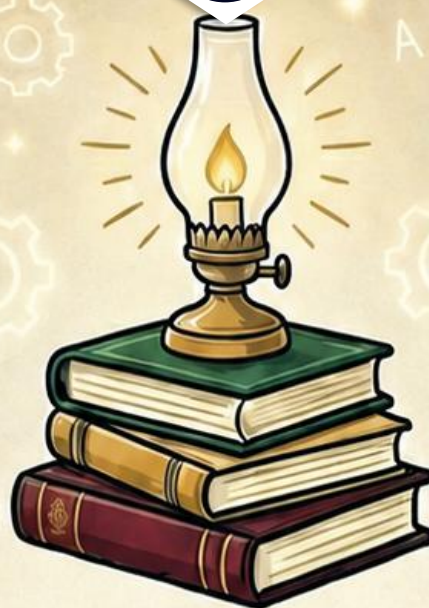




$$A = \frac{m}{(m^2 + c)^2}$$



NIOS PYQ's SOLUTIONS

$$fa = bc^2$$

$$\sqrt{h-x^2}$$

PREVIOUS YEARS' QUESTIONS & ANSWERS



APRIL 2026

Your Path to Success

(SET – A)

Q1. $(x + 8)(x - 10)$ is equal to:

(A) $x^2 - 2x + 80$

(B) $x^2 - 2x - 80$

(C) $x^2 + 2x + 80$

(D) $x^2 + 2x - 80$

Answer: (B) $x^2 - 2x - 80$

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

(A) $2x + 5 = 1$

(B) $x - 1 = 0$

(C) $y + 7 = 0$

(D) $5x + 7$

Answer: (D) $5x + 7$

Q3. If the roots of the equation $ax^2 + bx + c = 0$ are equal, then the value of c is:

(A) $-\frac{b}{2a}$

(B) $\frac{b}{2a}$

(C) $\frac{b^2}{4a}$

(D) $-\frac{b^2}{4a}$

Answer: (C) $\frac{b^2}{4a}$

Q4. The 9th term from the end of the A. P. 7, 11, 15, ..., 147 is:

(A) 135

(B) 125

(C) 115

(D) 110

Answer: (C) 115

Q5. There are 25 radio's, 16 of them are out of order. Percentage of out of order radio's is:

(A) 85

(B) 75

(C) 64

(D) 60

Answer: (C) 64

Q6. Simple interest on ₹2,500 for 2 years and 6 months at 6% per annum is:

(A) ₹350

(B) ₹750

(C) ₹375

(D) ₹850

Answer: (C) ₹375

Q7. If x co – ordinate of a point is zero, then this point always lies:

(A) in 1st quadrant

(B) in 2nd quadrant

(C) on x-axis

(D) on y-axis

Answer: (D) on y-axis



Q8. Number of tangents drawn to a circle from a point in the interior of the circle is:

- (A) 0 (B) 1
(C) 2 (D) 4

Answer: (A) 0

Q9. Angles in the same segment of a circle are:

- (A) Supplementary (B) Complementary
(C) Unequal (D) Equal

Answer: (D) Equal

Q10. 1 m^2 is equal to:

- (A) 100 cm^2 (B) 1000 cm^2
(C) $10,000 \text{ cm}^2$ (D) -01 cm^2

Answer: (C) $10,000 \text{ cm}^2$

Q11. Diameter of a circle is:

- (A) Twice of radius (B) Half of radius
(C) Equal to radius (D) One-third of radius

Answer: (A) Twice of radius

Q12. If $\sin A = \frac{3}{5}$, then the value of $\cos A$ is:

- (A) $\frac{5}{3}$ (B) $\frac{5}{4}$
(C) $\frac{4}{5}$ (D) $\frac{3}{4}$

Answer: (C) $\frac{4}{5}$

Q13. If $k + 7\sec^2 52^\circ - 7\tan^2 52^\circ = 7$, then the value of k is:

- (A) 0 (B) 1
(C) 7 (D) $\frac{1}{7}$

Answer: (A) 0

Q14. If $\cos \theta \times \frac{1}{\sec \theta} = 1$ and θ is an acute angle, the value of θ is:

- (A) 90° (B) 60°
(C) 30° (D) 0°

Answer: (D) 0°



Q15. Which of the following cannot be probability of an event?

- (A) $\frac{2}{3}$ (B) $-\frac{1}{5}$
 (C) 15% (D) 0.5

Answer: (B) $-\frac{1}{5}$

Q16. Mean of first five prime numbers is:

- (A) 2.6 (B) 3.6
 (C) 4.6 (D) 5.6

Answer: (D) 5.6

Q17. 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:

a) $(x^2 + 3)^2 + (x^2 - 3)^2 = _ : 2x^4 + 18$

b) $(a - 5b)^3 = _ : a^3 - 15a^2b + 75ab^2 - 125b^3$

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

Column-I:

- a) 15th term of the A.P.: 16, 11, 6, ... is —
 b) Sum of the first 12 terms of the A.P.; 11, 16, 21, 26, ... is —

Column-II:

- i) 462
 ii) 54
 iii) -54
 iv) 467

Answers: a) → iii) -54; b) → i) 462

Q20. Write 'True' for correct statement and 'False' for incorrect statement:

- a) The point (4, 3) lies on the line $3x + 7y = 27$: **False**
 b) The graph of the equation $y = -3$ is a line parallel to x -axis: **True**

Q21. Match Column-I statement with the correct option of Column-II.

Column-I:

- a) Roots of the equation $2x^2 + x - 6 = 0$ are:
 b) Roots of the equation $x^2 - 3x + 3 = 0$ are:

Column-II:

- i) real and equal
 ii) real and distinct
 iii) not real

Answers: a) → ii) real and distinct; b) → iii) not real



Q22. Fill in the blanks:

- a) The distance of the point $P(-2,3)$ from the y -axis is _ units : **2 units**
- b) The distance between the points $P(5\cos 35^\circ, 0)$ and $Q(0, 5\cos 55^\circ)$ is _ units : **5 units**

Q23. Fill in the blanks:

- a) If PQ is a chord of a circle and PT is a tangent to the circle at P such that $\angle QPT = 60^\circ$, then $\angle POQ$ is _ , where O is centre of the circle: **120°**
- b) If TP and TQ are two tangents to a circle with centre O such that $\angle POQ = 110^\circ$, then $\angle PTQ$ is _ : **70°**

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

- a) Construction of a triangle ABC , in which $BC = 3$ cm and $\angle C = 30^\circ$, is possible when $AB - AC = 3.2$ cm: **False**
- b) To draw perpendicular bisector of a line segment AB , we open the compass less than $\frac{1}{2}AB$: **False**

Q25. Fill in the blanks:

- a) If $ABCD$ is a cyclic quadrilateral in which $\angle DAB = 110^\circ$, then $\angle BCD$ is _ : **70°**
- b) AB is a chord of a circle with centre O and C is a point on the major arc. If $\angle OAB = 40^\circ$, then $\angle ACB$ is _ : **50°**

Q26. Fill in the blanks:

- a) If $\tan(A + B) = \sqrt{3}$ and $\tan(A - B) = \frac{1}{\sqrt{3}}$, where $A > B$ and A, B are acute angles, then $\sec(A - B) =$ _ : **$\frac{2\sqrt{3}}{3}$ (or equivalently $\frac{2}{\sqrt{3}}$)**
- b) The value of $\sec \theta (1 - \sin \theta)(\sec \theta + \tan \theta)$ is _ : **1**

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

- a) Two dice are thrown, simultaneously. The probability of getting even number on both dice is $\frac{3}{4}$: **False**
- b) The probability of selecting a prime number from the natural numbers 1 to 30 is $\frac{1}{3}$: **True**



Q28. In a juice shop, juice is served in two types of glasses. Both the glasses are cylindrical in shape with inner radius 3 cm and height 10 cm. First type of glass has hemispherical raised bottom and the second type of glass has conical raised bottom of height 1.5 cm.

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

i) The apparent capacity of the first type of glass is:

- (A) 282.85 cm^3 (B) 284.85 cm^3
(C) 286.85 cm^3 (D) 288.85 cm^3

Answer: (A) 282.85 cm^3

ii) The actual capacity of the first type of glass is:

- (A) 229.28 cm^3 (B) 226.28 cm^3
(C) 223.28 cm^3 (D) 220.28 cm^3

Answer: (B) 226.28 cm^3

iii) The actual capacity of the second type of glass is:

- (A) 272.71 cm^3 (B) 268.71 cm^3
(C) 265.71 cm^3 (D) 263.71 cm^3

Answer: (B) 268.71 cm^3

iv) Out of two glasses, which glass contains more quantity of Juice to drink and by how much?

- (A) First, 42.43 cm^3 (B) Second, 42.43 cm^3
(C) First, 48.43 cm^3 (D) Second, 48.43 cm^3

Answer: (B) Second, 42.43 cm^3

v) The curved surface area of a glass is:

- (A) 195.57 cm^2 (B) 192.57 cm^2
(C) 188.57 cm^2 (D) 183.57 cm^2

Answer: (C) 188.57 cm^2

Q29. Find the HCF of $P(x) = x^2 - 4$ and $Q(x) = x^2 + 4x + 8$.

Answer: $P(x) = x^2 - 4$ can be factored using the identity $a^2 - b^2 = (a - b)(a + b)$, where $a = x$ and $b = 2$: $P(x) = x^2 - 4 = (x - 2)(x + 2)$

Now we check whether $Q(x) = x^2 + 4x + 8$ can be factored, by finding its discriminant:

Discriminant of $Q(x)$: $D = (4)^2 - 4(1)(8) = 16 - 32 = -16$

Since the discriminant is negative, $Q(x)$ cannot be factored into real linear factors; it does not share any common linear factor with $P(x) = (x - 2)(x + 2)$.

To find the HCF using the Euclidean division algorithm, we divide $Q(x)$ by $P(x)$:



$$Q(x) = x^2 + 4x + 8, P(x) = x^2 - 4$$

$$Q(x) - P(x) = (x^2 + 4x + 8) - (x^2 - 4) = 4x + 12$$

Now divide $P(x)$ by the remainder $4x + 12$:

$$P(x) = x^2 - 4; \text{ dividing } x^2 - 4 \text{ by } 4x + 12, \text{ i.e., by } 4(x + 3):$$

$$x^2 - 4 = (x + 3)(x - 3) + 5 \text{ [since } (x + 3)(x - 3) = x^2 - 9, \text{ and } x^2 - 4 - (x^2 - 9) = 5]$$

Continuing the division process, the remainder never becomes zero with a common polynomial factor, which confirms that $P(x)$ and $Q(x)$ share no common polynomial factor.

Therefore, the HCF of $P(x)$ and $Q(x)$ is 1 (i.e., $P(x)$ and $Q(x)$ are relatively prime / co-prime polynomials).

OR

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

Answer: We square both sides of the given equation: $\left(x + \frac{1}{x}\right)^2 = 2^2$

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

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

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

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

Q30. Reena's mother said, to make idlis, you must take two parts rice and one part urad pulse.

What percentage of such a mixture would be rice and what percentage would be urad pulse?

Answer: The ratio of rice to urad pulse is 2: 1, so the total number of parts = $2 + 1 = 3$

$$\text{Percentage of rice} = \frac{2}{3} \times 100\% = \frac{200}{3}\% = 66.67\% \text{ (approximately, or exactly } 66\frac{2}{3}\%)$$

$$\text{Percentage of urad pulse} = \frac{1}{3} \times 100\% = \frac{100}{3}\% = 33.33\% \text{ (approximately, or exactly } 33\frac{1}{3}\%)$$

$$\text{Rice} = 66\frac{2}{3}\% \text{ (approximately } 66.67\%); \text{ Urad pulse} = 33\frac{1}{3}\% \text{ (approximately } 33.33\%)$$

OR

A table marked at ₹15,000 is available at ₹14,400. Find the discount percent.

Answer: Marked Price (MP) = ₹15,000

Selling Price (SP) = ₹14,400

$$\text{Discount amount} = MP - SP = 15000 - 14400 = ₹600$$

$$\text{Discount percentage} = \frac{\text{Discount amount}}{\text{Marked Price}} \times 100 = \frac{600}{15000} \times 100 = 4\%$$

Discount percent = 4%



Q31. By reducing the selling price of an article by ₹50, a gain of 5% turns into a loss of 5%. Find the original selling price of the article.

Answer: Let the cost price of the article be ₹ x .

$$\text{Selling price at 5\% gain} = x + \frac{5}{100}x = 1.05x$$

$$\text{Selling price at 5\% loss} = x - \frac{5}{100}x = 0.95x$$

According to the given condition, reducing the selling price (at gain) by ₹50 gives the selling price (at loss): $1.05x - 50 = 0.95x$

$$1.05x - 0.95x = 50$$

$$0.10x = 50$$

$$x = \frac{50}{0.10} = 500$$

So the cost price = ₹500

Original selling price (at 5% gain) = $1.05 \times 500 = ₹525$

Original selling price = ₹525

OR

What price should a shopkeeper mark on a pair of shoes, which costs him ₹1200 so as to gain 12% profit after allowing a discount of 16%.

Answer: Cost Price (CP) = ₹1200

Required profit = 12%

$$\text{Required Selling Price (SP)} = CP + 12\% \text{ of } CP = 1200 + \frac{12}{100} \times 1200 = 1200 + 144 = ₹1344$$

Let the Marked Price be ₹ M .

Since a discount of 16% is allowed on the marked price, the selling price becomes:

$$SP = M - \frac{16}{100}M = M(1 - 0.16) = 0.84M$$

Since SP must equal ₹1344: $0.84M = 1344$

$$M = \frac{1344}{0.84} = 1600$$

Marked Price = ₹1600

Q32. The cost of a car is ₹5,50,000 on 01.01.2025. Its value depreciates at the rate of 15% in the first year and then at the rate of 10% in the subsequent years. Find the value of the car on 31-12-2027. Initial cost (on 01.01.2025) = ₹5,50,000

Answer: Value after 1st year (i.e., on 31.12.2025), depreciation rate = 15%:

$$\text{Value} = 550000 \times \left(1 - \frac{15}{100}\right) = 550000 \times 0.85 = ₹4,67,500$$

Value after 2nd year (i.e., on 31.12.2026), depreciation rate = 10% (subsequent year):



$$\text{Value} = 467500 \times \left(1 - \frac{10}{100}\right) = 467500 \times 0.90 = ₹4,20,750$$

Value after 3rd year (i.e., on 31.12.2027), depreciation rate = 10% (subsequent year):

$$\text{Value} = 420750 \times \left(1 - \frac{10}{100}\right) = 420750 \times 0.90 = ₹3,78,675$$

Value of the car on 31-12-2027 = ₹3,78,675

Q33. Find the co-ordinates of a point which divides the line segment joining the points $(-1, 7)$ and $(4, -3)$ in the ratio 2:3 internally.

Answer: Using the section formula for internal division: if a point divides the line segment joining (x_1, y_1) and (x_2, y_2) in the ratio $m:n$ internally, then the coordinates of the point are:

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

Here, $(x_1, y_1) = (-1, 7)$, $(x_2, y_2) = (4, -3)$, $m = 2$, $n = 3$

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

$$y = \frac{2(-3) + 3(7)}{2+3} = \frac{-6+21}{5} = \frac{15}{5} = 3$$

The required point is $(1, 3)$

OR

Find the centroid of a triangle whose vertices are $A(7, 5)$, $B(2, -6)$ and $C(9, 10)$.

Answer: The centroid of a triangle with vertices (x_1, y_1) , (x_2, y_2) , (x_3, y_3) is given by:

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

$$x = \frac{7+2+9}{3} = \frac{18}{3} = 6$$

$$y = \frac{5+(-6)+10}{3} = \frac{9}{3} = 3$$

The centroid is $(6, 3)$

Q34. The in-circle of a $\triangle ABC$, touches the sides BC , CA and AB at D , E and F respectively. Prove that $AF + BD + CE = \frac{1}{2}(\text{perimeter of } \triangle ABC)$.

Answer: Proof: We use the well-known property that the lengths of the two tangent segments drawn from an external point to a circle are always equal to each other.

Since AF and AE are both tangent segments drawn from the external point A to the incircle: $AF = AE$... (i)

Since BD and BF are both tangent segments drawn from the external point B to the incircle: $BD = BF$... (ii)

Since CD and CE are both tangent segments drawn from the external point C to the incircle: $CD = CE$... (iii)



Let us denote $AF = AE = x$, $BD = BF = y$, and $CD = CE = z$. Now, the perimeter of $\triangle ABC$ is:

$$\text{Perimeter} = AB + BC + CA$$

$$AB = AF + FB = x + y$$

$$BC = BD + DC = y + z$$

$$CA = CE + EA = z + x$$

$$\text{Perimeter} = (x + y) + (y + z) + (z + x) = 2x + 2y + 2z = 2(x + y + z)$$

$$x + y + z = \frac{1}{2}(\text{Perimeter of } \triangle ABC)$$

But we know that $AF + BD + CE = x + y + z$ (from our notation above)

$$\text{Therefore: } AF + BD + CE = \frac{1}{2}(\text{Perimeter of } \triangle ABC)$$

Hence Proved.

Q35. A chord of a circle is equal to its radius. Find the angle subtended by this chord at a point in the major segment.

Answer: Let O be the centre of the circle with radius r , and let AB be a chord such that $AB = r$ (the chord is equal in length to the radius).

In $\triangle OAB$: $OA = OB = r$ (both are radii of the circle), and $AB = r$ (given)

Since all three sides OA, OB, AB are equal to r , $\triangle OAB$ is an equilateral triangle.

Therefore, all the angles of this equilateral triangle are equal to 60° each:

$$\angle AOB = 60^\circ$$

Now, the angle subtended by chord AB at any point on the major arc (that is, in the major segment) is half of the angle subtended by the same chord at the centre (this is because the angle at the centre is twice the angle at any point on the remaining part of the circle):

$$\text{Angle subtended at a point in the major segment} = \frac{1}{2}\angle AOB = \frac{1}{2} \times 60^\circ = 30^\circ$$

The angle subtended by the chord at a point in the major segment is 30°

Q36. Find the median of the following data:

x_i	20	25	35	40	50
f_i	5	11	24	16	5

Answer: First, we calculate the cumulative frequencies:

x_i	f_i	Cumulative frequency (cf)
20	5	5
25	11	$5+11=16$



35	24	$16+24=40$
40	16	$40+16=56$
50	5	$56+5=61$

Total number of observations $N = 61$

$$\frac{N}{2} = \frac{61}{2} = 30.5$$

We look for the cumulative frequency that is just greater than or equal to 30.5. Looking at the table, the cumulative frequency reaches 16 at $x = 25$, and jumps to 40 at $x = 35$. Since 30.5 falls between 16 and 40, the value of x_i corresponding to the cumulative frequency 40 is the median.

Median = 35

Q37. A bag contains 5 red balls and some blue balls. If the probability of drawing a blue ball from the bag is four times that of a red ball, find the number of blue balls in the bag.

Answer: Let the number of blue balls be b .

Number of red balls = 5

Total number of balls in the bag = $5 + b$

$$P(\text{red ball}) = \frac{5}{5+b}$$

$$P(\text{blue ball}) = \frac{b}{5+b}$$

According to the given condition:

$$P(\text{blue ball}) = 4 \times P(\text{red ball})$$

$$\frac{b}{5+b} = 4 \times \frac{5}{5+b}$$

Since the denominators on both sides are the same (and non-zero), we can equate the numerators:

$$b = 4 \times 5 = 20$$

Number of blue balls = 20

Q38. Solve the following system of linear equations graphically. $x + y = 7$, $x - y = -1$

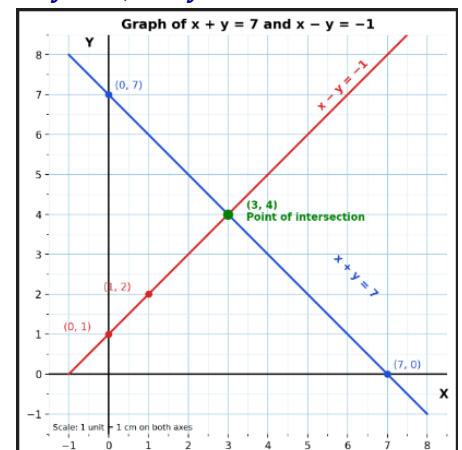
Answer: For the equation $x + y = 7$:

If $x = 0$: $0 + y = 7 \Rightarrow y = 7$; point $(0, 7)$

If $x = 7$: $7 + y = 7 \Rightarrow y = 0$; point $(7, 0)$

If $x = 3$: $3 + y = 7 \Rightarrow y = 4$; point $(3, 4)$

x	0	7	3
y	7	0	4



For the equation $x - y = -1$:

If $x = 0$: $0 - y = -1 \Rightarrow y = 1$; point $(0, 1)$

If $x = 1$: $1 - y = -1 \Rightarrow y = 2$; point $(1, 2)$

If $x = 3$: $3 - y = -1 \Rightarrow y = 4$; point $(3, 4)$

x	0	1	3
y	1	2	4

Plotting both sets of points on graph paper and drawing the two straight lines, we observe that both lines pass through the common point $(3, 4)$, which is the point of intersection.

Verification: Substituting $x = 3, y = 4$ into both equations:

$$x + y = 3 + 4 = 7$$

$$x - y = 3 - 4 = -1$$

The solution is $x = 3, y = 4$ (the lines intersect at the point $(3, 4)$)

Q39. Divide 16 into two parts such that twice the square of the larger part exceeds the square of smaller part by 164.

Answer: Let the larger part be x . Then the smaller part $= 16 - x$.

According to the given condition: $2x^2 - (16 - x)^2 = 164$

Expanding $(16 - x)^2 = 256 - 32x + x^2$:

$$2x^2 - (256 - 32x + x^2) = 164$$

$$2x^2 - 256 + 32x - x^2 = 164$$

$$x^2 + 32x - 256 = 164$$

$$x^2 + 32x - 256 - 164 = 0$$

$$x^2 + 32x - 420 = 0$$

Using the quadratic formula: $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$, where $a = 1, b = 32, c = -420$

$$x = \frac{-32 \pm \sqrt{(32)^2 - 4(1)(-420)}}{2(1)} = \frac{-32 \pm \sqrt{1024 + 1680}}{2} = \frac{-32 \pm \sqrt{2704}}{2}$$

$$\sqrt{2704} = 52$$

$$x = \frac{-32 \pm 52}{2}$$

Taking the positive sign: $x = \frac{-32 + 52}{2} = \frac{20}{2} = 10$

Taking the negative sign: $x = \frac{-32 - 52}{2} = \frac{-84}{2} = -42$ (rejected, since a part cannot be negative)

So $x = 10$ is the larger part, and the smaller part $= 16 - 10 = 6$

Verification: $2(10)^2 - (6)^2 = 2(100) - 36 = 200 - 36 = 164$



The two parts are 10 and 6

OR

The product of Ramu's age (in years) 2 years ago with his age (in years) 5 years later is 120. Find Ramu's present age.

Answer: Let Ramu's present age be x years.

Ramu's age 2 years ago = $(x - 2)$ years

Ramu's age 5 years later = $(x + 5)$ years

According to the given condition: $(x - 2)(x + 5) = 120$

Expanding: $x^2 + 5x - 2x - 10 = 120$

$$x^2 + 3x - 10 = 120$$

$$x^2 + 3x - 10 - 120 = 0$$

$$x^2 + 3x - 130 = 0$$

Using the quadratic formula: $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$, where $a = 1, b = 3, c = -130$

$$x = \frac{-3 \pm \sqrt{(3)^2 - 4(1)(-130)}}{2(1)} = \frac{-3 \pm \sqrt{9 + 520}}{2} = \frac{-3 \pm \sqrt{529}}{2}$$

$$\sqrt{529} = 23$$

$$x = \frac{-3 \pm 23}{2}$$

$$\text{Taking the positive sign: } x = \frac{-3 + 23}{2} = \frac{20}{2} = 10$$

$$\text{Taking the negative sign: } x = \frac{-3 - 23}{2} = \frac{-26}{2} = -13 \text{ (rejected, since age cannot be negative)}$$

Verification: $(10 - 2)(10 + 5) = (8)(15) = 120$

Ramu's present age = 10 years

Q40. Prove that the angles in the same segment of a circle are equal.

Answer: Given: A circle with centre O , and AB is a chord of the circle. Let C and D be two points on the circle lying on the same segment (i.e., on the same side of chord AB), such that $\angle ACB$ and $\angle ADB$ are the angles subtended by chord AB at points C and D respectively.

To Prove: $\angle ACB = \angle ADB$

Construction: Join OA and OB to form the central angle $\angle AOB$.

Proof: We use the theorem which states: "The angle subtended by an arc at the centre of a circle is double the angle subtended by the same arc at any point on the remaining part of the circle."

Since arc AB (not containing C and D) subtends the angle $\angle AOB$ at the centre O , and it subtends the angle $\angle ACB$ at point C on the remaining part of the circle: $\angle AOB = 2\angle ACB \dots$ (i)



Similarly, since the same arc AB subtends the angle $\angle ADB$ at point D , which also lies on the remaining part of the circle: $\angle AOB = 2\angle ADB \dots$ (ii)

From equations (i) and (ii), since both expressions are equal to $\angle AOB$: $2\angle ACB = 2\angle ADB$

Dividing both sides by 2: $\angle ACB = \angle ADB$

Since C and D were any two points chosen in the same segment, this proves that all angles subtended by the same chord (arc) at points lying in the same segment are equal.

Hence Proved: The angles in the same segment of a circle are equal.

Q41. The minute hand of a wall clock is 14 cm long. Find the area swept by the minute hand and the distance covered by the tip of the minute hand, between 9 a.m. and 9.20 a.m.

Answer: Length of the minute hand = $r = 14$ cm (this acts as the radius of the circular sweep)

Time interval = from 9:00 a.m. to 9:20 a.m. = 20 minutes

We know that the minute hand completes one full rotation (i.e., 360°) in 60 minutes.

Angle swept in 20 minutes = $\frac{20}{60} \times 360^\circ = \frac{1}{3} \times 360^\circ = 120^\circ$

Area swept by the minute hand (this is the area of the sector with angle 120° and radius 14 cm):

$$\begin{aligned} \text{Area of sector} &= \frac{\theta}{360^\circ} \times \pi r^2 = \frac{120^\circ}{360^\circ} \times \frac{22}{7} \times (14)^2 \\ &= \frac{1}{3} \times \frac{22}{7} \times 196 \\ &= \frac{1}{3} \times \frac{22 \times 196}{7} \\ &= \frac{1}{3} \times \frac{4312}{7} \\ &= \frac{1}{3} \times 616 \\ &= \frac{616}{3} = 205.33 \text{ cm}^2 \text{ (approximately)} \end{aligned}$$

Distance covered by the tip of the minute hand (this is the length of the arc swept, i.e., arc length of the sector):

$$\begin{aligned} \text{Arc length} &= \frac{\theta}{360^\circ} \times 2\pi r = \frac{120^\circ}{360^\circ} \times 2 \times \frac{22}{7} \times 14 \\ &= \frac{1}{3} \times 2 \times \frac{22}{7} \times 14 \\ &= \frac{1}{3} \times \frac{2 \times 22 \times 14}{7} \\ &= \frac{1}{3} \times \frac{616}{7} \\ &= \frac{1}{3} \times 88 \\ &= \frac{88}{3} = 29.33 \text{ cm (approximately)} \end{aligned}$$

Area swept $\approx 205.33 \text{ cm}^2$; **Distance covered by the tip** $\approx 29.33 \text{ cm}$



OR

A cube and a cuboid have same volumes. The dimensions of the cuboid are in the ratio 1: 2: 4. If the difference between the cost of polishing the cuboid and the cube at the rate of ₹5 per m² is ₹80.

Answer: Find their volumes. Let the dimensions of the cuboid be $x, 2x, 4x$ (since they are in the ratio 1: 2: 4).

$$\text{Volume of the cuboid} = x \times 2x \times 4x = 8x^3$$

Let the side of the cube be a .

$$\text{Volume of the cube} = a^3$$

Since both have the same volume:

$$a^3 = 8x^3$$

$$a = \sqrt[3]{8x^3} = 2x$$

Total Surface Area of the cuboid = $2(lb + bh + hl)$, where $l = x, b = 2x, h = 4x$:

$$= 2(x \times 2x + 2x \times 4x + 4x \times x)$$

$$= 2(2x^2 + 8x^2 + 4x^2)$$

$$= 2(14x^2)$$

$$= 28x^2$$

Total Surface Area of the cube = $6a^2 = 6(2x)^2 = 6 \times 4x^2 = 24x^2$

Since the cost of polishing is ₹5 per m², the cost of polishing the cuboid is $5 \times 28x^2 = 140x^2$, and the cost of polishing the cube is $5 \times 24x^2 = 120x^2$.

$$\text{Difference in cost} = 140x^2 - 120x^2 = 20x^2$$

According to the given condition, this difference equals ₹80: $20x^2 = 80$

$$x^2 = 4$$

$x = 2$ (taking the positive square root, since a dimension cannot be negative)

$$\text{Volume of the cuboid} = 8x^3 = 8(2)^3 = 8 \times 8 = 64 \text{ m}^3$$

$$\text{Volume of the cube} = a^3 = (2x)^3 = (2 \times 2)^3 = (4)^3 = 64 \text{ m}^3$$

Answer: Volume of the cuboid = Volume of the cube = 64 m³

Q42. If the mean of the following data is 6, find the value of P:

Answer:

x_i	2	4	6	10	P+5
f_i	3	2	3	1	2



First, we calculate $\sum f_i$ (total frequency): $\sum f_i = 3 + 2 + 3 + 1 + 2 = 11$

Next, we calculate $\sum f_i x_i$: $f_1 x_1 = 3 \times 2 = 6$

$$f_2 x_2 = 2 \times 4 = 8$$

$$f_3 x_3 = 3 \times 6 = 18$$

$$f_4 x_4 = 1 \times 10 = 10$$

$$f_5 x_5 = 2 \times (P + 5) = 2P + 10$$

$$\sum f_i x_i = 6 + 8 + 18 + 10 + (2P + 10) = 52 + 2P$$

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

Given that the mean is 6: $6 = \frac{52+2P}{11}$

$$6 \times 11 = 52 + 2P$$

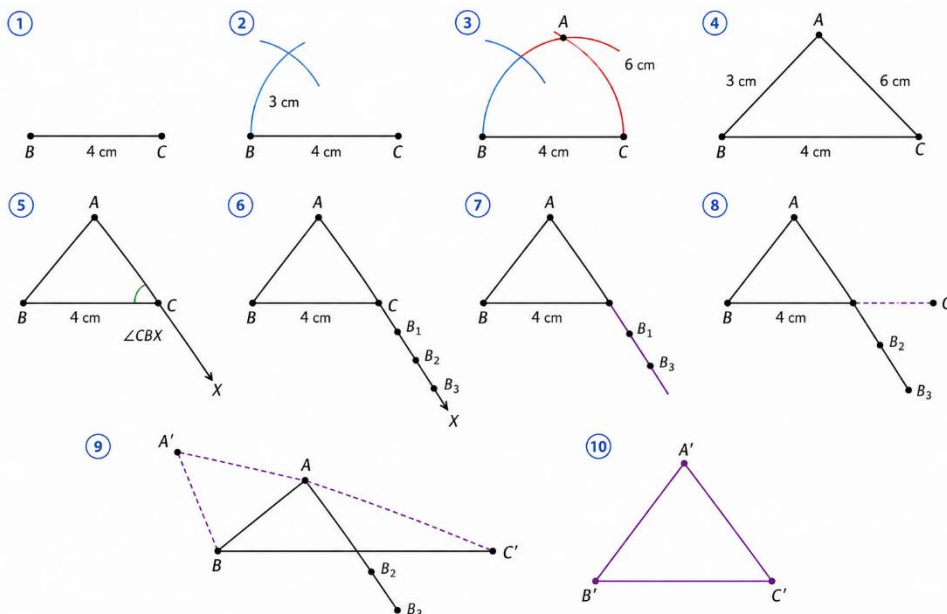
$$66 = 52 + 2P$$

$$2P = 66 - 52$$

$$2P = 14$$

$$P = 7$$

Q43. Construct a triangle ABC in which $AB = 3$ cm, $BC = 4$ cm and $AC = 6$ cm. Now construct a triangle similar to it whose sides are $\frac{2}{3}$ of the corresponding sides of $\triangle ABC$.



Answer: Steps of Construction:

1. Draw a line segment $BC = 4$ cm using a ruler.
2. With B as centre, draw an arc of radius 3 cm (since $AB = 3$ cm).
3. With C as centre, draw another arc of radius 6 cm (since $AC = 6$ cm), so that it intersects the arc drawn in the previous step at a point; name this point of intersection A .



4. Join AB and AC . Now $\triangle ABC$ is the required triangle with the given measurements $AB = 3$ cm, $BC = 4$ cm, $AC = 6$ cm.
5. Below BC (on the side opposite to vertex A), draw an acute angle $\angle CBX$ by drawing a ray BX .
6. Along ray BX , using a compass, mark off 3 equal points B_1, B_2, B_3 such that $BB_1 = B_1B_2 = B_2B_3$. (We take 3 equal divisions because the given fraction is $\frac{2}{3}$ and we always use the larger of the numerator and denominator, which is 3, as the number of equal parts to mark.)
7. Join the last point B_3 to C , forming line segment B_3C .
8. From point B_2 (which corresponds to the numerator value 2), draw a line parallel to B_3C , meeting the line segment BC (or BC extended) at a point; name this point C' .
9. From point C' , draw a line parallel to CA , meeting BA (or BA extended) at a point; name this point A' .
10. Then $\triangle A'BC'$ is the required triangle, which is similar to $\triangle ABC$ and whose each side is $\frac{2}{3}$ of the corresponding side of $\triangle ABC$.

Justification: In $\triangle BB_3C$, since $B_2C' \parallel B_3C$, by the Basic Proportionality Theorem (Thales' theorem), we have $\frac{BC'}{BC} = \frac{BB_2}{BB_3} = \frac{2}{3}$ which gives $BC' = \frac{2}{3}BC$.

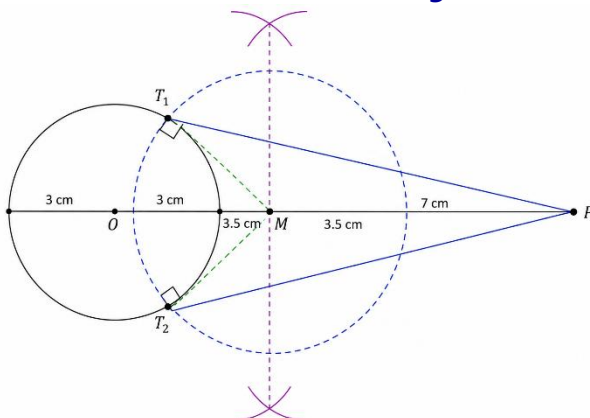
Also, since $C'A' \parallel CA$, triangles $BA'C'$ and BAC are similar by the AA similarity criterion (they share the common angle at B , and the corresponding angles formed by the parallel lines are equal).

Therefore, $\frac{BA'}{BA} = \frac{BC'}{BC} = \frac{A'C'}{AC} = \frac{2}{3}$.

This confirms that all sides of $\triangle A'BC'$ are exactly $\frac{2}{3}$ of the corresponding sides of $\triangle ABC$.

OR

Draw a circle of diameter 6 cm. From a point P outside the circle at a distance of 7 cm from the centre of the circle, draw two tangents to the circle.



Answer: Steps of Construction:



1. Draw a circle with centre O and diameter 6 cm; this means the radius of the circle is $OA = 3$ cm.
2. Mark a point P outside the circle such that the distance $OP = 7$ cm.
3. Join the centre O to the external point P by drawing the line segment OP .
4. Construct the perpendicular bisector of the line segment OP . To do this, with O as centre and a radius more than half of OP , draw arcs above and below OP ; then with P as centre and the same radius, draw two more arcs intersecting the previous arcs. Join the two points of intersection to get the perpendicular bisector, which meets OP at its midpoint, say M .
5. Since M is the midpoint of OP : $OM = MP = \frac{7}{2} = 3.5$ cm.
6. With M as centre and radius equal to MO (or MP , which is 3.5 cm), draw a circle. This new circle will intersect the original circle (with centre O and radius 3 cm) at two distinct points; name these points of intersection T_1 and T_2 .
7. Join PT_1 and PT_2 .
8. PT_1 and PT_2 are the required pair of tangents drawn from the external point P to the given circle.

Justification: Since T_1 and T_2 lie on the circle drawn with OP as diameter, by the theorem "angle in a semicircle is a right angle," we have $\angle OT_1P = 90^\circ$ and $\angle OT_2P = 90^\circ$.

Since OT_1 (and similarly OT_2) is a radius of the original circle, and $PT_1 \perp OT_1$ (as $\angle OT_1P = 90^\circ$), by the theorem "a line perpendicular to a radius at its outer end is a tangent to the circle," PT_1 must be a tangent to the circle at point T_1 . Similarly, PT_2 is a tangent to the circle at point T_2 .

Length of each tangent (calculated using the Pythagoras theorem in right triangle OT_1P):

$$PT_1 = \sqrt{OP^2 - OT_1^2} = \sqrt{(7)^2 - (3)^2} = \sqrt{49 - 9} = \sqrt{40} = 2\sqrt{10} \approx 6.32 \text{ cm}$$

Q44. As observed from the top of a light house, 100 m above sea level, the angle of depression of a ship, sailing directly towards it, changes from 30° to 45° . Find the distance travelled by the ship during the period of observation. (Take $\sqrt{3} = 1.732$)

Answer: Let AB represent the light house, where B is at sea level and A is at the top, so that $AB = 100$ m.

Let the ship be initially observed at point C , where the angle of depression from the top of the light house is 30° . As the ship sails directly towards the light house, let its new position be point D , where the angle of depression becomes 45° . Both C and D lie on the horizontal line at sea level, with D being closer to the base of the light house than C .



Since the angle of depression from a high point to an object is always equal to the angle of elevation of that high point as observed from the object (this follows from alternate angles, because the line of sight and the horizontal line at A are parallel to the sea-level line BC):

$$\angle ACB = 30^\circ \text{ and } \angle ADB = 45^\circ$$

In right triangle ABD (right-angled at B): $\tan 45^\circ = \frac{AB}{BD}$

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

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

In right triangle ABC (right-angled at B): $\tan 30^\circ = \frac{AB}{BC}$

$$\frac{1}{\sqrt{3}} = \frac{100}{BC}$$

$$BC = 100\sqrt{3} \text{ m}$$

$$\text{Distance travelled by the ship} = CD = BC - BD = 100\sqrt{3} - 100 = 100(\sqrt{3} - 1)$$

Substituting $\sqrt{3} = 1.732$:

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

The distance travelled by the ship = 73.2 m

OR

The angle of elevation of the top of a building from the foot of a tower is 30° and the angle of elevation of the top of the tower from the foot of the building is 60° . If the tower is 50 m high, find the height of the building (Take $\sqrt{3} = 1.732$)

Answer: Let PQ represent the tower, with Q at the foot of the tower and P at the top, so that $PQ = 50$ m. Let RS represent the building, with S at the foot of the building and R at the top. Since the tower and the building stand on the same horizontal ground, let the horizontal distance between the foot of the tower (Q) and the foot of the building (S) be $QS = x$ metres.

Given information: The angle of elevation of the top of the tower (P) as observed from the foot of the building (S) is 60° : $\angle PSQ = 60^\circ$

The angle of elevation of the top of the building (R) as observed from the foot of the tower (Q) is 30° : $\angle RQS = 30^\circ$

In right triangle PQS (right-angled at Q , since the tower PQ stands vertically on the ground):

$$\tan 60^\circ = \frac{PQ}{QS}$$

$$\sqrt{3} = \frac{50}{x}$$

$$x = \frac{50}{\sqrt{3}}$$



In right triangle RSQ (right-angled at S , since the building RS stands vertically on the ground):

$$\tan 30^\circ = \frac{RS}{QS}$$

$$\frac{1}{\sqrt{3}} = \frac{RS}{x}$$

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

Substituting the value of $x = \frac{50}{\sqrt{3}}$ into this equation: $RS = \frac{1}{\sqrt{3}} \times \frac{50}{\sqrt{3}} = \frac{50}{3}$

$$RS = \frac{50}{3} = 16.67 \text{ m (approximately)}$$

$$\text{Height of the building} = \frac{50}{3} \text{ m} \approx 16.67 \text{ m}$$





Thank you!



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



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