COMPREHENSIVE ASSESSMENT FEEDBACK
PRE-BOARD EXAMINATION (2024-25)
CLASS: X
SUBJECT: MATHEMATICS (241)

SECTION-A

1. A bag contains 5 red balls and 3 green balls. One ball is drawn at random. The probability of getting red ball is:

(a) $\frac{3}{8}$ **(b) $\frac{5}{8}$** **(c) $\frac{5}{3}$** **(d) $\frac{3}{5}$**

Sol: Number of red balls = 3
Number of green balls = 5
Total no. of balls = 3+5=8 $\Rightarrow$ P (red ball) = $\frac{5}{8}$

(a) In option (a) we have 3 in the numerator which is number of green balls so it is incorrect option.
(b) In option (b) we have 5 in the numerator which is number of green balls and 8 in the denominator which is total number of balls so it is correct option.
(c) In the option (c) we have 3 in the denominator which is incorrect because total number of balls is 8.
(d) In the option (d) we have 3 in numerator which is the total number of green balls and 5 in the denominator which is incorrect because total number of balls is 8.

Suggestive Measures–While attempting the question students should:
- **know the results of probability**
- **perform accurate calculations using the correct values**

2. The exponent of 2 in the prime factorisation of 96 is :

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

Sol: $96 = 2^5 \times 3$

(a) The option (a) 2 is incorrect as if 96 is divided by 2^2 we get 24 which still has the exponent of 2 in its prime factorisation .
(b) The option (b) 3 is incorrect as if 96 is divided by 2^3we get 12 which still has the exponent of 2 in its prime factorisation .
(c) The option (c) 4 is incorrect as if 96 is divided by32^4we get 6 which still has the exponent of 2 in its prime factorisation .
(d) The option (d) 5 is correct as if 96 is divided by 2^5we get 3 which has no exponent of 2 in its prime factorisation.

Suggestive Measures– While solving such type of questions students should:
- **know exponents and powers**
- **have understanding of prime factorization**

3. The discriminant of quadratic equation x^2- 4x+3 =0 is:

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

Sol: D = $b^2 - 4ac = (-4)^2 - 4 \times 1 \times 3 = 16 - 12 = 4$

Since D = 4 only option **(c) 4** is correct and other options are incorrect.

Suggestive Measures– While solving such type of questions students should:
- **know discriminant of quadratic equation**
- **understand coefficient of terms of quadratic equations**

4. How many tangents can a circle have?

(a) 0 **(b) 1** **(c) 2** **(d) infinitely many**

Sol: Since a circle is a collection of infinite points so tangent can be drawn from a fixed outside point on it on any infinite number of points. Hence (d) infinitely many is the only correct answer**.**

Suggestive Measures– While solving such type of questions students should:
- **be aware of properties of circle and tangents to a circle**

5. If P(E) = 0.8 ,then the probability of 'not E" is:

(a) 0.2 **(b) 0.8** **(c) 1** **(d) 0**

Sol: We know P(E) + P (not E) = 1, so P (not E) = 1 - 0.8 = 0.2

(a) The option (a) 0. 2 is correct as P (not E) = 1 - 0.8 = 0.2

(b) The option (b) 0.8 is incorrect as it is P(E) but we require P (not E)

(c) The option (c) 1 is incorrect as it is not sure event.

(d) The option (d) 0 is incorrect as it is not impossible event.

Suggestive Measures –While solving such type of questions students should:
- **know the results of Probability**
- **perform accurate calculations using the correct values**

6. If α and β are the zeroes of the polynomial $2x^2$+6x+3 then α + β is:

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

Sol: a =2, b = 6, c = 3, $\alpha + \beta = \frac{-b}{a} = \frac{-6}{2} = -3$

Since $\frac{-b}{a}$ = -3 so the only correct option is **(c)** -3 and all other options are incorrect.

Suggestive Measures–While solving such type of questions students should:
- **know the sum of zeroes and product of zeroes**
- **have the understanding of standard form of polynomial**

7. The area of the sector of angle θ is:

(a) $\frac{\theta}{180^\circ} \times 2\pi r$ **(b)** $\frac{\theta}{180^\circ} \times \pi r^2$

(c) $\frac{\theta}{360^\circ} \times 2\pi r$ **(d)** $\frac{\theta}{360^\circ} \times \pi r^2$

Sol: Since the area of whole circle is πr^2 so the area of the sector of angle θ is $\frac{\theta}{360^\circ} \times \pi r^2$ so the only correct option is (d) $\frac{\theta}{360^\circ} \times \pi r^2$ and rest options are incorrect.

Suggestive Measures – While solving such type of questions students should:
- **be aware how to find the area of sector of a circle**

8. Which of the following has 2 as root?

(a) $x^2-4 = 0$ **(b)**$x^2+4 = 0$ **(c)** $x^2+3x-12 = 0$ **(d))** $3x^2-6x-2 = 0$

Sol: If 2 is the root of any equation it must satisfy the equation $x^2-4 = 0$

putting x = 2 in the equation, we get $2^2 – 4 = 0$

(a) The option (a) $x^2-4 = 0$ is the only correct as when we put 2 in the equation it satisfies the equation.
(b) The option (b) $x^2+4 = 0$ is incorrect as when we put 2 in the equation it doesn't satisfy the equation.
(c) The option (c) $x^2+3x-12 = 0$ is incorrect as when we put 2 in the equation it doesn't satisfy the equation.
(d) The option (d)) $3x^2-6x-2 = 0$ is incorrect as when we put 2 in the equation it doesn't satisfy the equation.

Suggestive Measures – While solving such type of questions students should:
- **have the understanding of quadratic equation**
- **know the roots of the equation**

9. The solution of pair of linear equation x + y = 1 and x – y = 5 is:

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

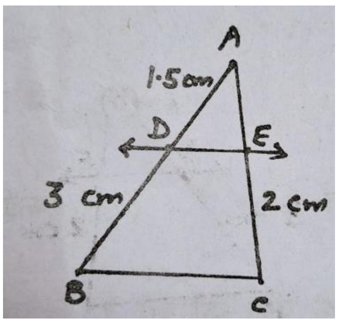
Sol: On adding linear equation x + y = 1 and x – y = 5 we get 2x = 6 so we get x =3 and y=-2

(a) The option **(-3,2)**is incorrect as when we put x = -3 and y =2 in the given equations it doesn't satisfy both the given equations.
(b) The option **(3,-2)**is correct as when we put x = 3 and y =-2 in the given equations it satisfy both the given equations.
(c) The option **(3,2)** is incorrect as when we put x = 3 and y =2 in the given equations it doesn't satisfy both the given equations.
(d) The option **(-3,-2)** is incorrect as when we put x = -3 and y = -2 in the given equations it doesn't satisfy both the given equations.

Suggestive Measures – While solving such type of questions students should:
- **be aware how to solve linear equations in two variables**
- **perform correct calculations**

10. In given figure DE||BC , AE = -------

(a) 1.5cm **(b) 2 cm** **(c) 3 cm** **(d) 1cm**



Sol: Since DE||BC, using BPT $\frac{AD}{AB} = \frac{AE}{AC}$

⇨ $\frac{AD}{AB} = \frac{AE}{AE+EC}$

⇨ $\frac{1.5}{4,5} = \frac{AE}{AE+2}$

⇨ AE = 1cm

So only correct option is **(**d) 1 cm and all other options are incorrect.

Suggestive Measures – While solving such type of questions students should:
- **have the understanding of ratio and proportion**
- **know how to apply BPT**
- **perform correct calculations**

11. **The class mark of interval of 25-40 is:**

(a)65 (b) 65.5 (c) 32 (d) 32.5

Sol: The class mark of a class-interval = $\frac{lower\ limit + upper\ limit}{2} = \frac{25+40}{2} = \frac{65}{2} = 32.5$

Clearly, (d) is the correct option.

Suggestive Measures - While solving such type of questions students should:
- **know about the lower and upper limits of a class interval**
- **know the correct formula of calculating the class mark**

12. **A quadratic polynomial whose sum of zeroes is 4 and product of zeroes is 1 will be:**

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

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

Sol: Given: Sum of zeroes = 4 and product of zeroes = 1

Now, let the required polynomial in variable x be p(x). Then,

p(x) = x^2 – (Sum of zeroes)x + Product of zeroes

= x^2 – (4)x + 1

p(x) = x^2 – 4x + 1

Clearly, (b) is the correct option.

Suggestive Measures - While solving such type of questions students should:
- **have clear understanding whether the given numbers are zeroes or sum and product of zeroes of a polynomial**
- **know the formula of writing the polynomial when sum and product of its zeroes are given**

13. **If sin A = $\frac{5}{13}$, then value of cos A will be:**

(a) $\frac{12}{13}$ (b) $\frac{5}{12}$ (c) $\frac{12}{5}$ (d) $\frac{13}{12}$

Sol: sin A = $\frac{5}{13} = \frac{P}{H}$ (Given)

On applying Pythagoras theorem, we have: $H^2 = P^2 + B^2$

$\Rightarrow 13^2 = 5^2 + B^2$

$\Rightarrow$ 144 = B^2 $\Rightarrow$ B = 12

Now, cos A = $\frac{B}{H} = \frac{12}{13}$ **So, the correct option is (a).**

Suggestive Measures - While solving such type of questions students should:
- **know how to find the missing side of a right triangle using Pythagoras theorem.**
- **know the various trigonometric ratios.**

14. **The surface area and volume of a sphere are numerically equal, then the diameter of sphere is:**

(a) 3 units (b) 2 units (c) 1 unit (d) 6 units

Sol: Given, surface area of sphere = volume of sphere

$\Rightarrow 4\pi r^2 = \frac{4}{3}\pi r^3$

$\Rightarrow$ r = 3 **So, (a) is the correct option.**

Suggestive Measures - While solving such type of questions students should:
- **know the correct formulae of surface areas and volumes of the solid figure**
- **know how to translate the given information into a mathematical equation**

15. The pair of linear equations 2x + y = 3 and 4x + 2y = 6 has:

(a) One solution **(b) Two solutions**

(c) Infinitely many solutions **(d) No solution**

Sol: The given equations are: 2x + y = 3 and 4x + 2y = 6.

Writing them in the standard form, we get 2x + y – 3 = 0 and 4x + 2y – 6 = 0.

Here, $a_1 = 2$, $b_1 = 1$, $c_1 = -3$ and $a_2 = 4$, $b_2 = 2$, $c_2 = -6$

Now, $\frac{a_1}{a_2} = \frac{2}{4} = \frac{1}{2}, \frac{b_1}{b_2} = \frac{1}{2}$ and $\frac{c_1}{c_2} = \frac{-3}{-6} = \frac{1}{2}$

Clearly, $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$ ⇒ infinitely many solutions.

Therefore, the correct option is (c).

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

- **know the how to write given pair of linear equations in standard form**
- **know how to calculate the ratios $\frac{a_1}{a_2}, \frac{b_1}{b_2}, \frac{c_1}{c_2}$ from the standard form**
- **be aware of the conditions of unique solution, no solution or infinitely many solutions**

16. The distance between the points (7, -5) and (3, -1) is:

(a) $\sqrt{52}$ **(b) $\sqrt{32}$** **(c) $\sqrt{10}$** **(d) $\sqrt{8}$**

Sol: Here $x_1 = 7$, $x_2 = 3$, $y_1 = -5$ and $y_2 = -1$

To find the distance between the two points, we have to apply distance formula,

$$\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} = \sqrt{(3-7)^2 + (-1-(-5))^2} = \sqrt{32} \text{ units}$$

Therefore, the correct option is (b).

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

- **know the how to write x_1, x_2, y_1 and y_2 from the given points**
- **know the distance formula correctly**

17. In a circle of radius 14 cm, an arc subtends an angle of 60° the centre. The length of the arc is:

(a) $\frac{22}{3}$ cm **(b) $\frac{44}{3}$ cm** **(c) $\frac{77}{3}$ cm** **(d) $\frac{308}{3}$ cm**

Sol: Given: r = 14 cm and θ = 60°

The length of arc of a circle is given by $\frac{\theta}{360^o} \times 2\pi r^2$

$$= \frac{60^o}{360^o} \times 2 \times \frac{22}{7} \times 14 = \frac{44}{3} \text{ cm}$$

So, the correct option is (b).

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

- **know the correct formula for calculating the length of arc of a circle**

18. If distance between two parallel tangents of a circle is 12 cm, then the radius of the circle is:

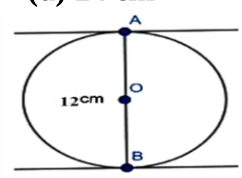
(a) 6 cm **(b) 12 cm** **(c) 3 cm** **(d) 24 cm**

Sol: If two tangents are parallel, then the line segment joining the points of contact pass through the centre of the circle.

Therefore, the diameter of the circle = 12 cm

Hence, the radius of the circle = 6 cm.

So, option (a) is the correct option.



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

- **know the concept of the parallel tangents of a circle**
- **know that the radius is half of the diameter**

Direction for question number 19 and 20:

There is one Assertion (A) and one Reason (R). Choose the correct answer of these questions from the four options (a), (b), (c) and (d) given below:

(a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the assertion (A).
(b) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of the 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 probability of getting a prime number when a dice thrown once is $\frac{1}{2}$.**
Reason (R): On the face of a dice, prime numbers are 2, 3 and 5.

Sol: A die has 6 faces each with a number 1, 2, 3, 4, 5 and 6.
Clearly, 2, 3 and 5 are prime numbers.
Therefore, Probability of getting a prime number = $\frac{3}{6} = \frac{1}{2}$
So, the assertion is true as well as reason is true.
Therefore, (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the assertion (A) is the correct option.

Suggestive Measures – While solving such type of questions students should:
- **Be aware about the prime numbers**
- **know the results of probability**
- **perform accurate calculations using the correct values**

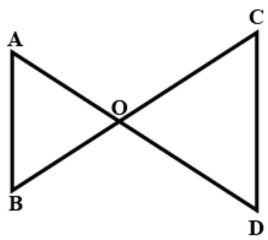
20. **Assertion (A): The value of $7\sin^2A + 7\cos^2A - 7$ is 0.**
Reason (R): $\sin^2A - \cos^2A = 1$

Sol: $7\sin^2A + 7\cos^2A - 7 = 7(\sin^2A + \cos^2A) - 7 = 7(1) - 7 = 0$
Therefore, the assertion is true.
And, $\sin^2A - \cos^2A = 1$, which is wrong.
Therefore, Reason is false.
So, **(c) Assertion (A) is true but reason (R) is false is the correct option.**

Suggestive Measures – While solving such type of questions students should:
- **know the basic trigonometric identities**
- **perform accurate calculations**

SECTION-B

21. In given figure, if AB || CD, prove that Δ AOB ~Δ DOC.
If Δ ABC ~Δ DEF, ∠A = 45° and ∠F = 56°, then find ∠B.



Sol: In ΔAOB and ΔDOC,
∠ABO = ∠DCO (Alternate interior angles)
∠AOB = ∠DOC (Vertically opposite angles)
By AA similarity criterion, ΔAOB ~ ΔDOC
∠C = ∠F = 56° (By CPST)
∠A + ∠B + ∠C = 180° (By Angle sum property of triangle)
⇒ ∠B = 79°

Suggestive Measures – While solving such type of questions students should:
- **know how to prove that two given triangles are similar**
- **know about the various similarity criteria**
- **know about the angle sum property of triangle**

22. Find HCF of 26 and 65 by the prime factorization method.

Sol: The prime factorisation of 26 and 65 is given by:

$26 = 2 \times 13$ and $65 = 5 \times 13$

Common prime factors of 26 and 65 are 13

Hence, HCF (26, 91) = 13

Suggestive Measures – While solving such type of questions students should:
- **be aware about the prime factorization of composite numbers**
- **know how to find how to find HCF of numbers with the help of prime factors**

23. A lot of 30 bulbs contain 5 defective ones. One bulb is drawn at random from the lot. What is the probability that the bulb drawn is good one?

Sol: It is given that the total number of bulbs in the lot = 30

number of defective bulbs = 5

Therefore, the number of good bulbs = 30 – 5 = 25

Now, as we know, Probability of an event = $\frac{\text{Number of favourable outcomes}}{\text{Total Number of outcomes}}$

$\Rightarrow$ P(bulb drawn is good) = $\frac{25}{30} = \frac{5}{6}$

Suggestive Measures – While solving such type of questions students should:
- **know the formula of calculating the probability of an event**
- **be aware of the fact that probability of an event cannot be greater than 1**

24. Find the value of $2\tan^2 45^\circ + \sin^2 60^\circ - \cos^2 30^\circ$.

Sol: $2\tan^2 45^\circ + \sin^2 60^\circ - \cos^2 30^\circ = 2(1)^2 + \left(\frac{\sqrt{3}}{2}\right)^2 - \left(\frac{\sqrt{3}}{2}\right)^2 = 2$

OR

If $\tan(A + B) = \sqrt{3}$ and $\angle A = 45^\circ$, then find the value of $\angle B$. $0^\circ < A + B \leq 90^\circ$, and A>B.

Sol: $\tan(A + B) = \sqrt{3} \Rightarrow \tan(A+B) = \tan 60^\circ \Rightarrow A+B = 60^\circ$

$\Rightarrow B = 60^\circ - 45^\circ = 15^\circ$

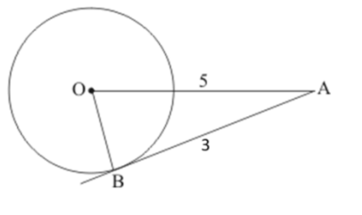
Suggestive Measures – While solving such type of questions students should:
- **know the value of trigonometric ratios for the various standard angles ($0^\circ, 30^\circ, 45^\circ, 60^\circ$ and 90°)**
- **perform accurate calculations**

25. The length of a tangent from a point P at a distance 5 cm from the centre of the circle is 3 cm. Find the radius of the circle.

Sol: Let O be the center of the circle and B be the point of contact.

We know that the radius of the circle will be perpendicular to the tangent at the point of contact.

Therefore, we have ΔOBA as a right triangle.



$\Rightarrow OB = \sqrt{5^2 - 3^2}$ (Pythagoras Theorem)

$\Rightarrow OB = 4$ cm

Therefore, radius of the circle is 4 cm.

Suggestive Measures – While solving such type of questions students should:
- **know that the radius of the circle will be perpendicular to the tangent at the point of contact**
- **know how to apply Pythagoras theorem**

SECTION-C

26. Find the value of K for which the quadratic equation $3x^2 + Kx + 3 = 0$ has two equal roots.

Sol: $3x^2 + Kx + 3 = 0$ is a quadratic equation in the standard form $\mathbf{ax^2 + bx + c = 0}$,

Here, a = 3, b = K, c = 3

For equal roots, D = 0 $\Rightarrow b^2 - 4ac = 0$

$\Rightarrow K^2 - 4(3)(3) = 0$

$\Rightarrow K^2 - 36 = 0 \Rightarrow (K - 6)(K + 6) = 0$

$\Rightarrow K = 6$ or $K = -6$

OR

Find the roots of the quadratic equation $2x^2 + 5x + 3 = 0$ by factorization.

Sol: $2x^2 + 5x + 3 = 0 \Rightarrow 2x^2 + 2x + 3x + 3 = 0$

$\Rightarrow 2x(x + 1) + 3(x + 1) = 0$

$\Rightarrow (2x + 3)(x + 1) = 0$

$\Rightarrow x = -1$ or $x = -\frac{3}{2}$

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

- **know how to write a given quadratic equation in the standard form and find the coefficients of its each term**
- **be aware about the relation between the nature of roots of a quadratic equation and its discriminant**
- **know how to factorize a quadratic polynomial**

27. Prove that $\sqrt{2}$ is an irrational number.

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

$\Rightarrow \sqrt{2} = p/q$

On squaring both sides we get $2q^2 = p^2$

$\Rightarrow$ 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.

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

$2q^2 = (2x)^2 \Rightarrow 2q^2 = 4x^2$

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

$\Rightarrow q^2$ 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.

This leads to the contradiction that root 2 is a rational number in the form of 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.

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

- **know the concepts such as rational number, irrational number, co-prime integers, HCF and contradiction method**
- **know that if p^2 is an even number, then, p is also even**

28. The length of the minute hand of a clock is 14 cm. Find the area swept by the minute hand in 15 minutes.

Sol: Minute hand completes full circle degree in 60 minutes.

Angle swept by minute hand in 60 minutes =360°

Angle swept by the minute hand in 15 minutes = $\frac{60 \times 15}{360°} = 90°$ ⇒ θ=90°

Length of minute hand = r = 14 cm

Area swept by minute hand in 15 minutes = Area of sector = $\frac{\theta}{360°} \times \pi \times r^2$

Area swept by the minute hand in 15 minutes = $\frac{90°}{360°} \times \frac{22}{7} \times (14)^2$ =14 × 616 =154 cm^2

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

- **know how to find the central angle when minute hand moves certain amount of time**
- **know that the length of the minute hand is equal to the radius of the circle**
- **know the correct formula of calculating the area of sector of a circle**

29. Find the zeroes of the polynomial x^2 – 9 and verify the relationship between the zeroes and the coefficients.

Sol: Let p(x) = x^2– 9 is a quadratic polynomial in standard form $ax^2 + bx + c$, where a = 1, b = 0 and c = – 9.

Now p(x) = (x+3) (x – 3) ⇒ α = –3, β= 3

Sum of zeroes = α+ β= –3 + 3 = 0 and $-\frac{b}{a} = -\frac{0}{1} = 0$ ⇒ α+ β= $-\frac{b}{a}$

Product of zeroes = αβ= (–3) (3) = –9 and $\frac{c}{a} = \frac{-9}{1} = -9$ ⇒ αβ= $\frac{c}{a}$

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

- **know how to write a given polynomial in the standard form and find the coefficients of its each term**
- **know the method of factorization of given polynomial to find its zeroes.**
- **know the relationship between zeroes and coefficients of a polynomial.**

30. Prove that: $\frac{2cos^3A - cosA}{sinA - 2sin^3A} = cot\ A$

Sol: LHS $= \frac{2cos^3A - cosA}{sinA - 2sin^3A} = \frac{\cos A(2\cos^2 A - 1)}{\sin A(1 - 2\sin^2 A)}$

$= \frac{\cos A[2(1 - \sin^2 A) - 1]}{\sin A\ (1 - 2\sin^2 A)} = \frac{\cos A(1 - 2\sin^2 A)}{\sin A(1 - 2\sin^2 A)}$

$= \frac{\cos A}{\sin A}$ = cot A = RHS

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

- **know the basic trigonometric ratios and trigonometric identities.**
- **know relationship between various t-ratios.**

31. In given figure, a quadrilateral PQRS is drawn to circumscribe a circle. Prove that PQ + RS = PS + QR.

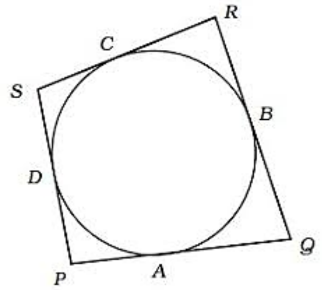
Sol: We know that the lengths of the two tangents drawn from an external point to a circle are equal. Therefore,

QA = QB ...(i) (tangents from point Q)

PA = PD ...(ii) (tangents from point P)

RC = RB ...(iii) (tangents from point R)

SC = SD ...(iv) (tangents from point S)



By adding (i), (ii), (iii), (iv), we get

(QA + PA) + (RC + SC) = (QB + RB) + (PD + SD)

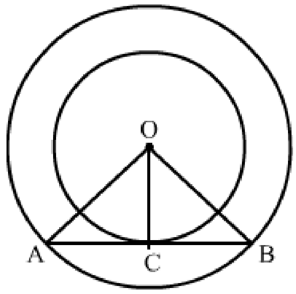
$\Rightarrow$ PQ + RS = PS + QR

Hence Proved

OR

Prove that in two concentric circles, the chord of the larger circle, which touches the smaller circle, is bisected at the point of contact.

Sol: Given: The chord AB of the larger of the two concentric circles, with centre O, touches the smaller circle at C.



To Prove: AC = CB.

Construction: Join OA, OB and OC.

Proof: We know that the radius and tangent are perpendicular at their point of contact

$\therefore$ $\angle OCA = \angle OCB = 90^\circ$

Now, In $\triangle OCA$ and $\triangle OCB$ $\angle OCA = \angle OCB = 90^\circ$

OA = OB (Radii of the larger circle)

OC = OC (Common)

By RHS congruency $\triangle OCA \cong \triangle OCB$

$\therefore$ CA = CB **Hence Proved**

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

- **know that the lengths of the two tangents drawn from an external point to a circle are equal.**
- **know that the radius and tangent are perpendicular at their point of contact.**
- **know how to draw correct figure as per the requirement of the question.**
- **know congruency rules of triangles.**

<u>SECTION-D</u>

32. In what ratio does the point (6, -4) divide the line segment joining the points A (10, -6) and B (-8, 3)?

Sol: Let P(6, –4) divides A(10, –6) and B(–8, 3) in K : 1. Using section formula, we have

P (6, -4) = P $\left(\frac{-8K+10}{K+1}, \frac{3K-6}{K+1}\right)$ $\Rightarrow$ 6 = $\frac{-8K+10}{K+1}$ and -4 = $\frac{3K-6}{K+1}$

Solving 6 = $\frac{-8K+10}{K+1}$ we get, 6K + 6 = $-8K + 10$

$\Rightarrow$ 14K = 4 or K = $\frac{2}{7}$

Therefore, the required ratio is 2 : 7.

OR

Show that the points E(-4, 4), F(-1, -1), G(4, 2) and H(1, 7) taken in order, are the vertices of a square.

Sol: Using distance formula, we have

EF = $\sqrt{(-1+4)^2+(-1-4)^2}$ = $\sqrt{(3)^2+(-5)^2}$ = $\sqrt{34}$ units

FG = $\sqrt{34}$ units

GH = $\sqrt{34}$ units

HE = $\sqrt{34}$ units

⇒All sides are equal.

⇒ EFGH may a square or rhombus.

Now EG = $\sqrt{(4+4)^2+(2-4)^2}$ = $\sqrt{(8)^2+(-2)^2}$ = $\sqrt{68}$ units

FH = $\sqrt{68}$ units

⇒ Diagonals are also equal.

Hence EFGH is a square.

Suggestive Measures – While solving such type of questions students should:
- **know the distance formula and section formula of internal division.**
- **know how to equate the coordinates of two points.**
- **be aware about the properties of rhombus and square.**

33. The table below shows the daily expenditure on food of 25 households in a locality.

Daily expenditure (in ₹)	**150-200**	**200-250**	**250-300**	**300-350**	**350-400**
No. of households	**4**	**5**	**12**	**2**	**2**

Find the mean daily expenditure on food.

Sol:

Daily expenditure (in ₹)	150-200	200-250	250-300	300-350	350-400	
x_i (Class-mark)	175	225	275	325	375	**Total**
No. of households (f_i)	4	5	12	2	2	**25**
f_ix_i	700	1125	3300	650	750	**6525**

Mean = $\frac{\sum f_i x_i}{\sum f_i}$ = $\frac{6525}{25}$ = 261

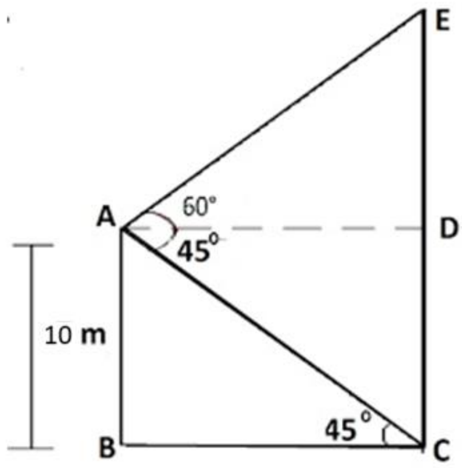
Therefore, mean daily expenditure is ₹261.

Suggestive Measures – While solving such type of questions students should:
- **know how to calculate the class mark of each given class-interval.**
- **know how to decide which method to be used to calculate the mean as per the given data.**
- **know the formula of calculating mean as per the method applied.**
- **write the final answer with proper units.**

34. From the top of a 10 m high building, the angle of elevation of the top of a cable tower is 60º and the angle of depression of its foot is 45^0. Determine the height of the tower.

(Take $\sqrt{3}$ = 1.73)

Sol: Let AB be the building and CD be the cable tower.



In ΔABC, tan 45° = $\frac{AB}{BC}$

⇒ 1 = $\frac{10}{BC}$

⇒ BC = 10 m

Also, BC = AD = 10 m

In ΔADE, tan 60° = $\frac{ED}{AD}$

$\sqrt{3}$ = $\frac{ED}{10}$

⇒ ED = $10\sqrt{3}$ m

Height of tower = CD + ED

= 10 + $10\sqrt{3}$

= 10 + 10(1.73) = 10 + 17.3 = 27.3 m

OR

Two poles of equal heights are standing opposite each other on either side of the road, which is 100 m wide. From a point between them on the road, the angles of elevation of the top of the poles are 60º and 30º, respectively. Find the height of the poles.

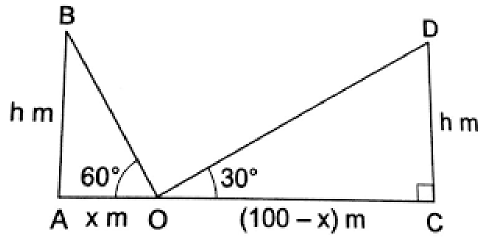
Sol: Let AB and CD be the two poles of equal height and their heights be h m.

BC be the 100 m wide road. O be any point on the road.

Let AO be x m, therefore CO = (100 – x) m.

Also, ∠AOB = 60° and ∠DOC = 30°

In right angled triangle AOB,



tan 60º = $\frac{AB}{OA}$

⇒ $\sqrt{3} = \frac{h}{x}$

$h = \sqrt{3}x$ … (i)

In right angled triangle DOC, tan 30º = $\frac{DC}{OC}$ ⇒ $\frac{1}{\sqrt{3}} = \frac{h}{100-x}$

⇒ $100 - x = \sqrt{3}h$

$100 - x = \sqrt{3}(\sqrt{3}x)$ … (using (i))

$100 - x = 3x$ ⇒ $25 = x$

Put x = 25 in equation (i), we get $h = 25\sqrt{3}$

Therefore, the height of each pole is $25\sqrt{3}$ m.

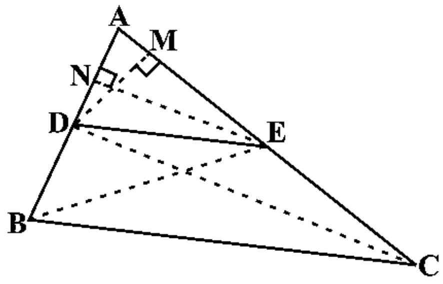
Suggestive Measures – While solving such type of questions students should:

- **draw correct figure according to information given in the question.**
- **identify angle of elevation and depression.**
- **apply correct trigonometric ratios and calculate the unknown side.**
- **write the final answer with proper units.**

35. If a line is drawn parallel to one side of a triangle to intersect the other two sides in distinct points, then prove that the other two sides are divided in the same ratio.

Sol: Given: A triangle ABC in which a line parallel to side BC intersects other two sides AB and AC at D and E respectively.

To Prove: $\frac{AD}{DB} = \frac{AE}{EC}$



Construction: Let us join BE and CD and then draw DM ⊥ AC and EN ⊥ AB.

Proof: ar(ΔADE) = $\frac{1}{2}$ ×AD × EN

ar (ΔBDE) = $\frac{1}{2}$ × DB × EN

ar(ΔADE) = $\frac{1}{2}$ ×AE × DM and

ar(ΔDEC) = $\frac{1}{2}$ ×EC × DM.

Therefore, $\frac{ar(\Delta ADE)}{ar(\Delta BDE)} = \frac{\frac{1}{2} \times AD \times EN}{\frac{1}{2} \times DB \times EN} = \frac{AD}{DB}$ …(1)

$\frac{ar(\Delta ADE)}{ar(\Delta DEC)} = \frac{\frac{1}{2} \times AE \times DM}{\frac{1}{2} \times EC \times DM} = \frac{AE}{EC}$ …(2)

Note that Δ BDE and DEC are on the same base DE and between the same parallels BC and DE. So, ar (Δ BDE) = ar (Δ DEC) …(3)

Therefore, from (1), (2) and (3), we have:

$\frac{AD}{DB} = \frac{AE}{EC}$ Hence Proved

Suggestive Measures – While solving such type of questions students should:
- **draw correct figure according to information given in the question.**
- **know the formula of calculating the area of a triangle.**
- **know that the triangles on the same base and between same parallels have equal areas.**

SECTION-E

While solving case study based questions students should:
- **Carefully note the given information**
- **relate the given information with the mathematical concept studied so far**
- **apply the correct formula and perform accurate calculations**

36. The lengths of the rungs of the ladder decrease uniformly by 2 cm from bottom to top. The bottom rung is 45 cm in length. After that second rung from bottom is 43 cm in length. The length of the rungs are respectively 45, 43, 41………
Based on the above information, answer the following questions:

(i) For the given AP find first term and common difference.

Sol: First term a = 45

Common difference d = 43 – 45 = –2

(ii) Find the length of tenth rung.

Sol: length of tenth rung = $a_{10} = a + 9d = 45 + [(-2) \times 9]$

$a_{10} = 27$ cm

(iii) Which rung of the ladder is 23 cm in length?

Sol: $a_n = 23 \Rightarrow a + (n-1)d = 23$

$\Rightarrow 45 + (-2)(n-1) = 23$

$\Rightarrow 45 - 2n + 2 = 23 \Rightarrow n = 12$

OR

Find S_{10} for given AP.

Sol: $S_n = \frac{n}{2}[2a + (n-1)d]$

We have to find S_{10}, so n = 10, a = 45 and d = –2

Putting values of a, d and n in $S_n = \frac{n}{2}[2a + (n-1)d]$

We get $S_{10} = \frac{10}{2}[2\times45+9\times(-2)] = 360$

37. Banks provide service and security for financial assets and transactions. Rocky went to a bank to withdraw ₹ 2000. He asked cashier to give him ₹ 50 and ₹ 100 notes only. The cashier gave Rocky a total of 25 notes.

Based on the above information, answer the following questions:

(i) Write a linear equation representing total number of notes.

Sol: Let x be ₹ 50 notes & y be ₹100 notes

So the equation is $x + y = 25$

(ii) Write a linear equation representing total amount.

Sol: $50x + 100y = 2000$

$\Rightarrow x + 2y = 40$

(iii) How many ₹ 50 notes did Rocky receive?

Sol: Multiplying equation $x + y = 25$ by 2 & subtracting $x + 2y = 40$ from it

$(2x - x) + (2y - 2y) = 50 - 40$

$\Rightarrow x = 10$

Hence Rocky receive x = 10 notes of ₹50

OR

How many ₹ 100 notes did Rocky receive?

Sol: Subtracting both the equations above, we get y = 15

Hence Rocky receive y = 15 notes of ₹100

Suggestive Measures :

- **Q 36 relates to the chapter 'Linear Equation in two variables'**
- **Form the equation from the given information**
- **Find required quantity by solving these equations by any method**

38. Pen-stand come in different designs and materials offering various styles for organizing stationary. A pen stand made of wood is in the shape of a cuboid with four conical depressions to hold pens. The dimensions of the cuboid are 15 cm x 10 cm x 3.5 cm. The radius of each of the depression is 1 cm and the depth is 2.1 cm.

Based on the above information, answer the following questions:

(i) Find the volume of cuboid (before depressions).

Sol: Volume of cuboid = $15 \times 10 \times 3.5 = 525 \text{ cm}^3$

(ii) Find the volume of one conical depression.

Sol: Volume of 1 conical depression = $\frac{1}{3} \times \frac{22}{7} \times 1 \times 1 \times 2.1$

$= 2.2 \text{cm}^3$

(iii) Find the volume of wood in entire stand.

Sol: Volume of wood in entire stand = volume of cuboid – volume of 4 conical depressions

$= 525 - (4 \times 2.2)$

$= 516.2 \text{ cm}^3$

OR

What is the volume of wood in the pen stand if it would have been 5 such depressions.

Sol: Volume of wood in pen-stand having 5 conical depressions

= volume of cuboid – volume of 5 conical depressions

$= 525 - (5 \times 2.2) = 514 \text{ cm}^3$

Suggestive Measures :

- **Q 38 relates to the chapter 'Surface Area and Volume'**
- **Identify the shapes discussed in the question**
- **Find required quantity by applying correct formula and performing proper calculations**