No. of pages – 21 **(M)**

COMPREHENSIVE ASSESSMENT FEEDBACK
PRE-BOARD EXAMINATION (2023-24)
CLASS: X
SUBJECT: MATHEMATICS (BASIC) (241)

SECTION - A

Section - A has 20 questions, carrying 1 mark each. Select the most appropriate option from the given options:

1. If HCF (96,104) = 8, then LCM (96, 104) is: **1**

(a) 96 **(b)** 404

(c) 1248 **(d)** 2496

Sol. We know that LCM (a, b) × HCF (a, b) = a × b

LCM (96,104) × 8 = 96 ×104

LCM (96,104) = 1248

(a) 96 is not a multiple of 104. So LCM = 96 is not possible. Hence (a) is incorrect option.

(b) 404 is neither a multiple of 96 nor 104. So LCM = 104 is not possible. Hence (b) is incorrect option.

(c) We know that LCM (a, b) × HCF (a, b) = a × b. So, LCM is 1248. Hence **(c) is the correct option.**

(d) 2496 is a multiple of both 96 and 104. But it is not the least common multiple of 96 and 104. So, 2496 is not LCM. Hence (d) is incorrect option.

Suggestive Measures – While solving such type of questions students should know that
• **LCM is the multiple of both numbers not only one of them.**
• **Smallest number divisible by both the numbers is their LCM.**

2. The product of the zeroes of the polynomial $ax^2 + bx - c$ (where a, b, c are real numbers and a ≠ 0) is: **1**

(a) $\frac{c}{a}$ **(b)** $-\frac{c}{a}$

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

Sol. We know that the product of the zeroes of the polynomial $ax^2 + bx + c$ is $\frac{\text{constant term}}{\text{coefficient of } x} = \frac{c}{a}$.

(a) In this question the constant term is (– c) not 'c'. So (a) $\frac{c}{a}$ cannot be the solution.

(b) The constant term is (– c) and coefficient of x^2 is 'a'. So **(b)** $\frac{-c}{a}$ **is the solution**

(c) 'b' is the coefficient of x not constant term. So (c) $\frac{b}{a}$ cannot be the solution.

(d) (– b) is the coefficient of x not constant term. So (d) $\frac{-b}{a}$ cannot be the solution.

Suggestive Measures – While solving such type of questions students should :
• **know the relation between coefficients of x^2, x and constant term**
• **know formula for the sum and product of zeroes of a polynomial**

- **have the clarity of signs like + or – while finding product or sum of zeroes as $\frac{-b}{c}$ and $\frac{c}{a}$ respectively**

3. Discriminant of the quadratic equation $3x^2 - 6x + 1 = 0$ is: **1**

(a) 24 **(b)** – 24

(c) 48 **(d)** – 48

Sol. For polynomial $3x^2 - 6x + 1$, $b^2 = (-6)^2 = 36$ and $4ac = 12$

(a) $b^2 - 4ac = 36 - 12 = 24$. So **(a) 24 is the correct option.**

(b) Here 36 > 12 i.e. $b^2 > 4ac$. Since discriminant cannot be negative, so (b) – 24 cannot be the correct option.

(c) $b^2 = 36$ and $4ac = 12$. Their difference cannot be more than these numbers. So (c) 48 cannot be the correct option.

(d) Since discriminant cannot be negative, so (d) – 48 cannot be the correct option.

Suggestive Measures – While solving such type of questions students should know the following conditions related to nature of roots

- **Discriminant (D) = $b^2 - 4ac = 0$ for equal roots.**
- **Discriminant (D) = $b^2 - 4ac \geq 0$ for real roots.**
- **Discriminant (D) = $b^2 - 4ac \leq$ for imaginary roots.**

4. The following pair of linear equations have: **1**

$$2x + 3y = -7$$
$$6x - 9y = 15$$

(a) No solution **(b)** Infinitely many solutions

(c) Two solutions **(d)** only one solution

Sol. For a pair of linear equations $a_1x + b_1y + c_1 = 0$, $a_2x + b_2y + c_2 = 0$

Here $\frac{a_1}{a_2} = \frac{2}{6} = \frac{1}{3}$, $\frac{b_1}{b_2} = \frac{3}{-9} = \frac{-1}{3}$, $\frac{c_1}{c_2} = \frac{-7}{15}$

(a) Condition for No solution is $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$. This condition is not fulfilled. Hence option (a) is not possible.

(b) Condition for infinitely many solutions is $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$. This condition is not fulfilled. Hence option (b) is not possible.

(c) There is no condition for two solutions. Hence option (c) is not possible.

(d) Condition for only one solution (unique solution) is $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$. This condition is fulfilled as $\frac{a_1}{a_2} = \frac{1}{3}$ and $\frac{b_1}{b_2} = -\frac{1}{3}$. Hence **correct option is (d).**

Suggestive Measures – While solving such type of questions students should know the

- **Condition for unique solution, $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$**
- **Condition infinitely many solutions, $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$**
- **Condition for No solutions, $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$**

5. HCF of two prime numbers is: **1**

(a) 1 **(b)** 2

(c) 3 **(d)** 4

Sol. HCF of two numbers is their highest common factor. Any two prime numbers have only 1 as their common factor. Hence **correct option is (a) 1.**

Suggestive Measures - While solving such type of questions students should know that
• **Any prime number have only 1 and the number itself as its factors.**
• **HCF is the highest common factor of the numbers.**

6. Distance of the point (4, – 3) from the origin is: **1**

(a) 4 units **(b)** 25 units

(c) 5 units **(d)** $\sqrt{7}$ units

Sol. Distance formula between two points Q (x_1, y_1) and P (x_2, y_2) is:

Distance PQ $=\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$.

Let P be (4, – 3) and Q be (0, 0). Then $x_2 = 4$, $y_2 = -3$, $x_1 = 0$ and $y_1 = 0$.

Thus Distance PQ $=\sqrt{(4-0)^2 + (-3-0)^2} = \sqrt{25} = 5$ units

Option (a) is incorrect since PQ $\neq$ 5 units

Option (b) is incorrect since PQ $\neq$ 5 units

Option (c) is correct since PQ = 5 units

Option (d) is incorrect since PQ $\neq$ 5 units

Suggestive Measures – While solving such type of questions students should
• **know the distance formula**
• **perform accurate calculations using the correct values**

7. 20^{th} term of the A.P.: 15, 12, 9, …. is: **1**

(a) – 45 **(b)** 45

(c) 42 **(d)** – 42

Sol. Here a = 15, d = 12 – 15 = – 3, n = 20

20^{th} term = a + (n –1) d = 15 – 57 = – 42

Option (a) Not correct since (– 45) is the 21^{st} term.

Option (b) not correct. The terms are decreasing, so the answer cannot be positive.

Option (c) not correct. The terms are decreasing, so the answer cannot be positive.

Option (d) is correct since 20^{th} term is – 42.

Suggestive Measures – While solving such type of questions students should
• **Correctly identify first term, common difference, number of terms**
• **understand that since terms are decreasing, so answer can be negative**

8. If the first term of an A.P. is 7 and its 13^{th} term is 35, then common difference of this A.P. will be: **1**

(a) $\frac{7}{3}$ **(b)** $\frac{3}{7}$

(c) $\frac{4}{5}$ **(d)** $\frac{5}{4}$

Sol. Here a = 7, 13th term = 35 ⇒n = 13 ⇒7 + 12d = 35 ⇒d = $\frac{7}{3}$

Option (a) is correct since d = $\frac{7}{3}$.

Option (b) is not correct since numerator is 3 and denominator is 7, which is reciprocal of the correct answer.

Option (c) is not correct.

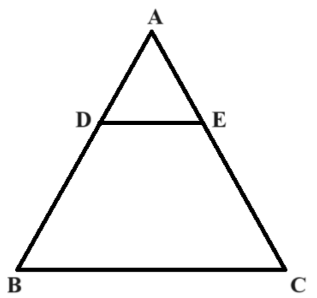
Option (d) is not correct.

Suggestive Measures – While solving such type of questions students should:
- **Correctly identify first term, common difference, number of terms**
- **Do proper calculation using correct formula**

9. In figure, if DE ∥ BC and AD = 1.2 cm, DB = 3.6 cm and EC = 3 cm, then the value of AC is: **1**

(a) 1.2 cm **(b)** 4 cm

(c) 3 cm **(d)** 2 cm



Sol: Since DE //BC ⇒$\frac{AD}{DB} = \frac{AE}{EC}$ ⇒AE = 1 cm

Hence AC = AE + EC = 4 cm

Option (a) is not correct since AC ≠ AD

Option (b) is correct since AC = 4cm

Option (c) is not correct since AC ≠ EC

Option (d) is not correct since AC ≠ EC – AE

Suggestive Measures – While solving such type of questions students should:
- **Correctly apply BPT theorem**
- **Attentively note down what is asked in the question**

10. If Δ ABC ~ Δ DEF and ∠ A = 47°, ∠ E = 83°, then ∠ C is: **1**

(a) 47° **(b)** 50°

(c) 83° **(d)** 130°

Sol: Since Δ ABC ∽ Δ DEF ⇒ ∠ B = ∠ E ⇒∠ C = 50°

Option (a) is not correct since ∠ C ≠ ∠ A

Option (b) is correct since ∠ C = 50°

Option (c) is not correct since ∠ C ≠ ∠ E

Option (d) is not correct since ∠ C ≠ ∠ A + ∠ B

Suggestive Measures – While solving such type of questions students should:
- **Equate angles using concept of similarity of two triangles**
- **Find missing angle using angle sum property**

11. The value of sin 30° cos60° is: **1**

(a) $\frac{1}{4}$ **(b)** $\frac{\sqrt{3}}{2}$

(c) $\frac{\sqrt{3}}{4}$ **(d)**

Sol: $\sin 30° = \frac{1}{2}$ and $\cos 60° = \frac{1}{2} \Rightarrow \sin 30° \cos 60° = \frac{1}{4}$

Option (a) correct since $\sin 30° \cos 60° = \frac{1}{4}$

Option (b) is not correct since $\sin 60° = \frac{\sqrt{3}}{2}$

Option (c) is not correct since $\cos 30° \sin 30° = \frac{\sqrt{3}}{4}$

Option (d) is not correct since $\cos 0° = 1$

Suggestive Measures – While solving such type of questions students should • **Find correct values of trigonometric ratios at certain angles** • **Do proper calculation using correct formula**

12. The maximum number of tangents a circle can have: **1**

(a) 1 **(b)** 2

(c) 3 **(d)** infinitely many

Sol: Tangents can be drawn from a point outside the circle. There are numerous points outside the circle, so infinitely many tangents can be drawn to the circle.

Option (a) and (c) are incorrect since 1 and 3 are finite numbers.

Option (b) is not correct since it indicates the maximum number of tangents drawn from a single point outside the circle.

Option (d) is correct

Suggestive Measures – While solving such type of questions students should • **Attentively note down what is asked in the question** • **Keep in mind about the theorems based on tangents**

13. The shadow of a 5 m long stick is 2m long. At the same time, the length of the shadow of a 12.5 m high tree (in m) is: **1**

(a) 3 **(b)** 3.5

(c) 4.5 **(d)** 5

Sol: PQ is tree, AB is stick. BR is shadow of stick, QR is shadow of tree.

In Δ PQR and Δ ABR,

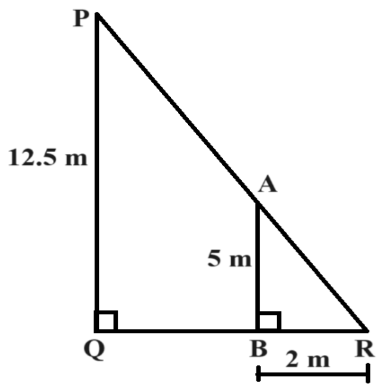
∠ PQR = ∠ ABR (each 90°)

∠ PRQ = ∠ ARB (common)

∴ Δ PQR ~ Δ ABR (AA Similarity)

$\frac{PQ}{AB} = \frac{QR}{BR}$ (CPCT)

(Corresponding parts of similar triangle are similar)



$\Rightarrow \frac{12.5}{5} = \frac{QR}{2}$

$\Rightarrow \frac{12.5 \times 2}{5} = QR$

$\Rightarrow$ QR= 5

Thus, shadow of tree is 5m

Option (a) is incorrect since QR ≠ 3

Option (b) is incorrect since QR ≠ 3.5

Option (c) is incorrect since QR ≠ 4.5

Option (d) is correct since QR = 5

Suggestive Measures – While attempting the question students should :

- **carefully note and draw the figure according to the information given in question**
- **know the concept of similarity of triangles and its application**
- **Perform accurate calculations using the correct values in the result of similarity.**

14. The value of ($\tan^2 45° - \cos^2 60°$) is: **1**

(a) $\frac{1}{2}$ **(b)** $\frac{1}{4}$

(c) $\frac{3}{4}$ **(d)** $\frac{3}{2}$

Sol: $\tan 45° = 1$ and $\cos 60° = \frac{1}{2}$

$\therefore (\tan^2 45° - \cos^2 60°) = [(1)^2 - (\frac{1}{2})^2] = 1 - \frac{1}{4} = \frac{4-1}{4} = \frac{3}{4}$

Option (a) incorrect since required value $\neq \frac{3}{4}$

Option (b) incorrect since required value $\neq \frac{3}{4}$

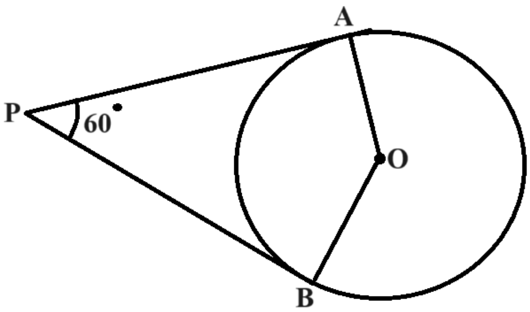
Option (c) is correct since required value = $\mathbf{\frac{3}{4}}$

Option (d) incorrect since required value $\neq \frac{3}{4}$

Suggestive Measures – While attempting the question students should

- **know correct values of trigonometric ratios at certain angles**
- **perform accurate calculations using the correct values**

15. In figure, if PA and PB are two tangents to a circle with centre O, such that $\angle$ APB = 60°, then $\angle$ AOP is equal to: **1**



(a) 120° **(b)** 100°

(c) 90° **(d)** 60°

Sol: The tangent at any point of a circle is perpendicular to the radius through the point of contact.

$\therefore \angle OAP = \angle OBP = 90°$

Also, the centre lies on the bisector of the angle between the two tangents.

So OP is the bisector of $\angle$ APB.

$\Rightarrow \angle OPA = \angle OPB = \frac{1}{2} \times \angle APB$

$= \frac{1}{2} \times \angle 60° = 30°$

Sum of the angles of a triangle is 180°.
∴ In Δ OAP, ∠ OAP + ∠ OPA + ∠ AOP = 180°
90° + 30° + ∠ AOP = 180°
120° + ∠AOP = 180°
∠ AOP = 180° – 120°
∠ AOP = 60°
Option (a) is incorrect since ∠ AOP ≠ 60°
Option (b) is incorrect since ∠ AOP ≠ 60°
Option (c) is incorrect since ∠ AOP ≠ 60°
Option (d) is correct since ∠ AOP = 60°

Suggestive Measures – While attempting the question students should:
- **carefully note the information given in figure and question**
- **know the theorems based on tangents and its application**

16. If P (E) = 0.96, then P (not E) is: **1**

(a) 4.0 **(b)** 0.4
(c) 0.04 **(d)** 0.004

Sol: The sum of the probabilities of all the elementary events of an experiment is 1.
∴ P (E) + P (not E) = 1
0.96 + P (not E) = 1
P (not E) = 1 – 0.96
P (not E) = 1.00 – 0.96
P (not E) = 0.04

Option (a) is incorrect since P (not E) ≠ 0.04
Option (b) is incorrect since P (not E) ≠ 0.04
Option (c) is correct since P (not E) = 0.04
Option (d) is incorrect since P (not E) ≠ 0.04

Suggestive Measures – While attempting the question students should:
- **carefully note the information given in question**
- **know the results of Probability**
- **perform accurate calculations using the correct values**

17. For the following distribution, the modal class is: **1**

Class Interval	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50
Frequency	5	7	6	8	4

(a) 10 – 20 **(b)** 20 – 30
(c) 30 – 40 **(d)** 40 – 50

Sol: The class interval with the maximum frequency is called the modal class.
Here maximum frequency is 8. The class interval corresponding to maximum frequency is 30 – 40.
Option (a) is incorrect since modal class ≠ 30 – 40
Option (b) is incorrect since modal class ≠ 30 – 40

Option (c) is correct since modal class = 30 – 40
Option (d) is incorrect since modal class ≠30 – 40

Suggestive Measures – While attempting the question students should:
• **carefully note the information given in question**
• **have the understanding of mode and modal class**

18. Curved surface area of a cylinder, whose radius is 3 cm and height 14 cm is: **1**

(a) 396 cm^2 **(b)** 264 cm^2
(c) 132 cm^2 **(d)** 42 cm^2

Sol: Here 'r' = 3 cm and 'h' = 14 cm.
Curved surface area of a cylinder = $2\pi rh$

$$= 2 \times \frac{22}{7} \times 3 \times 14$$
$$= 2 \times 22 \times 3 \times 2$$
$$= 264$$

Since the given dimensions are in cm, so the area will be measured in square cm (or cm^2)
Option (a) is incorrect since CSA ≠ 264 cm^2
Option (b) is correct since CSA = 264 cm^2
Option (c) is incorrect since CSA ≠ 264 cm^2
Option (d) is incorrect since CSA ≠ 264 cm^2

Suggestive Measures – While attempting the question students should:
• **carefully note the information given in question**
• **apply the correct formula**
• **perform accurate calculations using the correct values**
• **use appropriate units with answer**

DIRECTIONS: In the question number 19 and 20, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option out of the following:

(a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).
(b) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).
(c) Assertion (A) is true but Reason (R) is false.
(d) Assertion (A) is false but Reason (R) is true.

19. **Assertion (A):** The product of two consecutive positive integers is divisible by 2. **1**
Reason (R): The sum of exponents of prime factors in the prime factorisation of 196 is 4.

Sol. Among any two consecutive positive integers one is even and the other is odd and vice versa.

- Product of any number with an even number is always even.
- So the product of two consecutive positive integers will also be an even number
- Hence divisible by 2.
  Prime factorisation of 196 = $2 \times 2 \times 7 \times 7$
- Sum of exponents is 2 + 2 = 4.

- Reason doesn't explain anything about the product of two consecutive positive integers
  So the correct option is (b) - Both Assertion (A) and Reason (R) is true but Reason (R) is not the correct explanation of Assertion (A).

Suggestive Measures – While attempting the question students should:
• **Correlate the linkage between the statements given in the assertion and reason.**

20. **Assertion (A):** If 2 and 3 are the zeroes of a quadratic polynomial, then the polynomial is $x^2 - 5x + 6$. **1**

Reason (R): If α and β are the zeroes of a quadratic polynomial, then the polynomial is $x^2 - (\alpha + \beta)x + (\alpha \times \beta)$.

Sol: Let α and β be the zeroes of a quadratic polynomial. Also given that 2 and 3 are the zeroes of a quadratic polynomial. Suppose α = 2 and β = 3

- Sum of zeroes i.e. $(\alpha+\beta) = 2 + 3 = 5$
- Product of zeroes i.e. $(\alpha \times \beta) = 2 \times 3 = 6$
- Formula for finding a polynomial whose zeroes are known is $x^2 - (\alpha+\beta)\, x + (\alpha \times \beta)$
- Polynomial obtained $x^2 - 5x + 6$. The polynomial obtained is same as given in the Assertion (A).
- Reason (R) justifies the information given in the Assertion (A).
  So the correct option is (a) Both Assertion (A) and Reason (R) is true and Reason (R) is the correct explanation of Assertion (A).

Suggestive Measures – While attempting the question students should:
• **Correlate the linkage between the statements given in the assertion and reason.**

SECTION – B

Section –B consists of 5 questions of 2 marks each.

21. Find the zeroes of the quadratic polynomial $x^2 + 3x + 10$. **2**

Sol. $(x + 5)(x - 2)$ **1**

Zeroes are –5, 2 **1**

Suggestive Measures – While solving such type of questions students should know
• **To Factorise a polynomial by using identities or splitting middle term**
• **To equate the factors with zero and find zeroes.**
• **That a quadratic polynomial has maximum two zeroes.**

OR

If the zeroes of the polynomial $x^2 + 4x + 2a$ are α and $\frac{2}{\alpha}$, then find the value of 'a'.

Sol. $\alpha \times \frac{2}{\alpha} = 2a$ **1**

$2 = 2a$

$\Rightarrow$ a = 1 **1**

Suggestive Measures – While solving such type of questions students should know

- **that sum of zeroes =** $\frac{-b}{a}$
- **that product of zeroes =** $\frac{c}{a}$
- **the relation between coefficients of x^2, x and constant**

22. In △ ABC right angled at B, AB = 24 cm and BC = 7cm. Determine the value of sin C. **2**

Sol. In right triangle ABC, by Pythagoras theorem AC = 25 cm **1**

Sin C = $\frac{24}{25}$ **1**

Suggestive Measures - While solving such type of questions students should know the

- **Pythagoras theorem for finding Base, Height and hypotenuse in a right triangle**
- **Various Trigonometric ratios**

OR

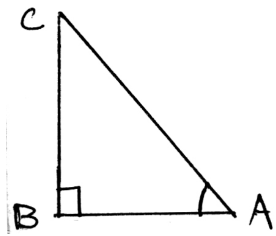
In △ ABC right angled at B, if 15 cot A = 8, then find the value of sin A.

Sol. Cot A = $\frac{8}{15} = \frac{AB}{BC}$

Let AB = 8x, BC = 15x, then by Pythagoras theorem

AC = 17x **1**

Sin C = $\frac{15}{17}$ **1**

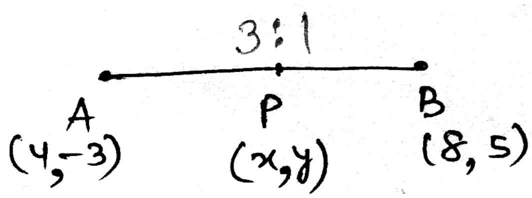


Suggestive Measures - While solving such type of questions students should know the

- **Pythagoras theorem for finding Base, Height and hypotenuse in a right triangle**
- **Various Trigonometric ratios**

23. Find the co-ordinates of the point which divides the line segment joining the points (4, – 3) and (8, 5) in the ratio 3:1 internally. **2**

Sol. Let point be P (x, y).



By section formula $x = \frac{3 \times 8 + 1 \times 4}{3+1}$, $y = \frac{3 \times 5 + 1 \times (-3)}{3+1}$ **1**

$\Rightarrow$ $x = 7$, $y = 3$

required point is (7, 3) **1**

Suggestive Measures – While solving such type of questions students should

- **Identify correct values of x_1, x_2, y_1, y_2 etc.**
- **Do proper calculation using correct formula**

24. Find the mean marks for the following distribution. **2**

Marks obtained	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50
Number of students	2	3	8	5	2

Sol.

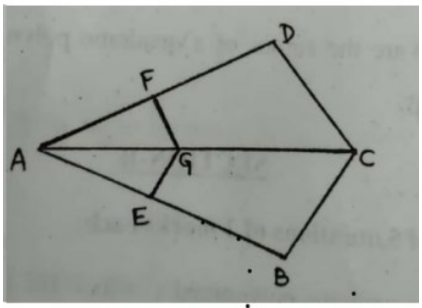
Marks Obtained	Number of students (f_i)	x_i	$f_i x_i$
0 – 10	2	5	10
10 – 20	3	15	45
20 – 30	8	25	200
30 – 40	5	35	175
40 – 50	2	45	90
Total	20		520

Correct table **1**

$\frac{\sum f_i x_i}{\sum f_i} = \frac{520}{20} = 26$ **1**

Suggestive Measures – While solving such type of questions students should
- **Apply correct formula**
- **Do proper calculation to find answer**

25. In the given figure GE∥BC, and GF∥CD, then prove that $\frac{AF}{FD} = \frac{AE}{EB}$. **2**



Sol. In Δ ADC, GF ∥CD,

$\therefore \frac{AF}{FD} = \frac{AG}{GC}$ by BPT …….. (i) **1**

In Δ ABC, GE∥CB,

$\therefore \frac{AE}{EB} = \frac{AG}{GC}$ by BPT …….. (ii)

From (i) and (ii)

$\frac{AF}{FD} = \frac{AE}{EB}$ **1**

Suggestive Measures – While attempting the question students should:
- **carefully note the information given in question**
- **apply BPT theorem correctly**
- **perform accurate calculations using the correct values**

SECTION – C

Section – C consists of 6 questions of 3 marks each.

26. Prove that : **3**

$$\frac{1+\tan^2 A}{1+\cot^2 A} = \sec^2 A - 1$$

Sol. We know that

$1 + \tan^2 A = \sec^2 A$ and $1 + \cot^2 A = \text{cosec}^2 A$ **1**

$$\text{LHS} = \frac{1+\tan^2 A}{1+\cot^2 A}$$

$$= \frac{\sec^2 A}{\text{cosec}^2 A}$$

$$= \frac{\frac{1}{\cos^2 A}}{\frac{1}{\sin^2 A}} = \frac{\sin^2 A}{\cos^2 A}$$ **1**

$= \tan^2 A$

$= \sec^2 A - 1 = \text{RHS}$ **1**

Suggestive Measures – While attempting the question students should:
- **know the basic trigonometric ratios and trigonometric identities**
- **know relationship between various t-ratios**
- **perform accurate calculations**

27. A die is thrown once. Find the probability of getting: **3**

(i) a number divisible by 3
(ii) a prime number
(iii) a number greater than 5

Sol. Possible outcome = 1, 2, 3, 4, 5 and 6.

(i) Numbers divisible by 3 are 3 and 6

P (number divisible by 3) = $\frac{2}{6} = \frac{1}{3}$ **1**

(ii) Prime Numbers are 2, 3 and 5.

P (prime numbers) = $\frac{3}{6} = \frac{1}{2}$ **1**

(iii) A number greater than 5 is 6

P (a number greater than 5) = $\frac{1}{6}$ **1**

Suggestive Measures – While attempting the question students should:
- **know the result of probability**
- **know about prime numbers and divisibility rules**
- **perform accurate calculations using the correct values**

28. Find the point on x-axis which is equidistant from the points A (2, – 5) and B (– 2, 9). **3**

Sol. Let the point P (x, 0) be equidistant from the points A (2, – 5) and B (– 2, 9)

Then PA = PB

Using distance formula,

$$\sqrt{(x-2)^2 + (0+2)^2} = \sqrt{(x+2)^2 + (0-9)^2}$$ **1**

$$\sqrt{(x)^2 - 4x + 4 + 4} = \sqrt{(x)^2 + 4x + 4 + 81}$$

$\sqrt{(x)^2 \ - 4x + 8} = \sqrt{(x)^2 \ + 4x + 85}$

Squaring both sides

$x^2 - 4x + 29 = x^2 + 4x + 85$ **1**

$-8x = 85 - 29$

$-8x = 56$

$x = -7$

The coordinate of point P is (– 7, 0) **1**

Suggestive Measures – While attempting the question students should:
• **carefully note the information given in question**
• **know the distance formula**
• **perform accurate calculations using the correct values**

OR

Prove that the points (3, 0), (6, 4) and (–1, 3) are the vertices of right angled isosceles triangle. Let A (3, 0), B (6, 4) and C (–1, 3) be the vertices of Δ ABC.

Sol. Using distance formula,

AB = $\sqrt{(3-6)^2 \ + (0-4)^2} = \sqrt{9+16} = \sqrt{25}$ = 5 units

BC = $\sqrt{(6+1)^2 \ + (4-3)^2} = \sqrt{49+1} = \sqrt{50} = 5\sqrt{2}$ units

AC = $\sqrt{(3+1)^2 \ + (0-3)^2} = \sqrt{16+9} = \sqrt{25}$ = 5 units **1**

We have AB = AC ……. (i)

$AB^2 = 25$, $BC^2 = 50$, and $AC^2 = 50$

Thus $AB^2 + BC^2 = 25 + 25 = 50 = BC^2$

∴ By converse of Pythagoras theorem

$AB^2 + BC^2 = BC^2$

⇒ ∠ A = 90° …….. (ii) **1**

From (i) and (ii)

ABC is a right angled isosceles triangle. **1**

Suggestive Measures - While attempting the question students should:
• **carefully note the information given in question**
• **know the distance formula**
• **have understanding of Pythagoras property**
• **have understanding of various type of triangles**
• **perform accurate calculations using the correct values**

29. Prove that $\sqrt{2}$ is an irrational number. **3**

Sol. To prove that $\sqrt{2}$ is an irrational number, we will use the contradiction method.

Let us assume that $\sqrt{2}$ is a rational number with p and q as co-prime integers and q ≠ 0

⇒ $\sqrt{2}$ = p/q $\mathbf{\frac{1}{2}}$

On squaring both sides we get,

⇒ $2q^2 = p^2$

⇒ Here, $2q^2$ is a multiple of 2 and hence it is even. Thus, p^2 is an even number. Therefore, p is also even.

So we can assume that p = 2x where x is an integer. $\frac{1}{2}$

By substituting this value of p in $2q^2 = p^2$, we get

$\Rightarrow 2q^2 = (2x)^2$

$\Rightarrow 2q^2 = 4x^2$ **1**

$\Rightarrow q^2 = 2x^2$

$\Rightarrow q^2$ is an even number. Therefore, q is also even.

Since p and q both are even numbers, they have 2 as a common multiple which means that p and q are not co-prime numbers as their HCF is 2. $\frac{1}{2}$

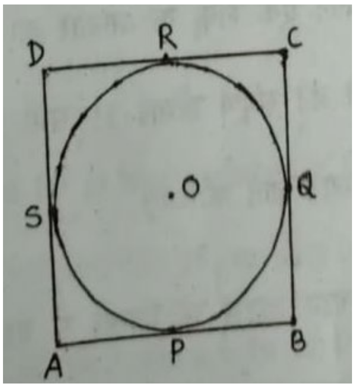
This leads to the contradiction that $\sqrt{2}$ is a rational number in the form of $\frac{p}{q}$ with "p and q both co-prime numbers" and $q \neq 0$.

Thus, $\sqrt{2}$ is an irrational number by the contradiction method. $\frac{1}{2}$

Suggestive Measures – While solving such type of questions students should know:

- **Difference between rational and irrational numbers**
- **Representation of rational number in $\frac{p}{q}$ form**
- **that if the square of a number is even the number is also even.**

30. A parallelogram ABCD is drawn to circumscribe a circle. Prove that ABCD is a rhombus. **3**



Sol. Given - A circle with centre O. A parallelogram ABCD touching the circle at points PQRS $\frac{1}{2}$

To prove - ABCD is a rhombus $\frac{1}{2}$

Proof - ABCD is a parallelogram. So AB = CD, AD = BC

Since length of tangents from an external point to a circle are equal

AP = AS………… (1)

BP = BQ………… (2)

CR = CQ ……. …..(3)

DR = DS………… (4)

Adding (1) + (2) + (3) + (4)

AP + BP + CR + DR = AS + BQ + CQ + DS **1**

AB + CD = AD + BC $\frac{1}{2}$

But 2 AB = 2 AD

AB = AD

Hence, ABCD is a Rhombus $\frac{1}{2}$

Suggestive Measures – While solving such type of questions students should know that:
• the length of tangents from an external point to a circle are equal • If pair of adjacent sides of a parallelogram are equal then it is a rhombus.

31. Find two numbers whose sum is 25 and product is 156. **3**

Sol. Let one number be x.

Then other number = $(25 - x)$ (assuming one and finding other by subtraction) $\frac{1}{2}$

According to question, $x(25 - x) = 156$ $\frac{1}{2}$

$\Rightarrow x^2 - 25x + 156 = 0$ $\frac{1}{2}$

$\Rightarrow (x - 13)\ (x - 13) = 0$ $\frac{1}{2}$

We get $x = 13$ or $x = 12$ $\frac{1}{2}$

Numbers are 12 and 13 $\frac{1}{2}$

Suggestive Measures – While solving such type of questions students should:
• Frame equation according to the given condition • Form factors by using middle term splitting/identities. • Solve the equation and finding unknowns

OR

Find two consecutive positive integers sum of whose squares is 421.

Sol. Let two consecutive positive integers be x, $x + 1$ $\frac{1}{2}$

According to question, $x^2 + (x+ 1)^2 = 421$ $\frac{1}{2}$

$x^2 + x - 210 = 0$ $\frac{1}{2}$

$(x + 15)\ (x - 14) = 0$ $\frac{1}{2}$

We get $x = -15$ which is not possible, so $x = 14$ $\frac{1}{2}$

Numbers are 14 and 15 $\frac{1}{2}$

Suggestive Measures – While solving such type of questions students should:
• Frame equation according to the given condition • Form factors by using middle term splitting/identities. • Solve the equation and finding unknowns

SECTION – D

Section – D consists of 4 questions of 5 marks each.

32. Prove that if a line is drawn parallel to one side of a triangle to intersect the other two sides in distinct points, then this line divides other two sides in the same ratio. **5**

Sol. Drawing correct figure **1**

Writing statement, Given, To Prove and Construction **1**

Steps to prove the theorem **3**

OR

The diagonals of a quadrilateral ABCD intersects each other at point O such that $\frac{AO}{BO} = \frac{CO}{DO}$.
Prove that ABCD is a trapezium.

Sol. Drawing correct figure **1**

Writing statement, Given, To Prove and Construction **1**

Correct proof **3**

Suggestive Measures – Theorems are definite and there is fixed pattern to prove the theorem. So, students should keep in mind the steps to arrive at the proof of the theorem.

33. Find the 31st term of an A.P whose 11th term is 38 and 16th term is 73. Also find the sum of first 10 terms of this A.P. **5**

Sol. $a_{11} = 38 \Rightarrow a + 10d = 38$ ……………. (1) $\frac{1}{2}$

$a_{16} = 73 \Rightarrow a + 15d = 73$ ………….. (2) $\frac{1}{2}$

Solving (1) and (2) we get

$a = -32$ and $d = 7$ $\frac{1}{2} + \frac{1}{2}$

Now $a_{31} = a + 30d = -32 + (30 \times 7) = 178$ **1**

Further $S_{10} = \frac{10}{2}[2 \times (-32) + 9 \times 7]$ **1**

$S_{10} = -5$ **1**

Suggestive Measures – While solving such type of questions students should: • **Be aware if question is about terms of AP or sum of terms of AP** • **Solve the equation and find unknown**

34. A toy is in the form of a cone of radius 7 cm mounted on a hemisphere of same radius. The total height of the toy is 31 cm. Find the cost of painting the toy at the rate of ₹ 5 per 100 cm^2. **5**

Sol. Height of cone 'h'= 31 – 7 = 24 cm

Slant height 'l' = $\sqrt{7^2 + 24^2} = 25$ cm **1**

Surface area of cone = $\frac{22}{7} \times 7 \times 25 = 550$ cm^2 **1**

Surface area of hemisphere = $2 \times \frac{22}{7} \times 7 \times 7 = 308$ cm^2 **1**

Total surface area of toy = (550 + 308) cm^2 = 858 cm^2 **1**

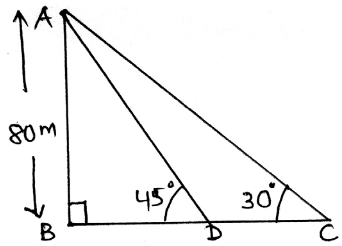
Cost of painting 100 cm^2 = ₹ 5

∴ Cost of painting toy = ₹ $\frac{5}{100} \times 858$ = ₹ 42.90 **1**

Suggestive Measures – While solving such type of questions students should:
• Draw a figure according to information given in question • Identify which part of solid will get hidden while combining • Perform accurate calculations using correct values

35. As observed from the top of 80 m high lighthouse from the sea level, the angles of depressions of two ships are 30° and 45°. If one ship is exactly behind the other on the same side of lighthouse, find the distance between the two ships (Take $\sqrt{3}$ = 1.73) **5**

Sol. Correct figure **1**



Let AB be the light house and two ships are at C and D.

In right angled triangle ABC

$\tan 45° = \frac{80}{BD} \Rightarrow BD = 80$ m **1**

In right angled triangle ABC

$\tan 30° = \frac{80}{BC} \Rightarrow BC = 80\sqrt{3}$ m **1**

$CD = BC - BD = 80(\sqrt{3} - 1)$ m **1**

$= 80\ (1.73 - 1) = 58.4$ m

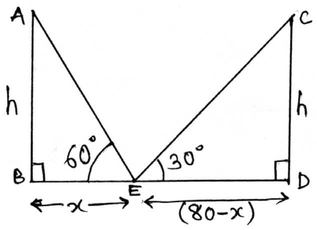
Distance between two ships = 58.4 m **1**

Suggestive Measures – While solving such type of questions students should:
• Draw figure according to information given in question • Identify angle of elevation and depression • Apply correct trigonometric ratios and calculate

OR

Two poles of equal height are standing opposite each other on either side of the road, which is 80 m wide. From a point between them on the road, the angles of elevation of the top of the poles are 60° and 30° respectively. Find the heights of the poles and the distance of the point from the poles.

Sol. Correct figure **1**



Let AB and CD be the two poles of height 'h' m each and E is the point on the road.

Let BE = x m then DE = $(80 - x)$ m **$\frac{1}{2}$**

In right angled triangle ABE

$\tan 60° = \frac{h}{x} \Rightarrow h = \sqrt{3}x$ ....(1) **1**

In right angled triangle CDE

$\tan 30° = \frac{h}{80 - x} \Rightarrow h = \frac{80-x}{\sqrt{3}}$ ....(2) **1**

From (1) and (2) we get $x = 20$ m **$\frac{1}{2}$**

Put $x = 20$ in (1) we get h = $20\sqrt{3}$ m $\frac{1}{2}$

So height of pole 20 m and distances of the point from the poles are 20 m and 60 m $\frac{1}{2}$

Suggestive Measures – While solving such type of questions students should:
• **Draw figure according to information given in question** • **Identify angle of elevation and depression** • **Apply correct trigonometric ratios and calculate**

SECTION – E

Section – E consists of 3 case based questions of 4 marks each.

36. An organization held a test to provide scholarships to brilliant students of class X. Students securing 60% or more than 60% marks in this test will be awarded a scholarship of amount ₹ 2000 each for one year.

The marks obtained by the students of a school are given below:

Marks Obtained	0 – 20	20 – 40	40 – 60	60 - 80	80 – 100
Number of Students	5	8	11	4	2

Based on the above information answer the following questions:

(i) Find the amount of scholarship the school will get from the organisation. **1**

Sol. For finding number of students eligible for scholarship i.e. 6 students $\frac{1}{2}$

For finding scholarship ₹ 2000 × 6 = ₹ 12000 $\frac{1}{2}$

(ii) Write the upper limit of modal class. **1**

Sol. For finding modal class i.e. 40 – 60 $\frac{1}{2}$

Upper limit of modal class i.e. 60 $\frac{1}{2}$

(iii) Find the mode of the marks obtained by the students **2**

Sol. Mode = $40 + \left(\frac{11-8}{2\times 11-8-4}\right) \times 20$ **1**

$= 46$ **1**

Suggestive Measures – While solving such type of questions students should:
• **Identify Modal class, median class** • **Identify Upper and lower limits of class** • **Know formula of mean, mode, median**

OR

Find the median of marks obtained by the students

Sol.

C.I	f_1	c.f.
0 – 20	5	5
20 – 40	8	13
40 – 60	11	24
60 – 80	4	28
80 – 100	2	30

Median class = 40 – 60, l = 40, f = 11, c.f. = 30 **1**

Median = $40 + \left(\frac{15-13}{11}\right) \times 20$ **$\frac{1}{2}$**

= 43.6 marks (approx) **$\frac{1}{2}$**

Suggestive Measures – While solving such type of questions students should:

- **How to find cumulative frequency (c.f.)**
- **Identify Upper and lower limits of class**
- **Know formula of mean, mode, median**

37. Priyanka went to a stationary shop and purchased 3 pencils and 2 erasers for ₹ 19. On seeing new variety of pencils and erasers, her friend Ritu also bought 5 pencils and 3 erasers of the same kind for ₹ 31.

Based on the above information, answer the following questions:

(i) Write the linear equations in two variables for both the situations. **1**

Sol. Let cost of 1 pencil = ₹ x and cost of 1 eraser = ₹ y

ATQ $3x + 2y = 19$ and $5x + 3y = 31$ **1**

(ii) Find the cost of 1 pencil. **1**

Sol. $3x + 2y = 19$ (i) × 3

and $5x + 3y = 31$ (ii) × 2

We get $9x + 6y = 57$

$10x + 6y = 62$

(–) (–) (–)

$-x = -5 \Rightarrow x = 5$

Cost of one pencil is ₹ 5 **1**

(iii) Find the cost of 2 pencils and 5 erasers. **2**

Sol. Putting value of $x = 5$ in $3x + 2y = 19$, we get

$3(5) + 2y = 19$

$2y = 19 - 5 \Rightarrow y = \frac{4}{2} = 2$

Cost of one eraser = ₹ 2 **1**

Now, cost of 2 pencils and 5 erasers = $2x + 5y$

$= 2(5) + 5(2) = 20$

Thus, cost of 2 pencils and 5 erasers = ₹ 20 **1**

OR

What is expensive between pencil and eraser and by how much?

Sol. Putting value of $x = 5$ in $3x + 2y = 19$, we get

$3(5) + 2y = 19$

$2y = 19 - 5$

$y = \frac{4}{2} = 2$

Cost of one eraser = ₹ 2 **1**

And Cost of one pencil is ₹ 5

$\therefore$ Pencil is expensive than eraser.

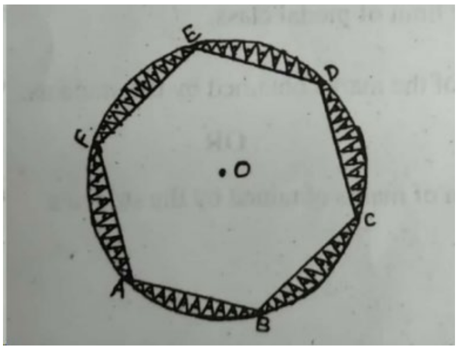
Difference in their cost = ₹ (5 –2) = ₹ 3

Thus pencil is expensive by ₹ 3 **1**

Suggestive Measures - While attempting the question students should:

- **carefully note the information given in question**
- **frame equation according to the given information**
- **solve the equation to find the unknown quantities**
- **perform accurate calculations using the correct values**

38. Meera bought a new house. To decorate it, she purchased some items from the market. One of them was a round table cover. It had six equal designs as shown in the figure. The radius of the round table cover is 35 cm.



Based on the above information, answer the following questions:

(i) Find the measure of the angle subtended by a chord at the centre. **1**

Sol. $\frac{360^\circ}{6} = 60^\circ$ **1**

(ii) Find the area of sector AOC. **1**

Sol. Area of sector AOC = $\frac{360^\circ}{6} \times \frac{22}{7} \times 35 \times 35 = \frac{3850}{3}$ cm^2 **1**

(iii) Find the area of major sector AOC. **2**

Sol. Area of major sector AOC = Area of circle – Area of sector AOC

$= \pi \times (35)^2 - \frac{3850}{3}$ **1**

$= \frac{7700}{3}$ cm^2 **1**

OR

Find the area of one design. (Take $\sqrt{3}$ =1.7)

Sol. Area of 1 design (Area of one segment) = Area of sector – Area of Δ DAB

$$= \frac{1925}{3} - \frac{1}{2} \times 35 \times 35 \times \sin 60° \quad \textbf{1}$$

$$= 121 \text{ cm}^2 \text{ (approx.)} \quad \textbf{1}$$

Suggestive Measures – While solving such type of questions students should:
• **Relate figure to the given condition according to question**
• **Identify sector/segment in the given figure**
• **Apply required formula and calculate**