NIOS PYQ's SOLUTIONS

PREVIOUS YEARS' QUESTIONS & ANSWERS

APRIL-2025

Your Path to Success

SECTION - A

Q1 - Factors of $3x^2 - x - 4$ are:

(A) $(3x - 4)(x - 1)$

(B) $(3x - 4)(x + 1)$

(C) $(3x + 4)(x - 1)$

(D) $(3x + 4)(x + 1)$

Answer - (B) $(3x - 4)(x + 1)$

Q2 – If $2p + 1$, 13 and $5p - 3$ are in A.P., then the value of p is:

(A) -4

(B) 3

(C) 4

(D) -5

Answer - (C) 4

Q3 - A person bought an almirah for ₹3,250 and spent ₹750 on its repair. If he sold it for ₹5,000, his gain percent is:

(A) 16%

(B) 20%

(C) 25%

(D) 30%

Answer - (C) 25%

Q4 - A point both of whose x and y coordinates are negative lies in:

(A) 1st quadrant

(B) 2nd quadrant

(C) 3rd quadrant

(D) 4th quadrant

Answer - (C) 3rd quadrant

Q5 – If the y coordinate of a point is zero, then the point lies:

(A) in 1^{st} quadrant

(B) in 2^{nd} quadrant

(C) on x-axis

(D) on y-axis

Answer - (C) on x-axis

Q6 - If an arc of a circle subtends an angle of x^o at the centre of the circle and y^o at any point on the remaining part of the circle, then the relation between x and y is:

(A) $x = 2y$ **(B)** $y = 2\,x$

(C) $x = y$ **(D)** $x + y = 0$

Answer - (A) $x = 2y$

Q7 - TP and TQ are two tangents, from an external point T, to a circle with centre O. If $\angle POQ = 110^\circ$, then $\angle PTQ$ is:

(A) 60° **(B)** 70°

(C) 80° **(D)** 90°

Answer - (B) 70°

Q8 - If PQ is a chord of a circle with centre O and the tangent PR at P makes an angle of 50° with PQ, then $\angle POQ$ is:

(A) 100° **(B)** 90°

(C) 80° **(D)** 75°

Answer - (A) 100°

Q9 - The curved surface area (in cm^2) of a right circular cone of slant height 10 cm and base radius 7 cm is:

(A) 120 **(B) 140**

(C) 220 **(D) 240**

Answer - (C) 220

Q10 - Total surface area $(in\ cm^2)$ of a solid hemisphere of radius 10 cm, when $\pi = 3.14$, is:

(A) 840 **(B) 842**

(C) 940 **(D) 942**

Answer - (D) 942

Q11 - The curved surface area of a cylinder of height 14 cm is $88\ cm^2$. The diameter (in cm) of the cylinder is:

(A) 0.5 **(B) 1**

(C) 1.5 **(D) 2**

Answer - (D) 2

Q12 - The value of $\frac{1-tan^2 45^\circ}{1+tan^2 45^\circ}$ is:

(A) 1 **(B) $\frac{1}{2}$**

(C) 0 **(D) $\frac{\sqrt{3}}{2}$**

Answer - (C) 0

Q13 - The value of $\left(\frac{sin^2 22^\circ + sin^2 68^\circ}{cos^2 22^\circ + cos^2 68^\circ} + sin^2 63^\circ + cos\, 63^\circ sin\, 27^\circ\right)$ is:

(A) 3 **(B) 2**

(C) 1 **(D) 0**

Answer - (B) 2

Q14 - If $tan(A - B) = \frac{1}{\sqrt{3}}$ and tan (A+B) = √3, then the values of A and B respectively are:

(A) $45^\circ, 15^\circ$ **(B) $30^\circ, 15^\circ$**

(C) $45^\circ, 30^\circ$ **(D) $15^\circ, 60^\circ$**

Answer - (A) 45°, 15°

Q15 - The mean of first five multiples of 7 is:

(A) 20 **(B) 21**

(C) 22 **(D) 25**

Answer - (B) 21

Q16 - The median of 10, 12, 14, 16, 18, 20 is:

(A) 12 **(B) 14**

(C) 15 **(D) 16**

Answer - (C) 15

Q17 - A die is thrown once. The probability of getting a number between 2 and 6 is:

(A) $\frac{1}{6}$ **(B) $\frac{1}{2}$**

(C) 1 **(D) 0**

Answer - (B) $\frac{1}{2}$

Q18 - Fill in the blanks:

(i) If the 1st term and common difference of an A.P. are 6 and 5 respectively, then the 11^{th} term of the A.P. is _______

(ii) The sum of first ten terms of the A.P. 7, 14, 21, 28, ... is _______

Answer - (i) 56

(ii) 385

Q19 - Match Column-I statement with the correct option of Column-II:

Column-I	Column-II
(i) The coefficient of y in the linear equation $5(2x-4)+3x+4y-7=0$ is:	(A) 0
(ii) When $y=3$ is expressed in the form $ax+by+c=0$. then the value of a is:	(B) -3
	(C) 4

Answer – (i) The coefficient of y in the linear equation $5(2x-4)+3x+4y-7=0$ is: → **(C) 4**

(ii) When $y=3$ is expressed in the form $ax+by+c=0$. then the value of a is: → **(A) 0**

Q20 - Match Column-I statement with the correct option of Column-II:

Column-I	Column-II
(i) If the roots of the quadratic equation $(\alpha-3)x^2+4(\alpha-3)x+4=0$ are equal and real, then the value/s of α is:	(A) 3 and 4
(ii) If $x=\frac{1}{2}$ is a root of the equation $x^2+kx-\frac{5}{4}=0$ then the value of k is:	(B) 4 and 5
	(C) 2
	(D) 6

Answer – (i) If the roots of the quadratic equation $(\alpha-3)x^2+4(\alpha-3)x+4=0$ are equal and real, then the value/s of α is: → **(A) 3 and 4**

(ii) If $x=\frac{1}{2}$ is a root of the equation $x^2+kx-\frac{5}{4}=0$ then the value of k is: → **(C) 2**

Q21 - Fill in the blanks:

(i) 20^{th} term from the end of the A.P. 3, 8, 13, ... 253 is _______

(ii) If the first term of an A.P. is 5, last term is 45 and the sum of all terms is 400, then the number of terms of the A.P. is _______

Answer – (i) 158

(ii) 16

Q22 – Write 'True' for correct statement and 'False' for incorrect statement :

(i) The graph of the linear equation $2x - 3y = 6$ intersects the y-axis at the point (0, 2).

(ii) The graph of $x = 2$ is a line parallel to x-axis.

Answer – (i) False

(ii) False

Q23 - Fill in the blanks:

(i) If the distance between the points A (0, 0) and B (x, 3) is 5 units, then the value of x is _______

(ii) If the mid-point of the line segment joining the points (x, 4) and (5, 12) is (4, 8), then the value of x is _______

Answer – (i) ± 4

(ii) 3

Q24 - Write 'True' for correct statement and 'False' for incorrect statement:

(i) If a chord of a circle is equal to the radius of the circle, then the angle subtended by the chord at a point on minor arc is 30°.

(ii) If the tangents PA and PB from an external point P to a circle with centre O are inclined to each other at angle of 80°, then ∠POA is 60°.

Answer – (i) False

(ii) False

Q25 – Fill in the blanks:

(i) PAB is a secant and PT is a tangent to a circle. If $PT = x$ cm, $PA = 4$ cm and $AB = 5\ cm$, then the value of x is _______

(ii) AB is a diameter of a circle and XPY is a tangent to the circle at point P. If $\angle PBA = 30^{\circ}$, then $\angle BPY$ is _______

Answer – (i) 6

(ii) 60°

Q26 – Fill in the blanks:

(i) In a ΔABC right angled at C, if $AC = 4$ cm and $AB = 8\ cm.$ then $\angle A =$ ______

(ii) In a ΔABC right angled at B, if $BC = 5\ cm.\ \angle BAC = 30^{\circ}$, then $AB =$ ______

Answer – (i) $60°$

(ii) $5\sqrt{3}\ cm$

Q27 – Write 'True' for correct statement and 'False' for incorrect statement:

(i) Two dice are thrown together. Probability of getting same number on both dice is $\frac{1}{9}$

(ii) Two coins are tossed simultaneously. Probability of getting at least one tail is $\frac{1}{2}$.

Answer – (i) False

(ii) False

Q28 - Cost of a washing machine is ₹19,400, but due to Diwali Festival Sale it is available for ₹4,200 cash down payment followed by three equal monthly instalments. Shopkeeper charges interest at the rate of 16% per annum under this instalment plan.

On the basis of the above information, answer the following questions:

Let the amount of each equal instalment be x, then

(i) Total interest paid under the plan is:

(A) ₹ $(3x - 15,200)$ **(B) ₹ $(2x - 15,200)$**

(C) ₹ $(x - 15,200)$ **(D) ₹ $(15,200 - x)$**

Answer – (A) ₹ $(3x - 15{,}200)$

(ii) Amount owes by the buyer to the seller for 1^{st} month is:

(A) ₹4,200 **(B) ₹19,400**

(C) ₹15,200 **(D) ₹11,000**

Answer – (C) ₹15,200

(iii) Amount owes by the buyer to the seller for 3^{rd} month is:

(A) ₹$15,200$

(B) ₹ $(15,200 - x)$

(C) ₹ $(15,200 \ - 3x)$

(D) ₹ $(15,200 \ - 2x)$

Answer – (D) ₹ $(15,200 \ - 2x)$

(iv) Total amount paid by the buyer under the instalment plan is:

(A) ₹$19,400$

(B) ₹$15,200$

(C) ₹ $(4,200 + 3x)$

(D) ₹ $(19,400 - x)$

Answer – (C) ₹ $(4,200 + 3x)$

(v) Amount of each instalment is:

(A) ₹4,200

(B) ₹4,600

(C) ₹4,800

(D) ₹5,200

Answer – (D) ₹5,200

SECTION - B

Q29 - Find the LCM of $P(x) = (x-2)(x^2 - 3x + 2)$ and $Q(x) = x^2 - 4$

Answer – First, we find the linear factors of both polynomials by factorizing them completely.

For the first polynomial $P(x)$:

$$P(x) = (x-2)(x^2 - 3x + 2)$$

We factorize the quadratic part $x^2 - 3x + 2$ by splitting the middle term:

$$x^2 - 2x - x + 2 = x(x-2) - 1(x-2) = (x-2)(x-1)$$

Substituting this back into $P(x)$ gives:

$$P(x) = (x-2)(x-2)(x-1) = (x-2)^2(x-1)$$

For the second polynomial $Q(x)$:

$$Q(x) = x^2 - 4$$

Using the identity $a^2 - b^2 = (a-b)(a+b)$, we get:

$$Q(x) = (x)^2 - (2)^2 = (x-2)(x+2)$$

The Lowest Common Multiple (LCM) is the product of all the distinct factor expressions with their highest powers that occur in either factorization.

$$\text{LCM} = (x-1)(x-2)^2(x+2)$$

Answer: The LCM of the given polynomials is $(x-1)(x-2)^2(x+2)$.

OR

If $x - \frac{1}{x} = 2$, find the value of $x^2 + \frac{1}{x^2}$

Answer – Given equation:

$$x - \frac{1}{x} = 2$$

To find the value of $x^2 + \frac{1}{x^2}$, we square both sides of the given equation:

$$\left(x - \frac{1}{x}\right)^2 = (2)^2$$

Using the algebraic identity $(a-b)^2 = a^2 - 2ab + b^2$, we expand the left-hand side:

$$x^2 - 2(x)\left(\frac{1}{x}\right) + \left(\frac{1}{x}\right)^2 = 4$$

$$x^2 - 2 + \frac{1}{x^2} = 4$$

Now, transposing -2 from the left-hand side to the right-hand side:

$$x^2 + \frac{1}{x^2} = 4 + 2$$

$$x^2 + \frac{1}{x^2} = 6$$

Answer: The value of $x^2 + \frac{1}{x^2}$ is 6.

Q30 - A man started a business with an initial investment of ₹5,00,000. In the first year, he incurred a loss of 4%, however, during second year, he earned a profit of 5% which in the third year was raised to 10%. Calculate his net profit for the entire period of 3 years.

Answer – Given:

- Initial Investment (Principal, V_0) = ₹ 5,00,000

- First-year loss rate (r_1) = 4%
- Second-year profit rate (r_2) = 5%
- Third-year profit rate (r_3) = 10%

We can calculate the final accumulated value (V_3) at the end of 3 years using the variable growth/depreciation compound formula:

$$V_3 = V_0 \times \left(1 - \frac{r_1}{100}\right) \times \left(1 + \frac{r_2}{100}\right) \times \left(1 + \frac{r_3}{100}\right)$$

Substitute the given values into the formula:

$$V_3 = 5{,}00{,}000 \times \left(1 - \frac{4}{100}\right) \times \left(1 + \frac{5}{100}\right) \times \left(1 + \frac{10}{100}\right)$$

$$V_3 = 5{,}00{,}000 \times \left(\frac{96}{100}\right) \times \left(\frac{105}{100}\right) \times \left(\frac{110}{100}\right)$$

$$V_3 = 5 \times 96 \times 105 \times 1.10$$

$$V_3 = 480 \times 115.5 = 5{,}54{,}400$$

The total accumulated amount after 3 years is ₹ 5,54,400.

Now, we find the net profit earned over the entire period:

$$\text{Net Profit} = \text{Final Value } (V_3) - \text{Initial Investment } (V_0)$$

$$\text{Net Profit} = 5{,}54{,}400 - 5{,}00{,}000 = 54{,}400$$

Answer: The net profit for the entire period of 3 years is ₹ 54,400.

Q31 - Find the centroid of a triangle whose vertices are $A(5, -2)$, $B(9, 6)$ and $C(4, 5)$.

Answer – Given vertices of the triangle:

- $A(x_1, y_1) = (5, -2)$
- $B(x_2, y_2) = (9,6)$
- $C(x_3, y_3) = (4,5)$

The standard formula to find the coordinates of the centroid $G(x, y)$ of a triangle is given by:

$$G(x, y) = \left(\frac{x_1 + x_2 + x_3}{3}, \frac{y_1 + y_2 + y_3}{3}\right)$$

Now, substituting the respective coordinate values:

$$x = \frac{5 + 9 + 4}{3} = \frac{18}{3} = 6$$

$$y = \frac{-2+6+5}{3} = \frac{9}{3} = 3$$

Answer: The coordinates of the centroid of the triangle are $(6,3)$.

OR

Find the coordinates of a point which divides the line segment joining the points $A(-1,3)$ and $B(2,-3)$ in the ratio 1:4 internally.

Answer – Given:

- First endpoint $A(x_1, y_1) = (-1,3)$
- Second endpoint $B(x_2, y_2) = (2,-3)$
- Internal section division ratio $m{:}n = 1{:}4$

Let $P(x, y)$ be the required coordinates of the point. By using the coordinate Section Formula:

$$x = \frac{mx_2 + nx_1}{m+n} \quad \text{and} \quad y = \frac{my_2 + ny_1}{m+n}$$

Substitute the values to calculate the x-coordinate:

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

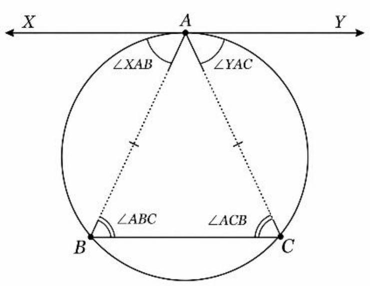
Substitute the values to calculate the y-coordinate:

$$y = \frac{1(-3) + 4(3)}{1+4} = \frac{-3+12}{5} = \frac{9}{5}$$

Answer: The required coordinates of the point are $\left(\frac{-2}{5}, \frac{9}{5}\right)$.

Q32 - ABC is an isosceles triangle with $AB = AC$ and XAY is a tangent to the circumcircle of ΔABC. Show that XY is parallel to the base BC of the triangle.

Answer – Proof:



Given that ΔABC is an isosceles triangle with $AB = AC$. Therefore, the angles opposite to the equal sides must also be equal:

$$\angle ACB = \angle ABC \quad \text{--- (Equation 1)}$$

Since XAY is a tangent line touching the circumcircle at point A, and AB is a chord of the circle, by the **Alternate Segment Theorem**, the angle formed between the tangent and the chord is equal to the angle subtended by that chord in the alternate segment:

$$\angle XAB = \angle ACB \quad \text{--- (Equation 2)}$$

Now, comparing Equation 1 and Equation 2, we can conclude that:

$$\angle XAB = \angle ABC$$

Since $\angle XAB$ and $\angle ABC$ form a pair of **alternate interior angles** with respect to the lines XY and BC intersected by the transversal line AB. Since the alternate interior angles are equal, the lines must be parallel.

Therefore, $XY \parallel BC$.

Hence Proved.

Q33 - ABCD is a cyclic quadrilateral in which $\angle A = (x + 2y)^\circ$, $\angle B = (5y - x)^\circ$, $\angle C = 2x^\circ$ and $\angle D = (x + y)^\circ$. Find the value of x and y.

Answer - We know that in a cyclic quadrilateral, the sum of opposite angles is always equal to 180°. Therefore, we have two geometric conditions:

1. $\angle A + \angle C = 180^\circ$
2. $\angle B + \angle D = 180^\circ$

Using the first condition ($\angle A + \angle C = 180^\circ$):

$$(x + 2y) + 2x = 180$$

$$3x + 2y = 180 \quad \text{--- (Equation 1)}$$

Using the second condition ($\angle B + \angle D = 180^\circ$):

$$(5y - x) + (x + y) = 180$$

$$6y = 180$$

$$y = \frac{180}{6} = 30$$

Now, substitute the value of $y = 30$ directly into Equation 1 to solve for x:

$$3x + 2(30) = 180$$

$$3x + 60 = 180$$

$$3x = 180 - 60$$

$$3x = 120 \Longrightarrow x = \frac{120}{3} = 40$$

Answer: The value of x is 40 and the value of y is 30.

Q34 - Find the perimeter and area of the sector of a circle of radius 14 cm and central angle 30°.

Answer – Given parameters of the sector:

- Radius of the circle (r) = 14 cm
- Central angle (θ) = 30°
- Use value of $\pi = \frac{22}{7}$

First, we calculate the length of the arc (l) of the sector:

$$l = \frac{\theta}{360^\circ} \times 2\pi r$$

$$l = \frac{30^\circ}{360^\circ} \times 2 \times \frac{22}{7} \times 14 = \frac{1}{12} \times 2 \times 22 \times 2 = \frac{88}{12} = \frac{22}{3} \text{ cm} \approx 7.33 \text{ cm}$$

Now, we calculate the total perimeter of the sector:

$$\text{Perimeter} = 2r + l = 2(14) + \frac{22}{3} = 28 + 7.33 = 35.33 \text{ cm}$$

Next, we calculate the area of the sector:

$$\text{Area} = \frac{\theta}{360^\circ} \times \pi r^2$$

$$\text{Area} = \frac{30^\circ}{360^\circ} \times \frac{22}{7} \times 14 \times 14 = \frac{1}{12} \times 22 \times 2 \times 14 = \frac{616}{12} = \frac{154}{3} \text{ cm}^2 \approx 51.33 \text{ cm}^2$$

Answer: The total perimeter of the sector is 35.33 cm and its total area is 51.33 cm^2.

OR

The sides of a triangle are 3:5:7. If the perimeter of the triangle is 60 cm, then find its area.

Answer – Given:

- Ratio of sides of the triangle = $3:5:7$
- Total Perimeter = 60 cm

Let the three side lengths of the triangle be $3x$, $5x$, and $7x$ respectively.

Since perimeter is the sum of all sides:

$$3x + 5x + 7x = 60$$

$$15x = 60 \Rightarrow x = \frac{60}{15} = 4$$

Now, determine the individual length of each side:

- Side $a = 3(4) = 12$ cm
- Side $b = 5(4) = 20$ cm
- Side $c = 7(4) = 28$ cm

To find the area using Heron's Formula, we first compute the semi-perimeter (s):

$$s = \frac{\text{Perimeter}}{2} = \frac{60}{2} = 30 \text{ cm}$$

Now, apply Heron's Formula for the area of a triangle:

$$\text{Area} = \sqrt{s(s-a)(s-b)(s-c)}$$

$$\text{Area} = \sqrt{30(30-12)(30-20)(30-28)}$$

$$\text{Area} = \sqrt{30 \times 18 \times 10 \times 2}$$

$$\text{Area} = \sqrt{10800} = \sqrt{3600 \times 3} = 60\sqrt{3} \text{ cm}^2$$

Using $\sqrt{3} \approx 1.732$:

$$\text{Area} = 60 \times 1.732 = 103.92 \text{ cm}^2$$

Answer: The total area of the triangle is $60\sqrt{3}$ cm^2 (or 103.92 cm^2).

Q35 - A solid metallic sphere of radius 21 cm is melted and recast into a number of smaller solid cones, each radius 7 cm and height 3 cm. Find the number of cones so formed.

Answer – Given values for the solid dimensions:

- Radius of the solid metal sphere (R) = 21 cm
- Radius of each smaller recast cone (r) = 7 cm
- Height of each smaller recast cone (h) = 3 cm

When one solid shape is melted and completely recast into another, the total volume remains constant.

$$\text{Number of cones formed } (n) = \frac{\text{Volume of the solid sphere}}{\text{Volume of a single cone}}$$

Using the geometric formulas for volume:

$$\text{Volume of Sphere} = \frac{4}{3}\pi R^3 \quad \text{and} \quad \text{Volume of Cone} = \frac{1}{3}\pi r^2 h$$

Set up the equation to find n:

$$n = \frac{\frac{4}{3}\pi R^3}{\frac{1}{3}\pi r^2 h}$$

$$n = \frac{4 \times R^3}{r^2 \times h}$$

Substitute the numerical values:

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

$$n = \frac{4 \times 21 \times 21 \times 21}{147}$$

$$n = 4 \times 3 \times 3 \times 21 = 12 \times 21 = 252$$

Answer: The total number of cones formed is 252.

OR

Curved surface area of a solid cylinder is two-third of its total surface area. If its total surface area is 231 cm^2, find its radius.

Answer – Given:

- Total Surface Area (T.S.A.) = 231 cm^2
- Curved Surface Area (C.S.A.) = $\frac{2}{3}$ × T.S.A.

We know the standard formulas for a solid cylinder are:

$$\text{C.S.A.} = 2\pi rh \quad \text{and} \quad \text{T.S.A.} = 2\pi r(r+h) = 2\pi r^2 + 2\pi rh$$

According to the question's relational condition:

$$2\pi rh = \frac{2}{3}[2\pi r(r+h)]$$

Dividing both sides by $2\pi r$:

$$h = \frac{2}{3}(r+h)$$

$$3h = 2r + 2h \Longrightarrow h = 2r$$

Now substitute $h = 2r$ into the given formula for Total Surface Area (T.S.A. = 231):

$$2\pi r(r + 2r) = 231$$

$$2\pi r(3r) = 231$$

$$6\pi r^2 = 231$$

Substitute $\pi = \frac{22}{7}$ and isolate r^2:

$$6 \times \frac{22}{7} \times r^2 = 231$$

$$\frac{132}{7} \times r^2 = 231$$

$$r^2 = \frac{231 \times 7}{132}$$

$$r^2 = \frac{21 \times 7}{12} = \frac{7 \times 7}{4} = \frac{49}{4}$$

$$r = \sqrt{\frac{49}{4}} = \frac{7}{2} = 3.5 \text{ cm}$$

Answer: The radius of the solid cylinder is 3.5 cm.

Q36 - Find the median of the following data:

xi	5	15	25	35	45
fi	8	10	24	15	7

Answer – To find the median for grouped discrete data, we first construct a Cumulative Frequency (cf) table:

x_i	$Frequency\ (f_i)$	$Cumulative\ Frequency\ (cf)$
5	8	8
15	10	18
25	16	34
35	**24**	**58**
45	15	73
55	7	80

Here, total number of observations (N) = $\sum f_i = 80$.

We compute the rank value $\frac{N}{2}$:

$$\frac{N}{2} = \frac{80}{2} = 40$$

Now, we locate the cumulative frequency value in the table that is just greater than or equal to 40. That value is 58, which corresponds to the observation row value where $x_i = 35$.

Answer: The median of the given data is 35.

Q37 - A bag contains 5 red, 4 black and 3 green balls. A ball is drawn at random from the bag. Find the probability of getting :

(i) red or green ball

(ii) a ball which is not red.

Answer – First, find the total sample space of balls inside the bag:

$$\text{Total Balls} = 5\text{ (Red)} + 4\text{ (Black)} + 3\text{ (Green)} = 12\text{ balls}$$

(i) Probability of getting a red or green ball:

The total number of favorable outcomes (either a red ball or a green ball) is:

$$\text{Favorable Outcomes} = 5\text{ (Red)} + 3\text{ (Green)} = 8\text{ balls}$$

$$\text{Probability (Red or Green)} = \frac{\text{Favorable Outcomes}}{\text{Total Outcomes}} = \frac{8}{12} = \frac{2}{3}$$

(ii) Probability of getting a ball which is not red:

The total number of favorable outcomes (balls that are anything except red, i.e., black or green) is:

$$\text{Favorable Outcomes} = 4\text{ (Black)} + 3\text{ (Green)} = 7\text{ balls}$$

$$\text{Probability (Not Red)} = \frac{\text{Favorable Outcomes}}{\text{Total Outcomes}} = \frac{7}{12}$$

Answer:

(i) The probability of getting a red or green ball is $\frac{2}{3}$.

(ii) The probability of getting a ball which is not red is $\frac{7}{12}$.

Q38 - Solve the following system of linear equations graphically:

$\boldsymbol{x + y = 5,\ x - y = 1}$

Answer – To solve the system of equations graphically, we first find at least two solutions (points) for each linear equation to plot their straight lines.

For Equation 1: $x + y = 5 \Longrightarrow y = 5 - x$

- When $x = 0$, $y = 5 - 0 = 5 \Longrightarrow$ Point $A(0,5)$
- When $x = 5$, $y = 5 - 5 = 0 \Longrightarrow$ Point $B(5,0)$

Table for $x + y = 5$:

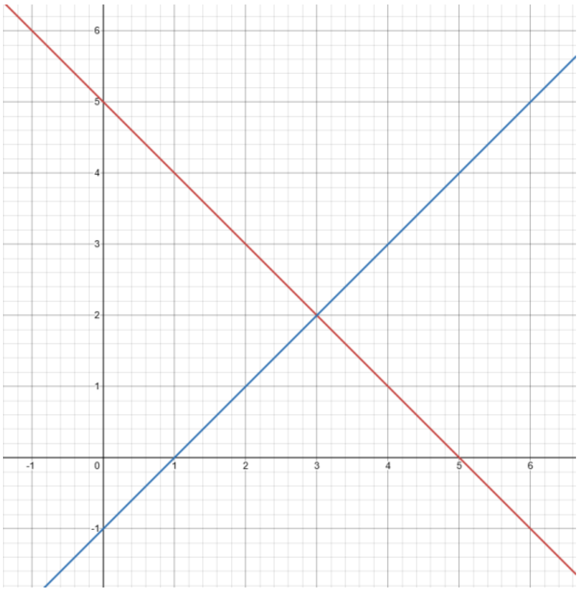
x	0	5
y	5	0

For Equation 2: $x - y = 1 \Longrightarrow y = x - 1$

- When $x = 0$, $y = 0 - 1 = -1 \Longrightarrow$ Point $C(0, -1)$
- When $x = 1$, $y = 1 - 1 = 0 \Longrightarrow$ Point $D(1,0)$

Table for $x - y = 1$:

x	0	1
y	-1	0



By plotting these lines on a graph sheet, we observe that the two straight lines intersect each other precisely at the point (3,2). Therefore, the coordinates of the point of intersection give the unique solution of the system of equations.

Answer: The solution of the given system of linear equations is $x = 3$ and $y = 2$.

Q39 - The length of a rectangular garden is 7 m more than its breadth. If area of the garden is 144 m^2, find the length and breadth of the garden.

Answer – Let the breadth of the rectangular garden be $= x$ m.

According to the question, the length of the garden is 7 m more than its breadth.

$$\text{Length} = (x + 7) \text{ m}$$

We know that the area of a rectangle is given by the formula:

$$\text{Area} = \text{Length} \times \text{Breadth}$$

Substituting the given values:

$$144 = (x + 7) \times x$$

$$144 = x^2 + 7x$$

$$x^2 + 7x - 144 = 0$$

Now, we solve this quadratic equation by splitting the middle term:

$$x^2 + 16x - 9x - 144 = 0$$

$$x(x + 16) - 9(x + 16) = 0$$

$$(x - 9)(x + 16) = 0$$

This gives two possible values for x:

$$x - 9 = 0 \Longrightarrow x = 9$$

$$x + 16 = 0 \Longrightarrow x = -16$$

Since breadth represents a physical distance, it cannot be a negative value. Therefore, we reject $x = -16$, and accept $x = 9$.

- Breadth $= x = 9$ m
- Length $= x + 7 = 9 + 7 = 16$ m

Answer: The length of the rectangular garden is 16 m and its breadth is 9 m.

OR

The altitude of a right triangle is 2 cm more than its base. If the hypotenuse of the triangle is 10 cm, find the other two sides.

Answer – Let the base of the right-angled triangle be $= x$ cm.

According to the question, its altitude (height) is 2 cm more than its base.

$$\text{Altitude} = (x + 2) \text{ cm}$$

Given that the Hypotenuse $= 10$ cm.

By applying Pythagoras Theorem in the right-angled triangle, we have:

$$(\text{Base})^2 + (\text{Altitude})^2 = (\text{Hypotenuse})^2$$

$$(x)^2 + (x+2)^2 = (10)^2$$

$$x^2 + (x^2 + 4x + 4) = 100$$

$$2x^2 + 4x + 4 - 100 = 0$$

$$2x^2 + 4x - 96 = 0$$

Dividing the entire equation by 2 to simplify:

$$x^2 + 2x - 48 = 0$$

We solve the quadratic equation by splitting the middle term:

$$x^2 + 8x - 6x - 48 = 0$$

$$x(x+8) - 6(x+8) = 0$$

$$(x-6)(x+8) = 0$$

This gives two values for x:

$$x - 6 = 0 \Longrightarrow x = 6$$

$$x + 8 = 0 \Longrightarrow x = -8$$

Since the length of a side of a triangle cannot be negative, we reject $x = -8$. Thus, $x = 6$.

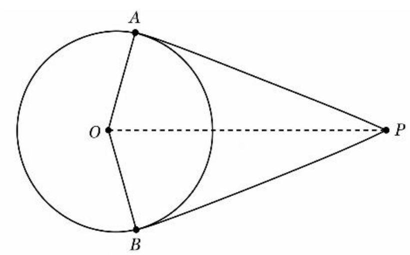
- Base $= x = 6$ cm
- Altitude $= x + 2 = 6 + 2 = 8$ cm

Answer: The other two sides of the right triangle are 6 cm and 8 cm.

Q40 - Prove that the tangents drawn from an external point to a circle are of equal length.

Answer – Proof:

- **Given:** A circle with centre O and an external point P outside the circle. Two tangents PA and PB are drawn from point P, touching the circle at points A and B respectively.
- **To Prove:** $PA = PB$
- **Construction:** Join line segments OA, OB, and OP.
- **Proof Statement:**



We know that a radius through the point of contact is perpendicular to the tangent line at that point. Therefore, $\angle OAP = 90^\circ$ and $\angle OBP = 90^\circ$.

Now, consider the two right-angled triangles ΔOAP and ΔOBP:

1. $\angle OAP = \angle OBP = 90°$ (From the tangent-radius property)

2. $OA = OB$ (Radii of the same circle)

3. $OP = OP$ (Common hypotenuse side for both triangles)

By the **RHS (Right angle-Hypotenuse-Side) congruence criterion**, we can state that:

$$\Delta OAP \cong \Delta OBP$$

Since the triangles are congruent, their corresponding parts must be equal by CPCT (Corresponding Parts of Congruent Triangles):

$$PA = PB$$

Hence Proved.

Q41 - Two perpendicular paths of width 10 m each run in the middle of a rectangular park of dimensions $200\ m \times 150\ n$, one parallel to the length and other parallel to the breadth. Find the cost of constructing these paths at the rate of 50 per m^2.

Answer – Given dimensions:

- Length of the rectangular park (l) = 200 m
- Breadth of the rectangular park (b) = 150 m
- Width of each perpendicular path (w) = 10 m
- Rate of construction = ₹ 50 per m^2

The cross-paths are arranged such that one runs parallel to the length and the other runs parallel to the breadth.

$$\text{Area of path parallel to length} = \text{Length of park} \times \text{Width of path} = 200 \times 10 = 2000\ \text{m}^2$$

$$\text{Area of path parallel to breadth} = \text{Breadth of park} \times \text{Width of path} = 150 \times 10 = 1500\ \text{m}^2$$

When these two paths cross each other in the middle of the park, they form a common square region of side $10\ \text{m} \times 10\ \text{m}$ which gets counted twice.

$$\text{Area of the common central square portion} = 10 \times 10 = 100\ \text{m}^2$$

Now, we find the net total area of the paths:

$$\text{Total Area of Paths} = \text{Area of first path} + \text{Area of second path} - \text{Area of common portion}$$

$$\text{Total Area of Paths} = 2000 + 1500 - 100 = 3400\ \text{m}^2$$

Next, compute the total cost of construction at the given rate:

$$\text{Total Cost} = \text{Total Area of Paths} \times \text{Rate per } m^2$$

$$\text{Total Cost} = 3400 \times 50 = ₹\ 1{,}70{,}000$$

Answer: The total cost of constructing these paths is ₹ 1,70,000.

OR

A rectangular sheet of metal with dimensions $66\ cm \times 12$ cm is rolled to form a cylinder of height 12 cm. Find the volume of the cylinder.

Answer – Given dimensions of the rectangular metal sheet:

- Length = 66 cm
- Breadth = 12 cm

When the rectangular sheet is rolled along its length to form a cylinder of height 12 cm, the length of the sheet becomes the circumference of the circular base of the cylinder, and the breadth becomes its height ($h = 12$ cm).

Let r be the base radius of the cylinder.

$$\text{Circumference of the base} = \text{Length of the sheet}$$

$$2\pi r = 66$$

Substitute $\pi = \frac{22}{7}$ to solve for radius r:

$$2 \times \frac{22}{7} \times r = 66$$

$$\frac{44}{7} \times r = 66$$

$$r = \frac{66 \times 7}{44} = \frac{3 \times 7}{2} = \frac{21}{2}\ \text{cm} = 10.5\ \text{cm}$$

Now, calculate the volume of the cylinder using the standard volume formula:

$$\text{Volume} = \pi r^2 h$$

$$\text{Volume} = \frac{22}{7} \times \left(\frac{21}{2}\right) \times \left(\frac{21}{2}\right) \times 12$$

$$\text{Volume} = \frac{22}{7} \times \frac{21}{2} \times \frac{21}{2} \times 12$$

$$\text{Volume} = 11 \times 3 \times 21 \times 6 = 33 \times 126 = 4158\ \text{cm}^3$$

Answer: The total volume of the cylinder is $4158\ \text{cm}^3$.

Q42 - If the mean of the following data is 8, find the value of p:

X_i	3	5	7	9	11	13
F_i	6	8	15	p	8	4

Answer – Given that the Arithmetic Mean ($\bar{X}$) = 8.

We first construct the multiplication table to find $\sum F_i$ and $\sum F_i X_i$:

Xi	Fi	$FiXi$
3	6	$3 \times 6 = 18$
5	8	$5 \times 8 = 40$
7	15	$7 \times 15 = 105$
9	p	$9p$
11	8	$11 \times 8 = 88$
13	4	$13 \times 4 = 52$

Calculate the sum of all frequencies ($\sum F_i$):

$$\sum F_i = 6 + 8 + 15 + p + 8 + 4 = 41 + p$$

Calculate the total sum of products ($\sum F_i X_i$):

$$\sum F_i X_i = 18 + 40 + 105 + 9p + 88 + 52 = 303 + 9p$$

We know the standard formula for Arithmetic Mean is given by:

$$\text{Mean} = \frac{\sum F_i X_i}{\sum F_i}$$

Substituting the given mean value of 8:

$$8 = \frac{303 + 9p}{41 + p}$$

Cross-multiplying to clear the fraction:

$$8(41 + p) = 303 + 9p$$

$$328 + 8p = 303 + 9p$$

Rearranging the linear terms to solve for p:

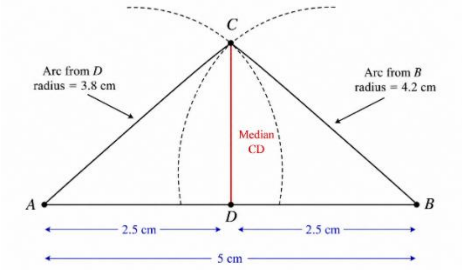
$$328 - 303 = 9p - 8p$$

$$25 = p \Rightarrow p = 25$$

Answer: The value of p is 25.

Q43 - Construct a triangle ABC in which $AB = 5$ cm, $BC = 4.2$ cm and median $CD = 3.8$ cm.

Answer –



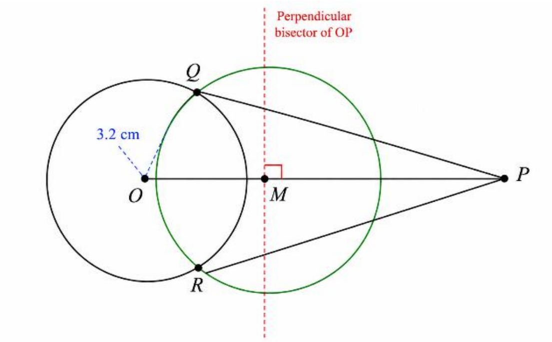
Steps of Construction:

1. Use a ruler to draw a horizontal line segment $AB = 5$ cm.
2. Find the midpoint of the line segment AB by drawing its perpendicular bisector. Label this midpoint as D. The lengths AD and DB will both be 2.5 cm.
3. Open the compass to a radius of 3.8 cm (the length of the median CD). Place the compass point at D and draw an arc above the line segment.
4. Next, open the compass to a radius of 4.2 cm (the length of the side BC). Place the compass point at B and draw another arc to intersect the first arc.
5. Label the point of intersection of the two arcs as C.
6. Finally, use a ruler to join point C to point A and point C to point B. $\triangle ABC$ is the required triangle.

OR

Draw a circle of radius 3.2 cm. From any point P outside the circle draw two tangents PQ and PR to the circle.

Answer –



Steps of Construction:

1. Open the compass to 3.2 cm and draw a circle with center O.
2. Mark a point P anywhere outside the circle and join O to P to form the line segment OP.

3. Construct the perpendicular bisector of the line segment OP to locate its midpoint, and label it M.

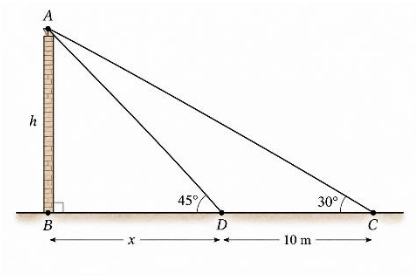
4. Place the compass point at M and set the radius to MO (or MP). Draw a new circle.

5. This new circle will intersect the original 3.2 cm circle at two distinct points. Label these intersection points Q and R.

6. Use a ruler to draw straight lines joining P to Q and P to R. PQ and PR are the required tangents to the circle from the external point P.

Q44 - The shadow of a tower, when the angle of elevation of the Sun is 30° is found to be 10 meters longer than when it was 45°. Find the height of the tower. (Use $\sqrt{3} = 1.732$)

Answer - Let the height of the vertical tower $AB = h$ m.



Let the initial horizontal shadow length when the sun's elevation is 45° be $BD = x$ m.

According to the question, the shadow increases by 10 m when the angle drops to 30°. Thus, $CD = 10$ m and the total shadow length $BC = (x + 10)$ m.

In the first right-angled triangle ΔABD:

$$\tan 45^\circ = \frac{\text{Perpendicular}}{\text{Base}} = \frac{AB}{BD}$$

$$1 = \frac{h}{x} \Longrightarrow x = h \quad \text{--- (Equation 1)}$$

In the second larger right-angled triangle ΔABC:

$$\tan 30^\circ = \frac{\text{Perpendicular}}{\text{Base}} = \frac{AB}{BC}$$

$$\frac{1}{\sqrt{3}} = \frac{h}{x + 10}$$

Cross-multiplying the values:

$$x + 10 = h\sqrt{3}$$

Substitute the value of $x = h$ from Equation 1 into this expression:

$$h + 10 = h\sqrt{3}$$

$$10 = h\sqrt{3} - h$$

$$10 = h(\sqrt{3} - 1)$$

$$h = \frac{10}{\sqrt{3} - 1}$$

To simplify, rationalize the denominator by multiplying the numerator and denominator by $(\sqrt{3} + 1)$:

$$h = \frac{10(\sqrt{3} + 1)}{(\sqrt{3} - 1)(\sqrt{3} + 1)} = \frac{10(\sqrt{3} + 1)}{3 - 1}$$

$$h = \frac{10(\sqrt{3} + 1)}{2} = 5(\sqrt{3} + 1)$$

Substitute the given value $\sqrt{3} = 1.732$:

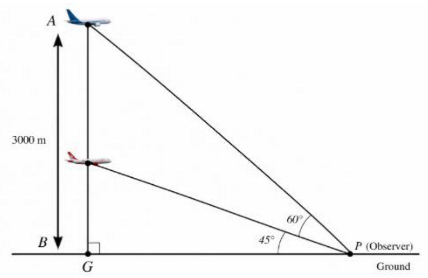
$$h = 5(1.732 + 1) = 5(2.732) = 13.66 \text{ m}$$

Answer: The height of the tower is 13.66 m.

OR

An aeroplane when 3000 m high passes vertically above another aeroplane at an instant when the angles of elevation of the two aeroplanes from the same point on the ground are 60° and 45° respectively. Find the vertical distance between the two planes. (Use $\sqrt{3} = 1.732$)

Answer - Let G be the base point on the ground directly below the planes.



Let A be the position of the higher aeroplane, so $AG = 3000$ m.

Let B be the position of the lower aeroplane vertically below A. Let $BG = h$ m.

Let P be the point of observation on the ground, and let the horizontal distance $PG = x$ m.

In the first right-angled triangle ΔBGP formed by the lower plane:

$$\tan 45^\circ = \frac{\text{Perpendicular}}{\text{Base}} = \frac{BG}{PG}$$

$$1 = \frac{h}{x} \Rightarrow x = h \quad \text{--- (Equation 1)}$$

In the second larger right-angled triangle ΔAGP formed by the higher plane:

$$\tan 60^\circ = \frac{\text{Perpendicular}}{\text{Base}} = \frac{AG}{PG}$$

$$\sqrt{3} = \frac{3000}{x}$$

$$x = \frac{3000}{\sqrt{3}}$$

Rationalizing the denominator:

$$x = \frac{3000\sqrt{3}}{3} = 1000\sqrt{3}\text{ m}$$

From Equation 1, we know that $h = x$, so the height of the lower plane is:

$$h = 1000\sqrt{3}\text{ m}$$

The vertical distance between the two aeroplanes is the difference between their heights ($AG - BG$):

$$\text{Vertical Distance} = 3000 - h = 3000 - 1000\sqrt{3} = 1000(3 - \sqrt{3})$$

Substitute the given value $\sqrt{3} = 1.732$:

$$\text{Vertical Distance} = 1000(3 - 1.732) = 1000(1.268) = 1268\text{ m}$$

Answer: The vertical distance between the two planes is 1268 m.

NIOS PYQ's SOLUTIONS

PREVIOUS YEARS' QUESTIONS & ANSWERS

OCTOBER-2025

Your Path to Success

SECTION – A

Q1 - The discriminant of the quadratic equation $x^2 - 4x + 3 = 0$ is:

(A) 28 **(B) -8**

(C) 4 **(D) 2**

Answer - (C) 4

Q2 – In an A.P., the sum of three consecutive numbers is 18 and their product is 120, then the three numbers are :

(A) 3, 4, 11 **(B) 2, 6, 10**

(C) 1, 7, 10 **(D) 3, 6, 9**

Answer - (B) 2, 6, 10

Q3 - By selling a school bag to a customer for ₹550, a shopkeeper makes a profit of 10%. The cost price (in ₹) of the school bag is:

(A) 625 **(B) 500**

(C) 575 **(D) 550**

Answer - (B) 500

Q4 - Ramesh purchases a radio set for ₹ 5,400 after getting 20% discount on its list-price. The list-price of the radio set is:

(A) ₹ 5,500 **(B) ₹ 5,800**

(C) ₹ 6,750 **(D) ₹ 6,000**

Answer - (C) ₹ 6,750

Q5 – O is the centre of the circle. CA is tangent at A and CB is tangent at B drawn to the circle. If $\angle ACB = 75^\circ$, then $\angle AOB =$

(A) 75° **(B) 85°**

(C) 95° **(D) 105°**

Answer - (D) 105°

Q6 - The length of tangent AP, from an external point A to a circle is 24 cm. If the distance of the point A from the centre O of the circle is 25 cm, then the diameter of the circle is

(A) 15 cm

(B) 14 cm

(C) 7 cm

(D) 12 cm

Answer - (B) 14 cm

Q7 - The distance between the points (a, b) and $(-a, -b)$ is :

(A) $\sqrt{a^2+b^2}$

(B) a^2+b^2

(C) $2\sqrt{a^2+b^2}$

(D) $4\sqrt{a^2+b^2}$

Answer - (C) $2\sqrt{a^2+b^2}$

Q8 - The mid-point of the line segment joining the points (-1, 3) and $\left(8, \frac{3}{2}\right)$ is :

(A) $\left(\frac{7}{2}, -\frac{3}{4}\right)$

(B) $\left(\frac{7}{2}, -\frac{9}{2}\right)$

(C) $\left(\frac{9}{2}, -\frac{3}{4}\right)$

(D) $\left(\frac{7}{2}, \frac{9}{4}\right)$

Answer - (D) $\left(\frac{7}{2}, \frac{9}{4}\right)$

Q9 - Area of a square, whose perimeter is 44 cm, is:

(A) 121 cm^2

(B) 121 cm

(C) 176 cm^2

(D) 11 cm^2

Answer - (A) 121 cm^2

Q10 - Length, breadth and height of a cuboid are 3 cm, 4 cm and 5 cm respectively. Its surface area is :

(A) 60 cm^2

(B) 70 cm^2

(C) 120 cm^2

(D) 94 cm^2

Answer - (D) 94 cm^2

Q11 - The volume of a cylinder of the same base radius and the same height as that of a cone is:

(A) the same as that of a cone

(B) 2 times the volume of the cone

(C) $\frac{1}{3}$ times the volume of the cone

(D) 3 times the volume of the cone

Answer - (D) 3 times the volume of the cone

Q12 - The value of sec 60° is:

(A) 2

(B) $\frac{\sqrt{3}}{2}$

(C) $\frac{2}{\sqrt{3}}$

(D) $\sqrt{2}$

Answer - (A) 2

Q13 - The mean of five observations is 15. If the mean of first three observations is 14 and that of the last three observations is 17, then the third observation is :

(A) 20

(B) 19

(C) 18

(D) 17

Answer - (C) 18

Q14 - If the mean of 6, 7, p, 8, q, 14 is 9, then

(A) $p - q = 19$

(B) $p + q = 19$

(C) $p - q = 21$

(D) $p + q = 21$

Answer - (B) $p + q = 19$

Q15 - The middle most observation of every data arranged in order is called:

(A) mode

(B) median

(C) mean

(D) deviation

Answer - (B) median

Q16 - Two dice are thrown together. The probability that they show different numbers is :

(A) $\frac{1}{6}$

(B) $\frac{5}{6}$

(C) $\frac{1}{3}$

(D) $\frac{2}{3}$

Answer - (B) $\frac{5}{6}$

Q17 - The probability of guessing the correct answer to a certain test question is $\frac{x}{6}$. If the probability of not guessing the correct answer to this question is $\frac{2}{3}$, then the value of x is:

(A) 2 **(B) 3**

(C) 4 **(D) 6**

Answer - (A) 2

Q18 - Fill in the blanks:

(i) HCF of $x^3 - y^3$ and $x^2 - y^2$ is ________.

(ii) LCM of $x^3 - y^3$ and $x^2 - y^2$ is ________.

Answer - (i) $x - y$

(ii) $(x-y)(x+y)(x^2+xy+y^2)$

Q19 - Fill in the blanks :

(i) The pair of equations $2x + 3y = 7$ and $(p-1)x + (p+2)y = 3p$ has infinitely many solutions for $p =$ ________.

(ii) The pair of equations $kx + 2y = 5$ and $3x + y = 1$ has no solution for k = ________.

Answer – (i) 7

(ii) 6

Q20 - Write TRUE for correct statement and FALSE for incorrect statement:

(i) Every quadratic equation has exactly one root.

(ii) If the quadratic equation $ax^2 + bx + c = 0$ has equal roots, then $b^2 - 4ac = 0$.

Answer – (i) FALSE

(ii) TRUE

Q21 - Write TRUE for correct statement and FALSE for incorrect statement:

(i) For the A. P. 10, 5, 0, -5, ... the common difference is equal to 5.

(ii) The sequence 2, 2, 2, 2, 2, 2, ..., is an A. P.

Answer – (i) FALSE

(ii) TRUE

Q22 – Read the passage and answer the questions that follow it: [(i) to (ii)]

Aarush earns ₹ 45,000 per month. He keeps 50% for household expenses, 20% for his personal expenses, 20% for expenditure on his children and the rest he saves.

(i) What amount does he spend per month?

(A) ₹ 40,500 **(B) ₹ 40,000**

(C) ₹ 38,000 **(D) ₹ 18,000**

Answer – (A) ₹ 40,500

(ii) What amount does he spend on his children?

(A) ₹ 18,000 **(B) ₹ 9,000**

(C) ₹ 10,000 **(D) ₹ 15,000**

Answer – (B) ₹ 9,000

Q23 - Fill in the blanks:

(i) From an external point P, two tangents PA and PB are drawn to the circle with centre O. Then the angle between OP and AB is _________.

(ii) PX and PY are two tangents drawn from an external point P to a circle with centre O. If $\angle XPY = 80^\circ$ then $\angle POX =$ ________.

Answer – (i) 90°

(ii) 50°

Q24 - Write TRUE for correct statement and FALSE for incorrect statement:

(i) In general, co-ordinates of a point $P(x, y)$ imply that distance of P from the y-axis is x units and its distance from the x-axis is y units.

(ii) R $(-2, -3)$ lies in the third quadrant as its both x and y co-ordinates are negative.

Answer – (i) TRUE

(ii) TRUE

Q25 – Write TRUE for correct statement and FALSE for incorrect statement:

(i) Surface area of a cube of side 'a' is $6a^2$.

(ii) Total surface area of a cone is πrl, where r and l are respectively the base radius and slant height of the cone.

Answer – (i) TRUE

(ii) FALSE

Q26 – Find the value of each of the following:

(i) $\frac{3\sin 19^\circ}{\cos 71^\circ}$

(ii) $\sec 41^\circ \sin 49^\circ + \cos 49^\circ \operatorname{cosec} 41^\circ$

Answer – (i) 3

(ii) 2

Q27 – Read the passage and answer the questions that follow it: [(i) to (ii)]

A bag contains 4 red, 5 white and some green balls. If probability of drawing a red ball at random is $1/5$, then find the probability of

(i) drawing a green ball

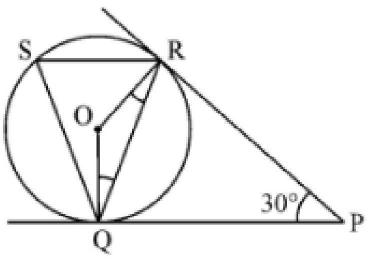
(ii) not drawing a green ball

Answer – (i) $\frac{11}{20}$

(ii) $\frac{9}{20}$

Q28 - Read the passage and answer the questions that follow it: [(i) to (v)]

London eye is an amusement ride consisting of a rotating upright big wheel with multiple passenger-carrying components attached to the rim in such a way that as the wheel turns, they are kept upright usually by gravity. After taking a ride in London eye, Anu came out from the crowd and was observing her friends who were enjoying the ride. She was curious about the different angles and measures that the wheel will form, she makes a figure as given.



(i) The measure of $\angle ROQ$ is:

(A) 60° **(B) 100°**

(C) 150° **(D) 90°**

Answer – (C) 150°

(ii) The measure of $\angle RQP$ is :

(A) 75° **(B) 60°**

(C) 30° **(D) 90°**

Answer – (A) 75°

(iii) The measure of $\angle RSQ$ is:

(A) 60° **(B) 75°**

(C) 100° **(D) 30°**

Answer – (B) 75°

(iv) The measure of $\angle ORP$ is:

(A) 90° **(B) 70°**

(C) 100° **(D) 60°**

Answer – (A) 90°

(v) The measure of $\angle ORQ$ is:

(A) 60° **(B) 15°**

(C) 75° **(D) 90°**

Answer – (B) 15°

SECTION - B

Q29 - Simplify: $(3x + 4y)^2 + (3x - 4y)^2$

Answer – To simplify the expression, we expand both terms using the standard algebraic identities

$(a + b)^2 = a^2 + 2ab + b^2$ and $(a - b)^2 = a^2 - 2ab + b^2$.

Expanding the first term:

$$(3x + 4y)^2 = (3x)^2 + 2(3x)(4y) + (4y)^2 = 9x^2 + 24xy + 16y^2$$

Expanding the second term:

$$(3x - 4y)^2 = (3x)^2 - 2(3x)(4y) + (4y)^2 = 9x^2 - 24xy + 16y^2$$

Adding both the expanded expressions together:

$$(9x^2 + 24xy + 16y^2) + (9x^2 - 24xy + 16y^2)$$

$$= 9x^2 + 9x^2 + 24xy - 24xy + 16y^2 + 16y^2$$

$$= 18x^2 + 32y^2$$

Answer: The simplified value of the expression is $18x^2 + 32y^2$.

OR

Factorise: $16x^2 - 25y^2$

Answer – Given expression:

$$16x^2 - 25y^2$$

We rewrite both terms as perfect squares:

$$16x^2 = (4x)^2 \quad \text{and} \quad 25y^2 = (5y)^2$$

Substituting these back into the expression:

$$(4x)^2 - (5y)^2$$

Using the algebraic identity for the difference of two squares, $a^2 - b^2 = (a - b)(a + b)$:

$$(4x - 5y)(4x + 5y)$$

Answer: The factors of the given expression are $(4x - 5y)(4x + 5y)$.

Q30 - A chair is sold for ₹2,700 cash or ₹600 as cash down payment, followed by 3 monthly instalments of ₹750 each. Find the interest paid under the instalment plan.

Answer – Given parameters:

- Cash Price of the chair = ₹ 2,700
- Cash Down Payment = ₹ 600
- Amount of each monthly instalment = ₹ 750
- Number of instalments = 3

First, calculate the total amount paid through instalments:

$$\text{Total Instalment Amount} = 3 \times 750 = ₹\ 2{,}250$$

Next, find the total amount paid by the customer under the instalment plan:

$$\text{Total Amount Paid} = \text{Cash Down Payment} + \text{Total Instalment Amount}$$

$$\text{Total Amount Paid} = 600 + 2250 = ₹\ 2{,}850$$

Now, calculate the extra interest charged under this plan:

$$\text{Interest Paid} = \text{Total Amount Paid} - \text{Cash Price}$$

$$\text{Interest Paid} = 2850 - 2700 = ₹\ 150$$

Answer: The total interest paid under the instalment plan is ₹ 150.

Q31 - A table is sold for ₹1,700 cash or for ₹500 as cash down payment, followed by ₹1,400 paid after 2 months. Find the annual rate of interest charged under the instalment plan.

Answer – Given parameters:

- Cash Price of the table = ₹ 1,700
- Cash Down Payment = ₹ 500
- Amount paid after 2 months = ₹ 1,400
- Time (T) = 2 months = $\frac{2}{12}$ year = $\frac{1}{6}$ year

First, we find the remaining principal balance (P) that was financed:

$$P = \text{Cash Price} - \text{Cash Down Payment}$$

$$P = 1700 - 500 = ₹\ 1{,}200$$

The final amount paid after 2 months (A) to clear this principal is ₹ 1,400.

Calculate the simple interest (I) charged on the financed balance:

$$I = A - P$$

$$I = 1400 - 1200 = ₹\ 200$$

Now, we use the simple interest formula $I = \frac{P \times R \times T}{100}$ to determine the annual rate of interest (R):

$$200 = \frac{1200 \times R \times \left(\frac{1}{6}\right)}{100}$$

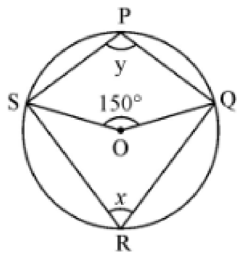
$$200 = \frac{200 \times R}{100}$$

$$200 = 2R$$

$$R = \frac{200}{2} = 100$$

Answer: The annual rate of interest charged under the instalment plan is 100% per annum.

Q32 - In figure, O is the centre of circle passing through P, Q, R and S. If $\angle SOQ = 150°$, find the values of x and y.



Answer – By the standard circle theorem, the angle subtended by an arc at the centre is double the angle subtended by it at any point on the remaining part of the circle.

Here, the central angle is $\angle SOQ = 150°$ and the inscribed angle at the circumference is $\angle SPQ = y$.

$$y = \frac{1}{2} \times \angle SOQ$$

$$y = \frac{1}{2} \times 150° = 75°$$

The vertices P, S, R, and Q all lie on the boundary of the circle, making $PQRS$ a cyclic quadrilateral. We know that the sum of opposite angles of a cyclic quadrilateral is always supplementary (180°).

$$\angle SRQ + \angle SPQ = 180°$$

$$x + y = 180°$$

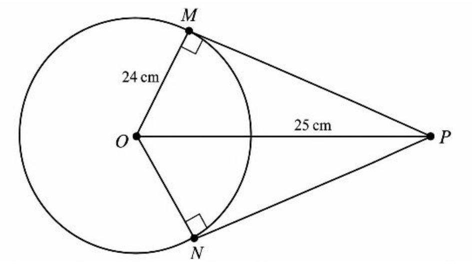
$$x + 75^\circ = 180^\circ$$

$$x = 180^\circ - 75^\circ = 105^\circ$$

Answer: The values are $x = 105^\circ$ and $y = 75^\circ$.

Q33 - PM and PN are the tangents drawn from a point P at a distance of 25 cm from the centre of the circle whose radius is 24 cm. Find the lengths of PM and PN.

Answer - Let O be the centre of the circle. Given that the distance of point P from the center is $OP = 25$ cm and the radius of the circle is $OM = ON = 24$ cm.



We know that a radius is perpendicular to the tangent at its point of contact. Therefore, $\angle OMP = 90^\circ$.

In the right-angled triangle ΔOMP, we apply the Pythagoras Theorem:

$$OP^2 = OM^2 + PM^2$$

Substitute the given values into the formula:

$$25^2 = 24^2 + PM^2$$

$$625 = 576 + PM^2$$

$$PM^2 = 625 - 576$$

$$PM^2 = 49 \Longrightarrow PM = \sqrt{49} = 7 \text{ cm}$$

Since the lengths of tangents drawn from an external point to a circle are always equal, we have $PN = PM = 7$ cm.

Answer: The lengths of both tangents PM and PN are 7 cm.

Q34 - The coordinates of the vertices of a triangle are (3, 5), (7, 10) and (1, 3). Find the co-ordinates of its centroid.

Answer – Given vertices of the triangle:

- $(x_1, y_1) = (3,5)$
- $(x_2, y_2) = (7,10)$
- $(x_3, y_3) = (1,3)$

The standard formula to determine the coordinates of the centroid (X, Y) of a triangle is given by:

$$X = \frac{x_1 + x_2 + x_3}{3} \quad \text{and} \quad Y = \frac{y_1 + y_2 + y_3}{3}$$

Calculating the horizontal X-coordinate component:

$$X = \frac{3+7+1}{3} = \frac{11}{3}$$

Calculating the vertical Y-coordinate component:

$$Y = \frac{5+10+3}{3} = \frac{18}{3} = 6$$

Answer: The coordinates of the centroid of the triangle are $\left(\frac{11}{3}, 6\right)$.

OR

Find the co-ordinates of the point on x-axis which is equidistant from the points whose co-ordinates are (8, 3) and (5, 9).

Answer – Let the required point situated on the x-axis be $P(x, 0)$ (since the y-coordinate of any point on the x-axis is always zero).

Let the given coordinate points be labeled as $A(8,3)$ and $B(5,9)$.

According to the problem, point P is equidistant from points A and B:

$$PA = PB \Longrightarrow PA^2 = PB^2$$

Applying the coordinate distance formula square $(x_2 - x_1)^2 + (y_2 - y_1)^2$ on both sides:

$$(x-8)^2 + (0-3)^2 = (x-5)^2 + (0-9)^2$$

Expanding using algebraic identities:

$$(x^2 - 16x + 64) + 9 = (x^2 - 10x + 25) + 81$$

$$x^2 - 16x + 73 = x^2 - 10x + 106$$

Canceling x^2 from both sides and rearranging the linear terms:

$$-16x + 10x = 106 - 73$$

$$-6x = 33$$

$$x = \frac{33}{-6} = -\frac{11}{2} = -5.5$$

Answer: The coordinates of the required point on the x-axis are $(-5.5,0)$.

Q35 - Find the area of sector of a circle of radius 15 cm with central angle 84°.

Answer – Given dimensions:

- Radius of the circle (r) = 15 cm
- Central angle (θ) = 84°

The formula to calculate the area of a sector of a circle is given by:

$$\text{Area} = \frac{\theta}{360^\circ} \times \pi r^2$$

Substituting the given values and using $\pi = \frac{22}{7}$:

$$\text{Area} = \frac{84^\circ}{360^\circ} \times \frac{22}{7} \times 15 \times 15$$

Simplifying the numerical expression:

$$\text{Area} = \left(\frac{84}{7}\right) \times \frac{1}{360} \times 22 \times 225$$

$$\text{Area} = 12 \times \frac{1}{360} \times 22 \times 225$$

$$\text{Area} = \frac{12}{360} \times 4950 = \frac{1}{30} \times 4950 = \frac{495}{3} = 165$$

Answer: The area of the sector of the circle is 165 cm^2.

OR

Area of a square field is 625 m^2. Find the perimeter of the field.

Answer – Let the side length of the square field be $= s$ metres.

We know that the area of a square is given by the formula:

$$\text{Area} = s^2$$

Given that Area = 625 m^2:

$$s^2 = 625 \Longrightarrow s = \sqrt{625} = 25 \text{ m}$$

The formula to calculate the total perimeter of a square is:

$$\text{Perimeter} = 4 \times s$$

$$\text{Perimeter} = 4 \times 25 = 100 \text{ m}$$

Answer: The perimeter of the square field is 100 m

Q36 - If $(1+\cos A)(1-\cos A)=\frac{3}{4}$, find the value of sec A.

Answer – Given trigonometric equation:

$$(1+\cos A)(1-\cos A)=\frac{3}{4}$$

Using the identity $(a+b)(a-b)=a^2-b^2$ on the left-hand side:

$$1-\cos^2 A=\frac{3}{4}$$

We know that $1-\cos^2 A=\sin^2 A$, but to directly find $\sec A$, we can rearrange the equation for $\cos^2 A$:

$$1-\frac{3}{4}=\cos^2 A$$

$$\cos^2 A=\frac{1}{4}$$

Taking the square root on both sides (considering the positive value for an acute angle):

$$\cos A=\sqrt{\frac{1}{4}}=\frac{1}{2}$$

Since secant is the reciprocal of cosine ($\sec A=\frac{1}{\cos A}$):

$$\sec A=\frac{1}{\frac{1}{2}}=2$$

Answer: The value of $\sec A$ is 2.

OR

If $\sin(A+B)=1$ and $\tan(A-B)=\frac{1}{\sqrt{3}}$, find the value of $\tan A+\cot B$.

Answer – Given equations:

1. $\sin(A+B)=1$

We know that $\sin 90^\circ=1$. Therefore:

$$A+B=90^\circ \quad \text{--- (Equation 1)}$$

2. $\tan(A-B)=\frac{1}{\sqrt{3}}$

We know that $\tan 30^\circ=\frac{1}{\sqrt{3}}$. Therefore:

$$A-B=30^\circ \quad \text{--- (Equation 2)}$$

Adding Equation 1 and Equation 2 together:

$$(A + B) + (A - B) = 90^\circ + 30^\circ$$

$$2A = 120^\circ \implies A = \frac{120^\circ}{2} = 60^\circ$$

Substituting $A = 60^\circ$ back into Equation 1:

$$60^\circ + B = 90^\circ \implies B = 90^\circ - 60^\circ = 30^\circ$$

Now, we evaluate the required expression $\tan A + \cot B$:

$$\tan A + \cot B = \tan 60^\circ + \cot 30^\circ$$

From standard ratio value tables, $\tan 60^\circ = \sqrt{3}$ and $\cot 30^\circ = \sqrt{3}$:

$$\tan A + \cot B = \sqrt{3} + \sqrt{3} = 2\sqrt{3}$$

Answer: The value of $\tan A + \cot B$ is $2\sqrt{3}$.

Q37 - One card is drawn at random from a well-shuffled deck of 52 cards. Find the probability that the card drawn.

(i) is queen of hearts

(ii) is not a jack

Answer – Total number of possible outcomes (total cards in a standard deck) = 52.

(i) Probability that the card drawn is a queen of hearts:

There is exactly 1 unique queen of hearts card in a standard deck.

$$\text{Probability} = \frac{\text{Number of favorable outcomes}}{\text{Total number of outcomes}} = \frac{1}{52}$$

(ii) Probability that the card drawn is not a jack:

There are a total of 4 jacks in a deck of cards.

Therefore, the number of cards that are **not** jacks is:

$$52 - 4 = 48 \text{ cards}$$

$$\text{Probability} = \frac{\text{Number of non-jack cards}}{\text{Total number of outcomes}} = \frac{48}{52} = \frac{12}{13}$$

Answer: (i) The probability of drawing a queen of hearts is $\frac{1}{52}$.

(ii) The probability of drawing a card that is not a jack is $\frac{12}{13}$.

Q38 - Factorise: $a^6 - 64b^6$

Answer – Given algebraic expression:

$$a^6 - 64b^6$$

We rewrite the terms as a difference of two cubes:

$$a^6 = (a^2)^3 \quad \text{and} \quad 64b^6 = (4b^2)^3$$

Substituting this back into the expression:

$$(a^2)^3 - (4b^2)^3$$

Using the cubic algebraic identity $X^3 - Y^3 = (X - Y)(X^2 + XY + Y^2)$:

$$= (a^2 - 4b^2)[(a^2)^2 + (a^2)(4b^2) + (4b^2)^2]$$

$$= (a^2 - 4b^2)[a^4 + 4a^2b^2 + 16b^4]$$

Now, we expand both parts further:

1. The first part can be factored using the identity $A^2 - B^2 = (A - B)(A + B)$:

$$a^2 - 4b^2 = (a)^2 - (2b)^2 = (a - 2b)(a + 2b)$$

2. The second part can be rewritten by completing the square:

$$a^4 + 4a^2b^2 + 16b^4 = (a^4 + 8a^2b^2 + 16b^4) - 4a^2b^2$$

$$= (a^2 + 4b^2)^2 - (2ab)^2$$

Applying $A^2 - B^2$ again:

$$= (a^2 + 4b^2 - 2ab)(a^2 + 4b^2 + 2ab) = (a^2 - 2ab + 4b^2)(a^2 + 2ab + 4b^2)$$

Combining all the simplified linear factors together:

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

Answer: The completely factored expression is $(a - 2b)(a + 2b)(a^2 - 2ab + 4b^2)(a^2 + 2ab + 4b^2)$.

OR

Divide: $\frac{a^2-1}{a^2-25}$ by $\frac{a^2-4a-5}{a^2+4a-5}$ and express the result in lowest form.

Answer – To divide the rational expressions, we multiply the first expression by the reciprocal of the second expression:

$$\frac{a^2 - 1}{a^2 - 25} \div \frac{a^2 - 4a - 5}{a^2 + 4a - 5} = \frac{a^2 - 1}{a^2 - 25} \times \frac{a^2 + 4a - 5}{a^2 - 4a - 5}$$

Now, we fully factorize each individual quadratic polynomial component:

- $a^2 - 1 = (a-1)(a+1)$
- $a^2 - 25 = (a-5)(a+5)$
- $a^2 + 4a - 5 = a^2 + 5a - a - 5 = a(a+5) - 1(a+5) = (a+5)(a-1)$
- $a^2 - 4a - 5 = a^2 - 5a + a - 5 = a(a-5) + 1(a-5) = (a-5)(a+1)$

Substituting these factored polynomial terms back into the division product expression:

$$= \frac{(a-1)(a+1)}{(a-5)(a+5)} \times \frac{(a+5)(a-1)}{(a-5)(a+1)}$$

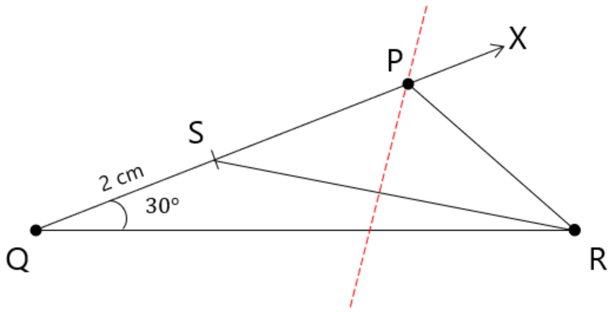
Canceling out identical common terms present in both the numerators and denominators ($a+1$ and $a+5$):

$$= \frac{(a-1)\times(a-1)}{(a-5)\times(a-5)} = \frac{(a-1)^2}{(a-5)^2} = \frac{a^2-2a+1}{a^2-10a+25}$$

Answer: The final fraction result expressed in its lowest form is $\frac{a^2-2a+1}{a^2-10a+25}$.

Q39 - Construct a Δ PQR, in which $QR = 8$ cm, $\angle Q = 30°$, $PQ - PR = 2$ cm.

Answer –



Steps of Construction:

1. Draw a horizontal base line segment $QR = 8$ cm using a metric ruler.
2. At point Q, use a protractor or compass to construct an angle $\angle RQX = 30°$.
3. Since the side condition specifies $PQ - PR = 2$ cm (meaning $PQ > PR$), cut a line segment length $QS = 2$ cm along the constructed ray QX.
4. Join point S to endpoint R using a straight edge ruler to form line segment SR.
5. Construct the perpendicular right bisector of this new line segment SR. Extend the bisector line upwards until it intersects the original ray QX at a point. Label this point of intersection as vertex P.
6. Join vertex P to endpoint R with a solid line to complete the boundaries of the triangle ΔPQR.

Q40 - Find the ratio in which the y-axis divides the line segment joining the points $(4, -5)$ and (-1, 2). Also find the point of intersection.

Answer – Let the horizontal y-axis divide the line segment joining points $A(4, -5)$ and $B(-1,2)$ internally in the ratio $k: 1$.

Any point located on the y-axis has an x-coordinate value equal to 0, so we denote the point of intersection as $P(0, y)$.

Using the standard coordinate Section Formula for the x-axis component:

$$x = \frac{mx_2 + nx_1}{m + n}$$

Substituting known parameters ($x = 0$, $x_1 = 4$, $x_2 = -1$, $m = k, n = 1$):

$$0 = \frac{k(-1) + 1(4)}{k + 1}$$

$$0 = -k + 4 \implies k = 4$$

Thus, the internal division ratio $k: 1$ is equal to $4: 1$.

Now, substitute $k = 4$ into the section formula component for the vertical y-coordinate to locate the intersection point:

$$y = \frac{my_2 + ny_1}{m + n}$$

$$y = \frac{4(2) + 1(-5)}{4 + 1} = \frac{8 - 5}{5} = \frac{3}{5}$$

Answer: The y-axis divides the line segment in the ratio $4: 1$, and the coordinates of the point of intersection are $\left(0, \frac{3}{5}\right)$.

OR

Show that the points $A(1, 5)$, $B(7, -1)$and $C(4, 2)$are collinear.

Answer – Given points: $A(1,5)$, $B(7, -1)$, and $C(4,2)$.

To show that these points are collinear, we find the distance between each pair of points using the distance formula $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$.

Calculate distance AB:

$$AB = \sqrt{(7 - 1)^2 + (-1 - 5)^2} = \sqrt{(6)^2 + (-6)^2} = \sqrt{36 + 36} = \sqrt{72} = 6\sqrt{2} \text{ units}$$

Calculate distance BC:

$$BC = \sqrt{(4-7)^2 + \left(2-(-1)\right)^2} = \sqrt{(-3)^2 + (3)^2} = \sqrt{9+9} = \sqrt{18} = 3\sqrt{2} \text{ units}$$

Calculate distance AC:

$$AC = \sqrt{(4-1)^2 + (2-5)^2} = \sqrt{(3)^2 + (-3)^2} = \sqrt{9+9} = \sqrt{18} = 3\sqrt{2} \text{ units}$$

Now, we add the two smaller distance segments together:

$$AC + BC = 3\sqrt{2} + 3\sqrt{2} = 6\sqrt{2} \text{ units}$$

Notice that $AC + BC = AB$ ($6\sqrt{2} = 6\sqrt{2}$).

Since the sum of the distances between A to C and C to B equals the total straight-line distance from A to B, the points must lie along the same straight line.

Hence, the points A, B, and C are collinear.

Q41 - There is a practical path of width 2 m along the boundary and inside a circular park of radius 16 m. Find the cost of paving the path with bricks at the rate of 24 per m^2. (Use $\pi = 3.14$)

Answer – Given dimensions of the circular park:

- Outer boundary radius (R) = 16 m
- Width of the internal boundary path = 2 m
- Inner radius (r) = Outer Radius – Path Width = 16 – 2 = 14 m
- Rate of paving bricks = ₹ 24 per m^2

First, we calculate the total surface area of the circular path using the concentric ring formula:

$$\text{Area of the path} = \pi R^2 - \pi r^2 = \pi(R^2 - r^2)$$

Using the given value $\pi = 3.14$:

$$\text{Area} = 3.14 \times (16^2 - 14^2)$$

$$\text{Area} = 3.14 \times (256 - 196)$$

$$\text{Area} = 3.14 \times 60 = 188.4 \text{ m}^2$$

Now, compute the total cost of paving the path with bricks at the rate of ₹ 24 per m^2:

$$\text{Total Cost} = \text{Area of the path} \times \text{Rate}$$

$$\text{Total Cost} = 188.4 \times 24 = ₹\ 4{,}521.60$$

Answer: The total cost of paving the internal circular path with bricks is ₹ 4,521.60.

Q42 - The distribution below gives the weights of 30 students of a class. Find the median weight of the students.

Weight (in kg)	**40-45**	**45-50**	**50-55**	**55-60**	**60-65**	**65-70**	**70-75**
No. of students	**2**	**3**	**8**	**6**	**6**	**3**	**2**

Answer – To determine the median weight for grouped continuous distribution data, we first construct a Cumulative Frequency (cf) column table:

$\boldsymbol{Weight\ Interval\ (in\ kg)}$	$\boldsymbol{Frequency\ (f)}$	$\boldsymbol{Cumulative\ Frequency\ (cf)}$
$40 - 45$	2	2
$45 - 50$	3	$2 + 3 = 5$
$50 - 55$	8	$5 + 8 = 13$
$\boldsymbol{55 - 60\ (Median\ Class)}$	$\boldsymbol{6}$	$13 + 6 = 19$
$60 - 65$	6	$19 + 6 = 25$
$65 - 70$	3	$25 + 3 = 28$
$70 - 75$	2	$28 + 2 = 30$

Here, total number of observations (N) = $\sum f = 30$.

Compute the partial median rank value:

$$\frac{N}{2} = \frac{30}{2} = 15$$

Locate the row where the cumulative frequency is just greater than or equal to 15. That value is 19, identifying **55-60** as our active **Median Class**.

From this median class row, extract the parameters needed for interpolation:

- Lower class boundary limit (l) = 55
- Frequency of the median class (f) = 6
- Cumulative frequency of the preceding class (cf) = 13
- Class interval width size (h) = 5

Now, apply the standard continuous median interpolation formula:

$$\text{Median} = l + \left(\frac{\frac{N}{2} - cf}{f}\right) \times h$$

$$\text{Median} = 55 + \left(\frac{15 - 13}{6}\right) \times 5$$

$$\text{Median} = 55 + \left(\frac{2}{6}\right) \times 5 = 55 + \frac{5}{3} = 55 + 1.67 = 56.67 \text{ kg}$$

Answer: The median weight of the students in the class is 56.67 kg.

Q43 - Solve the following system of linear equations graphically:

Answer – To solve the system of linear equations using the graphical method, we find at least two sets of coordinate points for each individual straight line equation.

For Equation 1: $2x + y - 6 = 0 \Longrightarrow y = 6 - 2x$

- When $x = 0$, $y = 6 - 2(0) = 6 \Longrightarrow$ Point $A(0,6)$
- When $x = 3$, $y = 6 - 2(3) = 0 \Longrightarrow$ Point $B(3,0)$

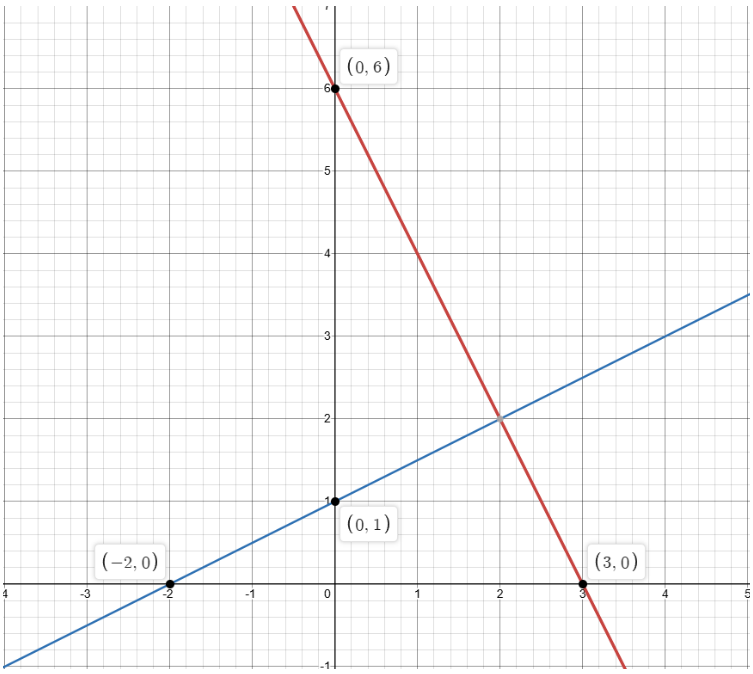
For Equation 2: $x - 2y = -2 \Longrightarrow 2y = x + 2 \Longrightarrow y = \frac{x+2}{2}$

- When $x = 0$, $y = \frac{0+2}{2} = 1 \Longrightarrow$ Point $C(0,1)$
- When $x = -2$, $y = \frac{-2+2}{2} = 0 \Longrightarrow$ Point $D(-2,0)$

Tables for coordinates:

Equation 1: 2x+y-6=0		
x	0	3
y	6	0

Equation 2: x-2y=-2		
x	0	-2
y	1	0



Answer: The graphical solution of the system of linear equations is $x = 2$ and $y = 2$.

OR

The area of a rectangle gets reduced by 9 square units, if its length is reduced by 5 units and breadth is increased by 3 units. If we increase the length by 3 units and the breadth by 2 units, the area increases by 67 square units. Find the dimensions of the rectangle.

Answer – Let the original length of the rectangle be $= x$ units and the original breadth be $= y$ units.

Therefore, the original primary surface area of the rectangle $= xy$ square units.

According to the first condition statement:

If length is reduced by 5 units and breadth is increased by 3 units, area reduces by 9 square units.

$$(x-5)(y+3) = xy - 9$$

$$xy + 3x - 5y - 15 = xy - 9$$

$$3x - 5y = 15 - 9 \Longrightarrow 3x - 5y = 6 \quad \text{--- (Equation 1)}$$

According to the second condition statement:

If length is increased by 3 units and breadth is increased by 2 units, area increases by 67 square units.

$$(x+3)(y+2) = xy + 67$$

$$xy + 2x + 3y + 6 = xy + 67$$

$$2x + 3y = 67 - 6 \Longrightarrow 2x + 3y = 61 \quad \text{--- (Equation 2)}$$

Now, we solve this system of equations by multiplying Equation 1 by 3 and Equation 2 by 5:

- $9x - 15y = 18$
- $10x + 15y = 305$

Adding both the equations together to eliminate y:

$$(9x + 10x) + (-15y + 15y) = 18 + 305$$

$$19x = 323 \Longrightarrow x = \frac{323}{19} = 17 \text{ units}$$

Substitute $x = 17$ back into Equation 1 to find y:

$$3(17) - 5y = 6$$

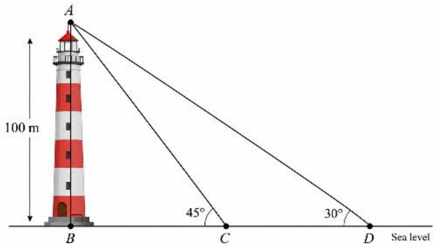
$$51 - 5y = 6 \Longrightarrow 5y = 51 - 6$$

$$5y = 45 \Longrightarrow y = \frac{45}{5} = 9 \text{ units}$$

Answer: The dimensions of the rectangle are: Length = 17 units and Breadth = 9 units.

Q44 - As observed from the top of a 100 m high light house from the sea level, the angles of depression of two ships are 30° and 45°. If one ship is exactly behind the other on the same side of the light house, find the distance between the two ships. [Use $\sqrt{3} = 1.732$]

Answer - Let AB be the vertical lighthouse such that height $AB = 100$ m.



Let C and D represent the positions of the two ships along the horizontal line of sight.

By alternate interior angles, the angles of elevation from the ships C and D to the top of the lighthouse A are 45° and 30° respectively.

Let distance $BC = x$ m and the distance between the two ships $CD = d$ m. Thus, total distance $BD = (x + d)$ m.

In the first right-angled triangle ΔABC:

$$\tan 45^\circ = \frac{\text{Perpendicular}}{\text{Base}} = \frac{AB}{BC}$$

$$1 = \frac{100}{x} \Rightarrow x = 100 \text{ m} \quad \text{--- (Equation 1)}$$

In the second larger right-angled triangle ΔABD:

$$\tan 30^\circ = \frac{\text{Perpendicular}}{\text{Base}} = \frac{AB}{BD}$$

$$\frac{1}{\sqrt{3}} = \frac{100}{x + d}$$

$$x + d = 100\sqrt{3}$$

Substitute the value of $x = 100$ from Equation 1 into this expression:

$$100 + d = 100\sqrt{3}$$

$$d = 100\sqrt{3} - 100 = 100(\sqrt{3} - 1)$$

Substitute the given value $\sqrt{3} = 1.732$:

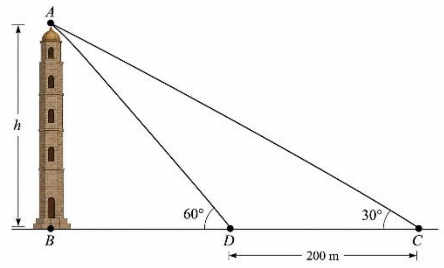
$$d = 100(1.732 - 1) = 100 \times 0.732 = 73.2 \text{ m}$$

Answer: The distance between the two ships is 73.2 m.

OR

The shadow of a tower standing on a level ground is found to be 200 m longer when the sun's altitude is 30° than when it is 60°. Find the height of the tower. [Use $\sqrt{3} = 1.73$]

Answer - Let the height of the vertical tower be $AB = h$ metres.



Let the horizontal length of the shadow when the sun's altitude is 60° be $BD = x$ m.

The length of the shadow increases by 200 m when the altitude drops to 30°. Therefore, $CD = 200$ m and total base length $BC = (x + 200)$ m.

In the first right-angled triangle ΔABD:

$$\tan 60^\circ = \frac{\text{Perpendicular}}{\text{Base}} = \frac{AB}{BD}$$

$$\sqrt{3} = \frac{h}{x} \Longrightarrow x = \frac{h}{\sqrt{3}} \quad \text{--- (Equation 1)}$$

In the second larger right-angled triangle ΔABC:

$$\tan 30^\circ = \frac{\text{Perpendicular}}{\text{Base}} = \frac{AB}{BC}$$

$$\frac{1}{\sqrt{3}} = \frac{h}{x + 200}$$

$$x + 200 = h\sqrt{3}$$

Substitute the value of x from Equation 1 into this expression:

$$\frac{h}{\sqrt{3}} + 200 = h\sqrt{3}$$

Multiplying the entire equation by $\sqrt{3}$ to clear the fraction:

$$h + 200\sqrt{3} = 3h$$

$$200\sqrt{3} = 3h - h$$

$$2h = 200\sqrt{3} \Longrightarrow h = 100\sqrt{3} \text{ m}$$

Substitute the given value $\sqrt{3} = 1.73$:

$$h = 100 \times 1.73 = 173 \text{ m}$$

Answer: The height of the tower is 173 m.

Thank you!

We hope you found this material helpful. We wish you the very best for your examination.

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