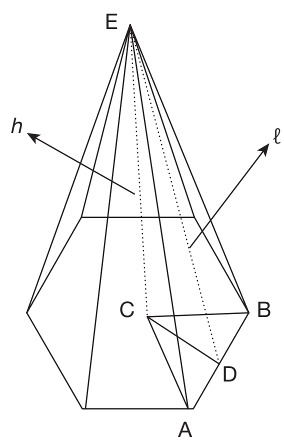
9. The curved surface area of a cone $= \pi (R + r)\, l$

   Given $R = 14$, $r = 9$, and $l = 13$

   CSA $= \pi (14 + 9)(13)$

   $= 299\pi\,\text{cm}^2$

   Hence, the correct option is (c).

10. 

   AB = 6 m,

   ABC is an equilateral triangle.

   $\therefore$ CD $= \frac{\sqrt{3}}{2} \times 6 = 3\sqrt{3}$ m

$DE^2 = DC^2 + CE^2$

$DE^2 = (3\sqrt{3})^2 + (12\sqrt{3})^2 = 27 + 432$

$l = DE$

$= \sqrt{459} = 3\sqrt{51}$ m

Hence, the correct option is (b).

11. Let l, r, and h be the slant height, radius, and height, respectively.

The curved surface area of cone = 23.1 cm^2

$\pi rl = 23.1$ cm^2

Given $r = 2.1$ cm

$\Rightarrow \frac{22}{7} \times (2.1) \times l = 23.1$

$\Rightarrow 22 \times 0.3 \times l = 23.1$

$\Rightarrow 2 \times 0.3 \times l = 2.1$

$\Rightarrow l = \frac{7}{2} = 3.5$ cm

Hence, the correct option is (c).

12. Let h_1 and h_2 be the heights of the two cylinders.

Let r_1 and r_2 be the radii of the two cylinders.

Given,

$h_1 : h_2 = 4:9$

Given

$\pi r_1^2 h_1 = \pi r_2^2 h_2$

$\Rightarrow \frac{r_1^2}{r_2^2} = \frac{h_2}{h_1}$

$\Rightarrow \left(\frac{r_1}{r_2}\right)^2 = \left(\frac{9}{4}\right)$

$\Rightarrow r_1 : r_2 = 3:2$

Hence, the correct option is (b).

13. Given $6s^2 = 4092$ cm^2

$\Rightarrow s^2 = 682$ cm^2

$\therefore$ TSA $= 4s^2 = 4(682)$ cm$^2 = 2728$ cm^2

Hence, the correct option is (c).

14. Let r and h be the radius and height of the cylinder, respectively.

$\pi r^2 h = 17.6$ m^3

$\frac{22}{7} \times r^2 \times 3500 = 17.6$

$r^2 \times 500 \times 22 = 17.6$

$r^2 = \frac{1.6}{1000} = \frac{16}{10000}$

$r^2 = \left(\frac{4}{100}\right)^2 \Rightarrow r = \frac{1}{25}$ m

$\Rightarrow r = 4$ cm

Hence, the correct option is (c).

15. (i) $\frac{1}{3}\pi r^2 h = \frac{1}{3}\pi r^2 \times r = \frac{\pi r^3}{3} \rightarrow$ (c)

(ii) $\pi r^2 h = \pi r^2 (r) = \pi r^3 \rightarrow$ (d)

(iii) $\frac{1}{3}\pi r^2 (6r) = 2\pi r^3 \rightarrow$ (a)

$\pi r^2 \left(\frac{2}{3}h\right) = \frac{2}{3}\pi r^2 h \rightarrow$ (b)

(i) $\rightarrow$ (C); (ii) $\rightarrow$ (D); (iii) $\rightarrow$ (A); (iv) $\rightarrow$ (B)

Hence, the correct option is (d).

Assessment Test IV

1. BDAC is the required sequential order.

Hence, the correct option is (a).

2. Given, the height of the equilateral triangle $= 15\sqrt{3}$ cm.

Circumradius of the equilateral triangle $= \frac{2}{3}$ of the height.

$= \frac{2}{3} \times 15\sqrt{3} = 10\sqrt{3}$ cm

Hence, the correct option is (a).

3. Area of the circle $= 64\pi$

Let r be the radius of the circle.

$\pi r^2 = 64\pi$

$r^2 = 64$

$r = 8$ cm

$\therefore$ Area of the regular hexagon

$= 6 \times \frac{\sqrt{3}}{4} \times (8)^2 = 6 \times \frac{\sqrt{3}}{4} \times 64$

$= 6 \times 16\sqrt{3} = 96\sqrt{3}$ cm^2

Hence, the correct option is (c).

4. Let l, b, and h be length, breadth, and height of the cuboid, respectively.

Sum of the all edges $= 4(l + b + h) = 120$ cm

$\Rightarrow l + b + h = 30$ cm

Length of the longest diagonal

$\sqrt{l^2 + b^2 + h^2} = \sqrt{308}$ cm

$\Rightarrow l^2 + b^2 + h^2 = 308$

$(l + b + h)^2 = (30)^2$

$l^2 + b^2 + h^2 + 2\,(lb + bh + hl) = 900$

$308 + 2\,(lb + bh + hl) = 900$

$2(lb + bh + hl) = 900 - 308$

$2(lb + bh + hl) = 592$

Hence, the correct option is (d).

5. Let n cubes be melted.

$n \times (5)^3 = \pi (35)^2 \times (35)$

$n \times 5 \times 5 \times 5 = \frac{22}{7} \times 35 \times 35 \times 35$

$n = 22 \times 7 \times 7 = 1078$

Hence, the correct option is (a).

6. Let n number of heaps be formed.

$\frac{11}{2} \times 3 \times 1\frac{1}{2} = n\, \frac{1}{3}\pi r^2 h$

$\frac{11}{2} \times 3 \times \frac{3}{2} = n \times \frac{1}{3} \times \frac{22}{7} \left(\frac{1}{2}\right)^2 \left(\frac{1}{2}\right)$

$n = 3 \times 7 \times 3 \times 3$

$n = 189$

Hence, the correct option is (b).

7. Given $r = 12$ cm

Surface area

$= 4\,\pi r^2$

$= 4\pi (12)^2$

$= 576\pi\,\text{cm}^2$

Hence, the correct option is (c).

8. Outer radius = 54 cm

Inner radius $(r) = 54 - 12$

$= 42$ cm

Inner surface area $= 2\pi r^2$

$= 2 \times \frac{22}{7} \times 42 \times 42 = 11{,}088\ \text{cm}^2$

Hence, the correct option is (c).

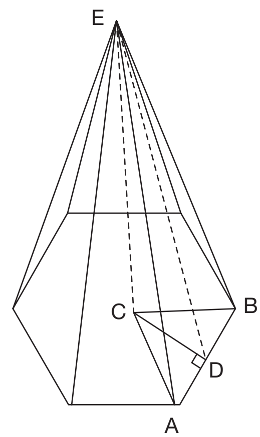
9. Given $R = 21$ cm, $r = 15$ cm, and $l = 10$ cm

$\therefore$ Curved surface area $= \pi (R + r)\, l$

$= (21 + 15) \times 10 = 360\pi\,\text{cm}^2$

Hence, the correct option is (d).

10.



$\text{CD} = \frac{\sqrt{3}}{2}\text{a} = \frac{\sqrt{3}}{2} \times 12 = 6\sqrt{3}$

$\text{CE}^2 = \text{DE}^2 - \text{CD}^2 = 18^2 - (6\sqrt{3})^2$

$= 324 - 108$

$\text{CE}^2 = 216$

$\therefore\ h = \text{CE} = \sqrt{216} = 6\sqrt{6}$

Hence, the correct option is (c).

11. Let r and l be the radius and the slant height of the cone, respectively.

$\pi r\,(l + r) = 858$

$\frac{22}{7} \times 6\,(l + 6) = 858$

$l + 6 = \frac{858 \times 7}{22 \times 6} \times l + 6 = 45.5$

$l = 45.5 - 6$

$l = 39.5$ cm

Hence, the correct option is (c).

12. Let r_1 and r_2 be the radii of two cones.

Let h_1 and h_2 be heights of two cones.

Given $h_1{:}h_2 = 3{:}4$

Given that the volumes of two cones

$= 3{:}4$

$\Rightarrow \frac{1}{3}\pi r_1^{\,2}\, h_1{:}\frac{1}{3}\,\pi r_2^{\,2}\, h_2 = 3{:}4$

$\Rightarrow r_1^{\,2}\, h_2{:}r_2^{\,2}\, h_2 = 3{:}4$

$\Rightarrow \frac{r_1^2 h_1}{r_2^2 h_2} = \frac{3}{4}$

$\Rightarrow \frac{r_1^2 \times 3}{r_2^{\,2} \times 1} = \frac{3}{4}$

$\Rightarrow \frac{r_1^2}{r_2^2} = \frac{1}{4}$

$\Rightarrow \left(\frac{r_1}{r_2}\right)^2 = \left(\frac{1}{2}\right)^2$

$\Rightarrow r_1 : r_2 = 1:2$

Hence, the correct option is (d).

13. Given $6s^2 = 864\text{ cm}^2$

$\Rightarrow s^2 = 144\text{ cm}^2$

$\Rightarrow s = 12\text{ cm}$

Volume $= s^3 = 1728\text{ cm}^3$

Hence, the correct option is (a).

14. Volume of water in the pipe $= \pi r^2 h$

$= \frac{22}{7} \times (10)^2 \times 4200 = 22 \times 100 \times 600$

$= 13{,}20{,}000\text{ cm}^3 = 1320\ l$

Hence, the correct option is (a).

15. (i) $2\pi r\,(h + r) = 2\,\pi Rr\,(l + r) \rightarrow$ (d)

(ii) $\pi r^2 + \pi rl = \pi r\,(l + r) \rightarrow$ (c)

(iii) $\pi(R + r)\,l = \pi(2r + r)\,l = 3\pi rl \rightarrow$ (b)

(iv) $\pi r\left(\frac{l}{3}\right) \rightarrow$ (a)

(i) → (D); (ii) → (C); (iii) → (B); (iv) → (A)

Hence, the correct option is (b).

CHAPTER 5
Number Systems, Polynomials and Rational Expressions

Assessment Test I

1. The required sequential order is BADC.
   Hence, the correct option is (c).
2. $1011_{(2)} + 1101_{(2)} + 1110_{(2)} = 11 + 13 + 14 = 38 = 2^5 + 2^2 + 2^1 = 100110_{(2)}$
   Hence, the correct option is (d).
3. $11011_{(2)} - 10101_{(2)} = 27 - 21 = 6 = 2^2 + 2^1 = 110_{(2)}$
   Hence, the correct option is (c).
4. $250 = 2^7 + 2^6 + 2^5 + 2^4 + 2^3 + 2^1 = 11111010_{(2)}$
   Hence, the correct option is (b).
5. 4^n ends in either 4 or 6.
   3^n ends in 3, 9, 7, or 1.
   $\therefore$ $4^n - 3^n$ ends in 1, 5, 7, 3, or 9.
   There are 5 possible units digits.
   Hence, the correct option is (c).
6. The degree of $f(x).g(x)$ is 15.
   The degree of $f(x) \leq 15$ (1)
   As $\dfrac{f(x)}{g(x)}$ is a polynomial, the degree of $f(x) \geq$ the degree of $g(x)$
   $\therefore$ The degree of $f(x) \geq 8$ (2)
   From Eqs (1) and (2), the degree of $f(x)$ can be 8, 9, 10, …, 15.
   Hence, the correct option is (c).
7. The product $= -(x + 1) \times \dfrac{1}{x^2 - 1}$.
   $= \dfrac{-1}{x-1}$
   Its multiplicative inverse is $1 - x$.
   Hence, the correct option is (b).
8. k can take the values 0, 1, 2, or 3.
   $\therefore$ The number of possible integer values of k is 4.
   Hence, the correct option is (b).
9. Given, HCF $= x - 4$
   $\therefore$ One of the factors of $x^2 - ax - 12$ is $x - 4$ and the other factor is $(x + 3)$.
   $\therefore$ $x^2 - ax - 12 = (x - 4)(x + 3)$
   $\Rightarrow x^2 - ax - 12 = x^2 - x - 12$
   $\Rightarrow a = 1$
   One of the factor of $(x - 3)(x - b)$ is $x - 4$.
   $\Rightarrow b = 4$
   $\therefore$ $a + b = 1 + 4 = 5$
   Hence, the correct option is (d).
10. LCM of 15 min, 30 min, and 45 min
    = 90 min = 1 h 30 minutes
    $\therefore$ The probable time at which the bells toll together is 10:30 am.
    Hence, the correct option is (a).
11. Given LCM = 468 and HCF = 3
    Let the two numbers be $3a$ and $3b$, where 3 is the HCF of $3a$ and $3b$,
    i.e., a and b are co-primes.
    LCM = 468
    $3ab = 468$
    $ab = 156$
    $= 1 \times 156$
    $= 3 \times 52$
    $= 4 \times 39$
    $= 12 \times 13$
    $\therefore$ The minimum possible sum $= (Ha + Hb) = 3 \times 12 + 3 \times 13 = 75$
    Hence, the correct option is (c).
12. Option (c): The HCF of the first 500 even natural numbers is 2.
13. Option (a): The degree of a non-zero constant polynomial is 0.

14. Option (b):

$$\frac{2x^3+7x^2+x-10}{2x^2+9x+10}=\frac{(2x+5)(x+2)(x-1)}{(2x+5)(x+2)}=x-1$$

$\therefore$ The degree is 1.

15. Option (d): $500 = 2^2 \times 5^3$; $502 = 2^1 \times 251$

$\therefore$ LCM $= 2^2 \times 5^3 \times 251 = 500(251)$

Assessment Test II

1. The required sequential order is BDCA.

Hence, the correct option is (b).

2. $101101_{(2)} = 1 \times 2^5 + 0 \times 2^4 + 1 \times 2^3 + 1 \times 2^2 \times 0 \times 2^1 + 1 \times 2^0 = 45$

$110011_{(2)} = 1 \times 2^5 + 1 \times 2^4 + 0 \times 2^3 + 0 \times 2^2 \times 1 \times 2^1 + 1 \times 2^0 = 51$

$\therefore 45 + 51 = 96 = 2^6 + 2^5 = 1100000_{(2)}$

Hence, the correct option is (a).

3. $10110_{(2)} = 2^4 + 2^2 + 2^1 = 22$

$11011_{(2)} = 2^4 + 2^3 + 2^1 + 2^0 = 27$

$11001_{(2)} = 2^4 + 2^3 + 2^0 = 25$

$22 - 27 + 25 = 20 = 2^4 + 2^2 = 10100_{(2)}$

Hence, the correct option is (a).

4. $425 = 2^8 + 2^7 + 2^5 + 2^3 + 2^0 = 110101001_{(2)}$

Hence, the correct option is (a).

5. 5^m always ends in 5.

9^{2m} ends in 1 as $2m$ is even.

$\therefore 5^m + 9^{2m}$ ends in 6.

Hence, the correct option is (a).

6. Based on the degree of $f(x)$, the degree of $g(x) \geq 0$, and the degree of $g(x) \leq$ the degree of $f(x)$.

Hence, the correct option is (d).

7. Required product $= -f(x)\ x\ \dfrac{1}{f(x)} = -1$.

Hence, the correct option is (d).

8. k can take the values 0, 1, or 2.

$\therefore$ The number of integer values of k is 3.

Hence, the correct option is (c).

9. $(x - a)$ is common factor of $(x - 2)(x - a)$ and $(x - 3)(x - b)$.

$\Rightarrow a = b$ or $a = 3$

$\therefore a - b$ cannot be determined.

Hence, the correct option is (d).

10. LCM of 12 s, 18 s, and 21 s = 252 s

Hence, the correct option is (a).

11. Let the numbers be Ha and Hb, where H is the HCF of Ha and Hb.

Given,

$Ha - Hb = 24$

i.e., $H(a - b) = 24$ (1)

And also, LCM = 180

i.e., $Hab = 180$ (2)

$\therefore H =$ HCF of (24, 180) = 12 (3)

From Eqs (1), (2), and (3), we get

$a - b = 2$ and $ab = 15$

$\Rightarrow a = 5$ and $b = 3$

The required sum $= Ha + Hb$

$= H(a + b) = 12(5 + 3) = 96$

Hence, the correct option is (d).

12. Option (d): $1.\overline{6} + 2.\overline{3} = 1 + 0.\overline{6} + 2 + 0.\overline{3}$

$$= 3 + \frac{6}{9} + \frac{3}{9} = 4$$

13. Option (a): The degree of a linear polynomial is 1.

14. Option (c): $159 = 3 \times 53$, $189 = 3^3 \times 7^1$

$\therefore$ HCF = 3

15. Option (b): $\left(\dfrac{2x^2-12x+16}{x^2+3x-10}\right)\left(\dfrac{x^2+9x+20}{x^2-16}\right)$

$$= \left[\frac{2(x-2)(x-4)}{(x+5)(x-2)}\right]\left[\frac{(x+4)(x+5)}{(x+4)(x-4)}\right] = 2$$

Assessment Test III

1. CADBE is the required sequential order.

Hence, the correct option is (b).

2.

$$\begin{array}{r} 11101 \\ \underline{+\ 1011} \\ =\underline{101000}_{(2)} \end{array} \qquad \begin{array}{r} 101000 \\ \underline{-\ 10011} \\ =\underline{10101}_{(2)} \end{array}$$

Hence, the correct option is (c).

3. Let $p(x) = (x + 5)^2 (x - 2) (x + 1)^2$ and

$q(x) = (x + 1)^3 (x + 5)$

HCF $= (x + 5)(x + 1)^2$

Hence, the correct option is (c).

4. $\dfrac{2x-5}{x^2+x-2} + \dfrac{3x-2}{2x^2+5x+2}$

$= \dfrac{2x-5}{x^2+2x-1x-2} + \dfrac{3x-2}{2x^2+4x+1x+2}$

$= \dfrac{2x-5}{(x+2)(x-1)} + \dfrac{3x-2}{(2x+1)(x+2)}$

$= \dfrac{(2x-5)(2x+1)+(3x-2)(x-1)}{(x+2)(x-1)(2x+1)}$

$= \dfrac{4x^2-10x+2x-5+3x^2-2x-3x+2}{(x^2+x-2)(2x+1)}$

$= \dfrac{7x^2-13x-3}{2x^3+3x^2-3x-2}$

Hence, the correct option is (a).

5. $\dfrac{x^2+x-6}{3x^2+7+2} \div \dfrac{3x^2+9x}{3x^2+7x+2}$

$= \dfrac{x^2+x-6}{3x^2+7x+2} \times \dfrac{3x^2+7x+2}{3x^2+9x}$

$= \dfrac{x^2+x-6}{3x^2+9x}$

$= \dfrac{(x+3)(x-2)}{3x(x+3)}$

$= \dfrac{x-2}{3x}$

Hence, the correct option is (a).

6. $\dfrac{\sqrt{6}}{\sqrt{18}+\sqrt{12}} \times \dfrac{\sqrt{18}-\sqrt{12}}{\sqrt{18}-\sqrt{12}}$

$= \dfrac{\sqrt{6}\left(\sqrt{18}-\sqrt{12}\right)}{\left(\sqrt{18}\right)^2-\left(\sqrt{12}\right)^2}$

$= \dfrac{\sqrt{6}.\sqrt{6}\left(\sqrt{3}-\sqrt{2}\right)}{6}$

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

Hence, the correct option is (b).

7. The two bells toll together toll at the multiples of the LCM of 60 min and 75 min.

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

$75 = 3 \times 5 \times 5$

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

$= 300$

300 min = 5 h

They toll together at 8:10 am → 1:10 pm → 6:10 pm, i.e., the two bells toll together 3 times in the same days.

Hence, the correct option is (b).

8. Let the two numbers be a and b.

Since their HCF is 24,

$a = 24x$, $b = 24y$

Such that x, y are co-primes.

LCM × HCF $= a \times b$

$144 \times 24 = 24x \times 24y$

$xy = 6$

$xy = 1 \times 6$

$xy = 2 \times 3$

∴ There are only two pairs of numbers.

Hence, the correct option is (a).

9. Let $f(x) = (x^2 + 3x)(x^2 + 3x + 2)$ and $g(x) = (x^2 + kx + 8)(x^2 + 5x + 6)$

$f(x) = x(x + 3)(x + 2)(x + 1)$

$g(x) = (x^2 + kx + 8)(x + 3)(x + 2)$

LCM $= x(x+1)(x+2)^2(x+3)(x+4)$ $(x+4)$, $(x+2)^2$ must be the factor of $g(x)$.

$\Rightarrow (x^2 + kx + 8) = (x + 2) (x + 4)$

$\Rightarrow x^2 + kx + 8 = x^2 + 6x + 8$

$\therefore k = 6$

Hence, the correct option is (b).

10. $\dfrac{x-1}{x+1} - \dfrac{x+1}{x-1} - \dfrac{8x}{1+x^2} + \dfrac{12x^3}{x^4-1}$

$= \dfrac{(x-1)^2(x^2+1)-(x+1)^2(x^2+1)-8x(x^2-1)+12x^3}{x^4-1}$

$= \dfrac{(x^2+1)\left[(x-1)^2-(x+1)^2\right] - 8x(x^2-1) + 12x^3}{x^4-1}$

$= \dfrac{(x^2+1)(-4x) - 8x^3+8x+12x^3}{x^4-1}$

$= \dfrac{-4x^3 - 4x + 8x + 4x^3}{x^4-1}$

$= \dfrac{4x}{x^4-1}$

Hence, the correct option is (c).

11. $a = \sqrt{11}+\sqrt{3}$

$a^2 = 11 + 3 + 2\sqrt{33}$

$= 14 + 2\sqrt{33}$

$b = \sqrt{12} + \sqrt{2}$

$b^2 = 12 + 2 + 2\sqrt{24}$

$= 14 + 2\sqrt{24}$

$c = \sqrt{9} + \sqrt{5}$

$c^2 = 9 + 5 + 2\sqrt{45}$

$= 14 + 2\sqrt{45}$

$\therefore\ b^2 < a^2 < c^2$

Hence, the correct option is (d).

12. $\overline{1.142857}$

$= 1 + 0.\overline{142857}$

$= 1 + \frac{1}{7} = \frac{8}{7}$

$0.\overline{63} = \frac{63}{99} = \frac{7}{11}$

$\overline{1.142857} \times 0.\overline{63} = \frac{8}{7} \times \frac{7}{11}$

$= \frac{8}{11}$

Hence, the correct option is (a).

13. $60 = 36 \times 1 + 24,\ 36 = 24 \times 1 + 12,\ 24 = 12 \times 2 + 0$

HCF of 60, 36 is 12.

$\therefore$ The maximum number of students for each row is 12.

Total number of rows $= \frac{60}{12} + \frac{36}{12}$

$= 5 + 3 = 8$

Hence, the correct option is (d).

14. $1 + \frac{1}{3} + \frac{1}{6} + \frac{1}{10} + \frac{1}{15} + \frac{1}{21}$

$= 1 + \frac{2}{2\times3} + \frac{2}{3\times4} + \frac{2}{4\times5} + \frac{2}{5\times6} + \frac{2}{6\times7}$

$= 1 + 2\left[\frac{1}{2}-\frac{1}{3}+\frac{1}{3}-\frac{1}{4}+\frac{1}{4}-\frac{1}{5}+\frac{1}{5}-\frac{1}{6}+\frac{1}{6}-\frac{1}{7}\right]$

$= 1 + 2\left[\frac{1}{2} - \frac{1}{7}\right] = 1 + 2\left[\frac{7-2}{14}\right]$

$= 1 + 2 \times \frac{5}{14}$

$= 1 + \frac{5}{7}$

$= \frac{12}{7}$

Hence, the correct option is (d).

15. (i) $\rightarrow$ (A); (ii) $\rightarrow$ (B); (iii) $\rightarrow$ (D); (iv) $\rightarrow$ (C)

Hence, the correct option is (a).

Assessment Test IV

1. CBAD is the required sequential order.

Hence, the correct option is (d).

2. $10110_{(2)} + 10101_{(2)} - (1010_{(2)} + 1111_{(2)})$

$= 101011_{(2)} - (11001)_2$

$= 10010_{(2)}$

Hence, the correct option is (b).

3. Let $p(x) = (x-1)(x-2)^2(x+4)^3$

$q(x) = (x+1)(x^2-4)(x+4)^2$

$q(x) = (x+1)(x-2)(x+2)(x+4)^2$

HCF $= (x-2)(x+4)^2$

Hence, the correct option is (d).

4. $\frac{3x+5}{x^2-3x-10} - \frac{2x-3}{x^2+5x+6}$

$= \frac{3x+5}{x^2-5x+2x-10} - \frac{2x-3}{x^2+3x+2x+6}$

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

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

$= \frac{3x^2+5x+9x+15-2x^2+10x+3x-15}{(x-5)(x^2+5x+6)}$

$= \frac{x^2+27x}{x^3+5x^2+6x-5x^2-25x-30}$

$= \frac{x^2+27x}{x^3-19x-30}$

Hence, the correct option is (b).

5. $\frac{3x^3-24}{x^2+2x-8} \div \frac{x^2+2x+4}{x+4}$

$\frac{3(x^3-8)}{x^2+4x-2x-8} \div \frac{x^2+2x+4}{x+4}$

$= \frac{3(x-2)(x^2+2x+4)}{(x+4)(x-2)} \times \frac{(x+4)}{(x^2+2x+4)}$

$= 3$

Hence, the correct option is (d).

6. $\dfrac{\sqrt{5}}{\sqrt{15}-\sqrt{10}} \times \dfrac{\sqrt{15}+\sqrt{10}}{\sqrt{15}+\sqrt{10}}$

$= \dfrac{\sqrt{5}(\sqrt{15}+\sqrt{10})}{15-10}$

$= \dfrac{5\sqrt{3}+5\sqrt{2}}{5}$

$= \dfrac{\sqrt{3}+\sqrt{2}}{1} = \sqrt{3}+\sqrt{2}.$

Hence, the correct option is (c).

7. Aloukya and Manoghna will meet at the multiples of LCM of 120 s and 150 s.

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

$150 = 2 \times 3 \times 5^2$

$\text{LCM} = 2^3 \times 3 \times 5^2$

$= 600$

600 s = 10 minutes

$\therefore$ They meet at 6:10, 6:20, 6:30, 6:40, 6:50, 7:00, 7:10, 7:20, and 7:30.

$\therefore$ The will meet 9 times in the given period.

Hence, the correct option is (b).

8. The HCF of the two numbers is 24. Let the two numbers be $24x$ and $24y$ such that x and y are co-primes.

The sum of the two numbers,

$24x + 24y = 240$

$24(x + y) = 240$

$x + y = 10$

$1 + 9 = 10$

$3 + 7 = 10$

There are only 2 pairs of co primes.

Hence, the correct option is (a).

9. $f(x) = (x - 3)(x^2 - x - \text{a})$

$g(x) = (x + 3)(x^2 + x - \text{b})$

HCF of $f(x)$ and $g(x) = (x^2 - 9) = (x + 3)(x - 3)$

$\Rightarrow (x + 3)(x - 3)$ is a factor of $(x - 3)\ (x^2 - x - a)$.

$\therefore (x + 3)$ is a factor of $(x^2 - x - a)$.

$\therefore (-3)^2 - (-3) - a = 0$

$a = 12$

$(x + 3)(x - 3)$ is a factor of $(x + 3)(x^2 + x - b)$.

$\Rightarrow (x - 3)$ is a factor of $(x^2 + x - b)$.

$\Rightarrow 9 + 3 - b = 0$

$b = 12$

$a + b = 12 + 12 = 24$

Hence, the correct option is (c).

10. $4A - B - C$

$= \dfrac{4(x+1)}{2x+1} - \dfrac{2x-1}{x+2} - \dfrac{4x-7}{2x^2+5x+2}$

$= \dfrac{4(x+1)(x+2) - (2x-1)(2x+1) - (4x-7)}{2x^2+5x+2}$

$= \dfrac{4(x^2+3x+2) - (4x^2-1) - 4x+7}{2x^2+5x+2}$

$= \dfrac{4x^2+12x+8-4x^2+1-4x+7}{2x^2+5x+2}$

$= \dfrac{8x+16}{(2x+1)(x+2)}$

$= \dfrac{8(x+2)}{(2x+1)(x+2)}$

$= \dfrac{8}{2x+1}$

Hence, the correct option is (c).

11. $x = \sqrt{12} - \sqrt{9}$

$\dfrac{1}{x} = \dfrac{1}{\sqrt{12}-\sqrt{9}} = \dfrac{\sqrt{12}+\sqrt{9}}{3}$

$y = \sqrt{13} - \sqrt{10}$

$\dfrac{1}{y} = \dfrac{1}{\sqrt{13}-\sqrt{10}} = \dfrac{\sqrt{13}+\sqrt{10}}{3}$

$z = \sqrt{11} - \sqrt{8}$

$\dfrac{1}{z} = \dfrac{1}{\sqrt{11}-\sqrt{8}} \times \dfrac{\sqrt{11}+\sqrt{8}}{3}$

$\dfrac{1}{y} > \dfrac{1}{x} > \dfrac{1}{z} \Rightarrow y < x < z$

$z > x > y$

Hence, the correct option is (a).

12. $1.\overline{285714}$

$= 1 + 0.\overline{285714}$

$= 1 + \dfrac{2}{7} = \dfrac{9}{7}$

$1.\overline{714285}$

$= 1+\frac{5}{7}=\frac{12}{7}$

$\therefore\ 1.\overline{285714} \div 1.\overline{714285}$

$= \frac{9}{7} \div \frac{12}{7}$

$= \frac{9}{7}\times\frac{7}{12}$

$= \frac{3}{4}$

Hence, the correct option is (a).

13. $612 = 324 \times 1 + 28$

$324 = 288 \times 1 + 36$

$288 = 36 \times 8 + 0$

$\therefore$ HCF of 612, 324 is 36.

$\therefore$ The lowest number of boxes required to pack them

$= \frac{612}{36}+\frac{324}{36}$

$= 17 + 9$

$= 26$

Hence, the correct option is (a).

14. $\frac{1}{3}+\frac{1}{15}+\frac{1}{35}+\frac{1}{63}+\frac{1}{99}$

$= \frac{1}{1\times3}+\frac{1}{3\times5}+\frac{1}{5\times7}+\frac{1}{7\times9}+\frac{1}{9\times11}$

$= \frac{1}{2}\left[1-\frac{1}{3}+\frac{1}{3}-\frac{1}{5}+\frac{1}{5}-\frac{1}{7}+\frac{1}{7}-\frac{1}{9}+\frac{1}{9}-\frac{1}{11}\right]$

$= \frac{1}{2}\left[1-\frac{1}{11}\right]$

$= \frac{1}{2}\left[\frac{10}{11}\right]=\frac{5}{11}$

Hence, the correct option is (a).

15. (i) $\rightarrow$ (B); (ii) $\rightarrow$ (D); (iii) $\rightarrow$ (C); (iv) $\rightarrow$ (A)

Hence, the correct option is (d).

CHAPTER 6
Progressions; Remainder and Factor Theorems

Assessment Test I

1. The required sequential order is BADC.

   Hence, the correct option is (c).

2. Given $S_n = 2n^2 + n$

   $t_n = S_n - S_{n-1} = 2n^2 + n - [2(n-1)^2 + (n+1)]$
   $= 2n^2 + n - 2n^2 + 4n - 2 - n + 1$
   $= 4n - 1$

   Hence, the correct option is (c).

3. Here, $a = 5$ and $d = 6$

   $t_n = 125 \Rightarrow a + (n-1)d = 125$
   $\Rightarrow 5 + (n-1)6 = 125$
   $\Rightarrow n - 1 = 20 \Rightarrow n = 21$

   Hence, the correct option is (b).

4. $S_n = 7 + 77 + 777 + \ldots n$ terms

   $= 7[1 + 11 + 111 + \ldots n \text{ terms}]$

   $= \frac{7}{9}[9 + 99 + 999 + \ldots n \text{ terms}]$

   $= \frac{7}{9}[(10-1)+(100-1)+(1000-1)+\ldots n \text{ terms}]$

   $= \frac{7}{9}[(10 + 10^2 + 10^3 + \ldots n \text{ terms})$
   $- (1 + 1 + 1 + \ldots n \text{ terms})]$

   $$S_n = \frac{7}{9}\left[\frac{10(10^n - 1)}{10-1} - n\right]$$

   $$\therefore S_{50} = \frac{7}{9}\left[\frac{10(10^{50} - 1)}{9} - 50\right]$$

   $$= \frac{70}{81}(10^{50} - 1) - \frac{350}{9}$$

   Hence, the correct option is (a).

5. Given $\frac{1}{a+b}, \frac{1}{b+c}$, and $\frac{1}{c+a}$ are in AP.

   $$\Rightarrow \frac{1}{b+c} - \frac{1}{a+b} = \frac{1}{c+a} - \frac{1}{b+c}$$

   $$\Rightarrow \frac{a+b-b-c}{(b+c)(a+b)} = \frac{b+c-c-a}{(c+a)(b+c)}$$

   $a^2 - c^2 = b^2 - a^2$
   $\Rightarrow 2a^2 = b^2 + c^2$
   $\Rightarrow b^2, a^2$, and c^2 are in AP.

   Hence, the correct option is (d).

6. Let $S = 5 + 10x + 15x^2 + 20x^3 + \ldots.$

   $Sx = 5x + 10x^2 + 15x^3 + 20x^4 + \ldots$
   $\Rightarrow S - Sx = 5 + 5x + 5x^2 + 5x^3 + \ldots$
   $\Rightarrow S(1-x) = 5(1 + x + x^2 + x^3 + \ldots)$

   $$\Rightarrow S(1-x) = 5\left(\frac{1}{1-x}\right)$$

   ($\because$ $1 + x + x^2 + \ldots$ is an infinite GP, $|x| < 1$.)

   $$\Rightarrow S = \frac{5}{(1-x)^2}$$

   Alternate method:
   Let $x = 0.0001$. We expect S to be slightly more than 5. In choices 2, 3, and 4, the denominators would be more than 1.
   $\therefore$ These choice values are less than 5.
   $\therefore$ Choice (a) follows.
   Hence, the correct option is (a).

7. After inserting the harmonic means, let the harmonic progression be

   $$\frac{1}{a}, \frac{1}{a+d}, \frac{1}{a+2d}, \frac{1}{a+3d}, \frac{1}{a+4d}, \frac{1}{a+5d}, \text{ and } \frac{1}{a+6d}.$$

   Given $\frac{1}{a} = 2$ and $\frac{1}{a+6d} = 10$

   $$\Rightarrow a = \frac{1}{2} \text{ and } d = -\frac{1}{15}$$

   The 4th harmonic mean

   $$= \frac{1}{a+4d} = \frac{1}{\frac{1}{2} + 4\left(-\frac{1}{15}\right)} = \frac{30}{7}$$

   Hence, the correct option is (c).

8. Let $f(x) = x^2 - 3x + k$.

   $x + 7$ is a factor of $f(x)$.

   $\Rightarrow f(-7) = 0 \Rightarrow (-7)^2 - 3(-7) + k = 0$

   $\Rightarrow k = -70$

   Hence, the correct option is (b).

9. Let $f(x) = ax^3 + bx^2 + cx + d$.

   $x + 1$ is a factor of $f(x)$.

   $\Rightarrow f(-1) = 0 \Rightarrow a(-1)^3 + b(-1)^2 + c(-1) + d = 0$

   $\Rightarrow -a + b - c + d = 0 \Rightarrow a + c = b + d$ (1)

   $x + 2$ is a factor of $f(x)$.

   $\Rightarrow f(-2) = 0 \Rightarrow a(-2)^3 + b(-2)^2 + c(-2) + d = 0$

   $\Rightarrow -8a + 4b - 2c + d = 0$

   $\Rightarrow 8a + 2c = 4b + d$

   $\Rightarrow 8a + 2(b + d - a) = 4b + d$ [from Eq. (1)]

   $\Rightarrow 6a - 2b + d = 0$

   Hence, the correct option is (d).

10. Let the quotient be $q(x)$ and the remainder be $ax + b$, when x^{100} is divided by $x^2 - 3x + 2$.

    $\therefore x^{100} = (x^2 - 3x + 2)\, q(x) + (ax + b)$

    $\Rightarrow x^{100} = (x - 1)(x - 2)\, q(x) + (ax + b)$

    If $x = 1$, then $1 = a + b$ (1)

    If $x = 2$, then $2^{100} = 2a + b$ (2)

    Solving Eqs (1) and (2), we get

    $a = 2^{100} - 1$ and $b = 2 - 2^{100}$

    $\therefore$ Remainder $= (2^{100} - 1)x + (2 - 2^{100})$

    Hence, the correct option is (c).

11. Given $f(x - 1) = x^2 - 5x + 7$ (1)

    When $f(x)$ is divided by $x + 3$, then the remainder is $f(-3)$.

    $\therefore$ Put $x = -2$ in Eq. (1).

    $f(-2 - 1) = (-2)^2 - 5(-2) + 7$

    $\Rightarrow f(-3) = 21$

    Hence, the correct option is (b).

12. Option (c): $(n - 1)\, r + a$

13. Option (d): ar^{n-1}

14. Option (a): $\dfrac{a}{1-r}$

15. Option (b): $\dfrac{a-r}{n+1}$

Assessment Test II

1. The required sequential order is BDAC.

   Hence, the correct option is (d).

2. Given $S_n = n(3n + 1)$

   $t_n = S_n - S_{n-1} = n(3n + 1) - (n - 1)(3n - 3 + 1)$

   $= 3n^2 + n - (3n^2 - 3n - 2n + 2)$

   $= 6n - 2$

   Alternate method:

   $t_1 = S_1 = 4$. When $n = 1$, the only choices whose values equal 4 are 2 and 3.

   $t_2 = S_2 - S_1 = 14 - S_1 = 10$, which is $6(2) - 2$ but not $10(2) - 6$.

   $\therefore$ Option (b) follows.

   Hence, the correct option is (b).

3. Here, $a = 7$ and $d = -4$

   $t_n = -153 \Rightarrow a + (n - 1)d = -153$

   $\Rightarrow 7 + (n - 1)(-4) = -153$

   $\Rightarrow n - 1 = 40 \Rightarrow n = 41$

   Hence, the correct option is (d).

4. $S_n = 9 + 99 + 999 + \ldots n$ terms

   $= (10 - 1) + (100 - 1) + (1000 - 1) + \ldots n$ terms

   $= (10 + 10^2 + 10^3 + \ldots n$ terms$) - (1 + 1 + 1 + \ldots n$ terms$)$

   $$S_n = \frac{10(10^n - 1)}{10 - 1} - n$$

   $$\therefore S_{100} = \frac{10(10^{100} - 1)}{9} - 100 = \frac{10}{9}(10^{100} - 91)$$

   Hence, the correct option is (b).

5. Given $\dfrac{a}{b}, \dfrac{b}{c}$, and $\dfrac{c}{a}$ are in AP.

   $$\Rightarrow \frac{2b}{c} = \frac{a}{b} + \frac{c}{a} \Rightarrow \frac{2b}{c} = \frac{a^2 + bc}{ab}$$

   $\Rightarrow 2ab^2 = a^2c + bc^2$

   $\Rightarrow a^2c, ab^2$, and bc^2 are in AP.

   Hence, the correct option is (a).

6. Let $S = 1 + x + 2x^2 + 3x^3 + \ldots.$

   $Sx = x + x^2 + 2x^3 + 3x^4 + \ldots$

   $S - Sx = 1 + x^2 + x^3 + \ldots$

   $\Rightarrow S(1 - x) = 1 + \dfrac{x^2}{1-x}$ ($\because x^2, x^3, \ldots$ is an infinite

GP since $|x| < 1$.)

$$\Rightarrow S = \frac{x^2 - x + 1}{(1-x)^2}$$

Hence, the correct option is (c).

7. After inserting the harmonic means, let the harmonic progression be
$\frac{1}{a}, \frac{1}{a+d}, \frac{1}{a+2d}, \frac{1}{a+3d}$, and $\frac{1}{a+4d}$.

Given $\frac{1}{a} = \frac{1}{5}$ and $\frac{1}{a+4d} = \frac{-1}{12}$

$\Rightarrow a = 5$ and $d = -\frac{17}{4}$

The 2nd harmonic mean $= \frac{1}{a+2d}$

$$= \frac{1}{5 + 2\left(\frac{-17}{4}\right)} = -\frac{2}{7}$$

Hence, the correct option is (c).

Note: When N harmonic means are inserted between a and b and N is odd, the middle harmonic mean inserted will be the harmonic mean of a and b. ∴ The 2nd harmonic mean in the given problem is the harmonic mean of $\frac{1}{5}$ and $-\frac{1}{12}$, i.e., $\frac{2\left(\frac{1}{5}\right)\left(\frac{-1}{12}\right)}{\frac{1}{5} + \left(\frac{-1}{12}\right)} = \frac{-2}{7}$.

8. Let $f(x) = 6x^2 - 5x + k$.

$2x + 3$ is a factor of $f(x)$.

$$\Rightarrow f\left(\frac{-3}{2}\right) = 0 \Rightarrow 6\left(\frac{-3}{2}\right)^2 - 5\left(\frac{-3}{2}\right) + k = 0$$

$$\Rightarrow \frac{27}{2} + \frac{15}{2} + k = 0$$

$\Rightarrow k = -21$

Hence, the correct option is (b).

9. Let $f(x) = px^3 + qx^2 + rx + s$.

$x + 1$ is a factor of $f(x)$.

$\Rightarrow f(-1) = 0 \Rightarrow p(-1)^3 + q(-1)^2 + r(-1) + s = 0$

$\Rightarrow p + r = q + s$ (1)

$x - 3$ is a factor of $f(x)$.

$\Rightarrow f(3) = 0 \Rightarrow p(3)^3 + q(3)^2 + r(3) + s = 0$

$\Rightarrow 27p + 9q + 3r + s = 0$

$\Rightarrow 27p + 9q + 3(q + s - p) + s = 0$ [from Eq. (1)]

$\Rightarrow 24p + 12q + 4s = 0$

$\Rightarrow 6p + 3q + s = 0$

Hence, the correct option is (a).

10. Let the quotient be $q(x)$ and the remainder be $ax + b$, when x^{2014} is divided by $x^2 + 5x + 6$.

$\therefore x^{2014} = (x^2 + 5x + 6)\, q(x) + (ax + b)$

$\Rightarrow x^{2014} = (x + 2)(x + 3)\, q(x) + ax + b$

If $x = -2$, then $2^{2014} = -2a + b$ (1)

If $x = -3$, then $3^{2014} = -3a + b$ (2)

Solving Eqs (1) and (2), we get

$a = 2^{2014} - 3^{2014}$ and $b = 3.2^{2014} + 2.3^{2014}$

$\therefore$ Remainder $= (2^{2014} - 3^{2014})x - (3.2^{2014} + 2.3^{2014})$

Hence, the correct option is (b).

11. Given $f(x + 4) = x^2 - 7x + 9$ (1)

When $f(x)$ is divided by $x + 7$, the remainder is $f(-7)$.

$\therefore$ Put $x = -11$ in Eq. (1).

$f(-11 + 4) = (-11)^2 - 7(-11) + 9$

$\Rightarrow f(-7) = 207$

Hence, the correct option is (a).

12. Option (b): $\frac{n}{2}(2a + nr - r)$

13. Option (d): $\left(\frac{b}{a}\right)^{\frac{1}{r+1}}$

14. Option (c): $\frac{a(r^n - 1)}{r - 1}$

15. Option (a): $\frac{n}{2}(a + r)$

Assessment Test III

1. CBAD is the required sequential order.

Hence, the correct option is (c).

2. Let $f(x) = 12x^6 - 4x^3 - 9$.

$f(x^3) = 12(x^3)^2 - 4(x^3) - 9$

$f(y) = 12y^2 - 4y - 9$

$x^3 = y \Rightarrow x^3 - 5 = y - 5$

If $f(y)$ is divided by $(y - 5)$, then the remainder $= f(5)$.

$\Rightarrow f(5) = 12\,(5)^2 - 4(5) - 9$

$= 300 - 20 - 9 = 271$

Hence, the correct option is (b).

3. $f(x) = x^2 + 6x + 8$

$$f\left(\frac{1}{2}\right) = \left(\frac{1}{2}\right)^2 + 6\left(\frac{1}{2}\right) + 8$$

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

$$= 11\frac{1}{4} = \frac{45}{4}$$

Hence, the correct option is (a).

4. Given $f(x) = x^3 + ax^2 - bx - 30$ and

$g(x) = x^2 - x - 6 = (x + 2)(x - 3)$

Since the coefficient of x^3 is 1 and the constant term is –30, $(x + 5)$ must be the third factor.

Hence, the correct option is (d).

5. $f(x) = x^2 + 5x + 6 = (x + 2)(x + 3)$

$g(x) = x^2 - 2x + k$

As $f(x)$ and $g(x)$ have a common factor, $(x + 2)$ or $(x - 3)$ is a factor of $g(x)$.

(i) If $(x + 2)$ is a factor of $g(x)$, then $g(-2) = 0$.

$\Rightarrow 4 + 4 + k = 0 \Rightarrow k = -8$

(ii) If $x + 3$ is a factor of $g(x)$, then $g(-3) = 0$.

$9 + 6 + k = 0$

$k = -15$

$\therefore$ The maximum value of k is –8.

Hence, the correct option is (a).

6. Let $f(x) = 3x^3 + 5x^2 - 7x + 5$.

$f(2) = 3(2)^3 + 5(2)^2 - 7(2) + 5$

$= 24 + 20 - 14 + 5$

$= 35$

$\therefore$ –35 should be added to $f(x)$, so that the sum is divisible by $x - 2$.

Hence, the correct option is (b).

7. Let $f(x) = x^4 - 25x^2 + 144$.

$\Rightarrow f(x^2) = (x^2)^2 - 25(x^2) + 144$

$\Rightarrow f(x) = (x^2 - 16)(x^2 - 9)$

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

$\therefore$ $(x - 8)$ is not a factor.

Hence, the correct option is (d).

8. 8, x_1, x_2, x_3, x_4, x_5, and 3 are in AP.

$t_1 = 8, t_7 = 3$

$t_7 = a + 6d = 3$

$8 + 6d = 3$

$6d = -5$

$d = \frac{-5}{6}$.

$x_4 = t_5 = a + 4d$

$= 8 + 4\left(\frac{-5}{6}\right)$.

$= \frac{24 - 10}{3} = \frac{14}{3}$

Hence, the correct option is (d).

9. Given sequence, 7, 16, 25, 34, 43, … are in AP.

$a = 7, d = 16 - 7 = 9$

$t_n = a + (n - 1)d = 115$

$7 + (n - 1)(9) = 115$

$7 + 9n - 9 = 115$

$9n - 2 = 115$

$9n = 177 \Rightarrow n = 13$

Hence, the correct option is (d).

10. The sum of the first 'n' consecutive odd numbers $= n^2$.

$t_n = n^2$

$S_n = \Sigma t_n = \Sigma n^2 = \frac{n(n + 1)(2n + 1)}{6}$

$S_8 = \Sigma t_8 = \frac{8 \times 9 \times 17}{6} = 204$

Hence, the correct option is (c).

11. $t_n = ar^{n-1}$

$$t_9 = 12\left(\frac{3}{2}\right)^{9-1}$$

$$= 12 \times \left(\frac{3^8}{2^8}\right)$$

$$= \left(\frac{3^9}{2^6}\right) = \left(\frac{27}{4}\right)^3$$

Hence, the correct option is (d).

12. Geometric mean of 'n' terms of a GP $= \sqrt[n]{t_1 \times t_2 \times \ldots\ldots t_n}$.

Required GM $= \sqrt[33]{2^1 \times 2^2 \times 2^2 \times \ldots \times 2^{32} \times 2^{33}}$

$$= \sqrt[33]{2^{1+2+3+\ldots+32+33}}$$

$$= \sqrt[33]{2^{\frac{33 \times 34}{2}}} = 2^{17}$$

Hence, the correct option is (a).

13. $S_n = 9 + 99 + 999 + 9999 + \ldots$

$S_n = (10 - 1) + (100 - 1) + (1000 - 1) + \ldots$

$S_n = (10 + 10^2 + 10^3 + \ldots + 10^{20}) - (1 + 1 + \ldots + 1$ 20 times)

$$S_{20} = \frac{10(10^{20} - 1)}{10 - 1} - 20$$

$$= \frac{10}{9}(10^{20} - 1) - 20$$

$$= \frac{10}{9}[10^{20} - 1 - 18]$$

$$= \frac{10}{9}[10^{20} - 19]$$

Hence, the correct option is (a).

14. $a = \frac{1}{3}, r = \frac{1}{3}$

$$S_\infty = \frac{1}{1-r} = \frac{1/3}{1-\frac{1}{3}} = \frac{1/3}{2/3} = \frac{1}{2}$$

Hence, the correct option is (a).

15. (i) $1 + 3 + 5 + 3 \ldots + 99$

$= 50^2 \rightarrow$ (d)

(ii) $2 + 4 + 6 + \ldots + 100$

$= 2(1 + 2 + \ldots + 50)$

$= 50 \times 51 \ldots \rightarrow$ (a)

(iii) $1 + 2 + 3 + \ldots + 50$

$$= \frac{50 \times 51}{2} \ldots \rightarrow (b)$$

(iv) $1^3 + 2^3 + 3^3 + \ldots + 10^3$

$= (1 + 2 + 3 + \ldots 10)^2$

$$= \left(\frac{10 \times 11}{2}\right)^2 = 55^2 \rightarrow (c)$$

Hence, the correct option is (b).

Assessment Test IV

1. BADC is the required sequential order.

Hence, the correct option is (c).

2. $x = 1$

$$\begin{array}{c|cccc} x=1 & 1 & 6 & -8 & 1 \\ & 0 & 1 & 7 & -1 \\ \hline & 1 & 7 & -1 & \lfloor 0 \end{array}$$

$f(x) = (x^2 + 7x - 1)(x - 1)$

$f(x) = x^3 + 6x^2 - 8x + 1$

Remainder $= f(2)$

$= 2^3 + 6(2)^2 - 8(2)^1$

$= 8 + 24 - 16 + 1$

Quotient $= x^2 + 7x - 1$

$= 17$

Hence, the correct option is (a).

3. $f(x) = x^3 + bx^2 + ax + 40$

$g(x) = x^2 - 6x + 8$

Going by options, the third factor must be $(x + 5)$, since $x^2 \times x$.

$= x^3$ and $8 \times 5 = 40$

Hence, the correct option is (c).

4. $f(x) = x^2 + 13x + 36 = (x+4)(x+9)$

(i) If $x + 4$ is a factor of $2x^2 - 11x - k$, $2(-4)^2 - 11(-4) - k = 0 \Rightarrow 32 + 44 - k = 0 \Rightarrow k = 76$.

(ii) If $x + 9$ is a factor of $2x = - 11x - k$,

$2(-9)^2 - 11(-9) - k = 0$

$\Rightarrow 162 + 99 - k = 0 \Rightarrow k = 261$

$\therefore$ The minimum value of k is 76.

Hence, the correct option is (b).

5. Let $f(x) = 4x^4 - 5x^3 + 6x^2 - 79x + 6$.

$$\begin{array}{c|ccccc} x=3 & 4 & -5 & 6 & -79 & 6 \\ & 0 & 12 & 21 & 81 & 6 \\ \hline & 4 & 7 & 27 & 2 & \lfloor 12 \end{array}$$

$\therefore$ 12 should be subtracted from $f(x)$.

Hence, the correct option is (c).

6. The constant term of $x^5 - ax^3 + bx^2 + 200$ is 200 and it is not a multiple of 15. Hence, $(x + 15)$ cannot be a factor of the given polynomial.

Hence, the correct option is (d).

7. Given $f(x) = 15x^6 - 7x^3 + 15$

$f(x^3) = 15(x^3)^2 - 7(x^3) + 15$

Let $x^3 = y$

$f(y) = 15y^2 - 7y + 15$

$x^3 - 3 = y - 3$

If $f(y)$ is divided by $y - 3$, then the remainder is $f(3)$.

$\Rightarrow f(3) = 15(3)^2 - 7(3) + 15$

$= 135 - 21 + 15$

$= 114 + 15 = 129$

Hence, the correct option is (a).

8. $\frac{5}{16}, \frac{5}{24}, \frac{5}{26}, \frac{5}{54}, \ldots$

$r = \frac{t_2}{t_1} = \frac{t_3}{t_2} = \frac{2}{3}$

The given is a GP.

$t_5 = \frac{5}{16} \times \left(\frac{2}{3}\right)^4 = \frac{5}{81}$

$\therefore \frac{5}{18}$ be the term of the series.

Hence, the correct option is (c).

9. $t_n = 1 + 2 + 3 + \ldots + n$

$= \frac{n(n+1)}{2} = \frac{1}{2}[n^2 + n]$

$S_n = \Sigma t_n$

$= \frac{1}{2}\left[\Sigma n^2 + \Sigma n\right]$

$= \frac{1}{2}\left[\frac{n(n+1)(2n+1)}{6} + \frac{n(n+1)}{2}\right]$

$= \frac{1}{2}\left[\frac{10 \times 11 \times 21}{6} + \frac{10 \times 11}{2}\right]$

$= \frac{1}{2}[385 + 55] = \frac{1}{2}[440] = 220$

Hence, the correct option is (a).

10. $a = 8$ and $r = 5$

$t_5 = ar^4$

$= 8(5)^4$

$= 5000$

Hence, the correct option is (c).

11. 6, 18, 54, 162, are in GP.

$\text{GM} = \sqrt[4]{6 \times 18 \times 54 \times 162}$

$\sqrt[4]{2^4 \times 9^4 \times 3^2}$

$= \sqrt[4]{2^4 \times 3^{10}}$

$= 2 \times 9\sqrt{3} = 18\sqrt{3}$

Hence, the correct option is (d).

12. $S_{15} = 8 + 88 + 888 + 8888 + \ldots$ 15 terms

$S_{15} = \frac{8}{9}$ $[9 + 99 + 999 + 9999 + \ldots$ 15 terms]

$= \frac{8}{9}[(10 - 1) + (100 - 1) + (1000 - 1) + \ldots + \ldots$ 15 terms]

$= \frac{8}{9}[10^1 + 10^2 + 10^3 + \ldots$ (15 terms) $- (1 + 1 + 1 + \ldots$ 15 terms)]

$= \frac{8}{9}\left[\frac{10(10^{15} - 1)}{10 - 1} - 15\right]$

$\frac{8}{9}\left[\frac{10}{9}(10^{15} - 1) - 15\right]$

Hence, the correct option is (b).

13. $\Rightarrow 5, x_1, x_2, x_3, \ldots x_7, 8$ are in AP.

$a = 5 = t_{1,}\ t_9 = 8,\ d = \frac{8-5}{7+1} = \frac{3}{8}$

7th AM $= t_8 = a + 7d$

$= 5 + 7 \Rightarrow \frac{3}{8} = 5 + \frac{21}{8} = \frac{61}{8}$

Hence, the correct option is (a).

14. $a = 1,\ r = \frac{1}{2}$

$S_\infty = \frac{a}{1-r}$

$= \frac{1}{1 - \frac{1}{2}} = \frac{1}{1/2} = 2$

Hence, the correct option is (b).

15. (i) $\Sigma(n)\,(n - 1)$

$= \Sigma\,(n^2 - n)$

$= \Sigma\, n^2 - \Sigma n$

$= \frac{n(n+1)n(2n+1)}{6} - \frac{n(n+1)}{2}$

$= \frac{n(n+1)}{2}\left[\frac{2n + 1 - 3}{3}\right]$

$= \frac{n(n+1)}{2}\left[\frac{2(n-1)}{3}\right]$

$= \frac{n(n^2 - 1)}{3} \rightarrow$ (d)

(ii) $\Sigma(2n - 1)$ = The sum of the first n odd natural number $= n^2 \rightarrow$ (c)

(iii) $\Sigma(2n)$ = The sum of the first n even natural number $= n(n + 1) \rightarrow$ (b)

(iv) Σn^3 = The sum of the cubes of the first n even natural numbers $= \frac{n(n^2 + 1)^2}{4} \rightarrow$ (a)

Hence, the correct option is (b).

CHAPTER 7
Statistics, Counting Techniques, and Probability

Assessment Test I

1. The required sequential order is BDAC.
   Hence, the correct option is (d).

2. 2, 4, 8, 16, ... are in G.P.
   Here $a = 2$, $r = 2$
   $$S_n = \frac{a(r^n - 1)}{r - 1} = \frac{2(2^n - 1)}{2 - 1}$$
   $$\therefore S_{20} = 2(2^{20} - 1)$$
   $$\therefore \text{A.M.} = \frac{S_{20}}{20}$$
   $$= \frac{2(2^{20} - 1)}{20} = \frac{2^{20} - 1}{10}.$$
   Hence, the correct option is (b).

3. Ascending order of the given observations is
   $\frac{2x}{3}, \frac{3x}{8}, \frac{x}{3}, \frac{2x}{7}, \frac{x}{4}, \frac{x}{6}$, and $\frac{x}{7}$ $(\because x > 0)$.
   $$\text{Median} = \frac{2x}{7} = 12 \text{ (given)}$$
   $$\Rightarrow x = \frac{7 \times 12}{2} = 42.$$
   Hence, the correct option is (b).

4. $x \neq 3$ as $x > 3$
   $\therefore$ The most frequently found observation is 5.
   $\therefore$ mode = 5
   Hence, the correct option is (c).

5. The SD of 2005, 2009, 2008, 2007, and 2011 is same as the SD of (2005 – 2000), (2009 – 2000), (2008 – 2000), (2007 – 2000), and (2011 – 2000), i.e., 5, 9, 8, 7, and 11.
   $$\text{A.M.} = \frac{5+9+8+7+11}{5} = 8$$
   Variance =
   $$\frac{(5-8)^2 + (9-8)^2 + (8-8)^2 + (7-8)^2 + (11-8)^2}{5}$$
   $$= \frac{9+1+0+1+9}{5} = 4$$
   $$\therefore \text{S.D.} = \sqrt{\text{Variance}} = \sqrt{4} = 2.$$
   Hence, the correct option is (a).

6. The committee is to contain at least three gentlemen, i.e., it may contain either 3, 4, or 5 gentlemen.
   $\therefore$ The total number of ways
   $$= {}^9C_3 \times {}^6C_2 + {}^9C_4 \times {}^6C_1 + {}^9C_5$$
   $$= 84 \times 15 + 126 \times 6 + 126 = 2142.$$
   Hence, the correct option is (c).

7. The number of 4 letter passwords that can be formed with a, b, c, d, and e (without repetition) is ${}^5P_4$, i.e., 120.
   Hence, the correct option is (b).

8. The number of words which begin with A and end with Z is 7!, i.e., 5040.
   ($\because$ The 7 places between A and Z are filled in 7! ways.)
   Hence, the correct option is (a).

9. The number of four-digit numbers formed by using the digits 3, 5, 6, 8, and 9 with repetition is $5 \times 5 \times 5 \times 5$ is 625.
   The number of four-digit odd numbers is $5 \times 5 \times 5 \times 3$, i.e., 375. ($\because$ The last digit is filled in 3 ways, i.e., 3, 5, or 9.)
   $$\therefore \text{The required probability} = \frac{375}{625} = \frac{3}{5}$$
   Alternative method:
   A four-digit number can end with 3, 5, 6, 8, or 9. Out of the five possibilities, three are odd digits (3, 5, 9).
   $$\therefore \text{The required probability} = \frac{3}{5}$$
   Hence, the correct option is (d).

10. We know that three non-collinear points form a triangle.

We select two points on line L_1 and one point on line L_2 or select two points on line L_2 and one point on line L_1 to form a triangle.

The number of selections is ${}^{10}C_2\,{}^8C_1 + {}^{10}C_1\,{}^8C_2$

$= 360 + 280 = 640$

Hence, the correct option is (c).

11. When a dice is rolled, it shows white or green or yellow.

When two dice are rolled, total number of possible cases is $3 \times 3 = 9$.

First dice shows any three colours and second dice shows remaining two colours.

The favourable cases $= 3 \times 2 = 6$

Required probability $= \frac{6}{9} = 2/3$

Hence, the correct option is (c).

12. Option (b): Total outcomes $= 2^3 = 8$

Favourable outcomes = 1

Required probability $= \frac{1}{8}$

13. Option (a): Total outcomes $= {}^4C_2 = 6$

Favourable outcomes are (1, 5), (1, 7), and (5, 7).

$\therefore$ Required probability $= \frac{3}{6} = \frac{1}{2}$

14. Option (e): There are 52 Sundays in the first 364 days. The probability that the 365th day is Sunday can be $\frac{1}{7}$.

15. Option (d): Total outcomes $= 6^2 = 36$

Favourable outcomes are (1, 1), (2, 2), (3, 3), (4, 4), (5, 5) and (6, 6).

$\therefore$ Required probability $= \frac{6}{36} = \frac{1}{6}$

Assessment Test II

1. The required sequential order is BADC.

Hence, the correct option is (c).

2. Mean $= \dfrac{2 + 6 + 10 + 14 + \ldots\ldots(100 \text{ terms})}{100}$

$= \dfrac{2(1 + 3 + 5 + 7 + \ldots\ldots 100 \text{ terms})}{100}$

$= \dfrac{2 \times 100^2}{100} = 200$

[$\because$ The sum of first n odd numbers $= n^2$]

Hence, the correct option is (b).

3. The ascending order is $\frac{5x}{12}, \frac{6x}{13}, \frac{x}{2}, \frac{4x}{7}, \frac{3x}{5}, \frac{2x}{3}$ $(x > 0)$.

Here, there are two middle terms, i.e., $\frac{x}{2}$ and $\frac{4x}{7}$.

$\therefore$ Median $= \dfrac{\frac{x}{2} + \frac{4x}{7}}{2} = \dfrac{7x + 8x}{28} = \dfrac{15x}{28}$

Given $\frac{15x}{28} = 60 \Rightarrow x = 112$

Hence, the correct option is (b).

4. If $x = 3$, then mode is 3 ($\because$ 3 occurs 5 times).

If $x = 6$, then mode is 6 ($\because$ 6 occurs 5 times).

If $x = 7$, then mode is 7 ($\because$ 7 occurs 5 times).

If $x = 9$, then mode cannot be 9 as 9 occurs 3 times and other observations occur 4 times each.

Hence, the correct option is (d).

5. The variance of 5012, 5013, 5015, 5018, and 5022 is same as the variance of 12, 13, 15, 18, and 22.

Mean $= \dfrac{12 + 13 + 15 + 18 + 22}{5} = \dfrac{80}{5} = 16$

$\therefore$ Variance =

$$\frac{(12-16)^2 + (13-16)^2 + (15-16)^2 + (18-16)^2 + (22-16)^2}{5}$$

$= \dfrac{16 + 9 + 1 + 4 + 36}{5} = \dfrac{66}{5} = 13.2$

Hence, the correct option is (a).

6. The committee is to contain at most two ladies, i.e., it may contain 0, 1 or 2 ladies.

$\therefore$ The total number of ways

$= {}^{10}C_5 + {}^{10}C_4 \times {}^7C_1 + {}^{10}C_3 \times {}^7C_2$

$= 252 + 210 \times 7 + 120 \times 21$

$= 4242$

Hence, the correct option is (d).

7. The number of 4-letter passwords that can be formed with a, e, i, o, and u with repetition is $5 \times 5 \times 5 \times 5$, i.e., 625.

Hence, the correct option is (c).

8. The number of words that begin with A and do not end with T is $1 \times 2 \times 3 \times 3 = 18$.

Hence, the correct option is (a).

9. Any four-digit number formed from the digits 4, 5, 7, and 8 (without repetition) is divisible by 3, since the sum of the digits is 24, i.e., divisible by 3.

   $\therefore$ The required probability is 1.

   Hence, the correct option is (b).

10. A triangle formed by selecting two points on line L_1 and one point on line L_2 or two points on line L_2 and one point on line L_1.

    The number of ways of selecting these points = ${}^{12}C_2 \times {}^6C_1 + {}^{12}C_1 \times {}^6C_2 = 396 + 180 = 576.$

    $\therefore$ Required number of triangles = 576.

    Hence, the correct option is (a).

11. When a dice is rolled, it shows either black, blue, or red, i.e., 3 possibilities.

    Two dice are rolled the total number of possibilities is 9.

    The favourable cases are {(red, red), (blue, blue), and (black, black)} = 3

    $\therefore$ Required probability $= \dfrac{3}{9} = \dfrac{1}{3}$

    Hence, the correct option is (b).

12. Options (c): Total number of outcomes = $2^3 = 8$

    Favourable outcomes are HHT, HTH, and THH.

    $\therefore$ The required probability $= \dfrac{3}{8}$

13. Options (e): The number of numbered cards (2 to 10) = 9

    Total numbered cards in a pack of cards is 9 × 4, i.e., 36.

    $\therefore$ The required probability $= \dfrac{36}{52} = \dfrac{9}{13}$

14. Options (a): Total number of outcomes = ${}^{10}C_2 =$ 45

    Favourable outcomes are (1, 2); (2, 3); (3, 4); (4, 5); (5, 6); (6, 7); (7, 8); (8, 9); (9, 10).

    $\therefore$ The required probability $= \dfrac{9}{45} = \dfrac{1}{5}$

15. Options (b): Total outcomes = 6 × 6 = 36

    Favourable outcomes are (1, 5); (2, 4); (3, 3); (4, 2); (5, 1); (6, 6).

    $\therefore$ The required probability $= \dfrac{6}{36} = \dfrac{1}{6}$

Assessment Test III

1. DACBE is the required sequential order.

   Hence, the correct option is (c).

2. Arithmetic mean of the data

   $= \dfrac{12+15+18+16+9}{5} = \dfrac{70}{5} = 14$

   Variance =

   $$\frac{(12-14)^2+(15-14)^2+(18-14)^2+(16-14)^2+(9-14)^2}{5}$$

   $= \dfrac{4+1+16+4+25}{5} = \dfrac{50}{5} = 10.$

   Standard deviation = $\sqrt{10}$

   Hence, the correct option is (b).

3. 13, 15, 17, 19, 21,…, 7 are the consecutive odd numbers that form an arithmetic progression.

   Arithmetic mean

   $= \dfrac{13+57}{2} = \dfrac{70}{2} = 35$

   Hence, the correct option is (d).

4. 123, 134, 145, 156, …, 343 are in A.P.

   Median = mean $= \dfrac{123+343}{2} = 233$

   Hence, the correct option is (b).

5. As 25 has highest frequency, the mode is 25.

   Hence, the correct option is (d).

6. Given digits are 2, 5, 7, 8, and 9.

H	T	U

   Units place can be filled with any one of the 5 digits in 5 ways. Hence, tens and hundreds digits can be filled in 4 ways and 3 ways, respectively, since repetition is not allowed.

   Number of 3-digit numbers can be formed = 5 × 4 × 3 = 60.

   Hence, the correct option is (c).

7. Given digits are 2, 3, 5, 7, 8, and 9.

T Th	Th	H	T	U

   Since we require only odd numbers, the units place can be filled by either 3, 5, 7, or 9 in 4 ways.

   The other places in order can be filled in 5 ways, 4 ways, 3 ways, and 2 ways, respectively. since repetition is not allowed.

Total number of 5-digit number can be formed $= 4 \times 5 \times 4 \times 3 \times 2 = 480$.

Hence, the correct option is (d).

8. For every different line, two points should be selected. The number of possible ways $= {}^{15}C_2$.

However, there are 5 points that are collinear, which give only one line.

Total number of distinct lines $= {}^{15}C_2 - {}^{5}C_2 + 1$

$= \dfrac{15 \times 14}{2} - \dfrac{5 \times 4}{2} + 1$

$= 105 - 10 + 1 = 96$

Hence, the correct option is (c).

9. ${}^{n}P_r = 2730$ and ${}^{n}C_r = 455$

$\dfrac{n!}{(n-r)!} = 2730$ and $\dfrac{n!}{(n-r)!r!} = 455$

$\dfrac{2730}{r!} = 455$

$\dfrac{2730}{455} = r!$

$r! = 6$

$\Rightarrow r! = 3 \times 2 \times 1$

$r! = 3!$

$r = 3$

Hence, the correct option is (b).

10. 4 men and 2 women can be selected in ${}^{8}C_2 \times {}^{5}C_2$ ways.

$= \dfrac{8!}{(8-4)!4!} \times \dfrac{5}{(5-2)! \times 2!}$

$= \dfrac{8 \times 7 \times 6 \times 5}{4 \times 3 \times 2 \times 1} \times \dfrac{5 \times 4}{2 \times 1}$

$= 70 \times 10 = 700$ ways

Hence, the correct option is (a).

11. A pack of cards contain 2 red cards of king.

Required probability $= \dfrac{2}{52} = \dfrac{1}{26}$

Hence, the correct option is (b).

12.

9	8								

The number of possibilities of different mobile numbers

$= {}^{8}P_8 = 8!$

$= 8 \times 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1 = 40{,}320$.

Hence, the correct option is (a).

13. Number of 4-digit natural numbers = 99,999 – 9999 = 9000

If all the digits are consecutive natural numbers, they can be $\underline{1, 2, 3, 4}$ or $\underline{2, 3, 4, 5}$

or $\underline{3, 4, 5, 6}$ or $\underline{4, 5, 6, 7}$ or $\underline{5, 6, 7, 8}$ or $\underline{6, 7, 8, 9}$.

From each set of number, we get $1 \times 2 \times 3 \times 4 = 24$

$\Rightarrow$ The number of required numbers $= 6 \times 24 = 144$

$\Rightarrow$ The required probability $= \dfrac{144}{9000} = \dfrac{2}{125}$

Hence, the correct option is (d).

14. $A = \dfrac{22(21)}{2} = 231$

$B = \dfrac{9(10)(19)}{6} = 285$

$C = 16^2 = 256$

$D = 15(16) = 240$

Average of $A, B, C, D =$

$\dfrac{231 + 285 + 256 + 240}{4} = \dfrac{1012}{4} = \mathbf{253}$

Hence, the correct option is (c).

15. (i) ${}^{100}C_0 = \dfrac{100!}{(100-0)!0!} = 1 \rightarrow$ (d)

(ii) ${}^{100}C_{99} = \dfrac{100!}{(100-99)!99!} = 100 \rightarrow$ (a)

(iii) ${}^{99}C_{98} = \dfrac{99!}{(99-98)!98!} = 99 \rightarrow$ (b)

(iv) ${}^{98}C_1 = \dfrac{98!}{(98!-1)!1!} = 98 \rightarrow$ (c)

(i) $\rightarrow$ (D); (ii) $\rightarrow$ (A); (iii) $\rightarrow$ (B); (iv) $\rightarrow$ (C)

Hence, the correct option is (b).

Assessment Test IV

1. DCABE is the required sequential order.

Hence, the correct option is (d).

2. Arithmetic mean of the data

$\frac{4+8+9+11+13}{5}=\frac{45}{5}=9$

Variance $=\frac{25+1+0+4+16}{5}$

$=\frac{46}{5}=9.2$

Variance $=9.2$

Hence, the correct option is (c).

3. 28, 30, 32, 34, …, 66

$\therefore$ Observations are in arithmetic progression.

Arithmetic mean $=\frac{\text{First term}+\text{last term}}{2}$

$=\frac{28+66}{2}=\frac{94}{2}=47$

Hence, the correct option is (a).

4. Given data is 32, 42, 52, 62, …,152.

$(13^2<6^3)$ we get

There are 13 terms

$\therefore$ median $=7^{\text{th}}$ term $=9^2=81$.

Hence, the correct option is (c).

5. As 35 has highest frequency, the mode is 35.

Hence, the correct option is (b).

6. Given digits are 0, 1, 3, and 7.

1st	2nd	3rd	4th

First place of the code can be one any of the digit of the given digits. It can be done in 4 ways.

Hence, the 2nd, 3rd, and 4th place can be filled in 3 ways, 2 ways, and 1 way, respectively.

Total number of codes that can be formed

$=4\times3\times2\times1=24$

Hence, the correct option is (a).

7. Given digits are 2, 3, 4, 5, 6, and 7.

Th	H	T	U

Since we require even numbers, the units place can be filled by either 2, 4, or 6 in 3 ways.

The remaining places can be filled in 5 ways, 4 ways, and 3 ways, respectively.

Total number of ways $=3\times5\times4\times3=180$

Hence, the correct option is (c).

8. For a triangle, we select three points out of 26 points in ${}^{26}C_3$ ways.

A, E, I, O, are U are the collinear points (given). We cannot get any triangle with these 5 points.

Total number of triangle formed $={}^{26}C_3-{}^{5}C_3$

$=\frac{26\times25\times24}{6}-\frac{5\times4\times3}{6}$

$=2600-10=2590$

Hence, the correct option is (b).

9. Given ${}^{n}P_r=5040$, and ${}^{n}C_r=210$

$\frac{{}^{n}P_r}{{}^{n}C_r}=\frac{5040}{210}$

$r!=24$

$r!=4\times3\times2\times1$

$r!=4!$

$r=4$.

Hence, the correct option is (d).

10. 5 boys and 3 girls can be selected in ${}^{10}C_5\times{}^{6}C_3$ ways.

Hence, the correct option is (b).

11. A pack of cards contains 4 queens.

Required probability $=\frac{4}{52}=\frac{1}{13}$

Hence, the correct option is (c).

12.

<table>
<tr><th colspan="2">I</th><th colspan="2">II</th><th colspan="2">III</th><th colspan="2">IV</th><th colspan="2">V</th></tr>
<tr><td>9</td><td>9</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

There are 4 pairs of places to fill with any of the 9 different digits (other than 9).

Out of 4 pairs, first pair can be filled in 9 ways, and the second can be filled in 8 ways, and so on.

The number of different such numbers

$=9\times8\times7\times6=3024$.

Hence, the correct option is (c).

13. Number of 3-digit numbers $999-99=900$

The number required number $=\frac{900}{2}=450$

Required probability $= \dfrac{450}{900} = \dfrac{1}{2}$

Hence, the correct option is (a).

14. $A = \dfrac{50 \times 51}{2}$

$= \dfrac{2550}{2}$

$= 1275$

$B = 38^2 = 1444$

$C = 38(39)$

$= 1482$

$\Rightarrow A < B < C$

$\therefore$ Median $= B = 1444$.

Hence, the correct option is (d).

15. 8, 12, 7, 5, 16, 10, 19, 21

Ascending Order 5, 7, 8, 10, 12, 16, 19, 21

$n = 8$.

(i) $Q_1 = \left(\dfrac{n}{4}\right)^{\text{th}}$ observation

$= \left(\dfrac{8}{4}\right) = $ 2nd observation $= 7 \rightarrow$ (b)

(ii) $Q_2 =$ mean of 10 and 12 $= 11 \rightarrow$ (c)

(iii) $Q_3 = \left(\dfrac{8}{4}\right)^{\text{th}} =$ 6th observation $= 16 \rightarrow$ (d)

(iv) Quartile deviation

$\dfrac{Q_3 - Q_1}{2}$

$= \dfrac{16-7}{2}$

$= \dfrac{9}{2} = 4.5 \rightarrow$ (a)

(i) $\rightarrow$ (B); (ii) $\rightarrow$ (C); (iii) $\rightarrow$ (D); (iii) $\rightarrow$ (A)

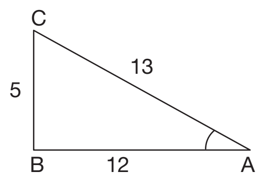
Hence, the correct option is (a).

CHAPTER 8
Trigonometry and Coordinate Geometry

Assessment Test I

1. The required sequential order is CABD.

   Hence, the correct option is (b).

2. 

   Given $\tan A = \frac{5}{12}$ and A is not in the quadrant I.

   $\Rightarrow$ A is in the quadrant III

   $AC^2 = AB^2 + BC^2 = 5^2 + 12^2$

   $\Rightarrow AC^2 = 13^2 \Rightarrow AC = 13$

   $\sin A = \frac{-5}{13}$ and $\cos A = \frac{-12}{13}$

   ($\because$ A is in the quadrant III.)

   $$\therefore \frac{\sin A + \cos A}{\sin A - \cos A} = \frac{\frac{-5}{13} - \frac{12}{13}}{\frac{-5}{13} + \frac{12}{13}} = \frac{-17}{7}$$

   Hence, the correct option is (b).

3. $\sec\theta + \operatorname{cosec}\theta = 0 \Rightarrow \sec\theta = -\operatorname{cosec}\theta$

   $\Rightarrow \frac{\operatorname{cosec}\theta}{\sec\theta} = -1 \quad \Rightarrow \tan\theta = -1.$

   Hence, the correct option is (c).

4. $\frac{1 + \tan A}{1 - \tan A} = \tan 75°$

   $\Rightarrow \frac{\tan 45^o + \tan A}{1 - \tan 45^o \tan A} = \tan 75°$

   $\Rightarrow \tan(45° + A) = \tan 75° \Rightarrow 45° + A = 75°$

   $\Rightarrow A = 30°$

   Hence, the correct option is (a).

5. $x = a \sec\theta \Rightarrow \sec\theta = \frac{x}{a}$

   $y = b\tan\theta \Rightarrow \tan\theta = \frac{y}{b}$

   $\sec^2\theta - \tan^2\theta = 1$

   $\Rightarrow \left(\frac{x}{a}\right)^2 - \left(\frac{y}{b}\right)^2 = 1$

   $\Rightarrow \frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$

   Hence, the correct option is (d).

6. $5\cot^2 A = \sin^2 60° + \sec^2 30° = \left(\frac{\sqrt{3}}{2}\right)^2 + \left(\frac{2}{\sqrt{3}}\right)^2$

   $\Rightarrow 5\cot^2 A = \frac{3}{4} + \frac{4}{3} = \frac{25}{12} \Rightarrow \cot^2 A = \frac{5}{12}$

   $\therefore \operatorname{cosec}^2 A = 1 + \cot^2 A = 1 + \frac{5}{12} = \frac{17}{12}.$

   Hence, the correct option is (c).

7. $\cos^2 10° + \cos^2 20° + \cos^2 30° + \ldots + \cos^2 90°$

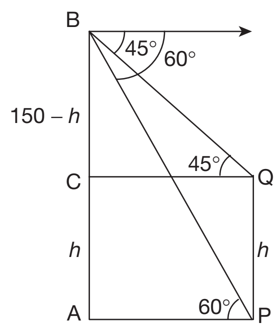
   $= (\cos^2 10° + \cos^2 80°) + (\cos^2 20° + \cos^2 70°) + (\cos^2 30° + \cos^2 60°) + (\cos^2 40° + \cos^2 50°) + \cos^2 90°$

   $= (\cos^2 10° + \sin^2 10°) + (\cos^2 20° + \sin^2 20°) + (\cos^2 30° + \sin^2 30°) + (\cos^2 40° + \sin^2 40°) + 0^2$

   $[\because \cos(90° - \theta) = \sin\theta]$

   $= 1 + 1 + 1 + 1 + 0 = 4.$

   Hence, the correct option is (c).

8. 

   Let AB be the tower and PQ be the building.

   Let PQ = h m.

   $\therefore$ AC = h m and BC = AB – AC = $(150 - h)$ m

   (Given AB = 150 m)

In ΔBCQ, $\tan 45° = \dfrac{BC}{CQ}$

$\Rightarrow 1 = \dfrac{150-h}{CQ} \Rightarrow CQ = 150 - h$

$\therefore AP = CQ = 150 - h$

In ΔBAP, $\tan 60° = \dfrac{AB}{AP} \Rightarrow \sqrt{3} = \dfrac{150}{150-h}$

$\Rightarrow 150 - h = \dfrac{150}{\sqrt{3}} \times \dfrac{\sqrt{3}}{\sqrt{3}} \Rightarrow 150 - h = 50\sqrt{3}$

$\Rightarrow h = 50(3 - \sqrt{3})$ m

Hence, the correct option is (b).

9. $5x + 4y - 20 = 0 \Rightarrow 5x + 4y = 20$

$\Rightarrow \dfrac{5x+4y}{20} = 1 \Rightarrow \dfrac{x}{4} + \dfrac{y}{5} = 1$

$\therefore$ Required area $= \dfrac{1}{2}|ab| = \dfrac{1}{2}|4 \times 5| = 10$ sq. units.

Hence, the correct option is (a).

10. x–intercepts $= 5 \Rightarrow$

The line passes through (5, 0).

$\therefore$ The equation of line passing through (–2, 3) and (5, 0) is

$\dfrac{x-x_1}{x_2-x_1} = \dfrac{y-y_1}{y_2-y_1} \Rightarrow \dfrac{x+2}{5+2} = \dfrac{y-3}{0-3}$

$\Rightarrow \dfrac{x+2}{7} = \dfrac{y-3}{-3} \Rightarrow -3x - 6 = 7y - 21$

$\Rightarrow 3x + 7y - 15 = 0$

Hence, the correct option is (d).

11. Let C(–3, 6) divides A(–9, –12) and B(0, 15) in the ratio $m:n$ internally.

$\therefore (-3, 6) = \left(\dfrac{0-9n}{m+n}, \dfrac{15m-12n}{m+n}\right)$

$\Rightarrow \dfrac{-9n}{m+n} = -3 \Rightarrow -9n = -3m - 3n$

$\Rightarrow -3m = -6n \Rightarrow \dfrac{m}{n} = \dfrac{2}{1}$

$\Rightarrow \dfrac{AB}{BC} = \dfrac{2}{1}$

Let $AC = 2x$ and $BC = x$

$\therefore \dfrac{AB}{AC} = \dfrac{AC+BC}{AC} = \dfrac{2x+x}{2} = \dfrac{3}{2}$

Hence, the correct option is (b).

12. Option (e): The midpoint of (5, 2) and (1, –10) $= \left(\dfrac{5+1}{2}, \dfrac{2-10}{2}\right)$

$= (3, -4)$

Distance between (0, 0) and (3, –4)

$= \sqrt{(0-3)^2 + (0+4)^2} = \sqrt{25} = 5$ units.

13. Option (d): Slope $= \dfrac{-a}{b} = \dfrac{\frac{-1}{2}}{\frac{-1}{6}} = 3$.

14. Option (a):

$$\sin\frac{\pi}{4}\cos\frac{\pi}{4}\tan\frac{\pi}{4} = \sin\frac{\pi}{4} \times \cos\frac{\pi}{4} \times \frac{\sin\frac{\pi}{4}}{\cos\frac{\pi}{4}}$$

$$= \sin^2\frac{\pi}{4}$$

$= \sin^2 45° = \left(\dfrac{1}{\sqrt{2}}\right)^2 = \dfrac{1}{2}$.

15. Option (b):

$\Delta = \dfrac{1}{2}|x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2)|$

$= \dfrac{1}{2}|1(3-4) + 2(4-2) + 3(2-3)| = \dfrac{1}{2}|-1+4-3|$

$= 0$

Assessment Test II

1. The required sequential order is BDAC.

Hence, the correct option is (d).

2. Given $\cos A = \dfrac{8}{17}$ and A is not in 1st quadrant.

$\Rightarrow$ A is in the 4th quadrant.

$AC^2 = AB^2 + BC^2 \Rightarrow 17^2 = 8^2 + BC^2$

$\Rightarrow BC^2 = 225 \Rightarrow BC = 15$

$\text{cosec } A = \dfrac{-17}{15}$, $\cot A = \dfrac{-8}{15}$

($\because$ A is in the 4th quadrant)

$$\frac{\text{cosec A} + \cot \text{A}}{\text{cosec A} - \cot \text{A}} = \frac{\frac{-17}{15} - \frac{8}{15}}{\frac{-17}{15} + \frac{8}{15}} = \frac{25}{9}.$$

Hence, the correct option is (c).

3. $\text{cosec}\,\theta - \cot\,\theta = 0$

$\Rightarrow \text{cosec}\,\theta = \cot\,\theta$

$\Rightarrow \frac{1}{\sin\theta} = \frac{\cos\theta}{\sin\theta}$

$\Rightarrow \cos\,\theta = 1 \Rightarrow \sec\,\theta = 1$

Hence, the correct option is (b).

4. $\frac{1-\tan\theta}{1+\tan\theta} = \tan 30^{\circ}$

$\Rightarrow \frac{\tan 45^{\circ} - \tan\theta}{1+\tan 45^{\circ}\,\tan\theta} = \tan 30^{\circ}$

$\Rightarrow \tan\,(45^{\circ} - \theta) = \tan 30^{\circ}$

$\Rightarrow 45^{\circ} - \theta = 30^{\circ} \Rightarrow \theta = 15^{\circ}$

Hence, the correct option is (a).

5. $a = b\,\text{cosec}\,\theta \Rightarrow \text{cosec}\,\theta = \frac{a}{b}$

$x = y\tan\,\theta \Rightarrow \tan\,\theta = \frac{x}{y} \Rightarrow \cot\,\theta = \frac{y}{x}$

$\text{cosec}^2\,\theta - \cot^2\,\theta = 1 \Rightarrow \left(\frac{a}{b}\right)^2 - \left(\frac{y}{x}\right)^2 = 1$

$\Rightarrow \frac{a^2}{b^2} - \frac{y^2}{x^2} = 1$

Hence, the correct option is (b).

6. $\sec^2 \text{A} = \cot^2 30^{\circ} + 2\cos^2 45^{\circ} = (\sqrt{3})^2 + 2 \times \left(\frac{1}{\sqrt{2}}\right)^2 = 4$

$\Rightarrow \cos^2 \text{A} = \frac{1}{4}$

$\therefore\ \sin^2 \text{A} = 1 - \cos^2 \text{A} = 1 - \frac{1}{4} = \frac{3}{4}.$

Hence, the correct option is (c).

7. $\sin^2 5^{\circ} + \sin^2 15^{\circ} + \sin^2 25^{\circ} + \ldots + \sin^2 85^{\circ}$

$= (\sin^2 5^{\circ} + \sin^2 85^{\circ}) + (\sin^2 15^{\circ} + \sin^2 75^{\circ})$
$+ (\sin^2 25^{\circ} + \sin^2 65^{\circ}) + (\sin^2 35^{\circ} + \sin^2 55^{\circ})$
$+ \sin^2 45^{\circ}$

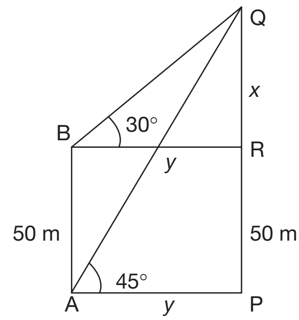
$= (\sin^2 5^{\circ} + \cos^2 5^{\circ}) + (\sin^2 15^{\circ} + \cos^2 15^{\circ})$
$+ (\sin^2 25^{\circ} + \cos^2 25^{\circ}) + (\sin^2 35^{\circ} + \cos^2 35^{\circ})$
$+ \left(\frac{1}{\sqrt{2}}\right)^2$

$[\because \sin\,(90^{\circ} - \theta) = \cos\,\theta]$

$= 1 + 1 + 1 + 1 + \frac{1}{2} = 4\frac{1}{2}.$

Hence, the correct option is (c).

8.



Let AB and PQ be the building and towers, respectively.

Let QR = x m and BR = AP = y m

In ΔBQR, $\tan 30^{\circ} = \frac{x}{y}$

$\Rightarrow \frac{1}{\sqrt{3}} = \frac{x}{y} \Rightarrow y = \sqrt{3}x$ (1)

In ΔAQP, $\tan 45^{\circ} = \frac{\text{PQ}}{\text{AP}}$

$\Rightarrow 1 = \frac{50 + x}{y} \Rightarrow y = 50 + x \Rightarrow \sqrt{3}x = 50 + x$ [From Eq. (1)]

$\Rightarrow x(\sqrt{3} - 1) = 50$

$\Rightarrow x = \frac{50}{\sqrt{3}-1} \times \frac{\sqrt{3}+1}{\sqrt{3}+1} = \frac{50(\sqrt{3}+1)}{2} = 25(\sqrt{3}+1)\,\text{m}$

Height of the tower $= x + 50 = 25\sqrt{3} + 25 + 50$

$= 25\sqrt{3} + 75 = 25\,(\sqrt{3} + 3).$

Hence, the correct option is (d).

9. Given line is $8x - 3y - 12 = 0$

If $y = 0 \Rightarrow 8x - 12 = 0 \Rightarrow x = \frac{3}{2}$

If $x = 0 \Rightarrow -3y - 12 = 0 \Rightarrow y = -4$

$\therefore$ x–intercept $(a) = \frac{3}{2}$ and y–intercept $(b) = -4$

$\therefore$ Required area of the triangle $= \frac{1}{2}|ab|$

$= \frac{1}{2}\left|\frac{3}{2} \times -4\right| = 3$ sq. units

Hence, the correct option is (a).

10. y–intercept $= 3 \Rightarrow$

The line passes through (0, 3).

$\therefore$ The equation of the line passing through (0, 3) and (–3, –5) is $\dfrac{x-x_1}{x_2-x_1}=\dfrac{y-y_1}{y_2-y_1} \Rightarrow \dfrac{x-0}{-3-0}=\dfrac{y-3}{-5-3}$.

$\Rightarrow -8x = -3y + 9 \Rightarrow 8x - 3y + 9 = 0$

Hence, the correct option is (a).

11. Centroid divides the median in the ratio 2:1 internally from the vertex.

Given, P(–4, 7) and Q(3, –5)

$\therefore$ The coordinates of centroid

$$= \left(\frac{2\times 3-1\times 4}{2+1}, \frac{2\times -5+1\times 7}{2+1}\right) = \left(\frac{2}{3}, -1\right)$$

Hence, the correct option is (c).

12. Option (c): Centroid $= \left(\dfrac{3+10+2}{3}, \dfrac{9+11+16}{3}\right)$

= (5, 12)

Distance between (0, 0) and (5, 12)

$= \sqrt{(0-5)^2+(0-12)^2} = \sqrt{169} = 13$ units.

13. Option (e): Given line is $\dfrac{x}{3}+\dfrac{y}{6}=1$.

$$\text{Slope} = -\frac{a}{b} = \frac{-\frac{1}{3}}{\frac{1}{6}} = -2$$

14. Option (b): $\sec\dfrac{\pi}{3} \operatorname{cosec}\dfrac{\pi}{3} \cot\dfrac{\pi}{3} = \sec$

$$\frac{\pi}{3} \times \operatorname{cosec}\frac{\pi}{3} \times \frac{\cos\frac{\pi}{3}}{\sin\frac{\pi}{3}}$$

$$= \frac{\operatorname{cosec} 60^\circ}{\sin 60^\circ} = \frac{\frac{2}{\sqrt{3}}}{\frac{\sqrt{3}}{2}} = \frac{4}{3} \; (\because \cos\theta \times \sec\theta = 1).$$

15. Option (d):

$$\Delta = \frac{1}{2}|x_1(y_2-y_3)+x_2(y_3-y_1)+x_3(y_1-y_2)|$$

$$= \frac{1}{2}|3(-3-1)+0(1-7)-5(7+3)|$$

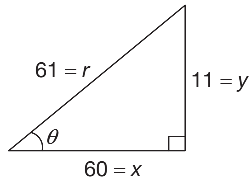
$$= \frac{1}{2}|-12+0-50| = \frac{62}{2} = 31 \text{ sq. units}$$

Assessment Test III

1. DBACE is the required sequential order.

Hence, the correct option is (d).

2.



$\sin\theta = \dfrac{11}{61} = \dfrac{y}{r}$

$x^2 + y^2 = r^2$

$x^2 = r^2 - y^2$

$x^2 = 61^2 - 11^2$

$= 3721 - 121$

$= 3600$

$x^2 = 60^2$

$\therefore x = 60$

$\therefore \sec\theta - \tan\theta = \dfrac{r}{x} - \dfrac{y}{x}$

$= \dfrac{r-y}{x} = \dfrac{61-11}{60} = \dfrac{50}{60} = \dfrac{5}{6}$

Hence, the correct option is (a).

3. $\sin 75^\circ = \sin(45^\circ + 30^\circ)$

$= \sin 45^\circ \cos 30^\circ + \cos 45^\circ \sin 30^\circ$

$= \dfrac{\sqrt{3}}{2\sqrt{2}} + \dfrac{1}{2\sqrt{2}} = \dfrac{\sqrt{3}+1}{2\sqrt{2}}$.

$\tan 15^\circ = \tan(45^\circ - 30^\circ)$

$$= \frac{\tan 45^\circ - \tan 30^\circ}{1+\tan 45^\circ \tan 30^\circ} = \frac{1-\frac{1}{\sqrt{3}}}{1+\frac{1}{\sqrt{3}}} = \frac{\sqrt{3}-1}{\sqrt{3}+1}$$

$$\sin 75^\circ \times \tan 15^\circ = \frac{\sqrt{3}+1}{2\sqrt{2}} \times \frac{\sqrt{3}-1}{\sqrt{3}+1} = \frac{\sqrt{3}-1}{2\sqrt{2}}.$$

Hence, the correct option is (c).

4. $x = a\cos\theta + b\,\mathrm{Sin}\,\theta$

$y = a\sin\theta - b\,\mathrm{Cos}\,\theta$

$x^2 + y^2 = a^2(\cos^2\theta + \sin^2\theta) + b^2(\sin^2\theta + \cos^2\theta)$

$x^2 + y^2 = a^2 + b^2$

Hence, the correct option is (d).

5. $\dfrac{1}{\sqrt{3}}\cos\theta + \sin\theta = \dfrac{2}{\sqrt{3}}$

$\dfrac{\sqrt{3}}{2}\dfrac{1}{\sqrt{3}}\cos + \dfrac{\sqrt{3}}{2}\sin\theta = \dfrac{2}{\sqrt{3}} \times \dfrac{\sqrt{3}}{2}$

$$\frac{1}{2}\cos\theta + \frac{\sqrt{3}}{2}\sin\theta = 1$$

$\cos 60° \cos\theta + \sin 60° \sin\theta = 1$

$\cos(60° - \theta) = 1$

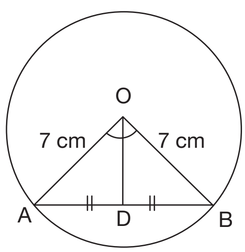
$\cos(60° - \theta) = \cos 0°$

$\Rightarrow 60 - \theta = 0 \Rightarrow \theta = 60°$

$\theta = \dfrac{\pi}{3}$

Hence, the correct option is (b).

6.



In ΔODB, $\angle DOB = \dfrac{100° \, 42^1}{2} = 50° \, 21^1$

$\sin 50° \, 21^1 = \dfrac{BD}{OB}$

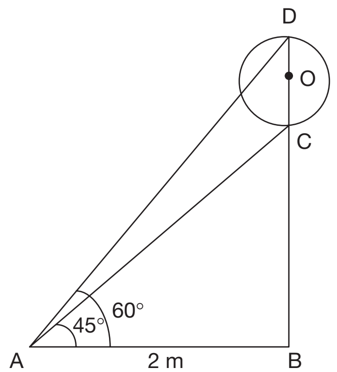
$0.77 = \dfrac{BD}{7}$

$BD = 5.39$

$\therefore$ length of the chord $AB = 2(5.39) = 10.78$ cm

Hence, the correct option is (a).

7. Let OC be the hour hand and OD be the minute hand of the clock. DC is the diameter of the clock.



$BC = BA = 2$

And $\tan 60° = \dfrac{BD}{BA}$

$\sqrt{3} = \dfrac{BD}{BA}$

$\Rightarrow BD = 2\sqrt{3}$ cm

$\therefore CD = BD - BC$

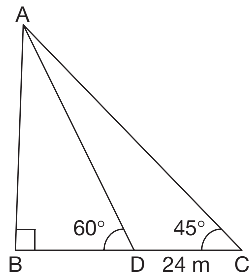
$= 2\sqrt{3} - 2 = 2(\sqrt{3} - 1)$ m $= 200\ (\sqrt{3} - 1)$ cm

$= 200\ (0.732) = 146.400$

$\therefore$ The diameter of the clock = 146.4 cm

Hence, the correct option is (b).

8.



Let AB is a tower.

In ΔABC, $\tan 45° = \dfrac{AB}{AC}$

$1 = \dfrac{AB}{BD + DC}$

$BD + CD = AB$

$BD + 24 = AB$ (1)

In ΔABD, $\tan 60° = \dfrac{AB}{BD}$

$\sqrt{3} = \dfrac{AB}{BD}$

$BD = \dfrac{AB}{\sqrt{3}}$ (2)

From Eqs (1) and (2) $\Rightarrow \dfrac{AB}{\sqrt{3}} + 24 = AB$

$24 = AB - \dfrac{AB}{\sqrt{3}}$

$24 = AB\dfrac{(\sqrt{3} - 1)}{\sqrt{3}}$

$\Rightarrow AB = \dfrac{24(\sqrt{3})}{(\sqrt{3} - 1)} = \dfrac{24\sqrt{3} \times (\sqrt{3} + 1)}{2}$

$= 12\sqrt{3}(\sqrt{3} + 1) = 36 + 12\sqrt{3}$ m

$= 36 + 12 \times 1.732$

$= 36 + 20.784$

$= 56.784$ m

Hence, the correct option is (c).

9. Let A(2, 4), B(6, 8), and C(2, 8).

$\therefore AB = \sqrt{(6-2)^2 + (8-4)^2}$

$= \sqrt{16+16} = \sqrt{32}$ m

$BC = \sqrt{(2-6)^2 + (8-8)^2}$

$= \sqrt{4^2} = 4$ m

$AC = \sqrt{(2-2)^2 + (8-4)^2}$

$= \sqrt{4^2} = 4$ m

$\therefore$ Perimeter of the triangle ABC $= \sqrt{32} + 4 + 4$

$= 4\sqrt{2} + 8 = 4(2+\sqrt{2})$ m

Hence, the correct option is (b).

10. Let $P(x, 0)$ be a point on the x–axis, such that AP = BP.

$\Rightarrow AP^2 = BP^2$

$(3 - x)^2 + (-6 - 0)^2 = (-2 - x)^2 + (5 - 0)^2$

$\Rightarrow 9 - 6x + x^2 + 36 = 4 + 4x + x^2 + 25$

$45 - 29 = 10x$

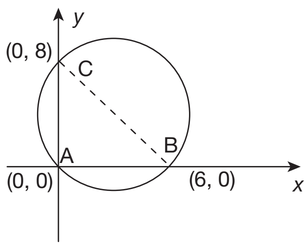
$16 = 10x$

$\Rightarrow x = \dfrac{8}{5}$

$\therefore$ The required point is $\left(\dfrac{8}{5}, 0\right)$.

Hence, the correct option is (b).

11.



Since $\Rightarrow$ CAB = 90°, BC is the diameter.

$\Rightarrow BC = \sqrt{6^2 + 8^2} = \sqrt{100} = 10$ units

$\therefore$ radius = 5 units

Hence, the correct option is (a).

12. Let the Equation of a line parallel to $2x + 3y + 5 = 0$ be

$2x + 3y + k = 0$.

This line is passing through (2, 3).

$\Rightarrow 2(2) + 3(3) + k = 0$

$4 + 9 + k = 0$

$k = -13$

$\therefore$ The required line is $2x + 3y - 13 = 0$.

Hence, the correct option is (c).

13. A(1, 2), B(3, 5), C(–2, 2)

$\therefore$ Area of triangle ABC =

$= \dfrac{1}{2}|1(5-2) + 3(2-2) + (-2)(2-5)|$

$= \dfrac{1}{2}|3 + 0 + 6|$

$= \dfrac{9}{2}$

= 4.5 sq. units

Hence, the correct option is (b).

14. Given P(4, 7), Q(6, 9)

Let M divides PQ in the ratio 2:3.

$\Rightarrow M(x, y) = \left(\dfrac{2\times6+3\times4}{2+3}, \dfrac{2\times9+3\times7}{2+3}\right)$

$= \left(\dfrac{24}{5}, \dfrac{39}{5}\right)$

Slope of $\overline{PQ} = \dfrac{9-7}{6-4} = \dfrac{2}{2} = 1$

Slope of its altitude = –1

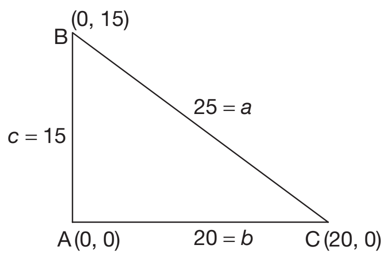
$\therefore$ Equation of the altitude is $y - \dfrac{39}{5} = -1\left(x - \dfrac{24}{5}\right)$

$\Rightarrow 5y - 39 = -5x + 24$

$\Rightarrow 5x + 5y - 63 = 0$

Hence, the correct option is (a).

15.



Centroid $= \left(\dfrac{0+0+20}{3}, \dfrac{0+15+0}{3}\right)$

$= \left(\dfrac{20}{3}, 5\right)$

Circumcentre = Midpoint of BC

$= \left(\dfrac{20}{2}, \dfrac{15}{2}\right)$

= (10, 7.5)

<u>Orthocentre:</u>

Vertex of the triangle containing right angle, i.e., (0, 0)

In centre:

$$\left(\frac{ax_1+bx_2+cx_3}{a+b+c}, \frac{ay_1+by_2+cy_3}{a+b+c}\right)$$

$$=\left(\frac{25(0)+20(0)+15\,(20)}{25+15+20}, \frac{25(0)+20(15)+15(0)}{25+15+20}\right)$$

$$=\left(\frac{300}{60}, \frac{300}{60}\right)=(5, 5)$$

(i) → (D); (ii) → (C); (iii) → (B); (iv) → (A)

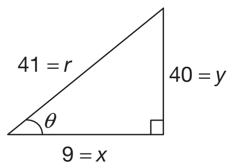
Hence, the correct option is (b).

Assessment Test IV

1. CEADB is the required sequential order.

   Hence, the correct option is (b).

2. $\cos\theta = \frac{9}{41} = \frac{x}{r}$ (say)



$x^2+y^2=r^2$

$9^2+y^2=41^2$

$y^2=1681-81$

$y^2=1600$

$y=\sqrt{1600}=40$

$\operatorname{cosec}\,\theta - \cot\,\theta = \frac{r}{y} - \frac{x}{y}$

$= \frac{r-x}{y}$

$= \frac{41-9}{40}$

$= \frac{32}{40} = \frac{4}{5}$

Hence, the correct option is (b).

3. $\tan 75° \times \sec 15°$

$= \frac{\sin 75°}{\cos 75°} \times \frac{1}{\sin 75°} = \frac{1}{\cos 75°}$

$\cos 75° = \cos(45° + 30°)$

$= \cos 45° \cos 30° - \sin 45° \sin 30°$

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

$\cos 75° = \frac{\sqrt{3}-1}{2\sqrt{2}}$

$\frac{1}{\cos 75°} = \frac{2\sqrt{2}}{\sqrt{3}-1}$

$= \frac{2\sqrt{2}(\sqrt{3}+1)}{2}$

$= \sqrt{2}(\sqrt{3}+1) = \sqrt{6}+\sqrt{2}.$

Hence, the correct option is (a).

4. $x = r\sin\,\theta$

$\Rightarrow \sin\,\theta = \frac{x}{r}$

$y = p\cos\,\theta$

$\Rightarrow \cos\theta = \frac{y}{p}$

$z = r\sin^2\theta + p\cos^2\theta$

$z = r.\frac{x^2}{r^2} + p\frac{y^2}{p^2}$

$\therefore\ px^2 + ry^2 = zrp$

Hence, the correct option is (c).

5. $\cos\theta + \frac{1}{\sqrt{3}}\sin\theta = \frac{2}{\sqrt{3}}$

$\frac{\sqrt{3}}{2}\cos\theta + \frac{\sqrt{3}}{2} + \frac{1}{\sqrt{3}}\sin\theta = \frac{2}{\sqrt{3}} \times \frac{\sqrt{3}}{2}$

$\frac{\sqrt{3}}{2}\cos\theta + \frac{1}{2}\sin\theta\ = 1$

$\sin 60° \cos\theta + \cos 60° \sin\theta = 1$

$\sin(60° + \theta) = 1$

$\sin(60° + \theta\,) = \sin 90°$

$\Rightarrow 60° + \theta = 90°$

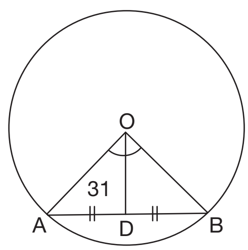
$\theta = 90° - 60°$

$\theta = 30°$

$\therefore\ \theta = \frac{\pi^c}{6}$

Hence, the correct option is (a).

6.



$\angle AOB = 103°22^1$, $\overline{OD} \perp \overline{AB}$

$\Rightarrow \angle DOB = \dfrac{103°22^1}{2} = 51°\ 41°$

In ΔDOB, $\cos 51°41^1 = \dfrac{OD}{OB}$

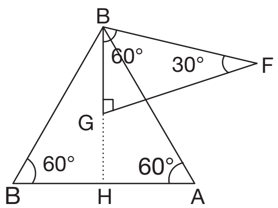
$\Rightarrow 0.62 = \dfrac{31}{OB}$

$\Rightarrow BO = \dfrac{31}{0.62}$

$\Rightarrow OB = \dfrac{3100}{62} = 50$ cm.

Hence, the correct option is (a).

7. Let ABC be the vertices of the plot and FG be the flagstaff with G as its foot. G is the centroid of the triangle,



Let 'BH' be the height of equilateral ΔABC.

$BH = \dfrac{\sqrt{3}}{2} \times AB$

But, $BH = \dfrac{3}{2}(BG)$ ($\because$ G is centroid.)

$\Rightarrow \dfrac{3(BG)}{2} = \dfrac{\sqrt{3}}{2} AB$

$\Rightarrow AB = \sqrt{3}\,BG$

In ΔBGF $\tan 60° = \dfrac{GF}{BG}$ ($\because$ BGF is a 90°, 60°, and 30° triangle.)

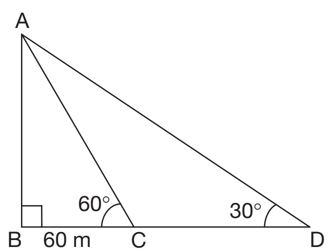
$\sqrt{3} = \dfrac{GF}{BG}$

$\Rightarrow GF = \sqrt{3}\,BG$

$\Rightarrow GF = AB = 15$ m

Hence, the correct option is (c).

8.



Let AB be a tower.

In ΔABC, $\tan 60° = \dfrac{AB}{BC}$

$\sqrt{3} = \dfrac{AB}{60}$

$\Rightarrow AB = 60\sqrt{3}$ m

In ΔABD, $\tan 30° = \dfrac{AB}{BD}$

$\dfrac{1}{\sqrt{3}} = \dfrac{60\sqrt{3}}{BD}$

$\Rightarrow BD = 180$ m

$CD = BD - BC = 180 - 60$

$\therefore CD = 120$ m.

Hence, the correct option is (d).

9. Let P(1, –1), Q(–1, 1), and $B(\sqrt{3}, \sqrt{3})$.

$PQ = \sqrt{(-1-1)^2 + (1+1)^2}$

$= \sqrt{4+4} = 2\sqrt{2}$ cm

$QR = \sqrt{(\sqrt{3}+1)^2 + (\sqrt{3}-1)^2}$

$= \sqrt{3 + 2\sqrt{3} + 1 + 3 - 2\sqrt{3} + 1}$

$= \sqrt{8} = 2\sqrt{2}$ cm

$PR = \sqrt{(\sqrt{3}-1)^2 + (\sqrt{3}+1)^2}$

$= \sqrt{2(\sqrt{3})^2 + 2(1)^2}$

$= \sqrt{6+2} = \sqrt{8} = 2\sqrt{2}$ cm

$\therefore$ Perimeter $= 2\sqrt{2} + 2\sqrt{2} + 2\sqrt{2} = 6\sqrt{2}$ cm

Hence, the correct option is (b).

10. Let P(3, 5) and Q(–5, 2). Let the point on the y–axis be $K(0, y)$ such that KP = KQ.

$\Rightarrow KP^2 = KQ^2$

$\Rightarrow (0-3)^2 + (y-5)^2 = (0+5)^2 + (y-2)^2$

$9 + y^2 - 10y + 25 = 25 + y^2 - 4y + 4$

$9 - 10y = -4y + 4$

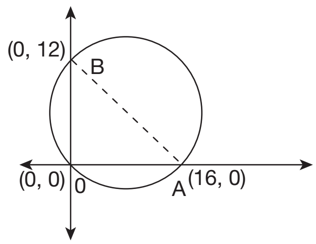
$5 = 6y$

$y = \dfrac{5}{6}$

$\therefore$ The point on the y–axis is $\left(0, \dfrac{5}{6}\right)$.

Hence, the correct option is (c).

11.



Since $\angle AOB = 90°$, AB is the diameter.

$\therefore$ AB is the diameter.

$\therefore AB = \sqrt{12^2 + 16^2} = \sqrt{400} = 20$ cm

$\therefore$ radius = 10 cm

$\therefore$ Circumference of the circle $= 2\pi r$

$= 20\pi$ units

Hence, the correct option is (c).

12. Let the equation of a line perpendicular to $3x - 7y + 5 = 0$

is $7x + 3y + k = 0$.

And it is passing through (8, 5).

$\Rightarrow 7(8) + 3(5) + k = 0$

$56 + 15 + k = 0 \therefore k = -71$

$\therefore$ The required line is $7x + 3y - 71 = 0$.

Hence, the correct option is (c).

13. A(3, 4), B(1, p), and C(2, 3)

Area of $\Delta ABC = 2$ sq. units

$$\frac{1}{2}|3(p-3)+1(3-4)+2(4-p)| = 2$$

$\Rightarrow |3p - 9 - 1 + 8 - 2p| = 4$

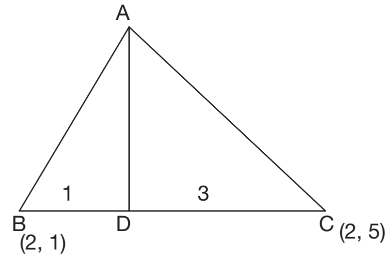
$|p - 2| = 4$

$p - 2 = \pm 4 \Rightarrow p - 2 = 4$ or $p - 2 = -4$

$\Rightarrow p = 6$ or $p = -2$

Hence, the correct option is (d).

14.



Given $\overline{AD} \perp \overline{BC}$.

Since the x–coordinates of B and C are same.

$\therefore \overline{BC}$ is Parallel to the y-axis.

$\therefore$ The coordinates of the point D are (2, 2).

Slope of BC is undetermined.

$\Rightarrow$ Slope of AD is zero.

$\therefore$ The equation of AD is $y = 2$.

Hence, the correct option is (a).

15. (i) $\sin 750° = \sin(2 \times 360° + 30°)$

$= \sin 30° = \dfrac{1}{2}$

(ii) $\cos 750° = \cos(2 \times 360° + 30°)$

$\cos 30° = \dfrac{\sqrt{3}}{2}$

(iii) $\sec 540°$

$= \sec(360° + 180°)$

$= \sec 180°$

$= \sec(90° + 90°)$

$= -\text{cosec } 90°$

$= -1.$

(iv) $\text{cosec } 135° = \text{cosec}(90° + 45°)$

$= \sec 45° = \sqrt{2}$

(i) $\to$ (D); (ii) $\to$ (C); (iii) $\to$ (A); (iv) $\to$ (B)

Hence, the correct option is (c).

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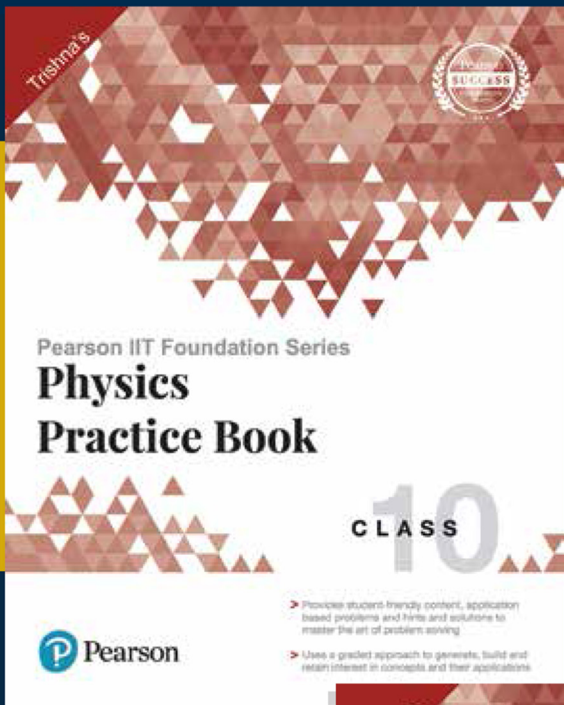

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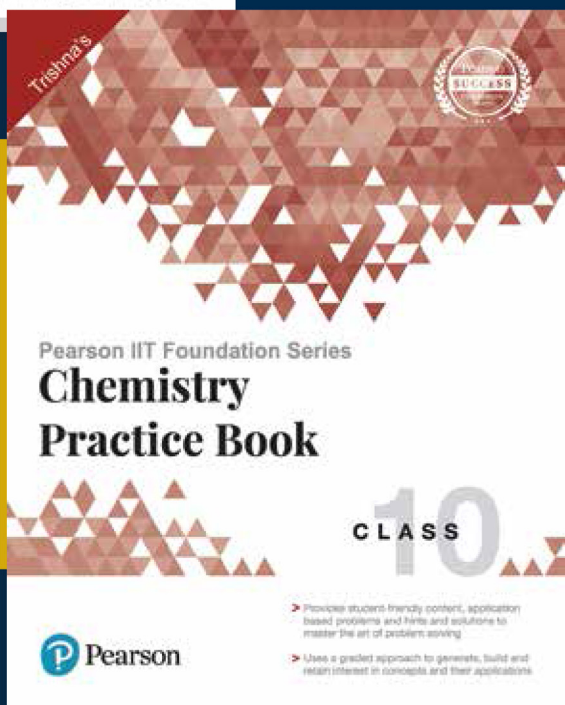

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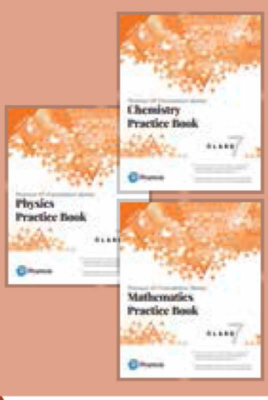

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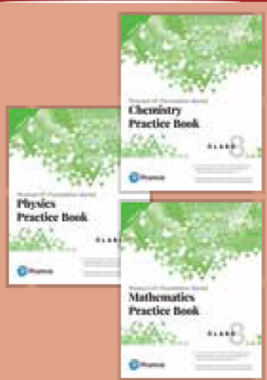

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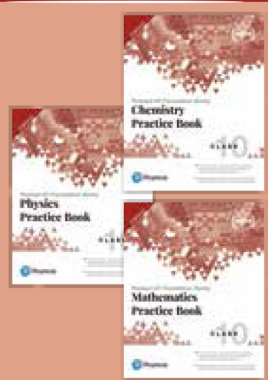

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