NIOS PYQ's SOLUTIONS

PREVIOUS YEARS' QUESTIONS & ANSWERS

APRIL-2024

Your Path to Success

SECTION - A

Q1 - $x^2 - 5x + 6$ can be written in the form of factors as:

(A) $(x+3)(x-2)$

(B) $(x-3)(x+2)$

(C) $(x+4)(x+2)$

(D) $(x-3)(x-2)$

Answer - (D) $(x-3)(x-2)$

OR

$9x^2 - y^2$ can be written in the form of factors as:

(A) $(3x+y)(3x-y)$

(B) $(3x+y)^2$

(C) $(3x-y)^2$

(D) $(x-3y)(x+3y)$

Answer - (A) $(3x+y)(3x-y)$

Q2 – Which of the following is not a linear equation?

(A) $x+2=3x$

(B) $x+y=\sqrt{2}\cdot y+7$

(C) $x+y^2=7-2x$

(D) $x-y=7$

Answer - (C) $x+y^2=7-2x$

OR

Which of the following is a quadratic equation?

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

(B) $x^2-5x+2=0$

(C) $\sqrt{x}+\frac{3}{\sqrt{x}}=2\sqrt{x}, x\neq 0$

(D) $x^3+2x^2-4x+1=0$

Answer - (B) $x^2-5x+2=0$

Q3 - If $x+2$, $2x+5$ and $4x+8$ are in AP then the value of x is :

(A) 0

(B) 2

(C) -2

(D) 1

Answer - (A) 0

OR

The number of terms of the AP: 3, 17, 31, ... 101 is:

(A) 6 **(B) 7**

(C) 8 **(D) 9**

Answer - (C) 8

Q4 - If the quadratic equation $kx^2 - 12x + 6 = 0$ has equal real roots, then the value of k is:

(A) -6 **(B) 6**

(C) -4 **(D) 4**

Answer - (B) 6

OR

Roots of the quadratic equation $2x^2 - 3x + 5 = 0$ are:

(A) real **(B) real and equal**

(C) real and unequal **(D) not real**

Answer - (D) not real

Q5 – 3.7 is equivalent to :

(A) 3.7% **(B) 37%**

(C) 370% **(D) 0.37%**

Answer - (C) 370%

OR

0.2% can be written as:

(A) 0.2 **(B) 0.02**

(C) 2.0 **(D) 0.002**

Answer - (D) 0.002

Q6 - In the word "PERCENTAGE" what percent of the letters are E's?

(A) 30% **(B) 40%**

(C) 25% **(D) 20%**

Answer - (A) 30%

OR

When 60 is reduced to 45, then percentage of reduction is :

(A) 40% **(B) 33 1/3%**

(C) 25% **(D) 75%**

Answer - (C) 25%

Q7 - Which of the following statements is true for a cyclic quadrilateral?

(A) one of the opposite angles is always acute.

(B) opposite angles are supplementary.

(C) opposite angles are complementary.

(D) one of the opposite angles is always obtuse.

Answer - (B) opposite angles are supplementary.

OR

Angle subtended at the centre by a semicircle is :

(A) acute angle **(B) obtuse angle**

(C) right angle **(D) straight angle**

Answer - (D) straight angle

Q8 - Distance (in units) of the point (3, 4) from x-axis is:

(A) 3 **(B) 4**

(C) 5 **(D) 6**

Answer - (B) 4

OR

Point (4, -5) lies in which of the following quadrants ?

(A) First **(B) Second**

(C) Third **(D) Fourth**

Answer - (D) Fourth

Q9 - Number of tangents drawn, from a point in the interior of a circle, to the circle is :

(A) 1 **(B) 2**

(C) 4 **(D) 0**

Answer - (D) 0

Q10 - Two parallel sides of a trapezium are 28 cm and 12 cm. If the distance between these parallel sides is 9 cm, then its area (in cm^2) is:

(A) 90 **(B) 180**

(C) 360 **(D) 540**

Answer - (B) 180

Q11 - Total surface area (in cm^2) of a solid hemisphere of radius 7 cm is :

(A) 154 **(B) 231**

(C) 308 **(D) 462**

Answer - (D) 462

Q12 - In a ΔABC right angled at B, if $AB = 12$ cm and $BC = 5$ cm, then sinC is equal to:

(A) 5/13 **(B) 13/5**

(C) 12/13 **(D) 13/12**

Answer - (C) 12/13

Q13 - The value of $cosec^2 67^\circ - tan^2 23^\circ + 1$ is:

(A) -1 **(B) 0**

(C) 1 **(D) 2**

Answer - (D) 2

Q14 - If $sin\ \theta - cos\ \theta = 0$ where $0^\circ < \theta < 90^\circ$, then the value of θ is:

(A) 0°

(B) 30°

(C) 45°

(D) 60°

Answer - (C) 45°

Q15 - The probability of an impossible event is :

(A) 0

(B) 1/3

(C) 1/2

(D) 1

Answer - (A) 0

Q16 - Which of the following is not a measure of central tendency ?

(A) mean

(B) median

(C) mode

(D) class-mark

Answer - (D) class-mark

Q17 - Mode of the data, 2, 7, 5, 9, 5, 7, 8, 11, 5 is:

(A) 9

(B) 7

(C) 5

(D) 4

Answer - (C) 5

Q18 - Fill in the blanks:

(i) H.C.F. of $x^3 + 1$ and $x^2 - 1$ is _______

(ii) L.C.M. of $x^3 + 1$ and $x^2 - 1$ is _______

(iii) Reciprocal of $x^3 + 8$ is _______

(iv) $(2x^2 + 5)^2 - (2x^2 - 5)^2 =$ _______

Answer - (i) $x + 1$

(ii) $(x - 1)(x^3 + 1)$

(iii) $\frac{1}{x^3+8}$

(iv) $40x^2$

Q19 - Match Column - I statements with the right options of Column - II.

Column - I	Column - II
(i) If $x^2 + 5x = 0$ then x is:	(a) 2, 3
(ii) If $x^2 - 5x + 6 = 0$, then x is:	(b) -2, -3
(iii) If $x^2 - 5x = 0$ then x is:	(c) 0, -5
(iv) If $x^2 + 5x + 6 = 0$ then x is :	(d) 0, 5

Answer – (i) If $x^2 + 5x = 0$ then x is: - **(c) 0, -5**

(ii) If $x^2 - 5x + 6 = 0$, then x is: - **(a) 2, 3**

(iii) If $x^2 - 5x = 0$ then x is: - **(d) 0, 5**

(iv) If $x^2 + 5x + 6 = 0$ then x is : - **(b) -2, -3**

Q20 - In a flower bed, there are 23 rose plants in first row, 21 in second row, 19 in third row and so on. If there are 5 rose plants in the last row, then:

(i) number of rows in the flower bed is ________

(ii) number of rose plants in 9th row is ________

Answer – (i) 10

(ii) 7

Q21 - Students of class X in a school were playing "MATHSBOLA" during Maths week. They were asked to choose two numbers. It was found that the difference between larger number and smaller number is 5. Based on this information answer the following:

(i) Linear equation in two variables representing the given data is ________ where $x > y$.

(ii) If smaller number is 36, then the greater number is ________

Answer – (i) $x - y = 5$

(ii) 41

Q22 – Fill in the blanks:

(i) Maximum number of common tangents that can be drawn to two non-intersecting circles is ________

(ii) At a point on the circle exactly ________ tangent can be drawn.

(iii) Tangents drawn at the extremities of a diameter of a circle are ________

(iv) Maximum number of common tangents drawn to two circles intersecting at two distinct points is ________

Answer – (i) 4

(ii) 1

(iii) parallel

(iv) 2

Q23 - Write true for correct statements and false for incorrect statements:

(i) The point (0, -4) lies in the fourth quadrant.

(ii) Distance of the point (2, 3) from x-axis is 3 units.

(iii) The mid-point of the line segment joining the points (1, 0) and (3, 2) is (-2,-1).

(iv) Radius of a circle having centre at origin and passing through the point (2, 3) is $\sqrt{13}$ units.

Answer – (i) False

(ii) True

(iii) False

(iv) True

Q24 - Fill in the blanks:

(i) PT is a tangent and PAB is a secant to a circle from an external point P. (A, B lie on the circle). If $PT = 6$ cm, $AB = 5$ cm and $PA = x$ cm, then the value of x is ________

(ii) PQ is a tangent drawn from a point P to a circle with centre O and QOR is a diameter of the circle such that $\angle POR = 120^{\circ}$, then ∠OPQ is ________

Answer – (i) 4

(ii) 30°

Q25 – Fill in the blanks:

(i) PQRS is a cyclic quadrilateral and side PS is extended to the point A. If $\angle PQR = 80^{\circ}$, then ∠ASR is ________

(ii) PQRS is a cyclic quadrilateral, if $\angle R = 78^\circ$, then ∠P is ________

Answer – (i) $80°$

(ii) $102°$

Q26 – Fill in the blanks:

(i) If $sec\, \theta = \frac{5}{4}$, then the value of $\frac{tan^2\theta}{1+tan^2\theta}$ is ________

(ii) The value of $cosA \cdot sin(90^\circ - A) + sin\, A \cdot cos(90^\circ - A)$ is ________

(iii) If $cos\theta + sin\, \theta = \sqrt{2} \cdot cos\theta$, then the value of $\tan\theta$ is ________

(iv) The value of $(sec^2 57^\circ - cot^2 33^\circ - tan^2 45^\circ)$ is ________

Answer – (i) $\frac{9}{25}$

(ii) 1

(iii) $\sqrt{2} - 1$

(iv) 0

Q27 – A box contains 3 blue, 4 white and 5 red marbles. If a marble is drawn at random from the box, then what is the probability that it will be:

(i) white

(ii) blue

(iii) red

(iv) neither white nor red

Answer – (i) $\frac{1}{3}$

(ii) $\frac{1}{4}$

(iii) $\frac{5}{12}$

(iv) $\frac{1}{4}$

Q28 - 10 members of a family went for a picnic to a hill station. Due to festival season, they did not get a hotel in the city. The weather was fine so they decided to make a conical tent at a park. They made the tent with height 6 m and radius of base 8 m.

(i) What was slant height of the tent ?

(ii) What was ratio of height to slant height ?

(iii) How much cloth was used for the tent ?

(iv) How much cloth was used for the floor?

(v) What was volume of tent ?

(vi) What was total cost of cloth at the rate of ₹70 per square meter ?

(vii) What was the saving of money if the floor would have been covered by the bed sheets carried by the family members ?

Answer – (i) $10\ m$

(ii) $3:5$

(iii) $251.4\ m^2$

(iv) $201.1\ m^2$

(v) $402.3\ m^3$

(vi) ₹17,600

(vii) ₹14,080

SECTION - B

Q29 - The first term of an A.P. is -2 and common difference is 5. Find its 10^{th} term and sum of its 1st 10 terms.

Answer – Given:

- First term $a = -2$
- Common difference $d = 5$
- Number of terms $n = 10$

To find the 10^{th} term, we use the general formula for the n^{th} term of an Arithmetic Progression, which is $t_n = a + (n-1)d$.

Substituting the given values into the formula:

$$t_{10} = -2 + (10 - 1)5$$

$$t_{10} = -2 + 9 \times 5$$

$$t_{10} = -2 + 45$$

$$t_{10} = 43$$

To find the sum of the first 10 terms, we use the sum formula $S_n = \frac{n}{2}[2a + (n-1)d]$.

$$S_{10} = \frac{10}{2}[2(-2) + (10 - 1)5]$$

$$S_{10} = 5[-4 + 9 \times 5]$$

$$S_{10} = 5[-4 + 45]$$

$$S_{10} = 5 \times 41$$

$$S_{10} = 205$$

Answer: The 10^{th} term is **43** and the sum of the first 10 terms is **205**.

OR

The 5th term of an A.P. is 23 and 12th term is 37. Find its first term and common difference.

Answer – Given:

- 5^{th} term (t_5) = 23
- 12^{th} term (t_{12}) = 37

Using the general term formula $t_n = a + (n-1)d$, we can set up two linear equations.

For the 5^{th} term:

$$a + (5 - 1)d = 23$$

$$a + 4d = 23 \; - \; (Eq. 1)$$

For the 12^{th} term:

$$a + (12 - 1)d = 37$$

$$a + 11d = 37 \; - \; (Eq. 2)$$

Subtracting Equation 1 from Equation 2 eliminates a:

$$(a + 11d) - (a + 4d) = 37 - 23$$

$$7d = 14$$

$$d = 2$$

Substitute the value of d back into Equation 1 to find a:

$$a + 4(2) = 23$$

$$a + 8 = 23$$

$$a = 23 - 8$$

$$a = 15$$

Answer: The first term is **15** and the common difference is **2**.

Q30 - The cost price of 25 articles is equal to the selling price of 20 articles. Find the loss or gain percent.

Answer – Let the Cost Price (C.P.) of 1 article be Rs 1.

Therefore, the C.P. of 20 articles = Rs 20.

According to the problem, the Selling Price (S.P.) of 20 articles is equal to the C.P. of 25 articles.

So, the S.P. of 20 articles = Rs 25.

Since the Selling Price is greater than the Cost Price, there is a profit (gain).

$$\text{Gain} = \text{S.P.} - \text{C.P.}$$

$$\text{Gain} = 25 - 20 = \text{Rs } 5$$

To find the gain percentage, we use the formula:

$$\text{Gain \%} = \left(\frac{\text{Gain}}{\text{C.P.}}\right) \times 100\%$$

$$\text{Gain \%} = \left(\frac{5}{20}\right) \times 100\%$$

$$\text{Gain \%} = \frac{1}{4} \times 100\%$$

$$\text{Gain \%} = 25\%$$

Answer: The gain percent is **25%**.

OR

A shopkeeper marks his goods at 20% more than their cost price and allows a discount of 10%. Find his gain or loss percent.

Answer – Let the Cost Price (C.P.) of the goods be Rs 100.

The shopkeeper marks the goods 20% higher than the C.P.

Marked Price (M.P.) = $100 + 20\%$ of 100 = Rs 120.

He allows a discount of 10% on the Marked Price. Discount is always calculated on the Marked Price.

$$\text{Discount} = 10\% \text{ of } 120 = \text{Rs } 12$$

$$\text{The Net Selling Price (S.P.)} = \text{M.P.} - \text{Discount}$$

$$\text{S.P.} = 120 - 12 = \text{Rs } 108$$

Since the S.P. (Rs 108) is greater than the C.P. (Rs 100), there is a gain.

$$\text{Gain} = \text{S.P.} - \text{C.P.} = 108 - 100 = \text{Rs } 8.$$

Since the base cost price is 100, the gain of Rs 8 directly translates to an 8% gain.

Answer: The shopkeeper makes a gain of **8%**.

Q31 - A table was purchased by paying a cash down payment of ₹7,500 followed by ₹4,360 after a period of 6 months. If the rate of interest charged is 18% per annum. Find the cash price of the table.

Answer – Given:

- Cash down payment = ₹7,500
- Amount paid after 6 months (A) = ₹4,360
- Time (T) = 6 months = 0.5 years
- Rate of Interest (R) = 18% p.a.

Let the cash price of the table be Rs x.

The principal amount (P) that the buyer owes after the down payment is $(x - 7500)$.

This principal accrues simple interest for 6 months, amounting to ₹4,360.

We know the formula for Amount under simple interest is $A = P + \frac{P \times R \times T}{100}$.

Substitute the known values into the equation:

$$4360 = P + \frac{P \times 18 \times 0.5}{100}$$

$$4360 = P + \frac{9P}{100}$$

$$4360 = \frac{109P}{100}$$

Now, solve for P:

$$109P = 436000$$

$$P = \frac{436000}{109}$$

$$P = 4000$$

The principal amount owed was ₹4,000.

$$\text{Cash Price} = \text{Cash down payment} + \text{Principal owed}$$

$$\text{Cash Price} = 7500 + 4000 = 11500$$

Answer: The cash price of the table is **₹11,500**.

OR

A television is sold for ₹20,000 cash or for ₹5,000 as cash down payment, followed by ₹15,500 paid after 4 month. Find the rate of interest per annum-charged under the instalment plan.

Answer – Given:

- Cash price = ₹20,000
- Cash down payment = ₹5,000
- Installment paid after 4 months (A) = ₹15,500
- Time (T) = 4 months = $\frac{4}{12}$ years = $\frac{1}{3}$ years

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

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

$$P = 20000 - 5000 = 15000$$

The total interest paid (I) is the difference between the final amount paid and the principal owed.

$$I = A - P$$

$$I = 15500 - 15000 = 500$$

Now, use the simple interest formula $I = \frac{P \times R \times T}{100}$ to find the rate R.

$$500 = \frac{15000 \times R \times (1/3)}{100}$$

$$500 = \frac{5000 \times R}{100}$$

$$500 = 50R$$

$$R = \frac{500}{50}$$

$$R = 10$$

Answer: The rate of interest charged under the installment plan is **10% per annum**.

Q32 - Find the centroid of the triangle whose vertices are (5, 1), (3, -2) and (1, 7).

Answer - Given: Vertices of the triangle: $(x_1, y_1) = (5,1)$, $(x_2, y_2) = (3,-2)$, and $(x_3, y_3) = (1,7)$.

The coordinates of the centroid of a triangle are found using the formula:

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

Substitute the coordinates into the formula:

x-coordinate = $\frac{5+3+1}{3} = \frac{9}{3} = 3$

y-coordinate = $\frac{1+(-2)+7}{3} = \frac{6}{3} = 2$

Answer: The centroid of the triangle is **(3, 2)**.

OR

Find the co-ordinates of a point which divides the line segment joining the points (1, 2) and (4, 7) in the ratio 1: 2 internally.

Answer - Given:

Points $(x_1, y_1) = (1,2)$ and $(x_2, y_2) = (4,7)$.

Ratio $m:n = 1:2$.

To find the coordinates of the point dividing the segment internally, we use the section formula:

$$\left(\frac{mx_2 + nx_1}{m+n}, \frac{my_2 + ny_1}{m+n}\right)$$

Substitute the values into the formula:

x-coordinate = $\frac{1(4)+2(1)}{1+2} = \frac{4+2}{3} = \frac{6}{3} = 2$

y-coordinate = $\frac{1(7)+2(2)}{1+2} = \frac{7+4}{3} = \frac{11}{3}$

Answer: The coordinates of the dividing point are $\left(2, \frac{11}{3}\right)$.

Q33 - Find a point on x-axis which is equidistant from the points (7, 6) and (-3, 4).

Answer - Any point on the x-axis has a y-coordinate of 0. Let the required point be $P(x, 0)$.

Let the given points be $A(7,6)$ and $B(-3,4)$.

Since P is equidistant from A and B, the distance $PA = PB$.

Using the distance formula $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$: $\sqrt{(x-7)^2 + (0-6)^2} = \sqrt{\left(x-(-3)\right)^2 + (0-4)^2}$

Squaring both sides to remove the square root:

$$(x-7)^2 + (-6)^2 = (x+3)^2 + (-4)^2$$

Expand the squared terms:

$$(x^2 - 14x + 49) + 36 = (x^2 + 6x + 9) + 16$$

$$x^2 - 14x + 85 = x^2 + 6x + 25$$

Cancel x^2 from both sides and group the x terms:

$$85 - 25 = 6x + 14x$$

$$60 = 20x$$

$$x = \frac{60}{20} = 3$$

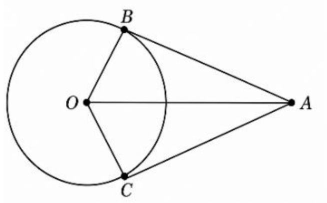
Answer: The point on the x-axis is **(3, 0)**.

Q34 - AB and AC are tangents to a circle with centre O from an external point A. If $\angle BAC = 50°$, find ∠BOC.

Answer – We know that a radius through the point of contact is perpendicular to the tangent at that point.

Therefore, the angles formed between the tangents and the radii are 90°.

$\angle OBA = 90°$ and $\angle OCA = 90°$.



Consider the quadrilateral ABOC. The sum of the interior angles of any quadrilateral is 360°.

$$\angle BAC + \angle OBA + \angle OCA + \angle BOC = 360^\circ$$

$$50^\circ + 90^\circ + 90^\circ + \angle BOC = 360^\circ$$

$$230^\circ + \angle BOC = 360^\circ$$

$$\angle BOC = 360^\circ - 230^\circ$$

$$\angle BOC = 130^\circ$$

Answer: The angle $\angle BOC$ is 130°.

Q35 - The cost of a car was ₹8,72,000 on 01.01.2021. If its value depreciates at the rate of 20% in the first year and at the rate of 10% in the subsequent years, then find the value of car on 31.12.2023.

Answer – Given:

- Initial Value (V_0) = ₹8,72,000
- Depreciation rate year 1 (r_1) = 20%
- Depreciation rate year 2 (r_2) = 10%
- Depreciation rate year 3 (r_3) = 10%
- Time duration = 3 full years (from Jan 1, 2021, to Dec 31, 2023).

When the rate of depreciation varies for each conversion period, the final value V_n is calculated using successive percentages:

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

Substitute the values into the formula:

$$V_3 = 872000 \times \left(1 - \frac{20}{100}\right) \times \left(1 - \frac{10}{100}\right) \times \left(1 - \frac{10}{100}\right)$$

$$V_3 = 872000 \times (1 - 0.20) \times (1 - 0.10) \times (1 - 0.10)$$

$$V_3 = 872000 \times 0.80 \times 0.90 \times 0.90$$

$$V_3 = 872000 \times 0.648$$

$$V_3 = 565056$$

Answer: The value of the car on 31.12.2023 will be **₹5,65,056**.

Q36 - Find the median of the following data:

xi	5	10	15	20	25
fi	3	7	12	20	28

Answer – To find the median of a discrete frequency distribution, we first need to construct a cumulative frequency (CF) table.

$Observation\ (xi)$	$Frequency\ (fi)$	$Cumulative\ Frequency\ (CF)$
5	3	3
10	7	$3 + 7 = 10$
15	12	$10 + 12 = 22$
20	20	$22 + 20 = 42$
25	28	$42 + 28 = 70$

The total number of observations $N = \sum f_i = 70$.

Calculate $\frac{N}{2}$ to find the median position:

$\frac{N}{2} = \frac{70}{2} = 35$.

Next, locate the cumulative frequency that is strictly greater than or equal to 35. Looking at the table, the CF just greater than 35 is 42.

The observation value (x_i) corresponding to the cumulative frequency of 42 is 20.

Answer: The median of the given data is **20**.

Q37 - The mean of 9 observations was found to be 35. Later on, it was detected that an observation which was 81, was taken as 18 by mistake. Find the correct mean of the observations.

Answer – The incorrect mean of the 9 observations is 35.

The incorrect sum of all 9 observations can be found by multiplying the mean by the number of observations:

Incorrect Sum = $35 \times 9 = 315$.

To find the correct sum, we must subtract the incorrect observation (18) and add the correct observation (81) to the sum.

Correct Sum = Incorrect Sum – Incorrect Value + Correct Value

Correct Sum = $315 - 18 + 81$

Correct Sum = $297 + 81 = 378$.

Now, calculate the new correct mean by dividing the correct sum by the number of observations (which remains 9).

Correct Mean = $\frac{\text{Correct Sum}}{9}$

Correct Mean = $\frac{378}{9} = 42$.

Answer: The correct mean of the observations is **42**.

Q38 - The sum of squares of two consecutive odd natural numbers is 130. Find the numbers.

Answer – Let the first odd natural number be x.

Since odd numbers have a difference of 2, the next consecutive odd natural number is $(x + 2)$.

According to the problem, the sum of their squares is 130. We set up the quadratic equation:

$$x^2 + (x + 2)^2 = 130$$

Expand the squared term:

$$x^2 + (x^2 + 4x + 4) = 130$$

$$2x^2 + 4x + 4 = 130$$

$$2x^2 + 4x - 126 = 0$$

Divide the entire equation by 2 to simplify:

$$x^2 + 2x - 63 = 0$$

Now, factorize the quadratic equation by splitting the middle term. We need two numbers that multiply to -63 and add to 2. Those numbers are 9 and -7.

$$x^2 + 9x - 7x - 63 = 0$$

$$x(x + 9) - 7(x + 9) = 0$$

$$(x - 7)(x + 9) = 0$$

This gives two possible values for x:

$x = 7$ or $x = -9$.

Since the problem specifies *natural numbers*, which must be positive, we discard $x = -9$.

Thus, $x = 7$.

The consecutive odd number is $x + 2 = 7 + 2 = 9$.

Answer: The two consecutive odd natural numbers are **7 and 9**.

OR

One table and 3 chairs together cost ₹3,000 whereas 2 tables and one chair together cost ₹3,750. Find the cost of one table and one chair.

Answer – Let the cost of one table be Rs t.

Let the cost of one chair be Rs c.

Based on the given conditions, we can formulate a system of linear equations.

Condition 1: One table and 3 chairs cost Rs 3,000.

$$t + 3c = 3000 \text{ --- (Equation 1)}$$

Condition 2: Two tables and one chair cost Rs 3,750.

$$2t + c = 3750 \text{ --- (Equation 2)}$$

From Equation 1, express t in terms of c:

$$t = 3000 - 3c$$

Substitute this expression for t into Equation 2:

$$2(3000 - 3c) + c = 3750$$

$$6000 - 6c + c = 3750$$

$$6000 - 5c = 3750$$

$$5c = 6000 - 3750$$

$$5c = 2250$$

$$c = 450$$

Now substitute $c = 450$ back into the expression for t:

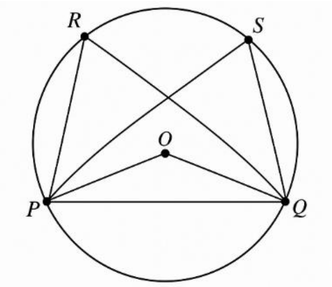
$$t = 3000 - 3(450)$$

$$t = 3000 - 1350$$

$$t = 1650$$

Answer: The cost of one table is **₹1,650** and the cost of one chair is **₹450**.

Q39 - Prove that the angles in the same segment of a circle are equal.



Answer – Given: A circle with center O and the angles $\angle PRQ$ and $\angle PSQ$ in the same segment formed by the chord PQ (or arc PAQ).

To Prove: $\angle PRQ = \angle PSQ$.

Proof:

1. Consider a circle with center O. Let PQ be a chord forming an arc PAQ. Let R and S be any two points on the remaining part of the circle (within the same segment).
2. The angle subtended by the arc PAQ at the points R and S are $\angle PRQ$ and $\angle PSQ$, respectively. We need to prove that $\angle PRQ = \angle PSQ$.
3. Join the center O to the points P and Q. The angle subtended by the arc PAQ at the center is $\angle POQ$.
4. According to the theorem regarding central and inscribed angles, the angle subtended by an arc at the center of a circle is double the angle subtended by it at any point on the remaining part of the circle.
5. Therefore, relating the central angle to point R:

$$\angle POQ = 2\angle PRQ \text{ --- (Equation 1)}$$

6. Relating the central angle to point S:

$$\angle POQ = 2\angle PSQ \text{ --- (Equation 2)}$$

7. From Equation 1 and Equation 2, we equate the right sides:

$$2\angle PRQ = 2\angle PSQ$$

8. Dividing both sides by 2 gives:

$$\angle PRQ = \angle PSQ$$

Conclusion: Angles in the same segment of a circle are equal.

Q40 - Solve the following system of linear equations graphically:

$\boldsymbol{x + y = 5}$

$\boldsymbol{x - y = 3}$

Answer - To graph these equations, we must find at least two points (solutions) for each line.

For the first equation: $x + y = 5$

Express y in terms of x: $y = 5 - x$.

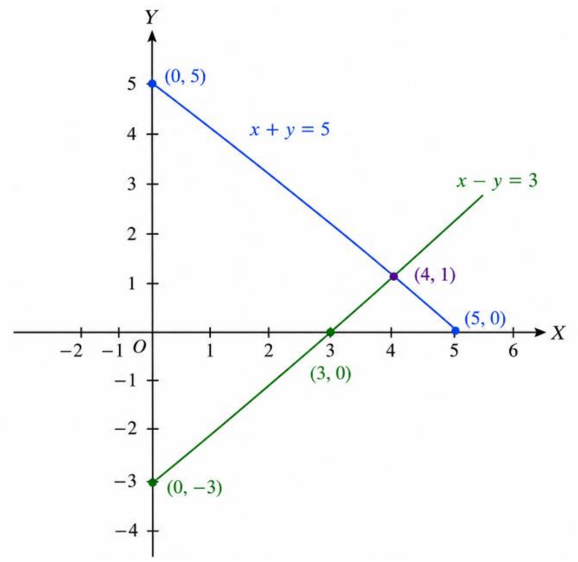
- If $x = 0$, then $y = 5 - 0 = 5$. Point: $(0,5)$
- If $x = 5$, then $y = 5 - 5 = 0$. Point: $(5,0)$

For the second equation: $x - y = 3$

Express y in terms of x: $y = x - 3$.

- If $x = 0$, then $y = 0 - 3 = -3$. Point: $(0, -3)$
- If $x = 3$, then $y = 3 - 3 = 0$. Point: $(3,0)$

When these two lines are plotted on a graph using the points above, they intersect at exactly one point. The intersection point provides the common solution for both simultaneous equations.



Looking at the graph, the lines cross perfectly at the point where the x-coordinate is 4 and the y-coordinate is 1. We can verify this algebraically: $4 + 1 = 5$ and $4 - 1 = 3$.

Answer: The graphical solution is $x = 4$, $y = 1$.

Q41 - A farmer buys a circular field at the rate of ₹7,000 per square meter for ₹31,68,000. Find the cost of fencing the field with barbed wire at the rate of ₹140 per meter.

Answer – First, we must determine the area of the circular field.

Total cost of the field = ₹31,68,000

Rate of the field = ₹7,000 per m^2

$$\text{Area} = \frac{\text{Total Cost}}{\text{Rate per } m^2}$$

$$\text{Area} = \frac{3168000}{7000} = \frac{3168}{7} \text{ m}^2$$

The area of a circle is calculated using the formula πr^2. Taking $\pi = \frac{22}{7}$:

$$\frac{22}{7} \times r^2 = \frac{3168}{7}$$

$$22 \times r^2 = 3168$$

$$r^2 = \frac{3168}{22}$$

$$r^2 = 144$$

$$r = 12 \text{ m}$$

The radius of the field is 12 meters.

To find the cost of fencing, we need to calculate the perimeter (circumference) of the circular field.

$$\text{Circumference} = 2\pi r$$

$$\text{Circumference} = 2 \times \frac{22}{7} \times 12 = \frac{528}{7} \text{ m}$$

Now, calculate the total cost of fencing at the given rate of ₹140 per meter.

$$\text{Cost of fencing} = \text{Circumference} \times \text{Rate per meter}$$

$$\text{Cost of fencing} = \frac{528}{7} \times 140$$

$$\text{Cost of fencing} = 528 \times 20$$

$$\text{Cost of fencing} = 10560$$

Answer: The cost of fencing the field is **₹10,560**.

Q42 - A die is thrown once. Find the probability of getting :

(i) a number greater than 4

(ii) an even number

(iii) a prime number

Answer – When a standard fair die is thrown, the sample space of possible outcomes is $\{1,2,3,4,5,6\}$.

Total number of possible outcomes = 6.

(i) Probability of a number greater than 4:

The numbers greater than 4 on a die are $\{5,6\}$.

Number of favorable outcomes = 2.

Probability = $\frac{\text{Favorable Outcomes}}{\text{Total Outcomes}} = \frac{2}{6} = \frac{1}{3}$.

(ii) Probability of an even number:

The even numbers on a die are $\{2,4,6\}$.

Number of favorable outcomes = 3.

Probability = $\frac{3}{6} = \frac{1}{2}$.

(iii) Probability of a prime number:

The prime numbers on a die are $\{2,3,5\}$. (Note: 1 is neither prime nor composite).

Number of favorable outcomes = 3.

Probability = $\frac{3}{6} = \frac{1}{2}$.

OR

One card is drawn at random from a well shuffled pack of 52 playing cards. Find the probability of getting:

(i) a face card

(ii) a diamond card

(iii) a queen of spade

Answer – Total number of cards in the deck = 52.

(i) Probability of a face card:

Face cards are Jacks, Queens, and Kings. Since there are 4 suits, the total number of face cards is $3 \times 4 = 12$.

Probability = $\frac{12}{52} = \frac{3}{13}$.

(ii) Probability of a diamond card:

A standard deck has 4 suits, one of which is diamonds. There are 13 diamond cards in the deck.

Probability = $\frac{13}{52} = \frac{1}{4}$.

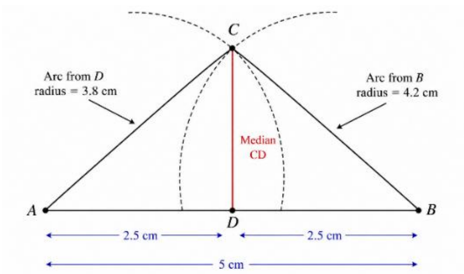
(iii) Probability of a queen of spade:

There is only 1 queen of spades in the entire 52-card deck.

Probability = $\frac{1}{52}$.

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

Answer –



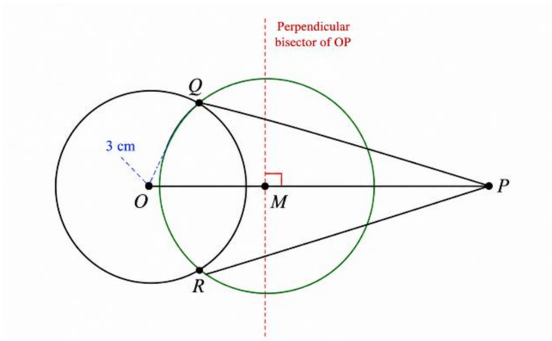
Steps of Construction:

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 cm. From any point P outside the circle draw two tangents PQ and PR to the circle.

Answer –



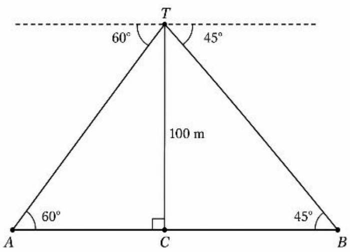
Steps of Construction:

1. Open the compass to 3 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 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 - From the top of a tower 100 m high, the angles of depression of two cars on the opposite sides of the tower are observed to be 60° and 45° respectively. Find the distance between the cars. $(\sqrt{3} = 1.732)$

Answer - Given:

- Height of the tower (h) = 100 m.
- Let the two cars be at points A and B on level ground on opposite sides of the tower base (C).
- Angle of depression of car A = 60°, so its angle of elevation from the ground is 60°.
- Angle of depression of car B = 45°, so its angle of elevation from the ground is 45°.



Let the distance of car A from the base of the tower be x and the distance of car B from the base be y.

In the right-angled triangle formed by car A and the tower ($\triangle TCA$):

$$\tan(60^\circ) = \frac{\text{Height}}{\text{Base}}$$

$$\sqrt{3} = \frac{100}{x}$$

$$x = \frac{100}{\sqrt{3}}$$

To rationalize, multiply the numerator and denominator by $\sqrt{3}$:

$$x = \frac{100\sqrt{3}}{3}$$

In the right-angled triangle formed by car B and the tower ($\triangle TCB$):

$$\tan(45^\circ) = \frac{\text{Height}}{\text{Base}}$$

$$1 = \frac{100}{y}$$

$$y = 100 \text{ m}$$

The total distance between the cars is the sum of their distances from the base:

$$\text{Total Distance} = x + y = \frac{100\sqrt{3}}{3} + 100$$

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

$$\text{Total Distance} = \frac{100 \times 1.732}{3} + 100$$

$$\text{Total Distance} = \frac{173.2}{3} + 100$$

$$\text{Total Distance} = 57.733 + 100$$

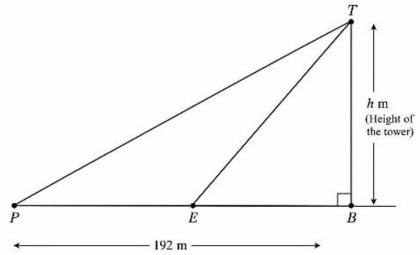
$$\text{Total Distance} = 157.733 \text{ m}$$

Answer: The distance between the cars is approximately **157.73 m**.

OR

At a point P on the level ground the angle made by the top of a tower is found to be such that $\tan\theta = \frac{1}{2}$. After walking a distance of 192 m from P towards the foot of the tower, at a point E on the level ground, the angle ϕ made by the top of the tower is found to be such that $\tan\phi = \frac{3}{4}$. Find the height of the tower. Also find the distance between the point E and Foot of the tower.

Answer - Given:



- Distance walked towards the tower (PE) = 192 m
- $\tan\theta = \frac{1}{2}$ at point P
- $\tan\phi = \frac{3}{4}$ at point E

Let the height of the tower (TB) be h meters.

Let the remaining distance from point E to the foot of the tower (EB) be x meters.

Therefore, the total distance from the starting point P to the foot of the tower (PB) is $(192 + x)$ meters.

In the right-angled triangle $\triangle EBT$:

$$\tan\phi = \frac{h}{x}$$

Substitute the given value for $\tan\phi$:

$$\frac{3}{4} = \frac{h}{x}$$

$$x = \frac{4h}{3} - \ (Eq.1)$$

In the larger right-angled triangle $\triangle PBT$:

$$\tan\theta = \frac{h}{192 + x}$$

Substitute the given value for $\tan\theta$:

$$\frac{1}{2} = \frac{h}{192 + x}$$

$$192 + x = 2h \ - \ (Eq.2)$$

Substitute the expression for x from Equation 1 into Equation 2:

$$192 + \frac{4h}{3} = 2h$$

Subtract $\frac{4h}{3}$ from both sides to isolate h:

$$192 = 2h - \frac{4h}{3}$$

$$192 = \frac{6h - 4h}{3}$$

$$192 = \frac{2h}{3}$$

Multiply by 3 and divide by 2 to solve for h:

$$h = \frac{192 \times 3}{2}$$

$$h = 96 \times 3$$

$$h = 288 \text{ m}$$

Now, substitute the height h back into Equation 1 to find x (the distance from E to the foot of the tower):

$$x = \frac{4 \times 288}{3}$$

$$x = 4 \times 96$$

$$x = 384 \text{ m}$$

Answer: The height of the tower is **288 m**, and the distance between point E and the foot of the tower is **384 m**.

NIOS PYQ's SOLUTIONS

PREVIOUS YEARS' QUESTIONS & ANSWERS

OCTOBER-2024

Your Path to Success

SECTION – A

Q1 - Factors of $4x^2 - 9y^2$ are:

(A) $(4x + 9y)(4x - 9y)$

(B) $(2x + 3y)(2x - 3y)$

(C) $(2x - 3y)(2x - 3y)$

(D) $(2x + 3y)(2x + 3y)$

Answer - (B) $(2x + 3y)(2x - 3y)$

Q2 – Factors of $1 + x + xy + x^2y$ are:

(A) $(1 + x)(1 + xy)$

(B) $(1 + x)(x + y)$

(C) $(x + y)(1 + xy)$

(D) $(1 + x)(1 + y)$

Answer - (A) $(1 + x)(1 + xy)$

Q3 - The HCF of smallest composite number and the smallest prime number is:

(A) 0

(B) 1

(C) 2

(D) 3

Answer - (C) 2

Q4 - If the number of illiterate persons in a country decreased from 150 lakh to 100 lakh in 10 years. The percentage rate of decrease is:

(A) 30%

(B) 50%

(C) $33\frac{1}{3}\%$

(D) $23\frac{1}{3}\%$

Answer - (C) $33\frac{1}{3}\%$

Q5 – Simple interest on ₹ 2,500 for 2 years 6 months at 6% per annum is:

(A) ₹ 275

(B) ₹ 350

(C) ₹ 375

(D) ₹ 750

Answer - (C) ₹ 375

Q6 - Perpendicular distance (in units) of the point $P(3, 4)$ from the y-axis is:

(A) 3 **(B) 4**

(C) 5 **(D) 7**

Answer - (A) 3

Q7 - A point P is 5 cm away from the centre of a circle and the length of the tangent drawn from P to the circle is 4 cm. Radius (in cm) of the circle is:

(A) 6 **(B) 5**

(C) 4 **(D) 3**

Answer - (D) 3

Q8 - Angle subtended by a semicircle is:

(A) acute angle **(B) obtuse angle**

(C) right angle **(D) straight angle**

Answer - (C) right angle

Q9 - The difference between the circumference and radius of a circle is 37 cm. The area (in cm^2) of the circle is:

(A) 111 **(B) 154**

(C) 184 **(D) 259**

Answer - (B) 154

Q10 - The curved surface area of a cylinder of height 14 cm is 88 cm^2. The diameter (in cm) of its circular base is:

(A) 5 **(B) 4**

(C) 3 **(D) 2**

Answer - (D) 2

Q11 - Two cubes of edge 12 cm each are joined together. The surface area (in cm^2) of the new cuboid is:

(A) 1440 **(B) 144**

(C) 140 **(D) 72**

Answer - (A) 1440

Q12 - In a ΔPQR, right angled at Q, $PQ = 3$ cm and $PR = 6$ cm. $\angle QPR$ is:

(A) 0°

(B) 30°

(C) 45°

(D) 60°

Answer - (D) 60°

Q13 - If $\tan 2A = \cot(A - 18^\circ)$, where $2A$ is an acute angle, then the value of A is:

(A) 26°

(B) 29°

(C) 30°

(D) 36°

Answer - (D) 36°

Q14 - If $3 \tan A = 4$, then the value of $\cos A$ is:

(A) $\frac{3}{5}$

(B) $\frac{5}{3}$

(C) $\frac{4}{3}$

(D) $\frac{3}{4}$

Answer - (A) $\frac{3}{5}$

Q15 - Which of the following is not the probability of an event?

(A) 0.5

(B) 25%

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

(D) $\frac{5}{4}$

Answer - (D) $\frac{5}{4}$

Q16 - Which of the following is not a measure of central tendency of a data?

(A) Mode

(B) Median

(C) Mean

(D) Range

Answer - (D) Range

Q17 - The median of the data 10, 12, 14, 16, 18, 20 is:

(A) 12

(B) 14

(C) 15

(D) 16

Answer - (C) 15

Q18 - Fill in the blanks:

(i) Factors of $64a^3 + 27b^3$ are $(4a + 3b)$ and (________).

(ii) Sum of $\frac{x^2+1}{x-2}$ and $\frac{x^2-1}{x-2}$ is ________.

Answer - (i) $16a^2 - 12ab + 9b^2$

(ii) $\frac{2x^2}{x-2}$

Q19 - Write True for correct statement and False for incorrect statement:

(i) 15^{th} term of the A.P. $-10, -5, 0, 5, \ldots$ is 65.

(ii) Sum of first 20 odd natural numbers is 400.

Answer – (i) False

(ii) True

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

Column-I	Column-II
(i) If $P(-1, 1)$ is the mid-point of the line segment joining $A(-3, b)$ and $B(1, b+4)$, then the value of b is:	**(A) 12**
(ii) The perimeter of a triangle with vertices $(0, 4)$, $(0, 0)$ and $(3, 0)$ is:	**(B) -1**
	(C) 2

Answer – (i) If $P(-1,1)$ is the mid-point of the line segment joining $A(-3, b)$ and $B(1, b+4)$, then the value of b is: → **(B) -1**

(ii) The perimeter of a triangle with vertices (0,4), (0,0) and (3,0) is: → **(A) 12**

Q21 - Fill in the blanks:

(i) If TP and TQ are the two tangents to a circle with centre O such that $\angle POQ = 110°$, then $\angle PTQ =$________.

(ii) $ABCD$ is a cyclic quadrilateral in which AC and BD are diagonals. If $\angle DBC = 55°$ and $\angle BAC = 45°$, then $\angle BCD$ is ________.

Answer – (i) $70°$

(ii) $80°$

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

(i) A, P and Q are three points on a circle with centre O. If $\angle PAQ = 35^\circ$, then $\angle OPQ = 50^\circ$.

(ii) $PQRS$ is a cyclic quadrilateral and side PS is extended to the point A. If $\angle PQR = 80^\circ$, then $\angle ASR$ is 100°.

Answer – (i) False

(ii) False

Q23 - Fill in the blanks:

(i) Two chords AB and CD of a circle intersect each other at a point P inside the circle. If $PA = 4$ cm, $PB = x + 3$, $PD = 3$ cm and $PC = x + 5$, then the value of x is ________.

(ii) AB is a diameter and XBY is a tangent to the circle with centre O. C is a point on the circle. If $AC = BC$, then $\angle CBY =$ ________.

Answer – (i) 3

(ii) 45° $(or\ 135^\circ)$

Q24 - Sonal bought a wall clock to gift her friend Anjali on her birthday. The minute hand and hour hand of the clock are 10 cm and 7 cm respectively. On the basis of above information answer the following questions:

(i) The angle described by the hour hand in 30 minutes is:

(A) 30° **(B)** 25°

(C) 20° **(D)** 15°

Answer – (D) 15°

(ii) The area swept by the minute hand in 20 minutes is:

(A) 82.046 cm^2 **(B)** 90.76 cm^2

(C) 104.76 cm^2 **(D)** 185 cm^2

Answer – (C) 104.76 cm^2

Q25 – Fill in the blanks:

(i) If the volume and curved surface area of a solid hemisphere are numerically equal, then the diameter of the hemisphere is ________ unit.

(ii) The capacity of a cylindrical tank is 6160 cm^3. If its base diameter is 28 cm, then the depth of the tank is ________ cm.

Answer – (i) 6

(ii) 10

Q26 – If $\sin(A-B)=\frac{1}{2}$ and $\cos(A+B)=\frac{1}{2}$, then:

(i) the value of A is:

(A) 45° **(B) 30°**

(C) 60° **(D) 90°**

Answer – (A) 45°

(ii) the value of B is:

(A) 60° **(B) 45°**

(C) 30° **(D) 15°**

Answer – (D) 15°

Q27 – Fill in the blanks:

(i) If the mode of the data 12, 16, 19, 16, x, 12, 16, 19, 12 is 16, then the value of x is _________.

(ii) The median of a raw data is 24. If each item is increased by 2, then the new median is _________.

Answer – (i) 16

(ii) 26

Q28 - Anjana and her mother Kavita went for a picnic. After having morning breakfast, Anjana insisted to travel in a motorboat. The speed of motorboat was 18 km/hour in still water. Anjana, being a mathematics student wanted to know the speed of current. So, she noted the time for upstream and downstream journeys. She found that for covering the distance of 24 km, the boat took 1 hour more for upstream than downstream. On the basis of above information, answer the following questions:

(i) Let the speed of steam be x km/hour, then speed of the motorboat upstream will be:

(A) $(18+x)$ km/hr **(B) $(18-x)$ km/hr**

(C) $(x-18)$ km/hr **(D) $18x$ km/hr**

Answer – (B) $(18-x)$ km/hr

(ii) Quadratic equation representing given conditions is:

(A) $x^2 + 48x - 324 = 0$

(B) $x^2 - 48x - 324 = 0$

(C) $x^2 - 48x + 324 = 0$

(D) $x^2 + 48x + 324 = 0$

Answer – (A) $x^2 + 48x - 324 = 0$

(iii) Speed of the stream is:

(A) 8 **km/hr**

(B) 6 **km/hr**

(C) 4 **km/hr**

(D) 9 **km/hr**

Answer – (B) 6 km/hr

(iv) Time taken by the motorboat going downstream is:

(A) 60 minutes

(B) 90 minutes

(C) 100 minutes

(D) 120 minutes

Answer – (A) 60 minutes

(v) Relation between speed, distance and time is:

(A) distance = speed + time

(B) distance = speed - time

(C) distance = speed × time

(D) distance = speed ÷ time

Answer – (C) distance = speed × time

SECTION - B

Q29 - If $a + \frac{1}{a} = 2$, find the value of $a^3 + \frac{1}{a^3}$.

Answer – To find the value of $a^3 + \frac{1}{a^3}$, we use the standard algebraic identity for the cube of a binomial:

$$\left(a + \frac{1}{a}\right)^3 = a^3 + \frac{1}{a^3} + 3(a)\left(\frac{1}{a}\right)\left(a + \frac{1}{a}\right)$$

Simplifying the identity gives:

$$\left(a + \frac{1}{a}\right)^3 = a^3 + \frac{1}{a^3} + 3\left(a + \frac{1}{a}\right)$$

Now, substitute the given value $a + \frac{1}{a} = 2$ into the equation:

$$(2)^3 = a^3 + \frac{1}{a^3} + 3(2)$$

$$8 = a^3 + \frac{1}{a^3} + 6$$

Isolating the required expression by subtracting 6 from both sides:

$$a^3 + \frac{1}{a^3} = 8 - 6$$

$$a^3 + \frac{1}{a^3} = 2$$

Answer: The value of $a^3 + \frac{1}{a^3}$ is **2**.

OR

Factorise : $3a^5b - 243ab^5$.

Answer – First, we look for the highest common monomial factor in both terms. Here, $3ab$ is common:

$$3a^5b - 243ab^5 = 3ab(a^4 - 81b^4)$$

Next, express the terms inside the parentheses as perfect squares:

$$= 3ab[(a^2)^2 - (9b^2)^2]$$

Using the difference of squares identity, $x^2 - y^2 = (x + y)(x - y)$:

$$= 3ab(a^2 + 9b^2)(a^2 - 9b^2)$$

The term $(a^2 - 9b^2)$ can be factored further as it is also a difference of squares:

$$a^2 - 9b^2 = (a)^2 - (3b)^2 = (a + 3b)(a - 3b)$$

Substituting this back into the complete factorization gives:

$$= 3ab(a^2 + 9b^2)(a + 3b)(a - 3b)$$

Answer: The completely factorised form is $3ab(a^2 + 9b^2)(a + 3b)(a - 3b)$.

Q30 - A reduction of 10% in the price of tea enables a dealer to purchase 25 kg more tea for ₹ 20,000. Find the original and reduced price per kg of tea.

Answer – Total expenditure amount = ₹ 20,000 Reduction rate in price = 10%

The reduction in price saves money out of the total budget. Let us calculate this savings amount:

$$\text{Money Saved} = 10\% \text{ of } ₹20{,}000$$

$$\text{Money Saved} = \frac{10}{100} \times 20000 = ₹2{,}000$$

According to the problem, this saved money of ₹ 2,000 allows the dealer to buy exactly 25 kg more tea. Therefore, the reduced price of 25 kg of tea is equal to ₹ 2,000.

$$\text{Reduced Price per kg} = \frac{\text{Money Saved}}{\text{Additional Quantity}}$$

$$\text{Reduced Price per kg} = \frac{2000}{25} = ₹80 \text{ per kg}$$

Now, let the original price of the tea be ₹ x per kg. Since the price was reduced by 10%, the reduced price is 90% of the original price.

$$90\% \text{ of } x = 80$$

$$\frac{90}{100} \times x = 80$$

$$x = \frac{80 \times 100}{90}$$

$$x = \frac{800}{9} \approx ₹88.89 \text{ per kg}$$

Answer: The original price of tea is **₹ 88.89 per kg** (or $\frac{800}{9}$ per kg) and the reduced price is **₹ 80 per kg**.

OR

A machine listed at ₹ 9,500 is available for ₹ 7,600. Find the percent rate of discount offered.

Answer – Given:

- Marked Price / List Price (M.P.) = ₹ 9,500
- Net Selling Price (S.P.) = ₹ 7,600

First, we find the absolute discount amount using the formula:

$$\text{Discount} = \text{Marked Price} - \text{Selling Price}$$

$$\text{Discount} = 9500 - 7600 = ₹1{,}900$$

Now, calculate the rate of discount percent. Discount is always calculated on the Marked Price:

$$\text{Discount } \% = \left(\frac{\text{Discount}}{\text{Marked Price}}\right) \times 100\%$$

$$\text{Discount }\% = \left(\frac{1900}{9500}\right) \times 100\%$$

$$\text{Discount }\% = \frac{1}{5} \times 100\%$$

$$\text{Discount }\% = 20\%$$

Answer: The percent rate of discount offered is **20%**.

Q31 - A camera is sold for ₹ 5,000 as cash down payment and ₹ 21,000 after 3 months. If the rate of interest charged is 20% per annum, find the cash price of the camera.

Answer – Given:

- Cash down payment = ₹ 5,000
- Financed installment amount (A) = ₹ 21,000
- Time (T) = 3 months = $\frac{3}{12}$ years = $\frac{1}{4}$ year
- Rate of interest (R) = 20% per annum

Let the remaining principal balance financed under the plan be ₹ P. The final payment after 3 months includes this principal balance plus simple interest. Therefore, using the simple interest amount formula:

$$A = P + \frac{P \times R \times T}{100}$$

Substitute the given values into the equation:

$$21000 = P + \frac{P \times 20 \times \frac{1}{4}}{100}$$

$$21000 = P + \frac{P \times 5}{100}$$

$$21000 = P + \frac{5P}{100}$$

$$21000 = \frac{105P}{100}$$

Now, solve for P:

$$105P = 21000 \times 100$$

$$105P = 2100000$$

$$P = \frac{2100000}{105}$$

$$P = 20000$$

The financed balance principal was ₹ 20,000.

$$\text{Cash Price} = \text{Cash Down Payment} + \text{Financed Principal } (P)$$

$$\text{Cash Price} = 5000 + 20000 = 25000$$

Answer: The cash price of the camera is **₹ 25,000**.

Q32 - On 1-1-2021 the population of a village was 20,000. It increased by 10% during first year but decreased by 10% in the second year. Find the population of the village on 31-12-2022.

Answer – Given:

- Initial Population (V_0) = 20,000
- Growth rate in the first year (r_1) = 10% (Increase)
- Growth rate in the second year (r_2) = 10% (Decrease)
- Time duration = 2 full years (from 1-1-2021 to 31-12-2022)

When the population change rates vary sequentially across periods, we use the generalized formula:

$$V_2 = V_0 \times \left(1 + \frac{r_1}{100}\right) \times \left(1 - \frac{r_2}{100}\right)$$

Substitute the values into the formula:

$$V_2 = 20000 \times \left(1 + \frac{10}{100}\right) \times \left(1 - \frac{10}{100}\right)$$

$$V_2 = 20000 \times (1 + 0.10) \times (1 - 0.10)$$

$$V_2 = 20000 \times 1.10 \times 0.90$$

$$V_2 = 20000 \times 0.99$$

$$V_2 = 19800$$

Answer: The population of the village on 31-12-2022 will be **19,800**.

OR

A retailer buys books from a whistleblower at the rate of ₹ 300 per book and marked them at ₹ 400 each. He allowed some discount and earns a profit of 20% on the cost price. Find the percentage discount given to the customers.

Answer - Given:

- Cost Price of a book (C.P.) = ₹ 300
- Marked Price of a book (M.P.) = ₹ 400

- Profit percentage = 20%

First, calculate the absolute profit earned using the profit percentage on C.P.:

$$\text{Profit} = 20\% \text{ of C.P.}$$

$$\text{Profit} = \frac{20}{100} \times 300 = ₹60$$

Now, determine the Selling Price (S.P.) of the book:

$$\text{S.P.} = \text{C.P.} + \text{Profit}$$

$$\text{S.P.} = 300 + 60 = ₹360$$

Next, find the discount amount allowed from the Marked Price:

$$\text{Discount} = \text{Marked Price} - \text{Selling Price}$$

$$\text{Discount} = 400 - 360 = ₹40$$

Now, calculate the percentage discount offered on the Marked Price:

$$\text{Discount }\% = \left(\frac{\text{Discount}}{\text{Marked Price}}\right) \times 100\%$$

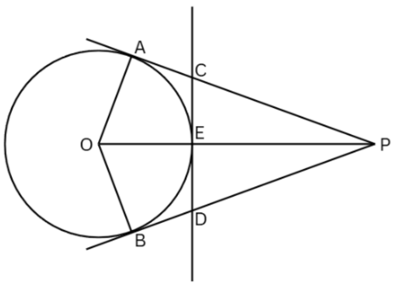
$$\text{Discount }\% = \left(\frac{40}{400}\right) \times 100\%$$

$$\text{Discount }\% = \frac{1}{10} \times 100\% = 10\%$$

Answer: The percentage discount given to the customers is **10%**.

Q33 - PA and PB are two tangents, to a circle with centre O, drawn from an external point P such that $PA = 14$ cm. CD is another tangent to the circle at point E intersecting PA and PB at C and D respectively. Find the perimeter of ΔPCD.

Answer - According to the properties of circle tangents, the lengths of tangents drawn from any common external point to a circle are equal.



1. From external point P: $PA = PB = 14$ cm
2. From external point C: $CA = CE$
3. From external point D: $DB = DE$

Now, we set up the expression for the perimeter of ΔPCD:

$$\text{Perimeter of } \Delta PCD = PC + CD + PD$$

Since point E lies on segment CD, we can expand CD as $CE + DE$:

$$\text{Perimeter} = PC + (CE + DE) + PD$$

Substitute $CE = CA$ and $DE = DB$ using the tangent relations found above:

$$\text{Perimeter} = PC + (CA + DB) + PD$$

$$\text{Perimeter} = (PC + CA) + (PD + DB)$$

From the visual geometry of the segments, we see that $(PC + CA) = PA$ and $(PD + DB) = PB$:

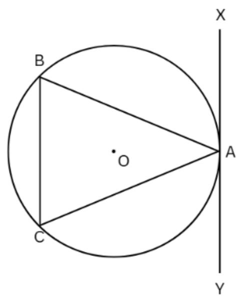
$$\text{Perimeter} = PA + PB$$

$$\text{Perimeter} = 14 + 14 = 28 \text{ cm}$$

Answer: The perimeter of ΔPCD is **28 cm**.

Q34 - ABC is an isosceles triangle with $AB = AC$ and XAY is a tangent to the circumcircle of ΔABC. Show that $XY \parallel BC$.

Answer –



Proof:

1. In ΔABC, it is given that $AB = AC$. Since angles opposite to equal sides are equal, we can write:

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

2. According to the **Alternate Segment Theorem**, the angle formed between a tangent and a chord through the point of contact is equal to the angle subtended by the chord in the alternate segment.

3. For tangent line XAY and chord AB, the angle $\angle XAB$ must be equal to the angle subtended by chord AB in the alternate segment, which is $\angle ACB$:

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

4. Comparing Equation 1 and Equation 2, we notice both share equality with $\angle ACB$:

$$\angle XAB = \angle ABC$$

5. From the diagram layout, $\angle XAB$ and $\angle ABC$ are alternate interior angles for lines XY and BC intersected by the transversal line AB.

6. Since these alternate interior angles are equal, the lines must be parallel. Hence, $XY \parallel BC$.

Q35 - Find the co-ordinates of a point dividing the line segment joining the points $A(-1, 4)$ and $(1, 3)$ internally in the ratio $2:3$.

Answer – To find the coordinates of the dividing point, we apply the internal section formula:

$$\text{Coordinates} = \left(\frac{mx_2 + nx_1}{m+n}, \frac{my_2 + ny_1}{m+n}\right)$$

Substitute the given coordinates and ratio values into the formula components:

$$\text{x-coordinate} = \frac{2(1) + 3(-1)}{2+3} = \frac{2-3}{5} = -\frac{1}{5}$$

$$\text{y-coordinate} = \frac{2(3) + 3(4)}{2+3} = \frac{6+12}{5} = \frac{18}{5}$$

Answer: The coordinates of the dividing point are $\left(-\frac{1}{5}, \frac{18}{5}\right)$.

OR

Find the centroid of the triangle whose vertices are $A(-2, 4)$, $B(7, -3)$ and $C(4, 5)$.

Answer – The standard coordinate formula to calculate the centroid of a triangle is given by:

$$\text{Centroid} = \left(\frac{x_1 + x_2 + x_3}{3}, \frac{y_1 + y_2 + y_3}{3}\right)$$

Substitute the values of the given vertices into the formula components:

$$\text{x-coordinate} = \frac{-2+7+4}{3} = \frac{9}{3} = 3$$

$$\text{y-coordinate} = \frac{4+(-3)+5}{3} = \frac{6}{3} = 2$$

Answer: The coordinates of the centroid of the triangle are **(3, 2)**.

Q36 - Find the median of the following data:

x_i	5	10	15	25	30
f_i	4	6	7	3	5

Answer – To find the median for this discrete data distribution, we construct the cumulative frequency table:

x_i	$Frequency\ (f_i)$	$Cumulative\ Frequency\ (C.F.)$
5	4	4
10	6	$4 + 6 = 10$
15	7	$10 + 7 = 17$
25	3	$17 + 3 = 20$
30	5	$20 + 5 = 25$

Total number of observations $(N) = \sum f_i = 25$.

Now, determine the median term position:

$$\text{Median Position} = \frac{N+1}{2} = \frac{25+1}{2} = \frac{26}{2} = 13^{\text{th}} \text{ position}$$

Next, we identify the cumulative frequency that contains or is just greater than 13. Looking at the table, the C.F. value of 17 contains the 13^{th} observation. The value of observation x_i corresponding to C.F. = 17 is 15.

Answer: The median of the data is **15**.

Q37 - If the mean of the following data is 15, find the value of p:

x_i	5	10	15	20	25
f_i	6	p	6	10	5

Answer – We construct a table to calculate the products $f_i \times x_i$ and their summations:

x_i	f_i	$f_i x_i$
5	6	$5 \times 6 = 30$
10	p	$10 \times p = 10p$
15	6	$15 \times 6 = 90$
20	10	$20 \times 10 = 200$
25	5	$25 \times 5 = 125$
$Total$	$\sum f_i = 27 + p$	$\sum f_i x_i = 445 + 10p$

We know the formula for the statistical arithmetic mean is:

$$\text{Mean} = \frac{\sum f_i x_i}{\sum f_i}$$

Given that the Mean = 15:

$$15 = \frac{445 + 10p}{27 + p}$$

$$15(27 + p) = 445 + 10p$$

$$405 + 15p = 445 + 10p$$

Rearranging the terms to isolate the variable p:

$$15p - 10p = 445 - 405$$

$$5p = 40$$

$$p = \frac{40}{5} = 8$$

Answer: The value of p is **8**.

Q38 - Solve the following system of linear equations graphically:

$\boldsymbol{x + y = 7, \quad x - y = 1}$

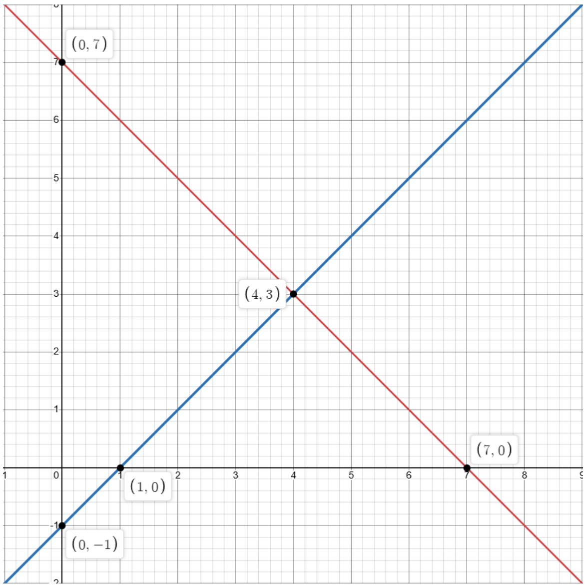
Answer – To represent the system of equations graphically, we find two coordinates for each linear equation.

For Equation 1: $x + y = 7 \Longrightarrow y = 7 - x$

- When $x = 0$, $y = 7 - 0 = 7$. Point: $(0,7)$
- When $x = 7$, $y = 7 - 7 = 0$. Point: $(7,0)$

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

- When $x = 0$, $y = 0 - 1 = -1$. Point: $(0, -1)$
- When $x = 1$, $y = 1 - 1 = 0$. Point: $(1,0)$



Plotting these coordinates on a graph paper and drawing straight lines through them reveals that they intersect at a single distinct point. The point of geometric intersection defines the common solution. From the drawn axes layout, the coordinates where the lines intersect are $x = 4$ and $y = 3$. We can check this algebraically: $4 + 3 = 7$ and $4 - 3 = 1$.

Answer: The solution to the linear equations is $x = 4, y = 3$.

Q39 - A sum of ₹ 700 is to be used to give seven cash prizes to students of a school for their overall academic performances. If each prize is ₹ 20 less than its proceeding prize, find the value of each of the prizes.

Answer – Total sum of prizes (S_n) = ₹ 700

Total number of cash prizes (n) = 7

Since each successive prize is ₹ 20 less than the previous one, the values form an Arithmetic Progression (A.P.) with a common difference (d) of -20.

We use the sum formula for an Arithmetic Progression:

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

Substitute the known parameters into the formula to find the first prize value a:

$$700 = \frac{7}{2}[2a + (7-1)(-20)]$$

$$700 \times \frac{2}{7} = 2a + 6(-20)$$

$$200 = 2a - 120$$

$$2a = 200 + 120$$

$$2a = 320 \Rightarrow a = \frac{320}{2} = 160$$

The value of the first prize (a) is ₹ 160. Now we calculate each subsequent prize by subtracting ₹ 20 successively:

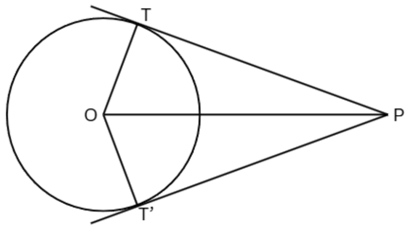
- 1^{st} Prize $=$ ₹160
- 2^{nd} Prize $= 160 - 20 =$ ₹140
- 3^{rd} Prize $= 140 - 20 =$ ₹120
- 4^{th} Prize $= 120 - 20 =$ ₹100
- 5^{th} Prize $= 100 - 20 =$ ₹80

- 6^{th} Prize $= 80 - 20 = ₹60$
- 7^{th} Prize $= 60 - 20 = ₹40$

Answer: The values of the seven cash prizes are **₹ 160, ₹ 140, ₹ 120, ₹ 100, ₹ 80, ₹ 60, and ₹ 40**.

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

Answer –



Proof:

1. Consider a circle with center O. Let P be a point outside the circle. From P, two tangents PT and PT' are drawn, touching the circle at points T and T' respectively. We need to prove that $PT = PT'$.
2. Join the center O to the points P, T, and T'.
3. We know that the radius through the point of contact is perpendicular to the tangent line. Therefore:

$$\angle OTP = 90^\circ \quad \text{and} \quad \angle OT'P = 90^\circ$$

4. Now, compare the two right-angled triangles ΔOPT and $\Delta OPT'$:

- $\angle OTP = \angle OT'P = 90^\circ$ (Right angles)
- $OT = OT'$ (Radii of the same circular boundary)
- $OP = OP$ (Common hypotenuse shared by both triangles)

5. By the **RHS (Right angle-Hypotenuse-Side) congruence criterion**, the triangles are congruent:

$$\Delta OPT \cong \Delta OPT'$$

6. Since the triangles are congruent, their corresponding parts are equal by CPCTC (Corresponding Parts of Congruent Triangles are Congruent):

$$PT = PT'$$

Hence, the lengths of tangents drawn from an external point are equal.

Q41 - The pillars of a building are cylindrical in shape. If each pillar has a circular base of diameter 40 cm and height 10 m, then how much concrete mixture would be required to build 14 such pillars?

Answer – Given:

Diameter of the pillar base = 40 cm

$$\text{Radius } (r) = \frac{40}{2} = 20 \text{ cm} = \frac{20}{100} \text{ m} = 0.2 \text{ m}$$

Height of each pillar (h) = 10 m Total number of pillars = 14

The quantity of concrete mixture needed corresponds to the cumulative volume of all 14 cylindrical pillars. The formula for the volume of a single cylinder is $V = \pi r^2 h$. Substitute the values into the formula to find the volume of one pillar:

$$V_{\text{one}} = \frac{22}{7} \times (0.2)^2 \times 10$$

$$V_{\text{one}} = \frac{22}{7} \times 0.04 \times 10$$

$$V_{\text{one}} = \frac{22 \times 0.4}{7} = \frac{8.8}{7} \text{ m}^3$$

Now, compute the total concrete mixture required for 14 pillars:

$$\text{Total Volume} = 14 \times V_{\text{one}}$$

$$\text{Total Volume} = 14 \times \frac{8.8}{7}$$

$$\text{Total Volume} = 2 \times 8.8 = 17.6 \text{ m}^3$$

Answer: The total concrete mixture required is **17.6** m^3.

OR

A village having a population of 4,000 requires 150 litres of water per head per day. It has a tank having internal dimensions $20 \text{ m} \times 15 \text{ m} \times 6 \text{ m}$. For how many days, the water of the tank will be sufficient for the village. [Use $1 \text{ m}^3 = 1000$ litre]

Answer – Given:

- Total population of the village = 4,000
- Water required per person per day = 150 litres
- Dimensions of the internal storage tank = $20 \text{ m} \times 15 \text{ m} \times 6 \text{ m}$

First, calculate the total daily water requirement of the entire village population:

$$\text{Daily water requirement} = 4000 \times 150 = 6{,}00{,}000 \text{ litres}$$

Next, find the total capacity volume of the cuboidal water tank:

$$\text{Volume of tank} = \text{length} \times \text{breadth} \times \text{height}$$

$$\text{Volume of tank} = 20 \times 15 \times 6 = 1800 \text{ m}^3$$

Convert this volume from cubic meters into litres using the conversion rate $1 \text{ m}^3 = 1000$ litres:

$$\text{Tank capacity in litres} = 1800 \times 1000 = 18{,}00{,}000 \text{ litres}$$

Now, calculate the number of days the water will last:

$$\text{Number of days} = \frac{\text{Total Capacity of Tank}}{\text{Daily Requirement}}$$

$$\text{Number of days} = \frac{1800000}{600000} = 3 \text{ days}$$

Answer: The water in the tank will be sufficient for **3 days**.

Q42 - The king, queen and jack of club are removed from a pack of 52 playing cards. One card is drawn at random from the remaining well shuffled cards. Find the probability of getting:

(i) a black card or an ace.

(ii) neither a heart nor a king.

Answer – Total cards initially = 52

Cards removed = 3 club cards (King, Queen, Jack)

Remaining total cards $= 52 - 3 = 49$

(i) Probability of getting a black card or an ace:

Initially, there are 26 black cards (13 spades + 13 clubs). Since 3 black club cards were removed, the remaining black cards count $= 26 - 3 = 23$.

There are 4 aces in a standard deck (2 red, 2 black). The black club ace is still in the deck because only face cards were removed. However, the 2 black aces are already counted inside the 23 black cards. Thus, we only add the remaining 2 red aces.

$$\text{Favorable cards} = 23 \text{ (black)} + 2 \text{ (red aces)} = 25$$

$$\text{Probability} = \frac{25}{49}$$

(ii) Probability of getting neither a heart nor a king:

Let us count the cards that are *either* a heart *or* a king, and then subtract them from the remaining deck.

Total heart cards = 13 (all are red, none were removed).

Total kings remaining = 3 (Heart, Diamond, Spade kings remain; the Club king was removed).

The King of Hearts is already included in the 13 heart cards. Thus, there are 2 other kings to account for (Diamond and Spade).

$$\text{Cards to avoid} = 13\ \text{(hearts)} + 2\ \text{(other kings)} = 15$$

$$\text{Favorable cards} = 49 - 15 = 34$$

$$\text{Probability} = \frac{34}{49}$$

Answer: The probabilities are **(i)** $\frac{25}{49}$ and **(ii)** $\frac{34}{49}$.

OR

Three coins are tossed simultaneously. Find the probability of getting:

(i) at least two heads

(ii) at most two tails

Answer – When three separate coins are tossed simultaneously, the complete sample space S consists of $2^3 = 8$ outcomes:

$$S = \{HHH, HHT, HTH, THH, HTT, THT, TTH, TTT\}$$

(i) Probability of getting at least two heads:

"At least two heads" means getting 2 or 3 heads. Favorable outcomes are:

$$\{HHH, HHT, HTH, THH\}$$

Number of favorable outcomes = 4.

$$\text{Probability} = \frac{\text{Favorable Outcomes}}{\text{Total Outcomes}} = \frac{4}{8} = \frac{1}{2}$$

(ii) Probability of getting at most two tails:

"At most two tails" means getting 0, 1, or 2 tails (it excludes only the outcome with 3 tails, i.e., TTT). Favorable outcomes are:

$$\{HHH, HHT, HTH, THH, HTT, THT, TTH\}$$

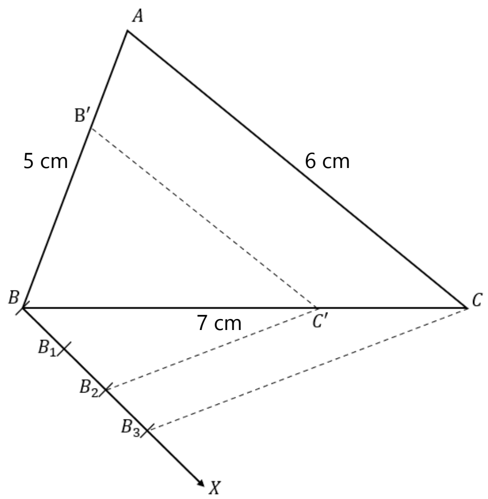
Number of favorable outcomes = 7.

$$\text{Probability} = \frac{7}{8}$$

Answer: The probabilities are **(i)** $\frac{1}{2}$ and **(ii)** $\frac{7}{8}$.

Q43 - Construct a triangle with sides 5 cm, 6 cm and 7 cm. Construct another triangle similar to it whose sides are $\frac{2}{3}$ of the corresponding sides of the first triangle.

Answer –



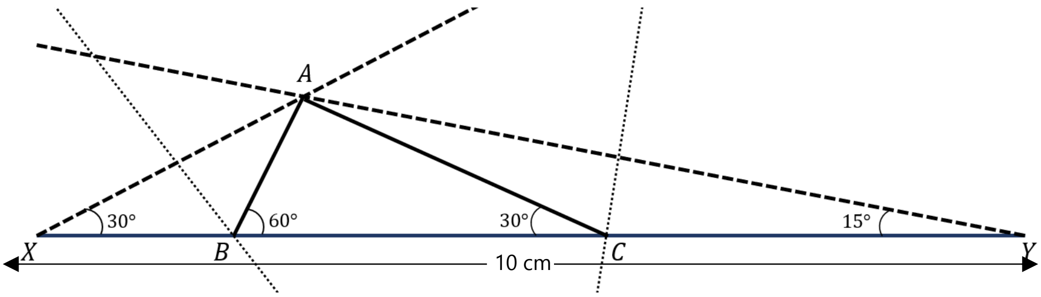
Steps of Construction:

1. Draw a baseline segment $BC = 7$ cm using a ruler.
2. Set the compass to 6 cm, place the point at B, and draw an arc. Set the compass to 5 cm, place the point at C, and draw an intersecting arc. Label the intersection point as A. Join AB and AC to get the primary ΔABC.
3. Draw a ray BX making any sharp acute angle downwards with the base line segment BC.
4. Mark 3 points B_1, B_2, and B_3 along the ray BX such that $BB_1 = B_1B_2 = B_2B_3$.
5. Join the terminal ratio point B_3 directly to the base corner point C.
6. Through the point B_2 (representing the $\frac{2}{3}$ scale proportion), draw a straight line parallel to B_3C to intersect the base line segment BC at a new point C'.
7. From C', draw a straight line parallel to the triangle side line CA to cross the opposite side line AB at a new point B'. $\Delta AB'C'$ is the required scaled similar triangle.

OR

Construct a triangle ABC in which $AB + BC + CA = 10$ cm, $\angle B = 60^\circ$ and $\angle C = 30^\circ$.

Answer –

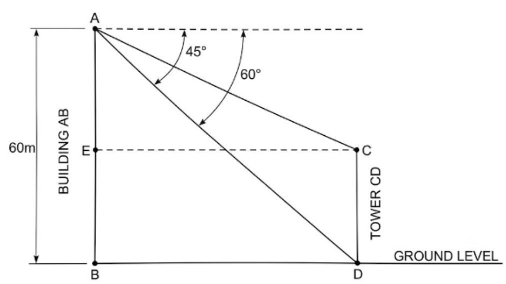


Steps of Construction:

1. Use a ruler to draw a horizontal baseline segment $XY = 10$ cm (representing the total perimeter length).
2. At the left point X, construct an angle measuring 30° (which is exactly $\frac{1}{2} \times \angle B$).
3. At the right point Y, construct an angle measuring 15° (which is exactly $\frac{1}{2} \times \angle C$). Let the rays from X and Y intersect at a top point labeled A.
4. Draw the perpendicular right bisector of the line segment AX. Let it intersect the baseline XY at a point labeled B.
5. Draw the perpendicular right bisector of the line segment AY. Let it intersect the baseline XY at a point labeled C.
6. Use a ruler to join point A to point B and point A to point C. $\triangle ABC$ is the required triangle with the specified base angles and perimeter.

Q44 - From the top of a building 60 m high, the angles of depression of the top and bottom of a tower are observed to be $45^\circ$and 60° respectively. Find the height of the tower and its distance from the building.

Answer - Given:



- Height of the building (AB) = 60 m
- Angle of depression to the top of the tower = 45°
- Angle of depression to the bottom of the tower = 60°

Let the height of the tower (CD) be h meters.

Let the horizontal distance between the building and the tower (BD) be x meters.

Draw a horizontal line from the top of the tower C perpendicular to the building at a point E. Then, $EC = BD = x$ and $ED = CD = h$. The remaining height segment of the building is $AE = 60 - h$.

By alternate interior angles, the angle of elevation from the base of the tower (D) to the top of the building (A) is 60°.

In right-angled triangle ΔABD:

$$\tan(60^\circ) = \frac{\text{Height}}{\text{Base}} = \frac{AB}{BD}$$

$$\sqrt{3} = \frac{60}{x} \Longrightarrow x = \frac{60}{\sqrt{3}}$$

Multiply the numerator and denominator by $\sqrt{3}$ to rationalize:

$$x = \frac{60\sqrt{3}}{3} = 20\sqrt{3}\text{ m}$$

Using $\sqrt{3} = 1.732$:

$$x = 20 \times 1.732 = 34.64\text{ m}$$

Now, consider the upper right-angled triangle ΔAEC, where the angle of elevation is 45°:

$$\tan(45^\circ) = \frac{AE}{EC}$$

$$1 = \frac{60 - h}{x} \Longrightarrow x = 60 - h$$

Substitute the value of $x = 20\sqrt{3}$ into this equation:

$$20\sqrt{3} = 60 - h$$

$$h = 60 - 20\sqrt{3}$$

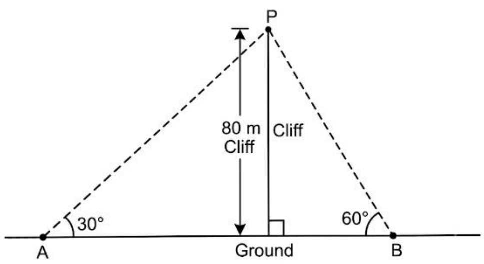
$$h = 60 - 34.64 = 25.36\text{ m}$$

Answer: The height of the tower is **25.36 m** and its horizontal distance from the building is **34.64 m** (or $20\sqrt{3}$ m).

OR

Two men on either side of a cliff 80 m high observe the angles of elevation of the top of the cliff to be 30° and 60° respectively. Find the distance between the two men, if they are in straight line with the base of the cliff.

Answer - Given:



- Height of the cliff (h) = 80 m
- Angle of elevation for the first man = 30°
- Angle of elevation for the second man = 60°

Let the cliff be represented by the vertical line $BC = 80$ m.

Let the first man be at point A on one side, at a distance x from the base C.

Let the second man be at point D on the opposite side, at a distance y from the base C.

In the right-angled triangle ΔBCA formed by the first man:

$$\tan(30^\circ) = \frac{\text{Height}}{\text{Base}} = \frac{BC}{AC}$$

$$\frac{1}{\sqrt{3}} = \frac{80}{x} \Rightarrow x = 80\sqrt{3} \text{ m}$$

In the right-angled triangle ΔBCD formed by the second man:

$$\tan(60^\circ) = \frac{\text{Height}}{\text{Base}} = \frac{BC}{DC}$$

$$\sqrt{3} = \frac{80}{y} \Rightarrow y = \frac{80}{\sqrt{3}} \text{ m}$$

The total distance between the two men is the sum of their distances from the base of the cliff $(x + y)$:

$$\text{Total Distance} = 80\sqrt{3} + \frac{80}{\sqrt{3}}$$

$$\text{Total Distance} = \frac{80(\sqrt{3} \times \sqrt{3}) + 80}{\sqrt{3}}$$

$$\text{Total Distance} = \frac{80(3) + 80}{\sqrt{3}} = \frac{240 + 80}{\sqrt{3}} = \frac{320}{\sqrt{3}} \text{ m}$$

Multiply the numerator and denominator by $\sqrt{3}$ to rationalize:

$$\text{Total Distance} = \frac{320\sqrt{3}}{3} \text{ m}$$

Using $\sqrt{3} = 1.732$:

$$\text{Total Distance} = \frac{320 \times 1.732}{3} = \frac{554.24}{3} \approx 184.75 \text{ m}$$

Answer: The total horizontal distance between the two men is approximately **184.75 m**.

Thank you!

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

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