Q. No. 2 Part (i) $x^2 - 2x + p = 0$

let roots of equation be α and β.

$\alpha + \beta = \frac{-b}{a} = -\frac{(-2)}{1} = 2$ $a = 1$ $b = -2$ $c = p$

$\alpha\beta = \frac{c}{a} = \frac{p}{1} = p$

$\alpha + \beta = 2 \rightarrow$ (i)

$\alpha\beta = p \rightarrow$ (ii)

$3\alpha + 4\beta = 5 \rightarrow$ (iii)

Using eq (i) & (iii)

Multiplying eq (i) by 3 on both sides,

$3(\alpha + \beta = 2)$

$3\alpha + 4\beta = 5$

Now Subtracting the equations,

$$\begin{aligned} \cancel{3\alpha} + 3\beta &= 6 \\ - \overset{-}{\oplus}\cancel{3\alpha} \overset{-}{\oplus} 4\beta &= \overset{-}{\oplus}5 \\ \hline -\beta &= 1 \end{aligned}$$

$\boxed{\beta = -1}$

Now,

$\alpha + \beta = 2$

$\alpha - 1 = 2$

$\alpha = 2 + 1$

$\boxed{\alpha = 3}$

Now put values of α & β in eq (ii)

$\rightarrow \alpha\beta = p$

$(3)(-1) = p$

$-3 = p$

$\boxed{p = -3}$

Q. No. 2 Part (ii)

$$\sqrt{x-3} + 5 = x$$

$$\sqrt{x-3} = -5 + x$$

Taking square on both sides,

$$(\sqrt{x-3})^2 = (-5+x)^2$$

$$x - 3 = (-5)^2 + (x)^2 + 2(-5)(x)$$

$$x - 3 = 25 + x^2 - 10x$$

$$x^2 - 10x - x + 25 + 3 = 0$$

$$x^2 - 11x + 28 = 0$$

$$x^2 - 7x - 4x + 28 = 0$$

$$x(x-7) - 4(x-7) = 0$$

$$(x-7)(x-4) = 0$$

$x - 7 = 0$	$x - 4 = 0$
$x = 7$	$x = 4$
Now Checking,	Now Checking,
$\sqrt{x-3} + 5 = x$	$\sqrt{x-3} + 5 = x$
$\sqrt{7-3} + 5 = 7$	$\sqrt{4-3} + 5 = 4$
$\sqrt{4} + 5 = 7$	$\sqrt{1} + 5 = 4$
$2 + 5 = 7$	$1 + 5 = 4$
$7 = 7$	$6 \neq 4$
It is true.	It is not true. (extraneous root)

$$\boxed{S.S = \{7\}}$$

Q. No. 2 Part (iii)

$$\frac{x}{p} = \frac{y}{q} = \frac{z}{r} \text{ then } \frac{x^3+y^3+z^3}{p^3+q^3+r^3} = \frac{xyz}{pqr}$$

By k – method,

$$\frac{x}{p} = \frac{y}{q} = \frac{z}{r} = k$$

$x = pk$, $y = qk$, $z = rk$

$L.H.S = \dfrac{x^3+y^3+z^3}{p^3+q^3+r^3}$	$R.H.S = \dfrac{xyz}{pqr}$
$= \dfrac{(pk)^3+(qk)^3+(rk)^3}{p^3+q^3+r^3}$	$= \dfrac{(\cancel{p}k)(\cancel{q}k)(\cancel{r}k)}{\cancel{pqr}}$
$= \dfrac{p^3k^3+q^3k^3+r^3k^3}{p^3+q^3+r^3}$	$= k \cdot k \cdot k$
$= \dfrac{k^3\cancel{(p^3+q^3+r^3)}}{\cancel{p^3+q^3+r^3}}$	$= k^3 \rightarrow$ (ii)
$= k^3 \rightarrow$ (i)	

From (i) & (ii),

$$L.H.S = R.H.S$$

$\longleftrightarrow$

Q. No. 2 Part (iv)

$A = \{1, 2, 3, 4\}$ $B = \{2, 3, 5, 7\}$

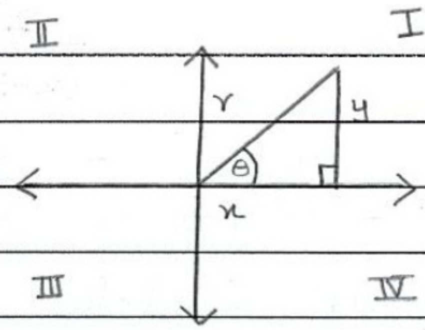
$A \times B = \{(1,2), (1,3), (1,5), (1,7), (2,2), (2,3), (2,5), (2,7), (3,2), (3,3), (3,5), (3,7), (4,2), (4,3), (4,5), (4,7)\}$

$R = \{(x, y) \mid x \in A, y \in B \wedge y < x\}$

$R = \{(3,2), (4,2), (4,3)\}$

Q. No. 2 Part (v)

θ lies in I quadrant.



$\sin\theta = \frac{3}{4}$

$\sin\theta = \frac{P}{H} = \frac{y}{r} = \frac{3}{4}$

$y = 3 \quad , \quad r = 4 \quad , \quad x = ?$

$\therefore r^2 = x^2 + y^2$

$x^2 = r^2 - y^2$

$x = \sqrt{r^2 - y^2}$

$x = \sqrt{(4)^2 - (3)^2}$

$x = \sqrt{16 - 9}$

$x = \sqrt{7}$

$x = \sqrt{7} \quad , \quad y = 3 \quad , \quad r = 4$

$\operatorname{cosec}\theta = \frac{H}{P} = \frac{r}{y} = \frac{4}{3} \longrightarrow \boxed{\operatorname{cosec}\theta = \frac{4}{3}}$

$\cos\theta = \frac{B}{H} = \frac{x}{r} = \frac{\sqrt{7}}{4} \longrightarrow \boxed{\cos\theta = \frac{\sqrt{7}}{4}}$

$\sec\theta = \frac{H}{B} = \frac{r}{x} = \frac{4}{\sqrt{7}} \longrightarrow \boxed{\sec\theta = \frac{4}{\sqrt{7}}}$

$\tan\theta = \frac{P}{B} = \frac{y}{x} = \frac{3}{\sqrt{7}} \longrightarrow \boxed{\tan\theta = \frac{3}{\sqrt{7}}}$

$\cot\theta = \frac{B}{P} = \frac{x}{y} = \frac{\sqrt{7}}{3} \longrightarrow \boxed{\cot\theta = \frac{\sqrt{7}}{3}}$

Q. No. 2 Part (vi) $\dfrac{20}{(x-3)(x^2+1)}$

$$\frac{20}{(x-3)(x^2+1)} = \frac{A}{x-3} + \frac{Bx+C}{x^2+1}$$

Multiplying both sides by $D(x) = (x-3)(x^2+1)$

$$20 = A(x^2+1) + (Bx+C)(x-3)$$

$$20 = Ax^2 + A + Bx^2 - 3Bx + Cx - 3C \rightarrow (i)$$

By Zero's method,

$x - 3 = 0 \Rightarrow \underline{x=3}$, put $x=3$ in eq (i)

$$20 = A(3)^2 + A + B(3)^2 - 3B(3) + C(3) - 3C$$

$$20 = 9A + A + \cancel{9B} - \cancel{9B} + \cancel{3C} - \cancel{3C}$$

$$20 = 10A$$

$$A = \frac{\cancel{20}^{2}}{\cancel{10}_{1}} \Rightarrow \boxed{A = 2}$$

Now,
Comparing coefficients of x^2 on both sides,

$$0 = A + B$$

$$0 = 2 + B$$

$$\boxed{B = -2}$$

Next,
Comparing coefficients of x on both sides,

$$0 = -3B + C$$

$$0 = -3(-2) + C$$

$$0 = 6 + C$$

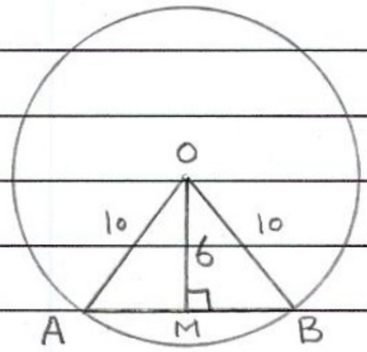
$$\boxed{C = -6}$$

$$\frac{20}{(x-3)(x^2+1)} = \frac{2}{x-3} + \frac{-2x-6}{x^2+1}$$

$$\frac{20}{(x-3)(x^2+1)} = \frac{2}{x-3} + \frac{-(2x+6)}{x^2+1}$$

$$\therefore \frac{20}{(x-3)(x^2+1)} = \frac{2}{x-3} - \frac{2x+6}{x^2+1}$$

Q. No. 2 Part (vii)



In ΔOMB,

$$H^2 = B^2 + P^2$$

$$(OB)^2 = (Bm)^2 + (Om)^2$$

$$(10)^2 = (Bm)^2 + (6)^2$$

$$(Bm)^2 = (10)^2 - (6)^2$$

$$(Bm)^2 = 100 - 36$$

$$(Bm)^2 = 64$$

$$\sqrt{(Bm)^{\cancel{2}}} = \sqrt{64}$$

$$\therefore \boxed{\overline{BM} = 8\,cm}$$

As, $\overline{Bm} + \overline{Am} = \overline{AB}$

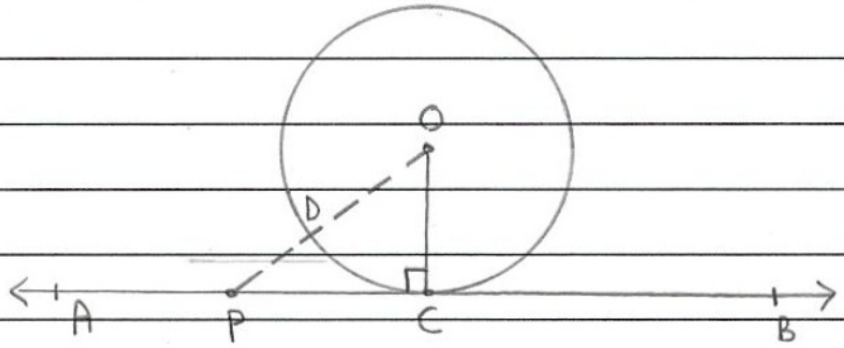
$$\overline{AB} = 2(\overline{Bm}) \quad \therefore \{ Am = Bm \Rightarrow 2Bm \}$$

$$\overline{AB} = 2(8)$$

$$\boxed{\overline{AB} = 16\,cm}$$

Q. No. 2 Part (viii) If a line is ...... at that point.

THEOREM :-



Given :-

A circle with O has radial segment $\overline{OC}$. $\overleftrightarrow{AB}$ is a line drawn to circle such that $\overleftrightarrow{AB} \perp \overline{OC}$ at C

To prove :- $\overleftrightarrow{AB}$ is tangent to circle at C.

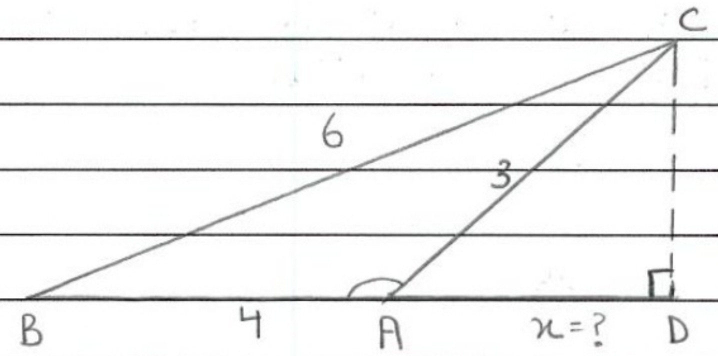
Construction :- Take point P on $\overleftrightarrow{AB}$ other than C and join P to O to form $\triangle OCP$.

Proof :-

Statements	Reasons
In $\triangle OCP$,	
$\angle OCP = 90^\circ$	given
$\angle OPC < 90^\circ$	acute angle of right triangle
$\overline{OP} > \overline{OC}$	greater angle has greater side opposite to it.
Point P lies outside circle	$\overline{OC}$ is the radial segment
So, every point on $\overleftrightarrow{AB}$ except C lies outside the circle.	—
So $\overleftrightarrow{AB}$ touches circle at one point only.	—

Hence $\overleftrightarrow{AB}$ is tangent to the circle at point C.

Q. No. 2 Part (ix)



By Theorem,

$$(\overline{BC})^2 = (\overline{AB})^2 + (\overline{AC})^2 + 2(\overline{AB})(\overline{AD})$$

$\overline{BC} = 6$, $\overline{AB} = 4$, $\overline{AC} = 3$, $(\overline{AD}) = ?$

$$(6)^2 = (4)^2 + (3)^2 + 2(4)(\overline{AD})$$

$$36 = 16 + 9 + 8(\overline{AD})$$

$$36 - 16 - 9 = 8(\overline{AD})$$

$$11 = 8(\overline{AD})$$

$$\overline{AD} = \frac{11}{8}$$

$$\overline{AD} = 1.37\text{cm}$$

$$\boxed{x = 1.37\text{cm}}$$

Q. No. 3 (Page 1)

$$\frac{x+7a}{x-7a} + \frac{x+7b}{x-7b} = 2 \quad \text{if} \quad x = \frac{14ab}{a+b}$$

$$x = \frac{14ab}{a+b}$$

$$x = \frac{7a \times 2b}{a+b}$$

$$\frac{x}{7a} = \frac{2b}{a+b}$$

Using componendo - dividendo theorem,

$$\frac{x+7a}{x-7a} = \frac{2b+(a+b)}{2b-(a+b)}$$

$$\frac{x+7a}{x-7a} = \frac{2b+a+b}{2b-a-b}$$

$$\frac{x+7a}{x-7a} = \frac{3b+a}{b-a} \rightarrow (i)$$

Now,

$$x = \frac{14ab}{a+b}$$

$$x = \frac{2a \times 7b}{a+b}$$

$$\frac{x}{7b} = \frac{2a}{a+b}$$

Using componendo - dividendo theorem,

$$\frac{x+7b}{x-7b} = \frac{2a+(a+b)}{2a-(a+b)}$$

$$\frac{x+7b}{x-7b} = \frac{2a+a+b}{2a-a-b}$$

Q. No. 3 (Page 2)

$$\frac{x+7b}{x-7b} = \frac{3a+b}{a-b} \rightarrow \text{(ii)}$$

Now adding eq (i) & (ii) on both sides,

$$\frac{x+7a}{x-7a} + \frac{x+7b}{x-7b} = \frac{3b+a}{b-a} + \frac{3a+b}{a-b}$$

$$= \frac{3b+a}{b-a} + \frac{3a+b}{-(b-a)}$$

$$= \frac{3b+a}{b-a} - \frac{3a+b}{b-a}$$

$$= \frac{3b+a-(3a+b)}{b-a}$$

$$= \frac{3b+a-3a-b}{b-a}$$

$$= \frac{2b-2a}{b-a}$$

$$= \frac{2\cancel{(b-a)}}{\cancel{b-a}}$$

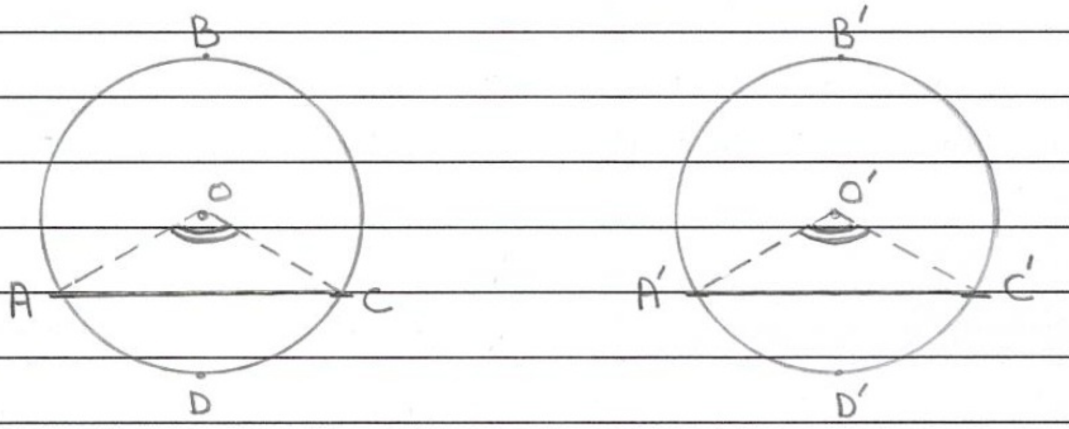
$$\therefore \frac{x+7a}{x-7a} + \frac{x+7b}{x-7b} = 2$$

Hence proved.

Q. No. 4 (Page 1)

THEOREM :-

If two arcs of a circle (or of congruent circles) are congruent, then the corresponding chords are equal :-



Given :-

ABCD and A'B'C'D' are two congruent circles with centres O and O' respectively. Arcs $\widehat{ADC} \cong \widehat{A'D'C'}$

To prove :-

$\overline{AC} = \overline{A'C'}$

Construction :-

Join O to A and C and O' to A' and C' to form Δ AOC and Δ A'O'C' respectively.

Proof :-

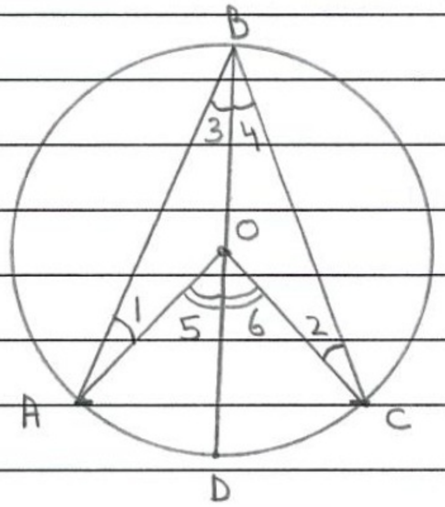
Q. No. 4 (Page 2)

Statements	Reasons
ABCD and A'B'C'D' are two circles with centres O & O'	given
$\overset{\frown}{ADC} = \overset{\frown}{A'D'C'}$	given
$\therefore \angle AOC = \angle A'O'C'$	central angles subtended by two equal arcs are always equal
Now, $\triangle AOC \longleftrightarrow \triangle A'O'C'$	
$\overline{OA} \cong \overline{O'A'}$	radii of congruent circles
$\overline{OC} \cong \overline{O'C'}$	radii of congruent circles
$\angle AOC \cong \angle A'O'C'$	already proved.
$\triangle AOC \cong \triangle A'O'C'$	$S.A.S \cong S.A.S$
Thus, $\overline{AC} \cong \overline{A'C'}$	corresponding sides of two congruent triangles.

Q. No. 5 (Page 1)

THEOREM :-

The measure of central angle of a minor arc of a circle is double that of the angle subtended by corresponding major arc.



Given :-

A circle with centre O has minor arc $\overset{\frown}{ADC}$ and major arc $\overset{\frown}{ABC}$. $\angle AOC$ is central angle subtended by minor arc and $\angle ABC$ is circum angle subtended by major arc.

To prove :-

$$\angle AOC = 2\angle ABC$$

Construction :-

Join B to O and produce it to meet the circle at D. Label angles; $\angle 1, \angle 2, \angle 3, \angle 4, \angle 5, \angle 6$.

Q. No. 5 (Page 2)

Proof :-

Statements		Reasons
In ΔAOB,		
$\angle 1 = \angle 3$	(i)	angles opposite to two equal sides in ΔAOB.
In ΔBOC,		
$\angle 2 = \angle 4$	(ii)	angles opposite to two equal sides in ΔBOC.
$\angle 5 = \angle 1 + \angle 3$	(iii)	exterior angle is equal to sum of interior opposite angles
$\angle 6 = \angle 2 + \angle 4$	(iv)	as in above
$\angle 5 = \angle 3 + \angle 3 = 2m\angle 3$	(v)	Using (i) & (iii)
$\angle 6 = \angle 4 + \angle 4 = 2m\angle 4$	(vi)	Using (ii) & (iv)
$\angle 5 + \angle 6 = 2m\angle 3 + 2m\angle 4$ $= 2(\angle 3 + \angle 4)$		adding (v) & (vi)
$\angle AOC = 2\angle ABC$		

$(BC)^2 = (AB)^2 + (AC)^2 + 2(AB)(AD)$

$(6)^2 = (4)^2 + (3)^2 + 2(4)(AD)$

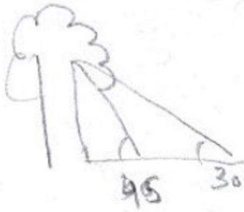
$36 = 14 + 9 + 8(\bar{AD})$

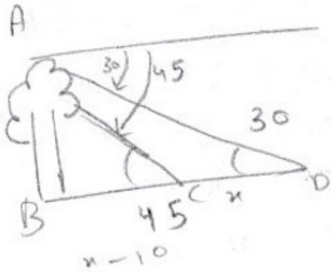
$36 - 14 - 9 = 8(\bar{AD})$

$13 = 8(\bar{AD})$

$\bar{AD} = \frac{13}{8}$

$\therefore \bar{AD} = 1.6\,cm$





$x = \frac{7a \times 2b}{a+b}$

$\frac{x}{7a} = \frac{2b}{a+b}$

$\frac{x+7a}{x-7a} = \frac{2b+a+b}{2b-a-b}$

$\frac{x+7a}{x-7a} = \frac{3b+a}{b-a}$

In $\triangle ABC$,

$\tan 45 = \frac{h}{x-10}$

$x - 10 = h$

$h = x - 10$

In $\triangle ABD$,

$\tan 30 = \frac{h}{x+(x-10)}$

$A = \frac{1}{2} r^2 \theta$

$= \frac{1}{2}(3)^2 \times \frac{\pi}{3}$

$= \frac{1}{2} \times \cancel{9}^{\,2} \times \frac{\pi}{\cancel{3}_{\,1}}$

$(7+5w+5w^2)^2$

$(7+5(w+w^2))^2$

$(7+5(-1))^2$

$(7-5)^2$

$(2)^2 = 4$

$\frac{x}{7b} = \frac{2a}{a+b}$

$\frac{x+7b}{x-7b} = \frac{2a+a+b}{2a-a-b}$

$\frac{x+7b}{x-7a} = \frac{3a+b}{a-b}$

$\tan 30 = \frac{x-10}{x+x-10}$

$\tan 30 = \frac{x-10}{2x-10}$

$(2x-10)(\tan 30) = x-10$

$2x\tan 30 - 10\tan 30 = x - 10$

$2x\tan 30 - x = -10 + 10\tan 30$

$x(2\tan 30 - 1) = -10 + 10\tan 30$

$= \frac{-10+10\tan 30}{2\tan 30 - 1}$

$x = -27.32$

$\frac{3b+a}{b-a} + \frac{3a+b}{a-b}$

$\frac{3b+a}{b-a} + \frac{3a+b}{-(b-a)}$

$\frac{3b+a}{b-a} - \frac{3a+b}{b-a}$

$\frac{2b-2a}{}$

$3b+a-3a-b$

-10