(Section B)

Q. No. 2 (i)

Solution:-

$$\frac{x+1}{x} + \frac{x}{x+1} = \frac{25}{12}$$

By L.C.M

$$\frac{(x+1)(x+1) + x^2}{x(x+1)} = \frac{25}{12}$$

$$\frac{(x+1)^2 + x^2}{x^2+x} = \frac{25}{12}$$

$$\frac{x^2+1+2x+x^2}{x^2+x} = \frac{25}{12}$$

$$12(x^2+1+2x+x^2) = 25(x^2+x)$$

$$12x^2+12+24x+12x^2 = 25x^2+25x$$

$$25x^2+25x-12x^2-12-24x-12x^2 = 0$$

$$25x^2-12x^2-12x^2+25x-24x-12 = 0$$

$$25x^2-24x^2+x-12 = 0$$

$$x^2+x-12 = 0$$

$$x^2+4x-3x-12 = 0$$

$$x(x+4)-3(x+4) = 0$$

$$(x-3)(x+4) = 0$$

$x-3 = 0$ or $x+4 = 0$

$x = +3$, $x = -4$

Solution set = $\{3, -4\}$

Q. No. 2 (ii)

$5^{1+x} + 5^{1-x} = 10$

$5^1 \cdot 5^x + 5^1 \cdot 5^{-x} = 10$

$5^1 \cdot 5^x + 5 \cdot \frac{1}{5^x} = 10 \rightarrow$ (i)

Take 5^x as y i.e $5^x = y$
putting $5^x = y$ in eq (i)

$5y + 5\frac{1}{y} = 10$

$5y + \frac{5}{y} = 10$

$\frac{5y^2 + 5}{y} = 10$

$5y^2 + 5 = 10y$

$5y^2 - 10y + 5 = 0$

$5y^2 - 5y - 5y + 5 = 0$

$5y(y-1) - 5(y-1) = 0$

$(5y-5)(y-1) = 0$

$5y - 5 = 0$ or $y - 1 = 0.$

$5y = 5$ or $y = 1$

$y = \frac{5}{5}$

$y = 1$

putting value of y in $5^x = y$

$y = 1$	$y = 1$
$5^x = y$	$5^x = y$
$5^x = 1$	$5^x = 1$
$\cancel{5}^x = \cancel{5}^0$	$\cancel{5}^x = \cancel{5}^0$
$x = 0$	$, x = 0$

Solution set $= \{0, 0\}$.

~~solution = {0, 0}~~.

~~Solution set: {0}~~

Hence value of x will 0.

Q. No. 2 (iii)

$x^2 + (mx+c)^2 = a^2$

Sol:-

$x^2 + (mx)^2 + (c)^2 + 2(mx)(c) = a^2$

$x^2 + m^2x^2 + c^2 + 2mxc = a^2$

$x^2(1+m^2) + (2mc)x + c^2 - a^2 = 0.$

$A = 1+m^2$, $B = 2mc$, $C = c^2 - a^2$

By Taking Discriminant.

Disc = $b^2 - 4ac$

$0 = (2mc)^2 - 4(1+m^2)(c^2-a^2)$

$0 = 4m^2c^2 - 4[c^2 - a^2 + m^2c^2 - m^2a^2]$ (∴ Disc is 0 because roots are equal)

$0 = \cancel{4m^2c^2} - 4c^2 + 4a^2 - \cancel{4m^2c^2} + 4m^2a^2$

$0 = -4c^2 + 4a^2 + 4m^2a^2$

~~$4c^2 = 4a^2 + 4m^2a^2$~~

$0 = 4(-c^2 + a^2 + m^2a^2)$

$\frac{0}{4} = -c^2 + a^2 + m^2a^2$

$0 = -c^2 + a^2 + m^2a^2$

$c^2 = a^2 + m^2a^2$

$\boxed{c^2 = a^2(1+m^2)}$ Hence proved

Q. No. 2 (iv)

Sol :-

Given :-

$$w \propto \frac{1}{z}$$

(a) $w = \frac{k}{z} \longrightarrow (i)$

put $w=5$ and $z=7$ in eq (i)

$$5 = \frac{k}{7}$$

$$k = 7 \times 5$$

(b) $\boxed{k = 35.}$

put $k=35$ in eq (i)

$$w = \frac{35}{z} \rightarrow (ii).$$

To find :- $w = ?$

$$z = \frac{175}{4}$$

put in eq (ii)

$$w = \frac{35}{\frac{175}{4}}$$

$$w = \cancel{35} \times \frac{4}{\cancel{175}\ 5}$$

(c) $\boxed{w = \frac{4}{5}}$

Q. No. 2 (v) Solution:-

$$\frac{a}{x} = \frac{b}{y} = \frac{c}{z} = k$$

K-method:-

$a = xk$, $b = yk$, $c = zk$.

Putting values of a, b and c in given equation.

$$\frac{x^3}{a^3} + \frac{y^3}{b^3} + \frac{z^3}{c^3} = \frac{3xyz}{abc}$$

$$\frac{\cancel{x^3}}{\cancel{x^3}k^3} + \frac{\cancel{y^3}}{\cancel{y^3}k^3} + \frac{\cancel{z^3}}{\cancel{z^3}k^3} = \frac{3xyz}{xk \cdot yk \cdot z \cdot k}$$

$$\frac{1}{k^3} + \frac{1}{k^3} + \frac{1}{k^3} = \frac{3xyz}{k \cdot k \cdot k(xyz)}$$

$$\frac{1}{k^3} + \frac{1}{k^3} + \frac{1}{k^3} = \frac{3\,\cancel{xyz}}{k^3(\cancel{xyz})}$$

$$\frac{1+1+1}{k^3} = \frac{3}{k^3}$$

$$\boxed{\frac{3}{k^3} = \frac{3}{k^3}}$$

Hence, L.H.S = R.H.S.

Q. No. 2 (vi)

Solution :-

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

$$\frac{3x-2}{x(2x-1)} = \frac{A}{x} + \frac{B}{2x-1} \rightarrow (i)$$

Multiplying both sides by $x(2x-1)$.

$$3x-2 = A(2x-1) + B(x) \longrightarrow (ii)$$

$$3x-2 = 2Ax - A + Bx$$

$$3x-2 = 2Ax + Bx - A$$

$$3x-2 = (2A+B)x - A \longrightarrow (iii)$$

put $2x-1=0 \Rightarrow x=\frac{1}{2}$ in (ii).

$$3\left(\frac{1}{2}\right)-2 = A\left[2\left(\frac{1}{2}\right)-1\right] + B\left(\frac{1}{2}\right)$$

$$\frac{3}{2}-2 = A(1-1) + \frac{B}{2}$$

$$\frac{3-4}{2} = 0 + \frac{B}{2}$$

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

$$-2 = 2B$$

$$B = -\frac{\cancel{2}^{1}}{\cancel{2}_{1}}$$

$$\boxed{B=-1.}$$

comparing coefficents of x

$$3 = 2A + B.$$

$$3 = 2A + (-1)$$

$$3 = 2A - 1$$

$$3+1 = 2A$$

$$4 = 2A$$

$$A = \frac{\cancel{4}^{2}}{\cancel{2}_{1}}$$

$$\boxed{A=2}.$$

putting values in eq (i)

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

Q. No. 2 (vii)

$U = \{0, 1, 2, 3, 4, 5, 6 \ldots\}$.
$A = \{\ \}$ or ϕ
$B = \{1, 2, 3, 4, 5, 6 \ldots\}$.

(a) A'

Sol:- $U - A$
$= \{0, 1, 2, 3, 4, \ldots\} - \{\ \}$
$= \{0, 1, 2, 3, 4 \ldots\} = U$ Ans

(b) B'

Sol:-
$B' = U - B$
$= \{0, 1, 2, 3, 4, 5 \ldots\} - \{1, 2, 3, 4, 5, 6 \ldots\}$
$= \{0\}$ Ans

(c) $(A \cup B)' = A' \cap B'$ (DeMorgans law)

L.H.S $= (A \cup B)'$
$(A \cup B) = \{\ \} \cup \{1, 2, 3, 4, 5, 6 \ldots\}$
$= \{1, 2, 3, 4, 5, 6, \ldots\}$.
$(A \cup B)' = U - (A \cup B)$
$= \{0, 1, 2, 3, 4, \ldots\} - \{1, 2, 3, 4, 5, \ldots\}$.
$\boxed{(A \cup B)' = \{0\}}$

R.H.S
$A' = \{0, 1, 2, 3, 4 \ldots\} = U$ [proved in (a)]
$B' = \{0\}$ [proved in (b)]
$A' \cap B' = \{0, 1, 2, 3, 4 \ldots\} \cap \{0\}$
$\boxed{A' \cap B' = \{0\}}$

Hence L.H.S = R.H.S

Q. No. 2 (viii)

(a)

$X = \{1, 2, 3, 4, 5\}$

$Y = \{2, 3, 5, 7, 9\}$.

(b) $(X \times Y)$

$(X \times Y) = \{(1,2), (1,3), (1,5), (1,7), (1,9), (2,2), (2,3)$
$(2,5), (2,7), (2,9), (3,2), (3,3), (3,5),$
$(3,7), (3,9), (4,2), (4,3), (4,5), (4,7), (4,9)$
$(5,2), (5,3), (5,5), (5,7), (5,9)\}$

(c)

$R = \{(1,5), (3,3), (4,2)\}$

Q. No. 2 (ix)

Class limits	f	x	log x	f log x
4 – 6	10	5	0.6989	10 × 0.6989 = 6.968
7 – 9	20	8	0.90308	20 × 0.9030 = 18.06
10 – 12	13	11	1.0413	13 × 1.0413 = 13.5361
13 – 15	7	14	1.1461	7 × 1.1461 = 8.0227
	Σf = 50			Σ

(a) $\Sigma f = 10 + 20 + 13 + 7$

$\Sigma f = 50$

(b) $\Sigma f \log x = 6.968 + 18.06 + 13.5369 + 8.0227$

$\Sigma f \log x = 46.5876$

(c) $G.M = \text{Antilog}\left(\frac{\Sigma f \log x}{\Sigma f}\right)$

$G.M = \text{Antilog}\left(\frac{46.5876}{50}\right)$

$G.M = \text{Antilog}(0.931)$

$\boxed{G.M = 8.54}$

Q. No. 2 (x)

$(\tan\theta + \cot\theta)(\cos\theta + \sin\theta) = \sec\theta + \operatorname{cosec}\theta.$

L.H.S

$= \left(\frac{\sin\theta}{\cos\theta} + \frac{\cos\theta}{\sin\theta}\right)(\cos\theta + \sin\theta)$

$= \left(\frac{\sin^2\theta + \cos^2\theta}{\cos\theta\cdot\sin\theta}\right)(\cos\theta + \sin\theta)$

$(\therefore \sin^2\theta + \cos^2\theta = 1)$

$= \left(\frac{1}{\cos\theta\cdot\sin\theta}\right)(\cos\theta + \sin\theta)$

$= \frac{\cos\theta + \sin\theta}{\cos\theta\cdot\sin\theta}$

$= \frac{\cos\theta}{\cos\theta\cdot\sin\theta} + \frac{\sin\theta}{\cos\theta\sin\theta}$

$\frac{1}{\sin\theta} + \frac{1}{\cos\theta}$

$\left\{\therefore \cos\theta = \frac{1}{\sec\theta} \quad \sin\theta = \frac{1}{\operatorname{cosec}\theta}\right\}$

$= \operatorname{cosec}\theta + \sec\theta$

$\boxed{\sec\theta + \operatorname{cosec}\theta = R.H.S}$

Q. No. 2 (xi)

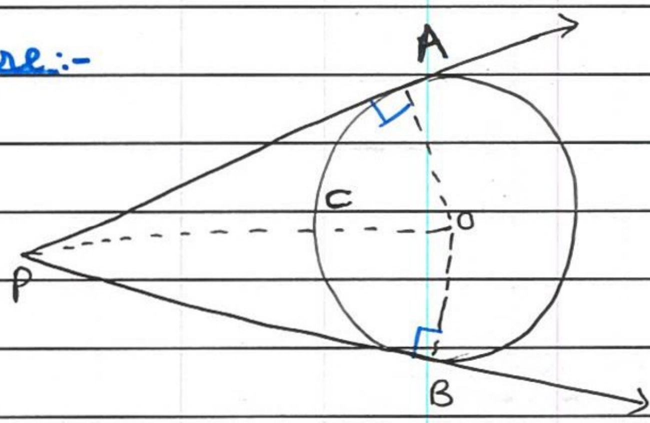
In ∠rt ΔABD

~~$\tan\theta = m$~~

$\cos\theta = m\overline{AB}$

Q. No. 2 (xii)

Figure:-



Given:-

Two tangents $\overrightarrow{PA}$ and $\overrightarrow{PB}$ are drawn from an external point P to a circle with centre O

To Prove:-

$m\overline{PA} = m\overline{PB}$

Construction:-

Join O to P and to A and B. So we have $\measuredangle$ rt Δs OAP and OBP

Proof:- Statement	Reason
In $\Delta OAP \longleftrightarrow \Delta OBP$	
$m\angle OAP = m\angle OBP$	$\overline{OB} \perp \overline{PA}$ (given) each 90°
hyp. $m\overline{OP} = $ hyp. $m\overline{OP}$	common
$m\overline{OA} = m\overline{OB}$	Radii of same circle
$\Delta OAP \cong \Delta OBP$	$H.S \cong H.S$
$\therefore$	
$m\overline{PA} = m\overline{PB}$ (Tangents $\overrightarrow{PA}$ and $\overrightarrow{PB}$ are equal in length)	corresponding sides of congruent triangles

Q. No. 2 (xiii)

Solution:-

In $\angle rt\triangle$ AOM

By pythagoras theorem

$(\overline{AO})^2 = (\overline{AM})^2 + (\overline{OM})^2$

$(13)^2 = (\overline{AM})^2 + (5)^2$

$(13)^2 - (5)^2 = (\overline{AM})^2$

$169 - 25 = (\overline{AM})^2$

$144 = (\overline{AM})^2$

Taking square root on both sides

$\sqrt{144} = \sqrt{(\overline{AM})^2}$

$m\overline{AM} = 12$ cm.

we know that

(a) $\overline{OM} \perp \overline{AB}$

so, $m\overline{AM} = m\overline{BM} = 12$ cm.

(b) $m\angle BOM = ?$

$\tan\theta = \frac{12}{5} = \frac{m\overline{BM}}{m\overline{OM}}$ $\left(\text{as } \tan\theta = \frac{\text{perp}}{\text{base}}\right)$

$\theta = \tan^{-1}\frac{12}{5}$

$\boxed{\cancel{\theta = 22.619^\circ}}$

$\theta = \tan^{-1}(2.4)$

$\boxed{\theta = 67.38^\circ}$

Q. No. 2 (xiv)

(Section C)

Q. No. 3 (Page 1/2)

Q. No. 3 (Page 2/2)

Q. No. 4 (Page 1/2)

Solution:-

$$\frac{4x^2}{(1-x)(1+x^2)^2} = \frac{A}{(1-x)} + \frac{Bx+C}{1+x^2} + \frac{Dx+E}{(1+x^2)^2} \rightarrow (i)$$

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

$$4x^2 = A(1+x^2)^2 + (Bx+C)(1-x)(1+x^2) + (Dx+E)(1-x) \quad (ii)$$

$$4x^2 = A(1+x^4+2x^2) + (Bx+C)[1(1+x^2) - x(1+x^2)] + Dx(1-x) + E(1-x)$$

$$4x^2 = A + Ax^4 + 2Ax^2 + (Bx+C)[1+x^2-x-x^3] + Dx - Dx^2 + E - Ex$$

$$4x^2 = A + Ax^4 + 2Ax^2 + Bx(1+x^2-x-x^3) + C(1+x^2-x-x^3) + Dx - Dx^2 + E - Ex$$

$$4x^2 = A + Ax^4 + 2Ax^2 + Bx + Bx^3 - Bx^2 - Bx^4 + C + Cx^2 - Cx - Cx^3 + Dx - Dx^2 + E - Ex$$

$$4x^2 = Ax^4 - Bx^4 + Bx^3 + Cx^3 + 2Ax^2 - Bx^2 + Cx^2 - Dx^2 + Bx - Cx + Dx - Ex + A + C + E$$

$$4x^2 = (A-B)x^4 + x^3(B+C) + x^2(2A-B+C-D) + x(B-C+D-E) + A+C+E \longrightarrow (iii)$$

put $1-x=0 \Rightarrow -x=-1 \Rightarrow x=1$ in eq (ii).

$$4x^2 = A(1+x^2)^2 + (Bx+C)(1-x)(1+x^2) + (Dx+E)(1-x).$$

$$4(1)^2 = A(1+1^2)^2 + (B1+C)(1-1)(1+1^2) + (D+E)(1-1)$$

$$4(1)^2 = A(1+1)^2 + 0 + 0$$

$$4(1) = A(2)^2$$

Q. No. 4 (Page 2/2)

$4 = A(4)$

$A = \frac{4}{4}$

$A = 1$

Comparing coefficients of x^4 , Comparing coefficent of x^3

$A - B = 0$ | $B + C = 0$

$1 - B = 0$ | $1 + C = 0$

$\cancel{+}B = \cancel{+}1$ | $C = -1$

$B = 1$

Comparing coefficents of x^2 , comparing coefficients of x

$2A - B + C - D = 4$ | $B - C + D - E = 0$

~~2(1) - B(1) + (-1~~ | $1 + 1 - 4 - E = 0$

$2(1) - (1) + (-1) - D = 4$ | $1 - 3 - E = 0$

$2 - 1 - 1 - D = 4$ | $-2 - E = 0$

$\cancel{2} - \cancel{2} - D = 4$ | $-E = 2$

$-D = 4$ | $\boxed{E = -2}$

$\boxed{D = -4}$

putting values of A, B, C, D and E in (i)

$$\frac{4x^2}{(1-x)(1+x^2)^2} = \frac{A}{1-x} + \frac{Bx+C}{1+x^2} + \frac{Dx+E}{(1+x^2)^2}$$

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

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

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

Q. No. 5 (Page 1/2)

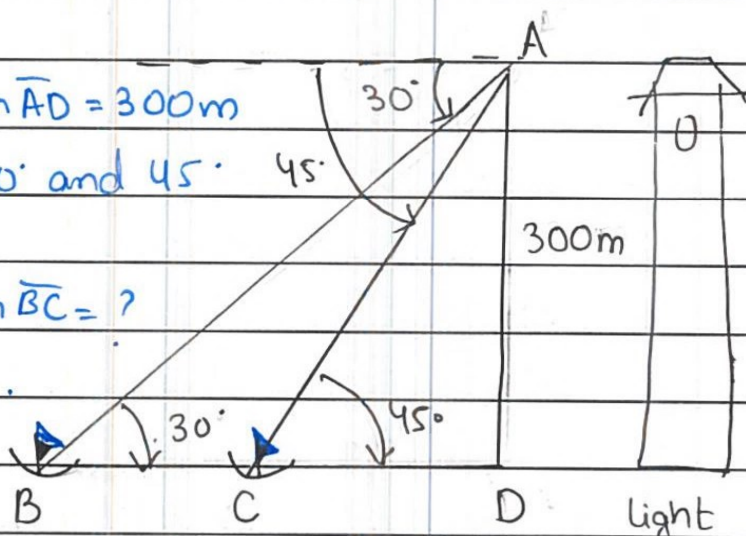
Data :-

Height of light house $= m\overline{AD} = 300m$

Angle of depression are 30° and 45° respectively.

Distance between boats $= m\overline{BC} = ?$

Boats are at points B and C.



Solution :-

Since $\angle A$ is alternate to ~~and~~ $\angle B$ and $\angle C$, Hence $\angle B = 30^\circ$ and $\angle C = 45^\circ$

→ In $\angle rt\ \Delta ACD$,

$$\tan\theta = \frac{P}{b} = \frac{m\overline{AD}}{m\overline{CD}}$$

$$\tan(45^\circ) = \frac{300}{m\overline{CD}}$$

$$m\overline{CD} = \frac{300}{\tan 45^\circ}$$

$$m\overline{CD} = \frac{300}{1}$$

$$\boxed{m\overline{CD} = 300\ m}$$

→ In $\angle rt\ \Delta ACD$, θ is 30°

$$\tan\theta = \frac{P}{b} = \frac{m\overline{AD}}{m\overline{BD}}$$

$\because m\overline{BD} = m\overline{BC} + m\overline{CD}$

$$\tan\theta = \frac{m\overline{AD}}{m\overline{BC} + m\overline{CD}}$$

$$\tan(30) = \frac{300}{m\overline{BC} + 300}$$

Q. No. 5 (Page 2/2)

$\cancel{\frac{1}{\sqrt{3}}}$

$$0.5773 = \frac{300}{m\overline{BC}+300}$$

$$0.5773(m\overline{BC}+300) = 300$$

$$m\overline{BC}+300 = \frac{300}{0.5773}$$

$$m\overline{BC}+300 = 519.6$$

$$m\overline{BC} = 519.6 - 300$$

$$\boxed{m\overline{BC} = 219.6 \approx 220\ m}$$

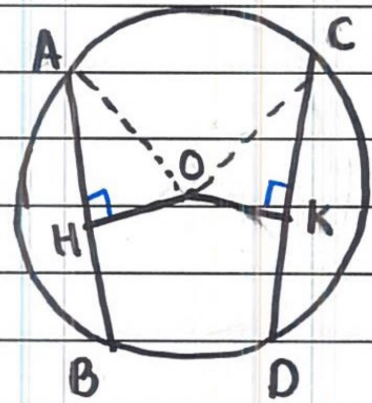
Hence the distance between the two boats will be

$m\overline{BC} = 220\ m$.

Q. No. 6 (Page 1/2)

If two chords of a circle are congruent then prove that they will be equidisdant from the centre.

Figure:-



Given:-

Two equal chords of a circle $\overline{AB}$ and $\overline{CD}$ in a circle with centre O. Such that $\overline{OH}$ ⊥ bisector to $\overline{AB}$ and $\overline{OK}$ ⊥ bisector to $\overline{CD}$ ($m\overline{AB} = m\overline{CD}$)

To Prove:-

$m\overline{OH} = m\overline{OK}$

Construction:-

Join O to A and O to C so we have ∠rt Δs AOH and COK respectively.

Proof:-

Statement	Reasons
$\overline{OH}$ bisects chord $\overline{AB}$	$\overline{OH}$ ⊥ bisector to $\overline{AB}$ (Given.
i.e $m\overline{AH} = \frac{1}{2} m\overline{AB}$ (i)	
$\overline{OK}$ bisects chord $\overline{CD}$	$\overline{OK}$ ⊥ bisector to $\overline{CD}$ (Given)
i.e $m\overline{CK} = \frac{1}{2} m\overline{CD}$ (ii)	
$m\overline{AB} = m\overline{CD}$ (iii)	Given.
$m\overline{AH} = m\overline{CK}$ (iv)	Using (i), (ii) and (iii)

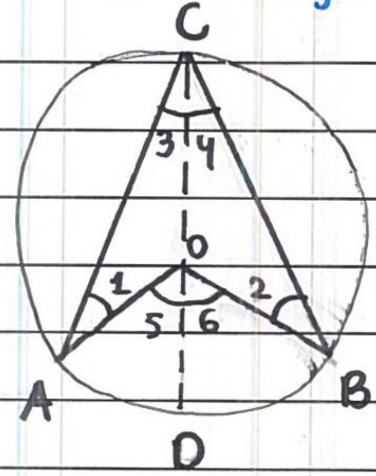
Q. No. 6 (Page 2/2)

In $\Delta OAH \leftrightarrow \Delta OCK$	
hyp $\overline{OA}$ = hyp $\overline{OC}$	Radii of same circle
$m\overline{AH} = m\overline{CK}$	Already proved in (iv)
Hence, $\Delta OAH \cong \Delta OCK$	H.S ≅ H.S (H.S postulate).
$\therefore m\overline{OH} = m\overline{OK}$	Corresponding sides of congruent triangles.

Q. No. 7 (Page 1/2)

Prove that the measure of central angle of minor arc of a circle is double the angle subtended by major arc

Figure :-



→ Given :-

A circle with centre O such that $\widehat{AB}$ is the minor arc whereas $m\angle AOB$ is central angle and $m\angle ACB$ is the circum angle.

→ To Prove :-

$m\angle AOB = 2m\angle ACB$

→ Construction : -

~~Draw~~ C Join C to O which meets Arc $\widehat{AB}$ at D. label angles $\angle 1, \angle 2, \angle 3, \angle 4, \angle 5$ and $\angle 6$.

→ Proof :-

Statements	Reasons
$\widehat{AB}$ is the arc, $m\angle AOB$ is central angle subtended.	Given
~~$m\angle 1 + m\angle 3 = m\angle 5$~~	
$m\angle 1 = m\angle 3$ (i)	Angles opposite to equal sides in ΔAOC
$m\angle 2 = m\angle 4$ (ii)	Angles opposite to equal sides in ΔBOC.

Q. No. 7 (Page 2/2)

$m\angle 5 = m\angle 1 + m\angle 3$ (iii) $m\angle 6 = m\angle 2 + m\angle 4$ (iv)	Exterior angle is the sum in interior adjacent angles.
$m\angle 5 = m\angle 3 + m\angle 3 = 2m\angle 3$ (v)	Using (i) and (iii)
$m\angle 6 = m\angle 4 + m\angle 4 = 2m\angle 4$ (vi)	Using (ii) and (iv)
$m\angle 5 + m\angle 6 = 2m\angle 3 + 2m\angle 4$ $m\angle AOB = 2(m\angle 3 + m\angle 4)$	Adding (v) and (vi)
$m\angle AOB = 2m\angle ACB$	From figure Hence proved.

Graph Page No. 1

Graph Page No. 2

Rough Work 1

Rough Work 2