Answer: (c)

Question 2: Write True/ False in the following: (1 * 5 = 5)

(i): Algebraic expression $x^2 + 3\sqrt{x} - 4$ is not a polynomial.

Answer: True

(ii): Property tax is an indirect tax

Answer: True

(iii): The line joining the centre of a circle to the midpoint of a chord is perpendicular to the chord.

Answer: True

(iv): The volume of cuboid = Length x Breadth x Height

Answer: True

(v): 2 is the mode of the following observation:
2, 3, 4, 2, 12, 9, 8, 9, 6, 9, 5, 9

Answer: False

Question 3: Fill in the blanks: (1 * 5 = 5)

(i) Third proportional of 8, 12 is ________________ (18)
(ii) Compound amount = Principle × [1 + _____ / 100] (rate)
(iii) Congruent figures are ____________ (similar)
(iv) If two chords of a circle are equidistant from the center of the circle, then they are ___________ to each other. (equal)
(v) The probability of any sure event is always___________ (1)

Question 4: Write the answer in one word/ sentence of each: (1 * 5 = 5)

(i) Additive inverse of x - [1 / x] is

Answer: - x + [1 / x]

(ii) log m / n =

Answer: log m - log n

(iii) The edge of a cube is 5cm. What will be its volume?

Answer: 125 cm^3

Volume = a^3

= 5^3

= 5 * 5 * 5

= 125 cm^3

(iv) The relation between the arc of a circle, the angle subtended by the arc at the centre and radius is

Answer: Twice

(v) Define Angle of Elevation.

Answer: Angle of elevation is the angle subtended by the line of sight with the horizontal.

Question 5: Match the following. (5 * 1 = 5)

Column A	Column B
(i) $\sin^2 45^o + \cos^2 45^o$	(a) 0
(ii) $\cot (90^o - \theta)$	(b) $\text{cosec}^2 \theta$
(iii) $\cos \theta \cos (90 - \theta) - \sin \theta \sin (90 - \theta)$	(c) $\sqrt{3} / 2$

(iv) $1 + \cot^2 \theta$ (d) 1

(v) $\cos 30^o$ (e) $\cos \theta$

(f) $\tan \theta$

(g) 2

Answer:

(i) - (d)

(ii) - (f)

(iii) - (a)

(iv) - (b)

(v) - (c)

Question 6: [i] What is the meaning of similarity? **2M**

OR

[ii] What are the conditions for the similarity of polygons?

Solution:

[i] Two figures are said to be similar if they both have the same shape, or one has the same shape as the mirror image of the other.

OR

[ii] Two polygons are similar if the corresponding angles are congruent and the corresponding sides are proportional.

Question 7: [i] The perimeters of two similar triangles are 30cm and 20cm respectively. If one side of the triangle is 12 cm, then find the length of the corresponding side of the other triangle. **3M**

OR

[ii] Write the statement of Basic Proportionality Theorem (Thales Theorem).

Solution:

[i] Let triangle ABC and triangle PQR are two similar triangles.

⇒ Perimeter of $\triangle ABC = 30$ cm

⇒ Perimeter of $\triangle PQR = 20$ cm

⇒ BC = 12 cm, QR = ?
⇒ In the similarity case,
Perimeter of △ABC / Perimeter of △PQR = AB / PQ = BC / QR = AC / PR
[Ratio of their corresponding sides]
⇒ 30 / 20 = 12 / x
⇒ 1.5 = 12 / x
⇒ x * 1.5 = 12
⇒ x = 8cm

OR

[ii] If a line is drawn parallel to one side of a triangle intersecting the other two sides in distinct points, then the other two sides are divided in the same ratio.

Question 8: [i] Check whether 6cm, 8cm and 10cm are the sides of the right-angled triangle? 2M

OR

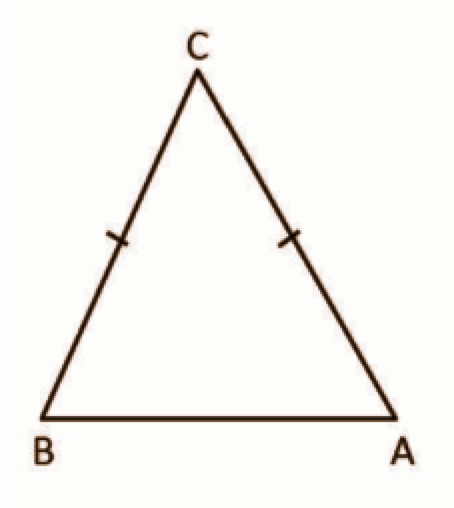
[ii] ΔACB is an isosceles triangle such that AC = BC, if $AB^2 = 2AC^2$, then prove that ΔACB is a right−angled triangle.

Solution:
[i] In a right-angled triangle,

$Hypotenuse^2 = Adjacent^2 + Opposite^2$
$10^2 = 8^2 + 6^2$
100 = 64 + 36
100 =100
These are the sides of a right-angled triangle.

OR

[ii]



$AB^2 = 2AC^2$
$AB^2 = AC^2 + AC^2$
$AB^2 = AC^2 + BC^2$
So, AB will be the largest side which is the hypotenuse.
$Hypotenuse^2 = Adjacent^2 + Opposite^2$
$AB^2 = AC^2 + BC^2$
$LHS = AB^2$
$RHS = AC^2 + AC^2$
$= 2AC^2$
$= AB^2$
LHS = RHS
Pythagoras theorem holds good and thus triangle ABC is a right-angled triangle.

Question 9: [i] Find the median of the following values:
15, 35, 18, 26, 19, 25, 29, 20, 27. **2M**

OR

[ii] Write any two merits of the Arithmetic Mean.

Solution:
[i] 15, 18, 19, 20, 25, 26, 27, 29, 35
Number of terms = 9
Median = $[(n + 1) / 2]^{th}$ term
= $[(9 + 1) / 2]^{th}$ term

= 5^{th} term
= 25

OR

[ii] (a) It can be easily calculated.
(b) It is based on all observations of the given data.

Question 10: [i] Find the probability that an even number turns up in a single throw of a die. 2M

OR

[ii] Find the probability of getting head and tail at a time in a single throw of a coin.

Solution:
[i] S = {1, 2, 3, 4, 5, 6}
n (S) = 6
A = {2, 4, 6}
n (A) = 3
P (A) = n (A) / n (S)
= 3 / 6
= 1 / 2

OR

[ii] Sample space = {H, T}
Probability (getting head and tail at a time in a single throw of a coin) = 0

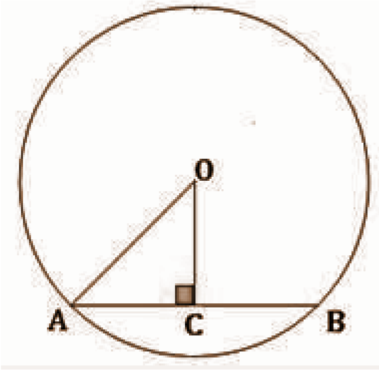
Question 11: [i] A chord of length 30cm is drawn at a distance of 8cm from the centre of the circle. Find the radius of a circle. 3M

OR

[ii] Prove that the length of two tangents drawn from an external point to a circle is equal.

Solution:

[i]



Chord of length 30 cm

Given that the distance from centre to the chord AB is OC = 8 cm.

OC ⊥ AB and AC = CB [Since perpendicular drawn from the centre of the circle bisects the chord]

∴ AC = CB = 15 cm

In right ΔOCA,

$OA^2 = AC^2 + OC^2$

= 152 + 82

= 225 + 64

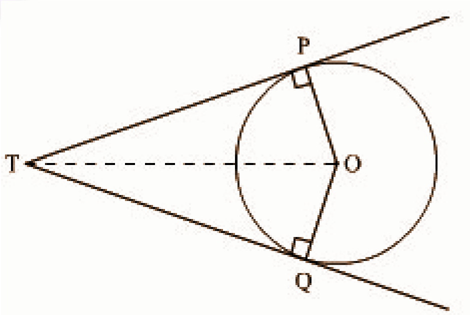
= 289

AC = 17 cm

Thus the radius of the circle is 17 cm.

OR

[ii]



Let two tangents PT and QT be drawn to the circle of centre O as shown in the figure.

Both the given tangents PT and QT touch to the circle at P and Q respectively.
To prove that the length of PT = length of QT.
Construction: Draw a line segment, from centre O to external point T {touching point of two tangents}.
Proof: In ΔPOT and ΔQOT, the tangent makes a right angle with the radius of the circle.
PO and QO are radii.
So, ∠OPT = ∠OQT = 90°
It is clear that both the triangles ΔPOT and ΔQOT are right-angled triangles with a common hypotenuse OT of these [as shown in the figure].
In ΔPOT and ΔQOT,
∠OPT = OQT = 90°
Common hypotenuse OT and OP = OQ [OP and OQ are radii]
So, by RHS rule of similarity,
ΔPOT ~ ΔQOT
OP / OQ = PT / QT = OT / OT
PT / QT = 1
PT = QT

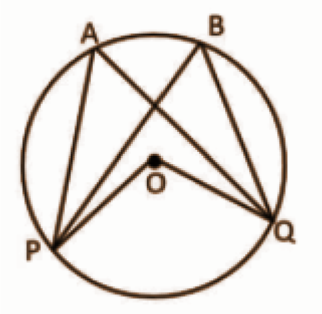
Question 12: [i] Prove that the angles in the same segment of a circle are equal to each other. 3M

OR

[ii] Prove that the angles in the semicircle are the right angle.

Solution:

[i]



Given a circle with centre O, the points P and Q subtends the angles $\angle PAQ$ and $\angle PBQ$ at points A and B respectively.

To prove that $\angle PAQ = \angle PBQ$

Proof:

Chord PQ subtends $\angle POQ$ at the centre.

From the theorem "Angles subtended by an arc at the centre is double the angles subtended by it at any other point on the circle."

$\angle POQ = 2\ \angle PAQ$ ------ (1)

$\angle POQ = 2\angle PBQ$ ------ (2)

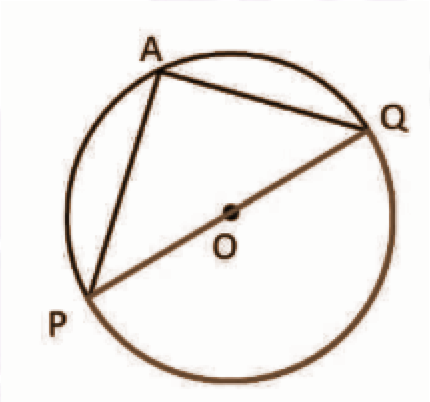
From (1) and (2),

$2\angle PBQ = 2\angle PAQ$

$\angle PBQ = \angle PAQ$

OR

[ii]



Given: A circle with centre O. PQ is the diameter of the circle subtending $\angle PAQ$ at point A on the circle.

To prove that: $\angle PAQ = 90^o$

Proof:

POQ is a straight line passing through centre O.

Angle subtended by arc PQ at O is $\angle POQ = 180^o$ ---- (1)

Also, by theorem "The angle subtended by an arc at the centre is double the angle subtended by it at any point on the remaining part of the circle."

$\angle POQ = 2\angle PAQ$

$\angle POQ / 2 = \angle PAQ$
$180^o / 2 = \angle PAQ$ ---- (from (1))
$90^o = \angle PAQ$
$\angle PAQ = 90^o$

Question 13: [i] If the mean of 5 observations x, x + 2, x + 4, x + 6, x + 8 is 11, then find the value of x.

OR

[ii] Find the arithmetic mean of 47, 53, 49, 60, 39, 42, 53, 52, 50, 55. 3M

Solution:
[i] x + x + 2 + x + 4 + x + 6 + x + 8 / 5 = 11
5x + 20 = 55
5x = 35
⇒ x = 7

OR

[ii] Mean = $\sum x / n$

= [47 + 53 + 49 + 60 + 39 + 42 + 53 + 52 + 50 + 55] / 10
= 503 / 10
= 50.3

Question 14: [i] Find the median of the following frequency distribution table:

Variable (X)	**4**	**6**	**8**	**10**	**12**	**14**	**16**
Frequency (F)	**2**	**4**	**5**	**3**	**2**	**1**	**4**

OR

[ii] Write two merits and one demerit of the median. 3M

Solution:
[i]

Variable (X)	4	6	8	10	12	14	16
Frequency (F)	2	4	5	3	2	1	4
Cumulative frequency(CF)	2	6	11	14	16	17	21

N = 21

Median = $[(N + 1) / 2]^{th}$ term

= [21 + 1] / 2

= 22 / 2

= 11^{th} term

= 8

OR

[ii] The two merits of the median are:

(a) It is easy to compute and understand.

(b) It is well defined an ideal average should be.

Demerits :

1) For computing, median data needs to be arranged in ascending or descending order.

Question 15: [i] Solve the following system of equation by Substitution Method: 4x+ y = 7

3x - 2y = 11 **4M**

OR

[ii] If in ΔABC, ∠C = 2∠B = ∠A + ∠B + 20, then find all the three angles of the triangle.

Solution:

[i] 4x + y = 7 ---- (1)

3x - 2y = 11 ---- (2)

From (1), y = 7 - 4x ---- (3)
Substitute (3) in (2),
3x - 2 * (7 - 4x) = 11
3x - 14 + 8x = 11
11x = 11 + 14
11x = 25
x = 25 / 11
Put the value of x in (1),
4 * (25 / 11) + y = 7
100 / 11 + y = 7
y = 7 - (100 / 11)
= [77 - 100] / 11
= -23 / 11
So,
x = 25 / 11 and y = -23 / 11

OR

[ii] $\angle C = 2\angle B = \angle A + \angle B + 20$
$\angle A + \angle B + \angle C = 180^o$
Since $\angle C = 2\angle B$ and $2\angle B = \angle A + \angle B + 20$,
$\angle B = \angle A + 20$
$\angle A + \angle B + 2\angle B = 180^o$
$\angle A + \angle A + 20 + 2 [\angle A + 20] = 180^o$
$\angle A + \angle A + 20 + 2\angle A + 40 = 180$
$4\angle A = 180 - 60$
$4\angle A = 120$
$\angle A = 120 / 4$
$\angle A = 30^o$
$\angle B = \angle A + 20$
$\angle B = 30 + 20$
$\angle B = 50^o$
$\angle C = 2\angle B = 2 * 50^o = 100^o$

Question 16: [i] A fraction becomes 1 / 4 when 2 is subtracted from its numerator and 3 is added to its denominator and on adding 6 to the numerator and multiplying the denominator by 3, it becomes 2 / 3. Find the fraction. **4M**

OR

[ii] The sum of two numbers is 7. If the sum of these numbers is 7 times of its difference, then find the numbers.

Solution:

[i] Let the numerator be 'a' and denominator be 'b'.

Given, 3 is added to the denominator and 2 is subtracted from the numerator a fraction becomes 1/4.

$\Rightarrow [a - 2] / [b + 3] = [1 / 4]$

$\Rightarrow 4a - 8 = b + 3$

$\Rightarrow 4a - b = 11$----(1)

Also, when 6 is added to the numerator and the denominator is multiplied by 3, it becomes 2/3.

$\Rightarrow [a + 6] / 3b = [2 / 3]$

$\Rightarrow 3a + 18 = 2b$

$\Rightarrow a + 6 = 2b$ ----(2)

On multiplying equation (2) by 4 and subtracting from equation (1),

$\Rightarrow 4a - b - 4a - 24 = 11 - 8b$

$\Rightarrow 7b = 35$

$\Rightarrow b = 5$

Thus, a = 4.

The fraction is 4 / 5.

OR

[ii] Let the numbers be x and y.

$x + y = 7$………(1)

$x + y = 7 (x - y)$

$6x - 8y = 0$

$3x - 4y = 0 * 2$ ---- (2)

$4x + 4y = 28$ ---- (3)

$7x = 28$

$x = 28 / 7$

$x = 4$

$4 + y = 7$

$y = 7 - 4$

$y = 3$

Question 17: [i] If b is the mean proportional of a and c then prove that $[a^2 + b^2] / ab = [a + c] / b$ 4M

OR

[ii] If x / b + c = y / c + a = z / a + b, then prove that (b - c) x + (c - a) y + (a - b) z = 0.

Solution:

[i] If b is the mean proportional of a and c, then $b^2 = ac$.

Take the LHS

$= [a^2 + b^2] / ab$

$= [a^2 + ac] / ab$

$= a (a + c) / ab$

$= (a + c) / b$

OR

[ii] Let x / b + c = y / c + a = z / a + b = k.

$x = k (b + c)$, $y = k (c + a)$, $z = k (a + b)$

LHS = $(b - c) x + (c - a) y + (a - b) z$

$= (b - c) (k (b + c)) + (c - a) (k (c + a)) + (a - b) (k (a + b))$

$= k (b^2 - c^2) + k (c^2 - a^2) + k (a^2 - b^2)$

$= k (b^2 - c^2 + c^2 - a^2 + a^2 - b^2)$

$= k * 0$

$= 0$

Question 18: [i] Solve the following equation by the formula method, $x^2 - 5x - 6 = 0$. 4M

OR

[ii] If α, β are the roots of the quadratic equation $ax^2 + bx + c = 0$, then find the value of $\alpha^2 + \beta^2$.

Solution:

[i] $x^2 - 5x - 6 = 0$

$x^2 - 6x + 1x - 6 = 0$

$x(x - 6) + 1(x - 6) = 0$

$(x - 6)(x + 1) = 0$

$x = 6, -1$

OR

[ii] The polynomial $ax^2 + bx + c = 0$ whose zeroes are α, β.

The sum of the zeroes = $\alpha + \beta = -b / a$.

The product of the zeroes = $\alpha * \beta = c / a$

$\alpha^2 + \beta^2 = (\alpha + \beta)^2 - 2 [\alpha * \beta]$

$= [-b / a]^2 - 2 * [c / a]$

$= b^2 / a^2 - 2c / a$

$= b^2 - 2ac / a^2$

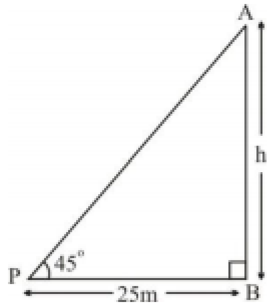
Question 19: [i] At a point 25 m away from the foot of a building, the angle of elevation at the top of the building is 45º. Find the height of the building. 4M

OR

[ii] From the top of the 60m high lighthouse, the angle of depression of the ship is 60º. Find the distance between the ship and food of the lighthouse.

Solution:

[i]



$\angle APB = 45^o$

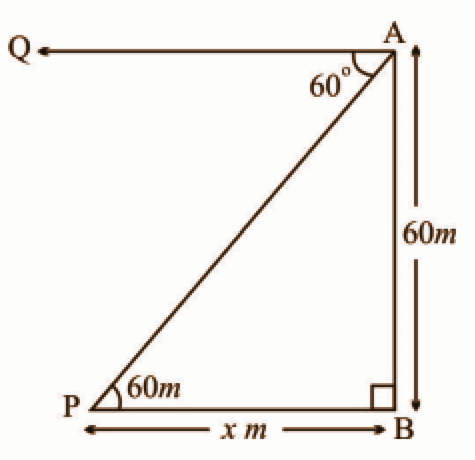
In triangle ABP,

h / 25 = tan 45 = 1

h = 25m

OR

[ii]



$\angle APB = \angle QAP = 60^o$

In triangle ABP,

$60 / x = \tan 60^o = \sqrt{3}$

$x = 60 / \sqrt{3} = 20\sqrt{3}$

= 20 * 1.732

= 34.64m

Question 20: [i] Find the length of arc and area of a sector of the circle, if the angle subtended at the centre and the radius are 60° and 6 cm respectively. 4M

OR

[ii] If V is the volume of a cuboid, whose length is a breadth is b and height is c and S is its total surface area, then prove that 1 / V = 2 / S [1/ a + 1/ b + 1/ c].

Solution:

[i] $\theta = 60^o$, r = 6cm

Area of the sector = $[\theta / 360^o] * 2\pi r$

= [60 / 360] * 2 * (22 / 7) * (6)
= [1 / 6] * [264 / 7]
= 44 / 7 cm

Length of the arc = [$\pi r^2\theta$] / 360^o
= [22 / 7] * [6 * 6 * 60] / 360^o
= 132 / 7
= 18.8 cm

OR

[ii] Volume of a cuboid = a × b × c
Surface area of cuboid = 2 (ab + bc + ac)
[2 / S] (1 / a + 1 / b + 1 / c) = [2 / S] ((bc + ac + ab) / abc)
It can be written as [2 / S] (1 / a + 1 / b + 1 / c) = [2 / S] (S / 2V)
[2 / S] (1 / a + 1 / b + 1 / c) = 1 / V
[1 / V] = [2 / S] (1 / a + 1 / b + 1 / c)

Question 21: [i] Two cubes of each 15cm side are joined end to end. Find the total surface area of the resulting cuboid. 4M

OR

[ii] An iron sphere of radius 8 cm is melted then recast into small spheres each of radius 1 cm. Find the number of small spheres.

Solution:
[i] Let the side each cube = a = 15 cm.
After joining the two cubes it becomes cuboid.
Dimensions of the cuboid are
Length = a + a = 15+15 = 30 cm
breadth = b = 15 cm
height = h = 15 cm
Total surface area = 2 (lb + bh + lh)
= 2 (30*15 + 15*15 + 30*15)
= 2 (450 + 225 + 450)
= 2 * 1125
= 2250 square cm

OR

[ii] Number of sphere = [4 / 3] * **π** * 8^2 / [4 / 3] * **π** * 1^2
= 512

Question 22: [i] Which rational expression should be added to [x^3 − 1] / [x^2 + 2] to get [2x^3 − x^2 + 3] / x^2 + 2?
5M

OR

[ii] Factorise a^2 (b + c) + b^2 (c + a) + c^2 (a + b) + 3abc.

Solution:
[i] [x^3 − 1] / [x^2 + 2] + p(x) / q(x) = [2x^3 − x^2 + 3] / x^2 + 2
p(x) / q(x) = [2x^3 − x^2 + 3] / [x^2 + 2] - [x^3 − 1] / [x^2 + 2]
= [2x^3 - x^2 + 3] - [x^3 - 1] / [x^2 + 2]
= [x^3 - x^2 + 4] / [x^2 + 2]

OR

[ii] a^2 (b + c) + b^2 (c + a) + c^2 (a + b) + 3abc
= a^2 (b + c) + abc + b^2 (c + a) + abc + c^2 (a + b) + abc
= a (ab + ca + bc) + b (bc + ab + ca) + c (ca + bc + ab)
= a (ab + bc + ca) + b (ab + bc + ca) + c (ab + bc + ca)
= (ab + bc + ca) (a + b + c)

Question 23: [i] The sum of a number and its reciprocal is 26 / 5. Find the number. **5M**

OR

[ii] Solve √3x^2 − 2 + 1 = 2x.

Solution:
[i] x + [1 / x] = 26 / 5
x^2 + 1 = [26 / 5] * x

$5x^2 + 5 = 26x$
$5x^2 - 26x + 5 = 0$
$5x^2 - 25x - 1x + 5 = 0$
$5x (x - 5) -1 (x - 5) = 0$
$(5x - 1) (x - 5) = 0$
$x = 1 / 5, 5$

OR

[ii] $\sqrt{3x^2 - 2} + 1 = 2x$
$\sqrt{3x^2 - 2} = 2x - 1$
On squaring both sides,
$3x^2 - 2 = (2x - 1)^2$
$3x^2 - 2 = 4x^2 + 1 - 4x$
$3x^2 - 4x^2 - 2 - 1 + 4x = 0$
$-x^2 - 3 + 4x = 0$
$x^2 - 4x + 3 = 0$
$x^2 - 3x - 1x + 3 = 0$
$x(x - 3) -1 (x - 3) = 0$
$(x - 1) (x - 3) = 0$
$x = 1, 3$

Question 24: [i] Find the depreciation and the depreciated cost of a motorcycle after 3 years at the rate of 10% depreciation, which costs Rs, 40,000. 5M

OR

[ii] Find the amount and compound interest on Rs, 2000 for 2 years at the rate of 10% per annum compound interest.

Solution:
[i] $V_t = V_o (1 - [r / 100])^t$
$= 40000 * (1 - [10 / 100])^3$
$= 40000 * (9 / 10)^3$
$= 40000 * (0.729)$
$= 29160$

Depreciation = 40000 - 29160 = Rs. 10,840

OR

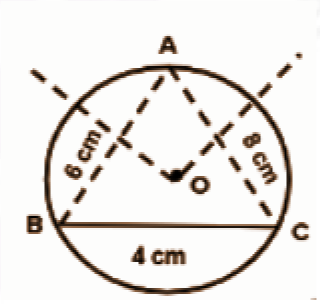
[ii] $A = P(1 + [r / 100])^t$
$= P(1 + [10 / 100])^2$
$= P(110 / 100)^2$
= 2000 * (1.21)
= Rs. 2420
CI = 2420 - 2000 = Rs. 420

Question 25: [i] Construct a triangle whose sides are 4cm, 6cm and 8cm. Draw the circumcircle of a triangle. Write the steps of construction also. 5M

OR

[ii] Construct a triangle ABC, in which BC = 6.5cm, ∠A = 60º and median AD = 4.5cm.

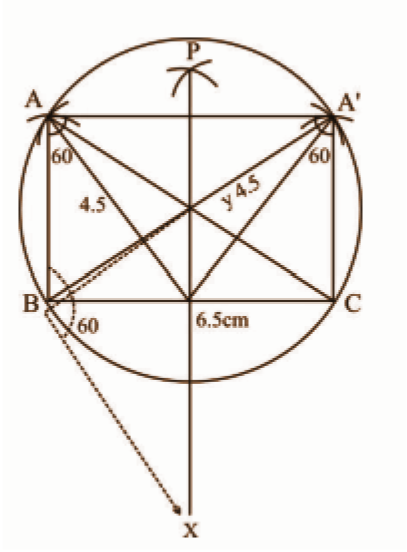
Solution:
[i]



Steps of construction:
[a] Draw the base = 4cm.
[b] Draw arcs of 6cm and 8cm radius using compass.
[c] Join them to get a triangle.
[d] Draw a perpendicular bisector to all the sides and the point of intersection is O.
[e] Pointing on this, draw a circle.

OR

[ii]



Question 26: [i] Prove it without using the table: 5M
sin 70° / cos 20° + cosec 20° / sec 70° - 2 cos 70º cosec 20º = 0.

OR

[ii] Prove that: [1 + cosA] / sin A + sin A / 1 + cos A = 2 / sin A.

Solution:

[i] L.H.S. = sin 70˚/cos 20˚ + cosec 20˚/sec 70˚ – 2 cos 70˚ × cosec 20˚
= sin(90˚ – 20˚) / cos 20˚ + cosec (90˚ – 70˚) / sec 70˚ - 2 cos 70˚ × cosec 20˚
= cos 20˚ / cos 20˚ + sec 70˚ / sec 70˚ – 2 cos 70˚ × cosec 20˚
= 1 + 1 – 2 cos (90˚ – 20˚) cosec 20˚
= 2 – 2 sin 20˚ . 1 / sin 20˚
= 2 – 2
= 0
= R.H.S

OR

[ii] LHS = [1 + cosA] / sin A + sin A / 1 + cos A
= $(1 + \cos A)^2 + \sin^2 A$ / sin A (1 + cos A)
= 1 + 2 cos A + $\cos^2 A + \sin^2 A$ / sin A (1 + cos A)
= 1 + 2 cos A + 1 / sin A (1 + cos A)

= 2 + 2 cos A / sin A (1 + cos A)
= 2 (1 + cos A) / sin A (1 + cos A)
= 2 / sin A
= RHS