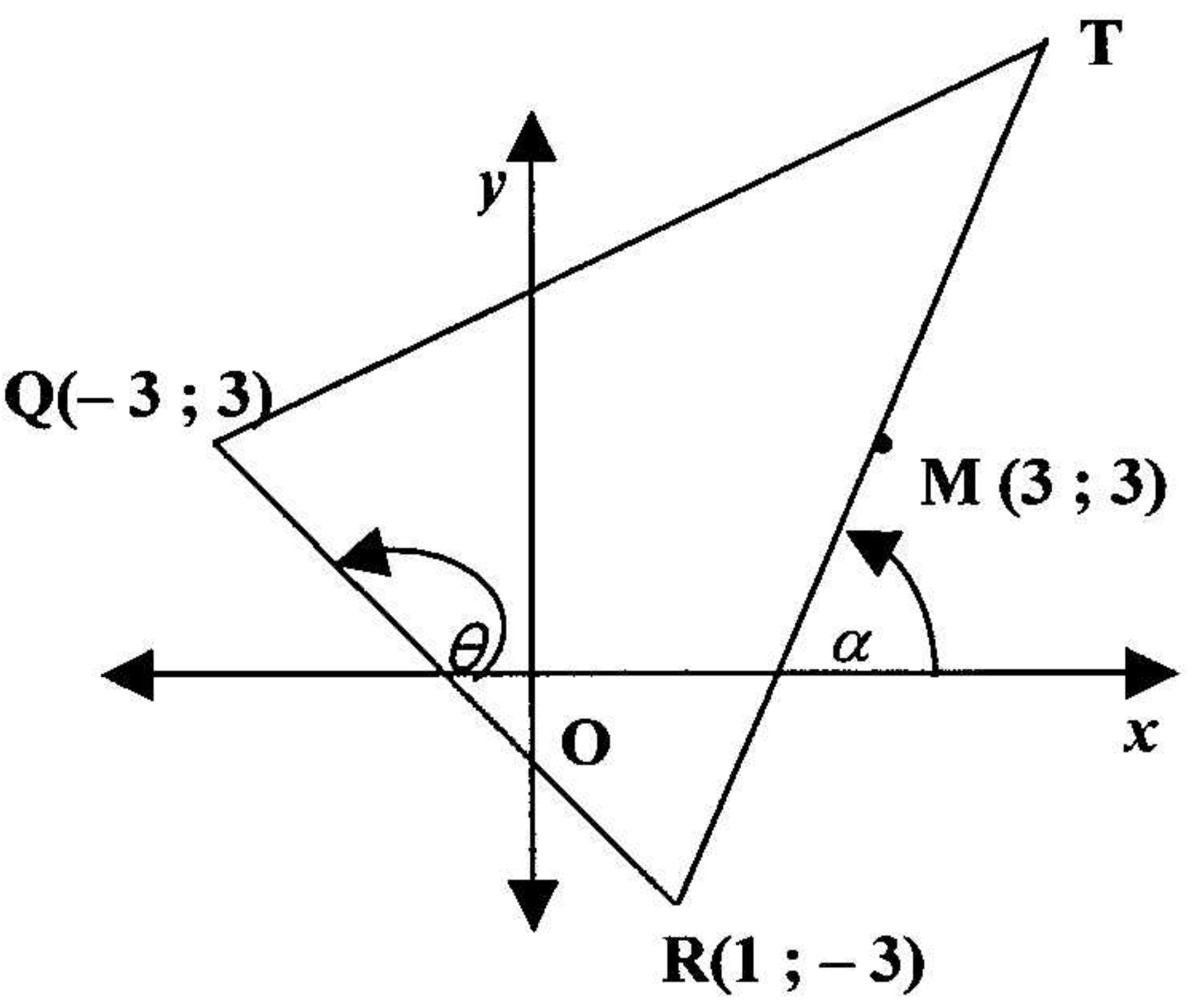


MATHEMATICS HIGHER GRADE

PAPER 2

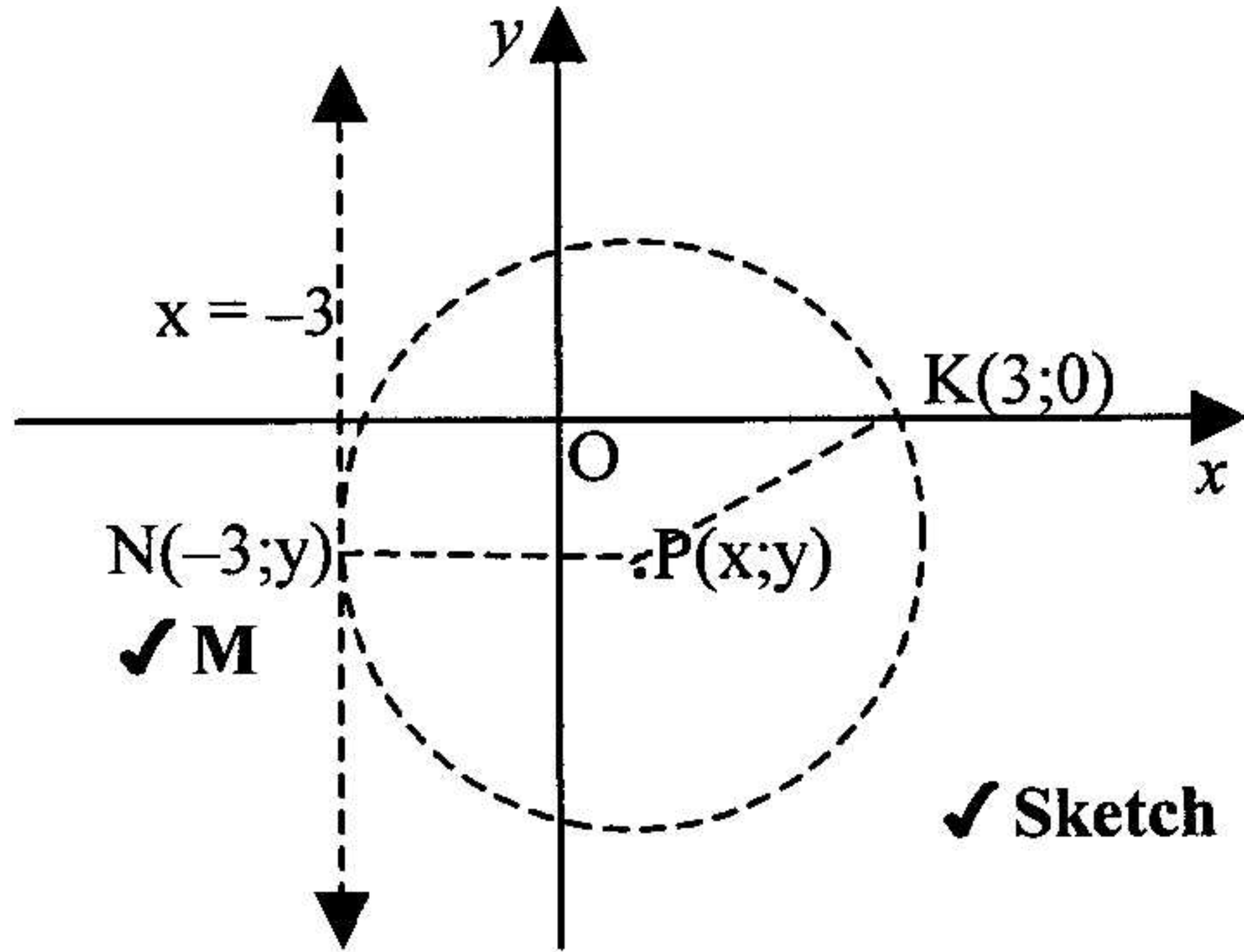
QUESTION 1		[23]
1.1		
1.1.1	$RM^2 = (3 - 1)^2 + (3 + 3)^2 \checkmark M \checkmark A$ $= 40$ $RM = \sqrt{40} \text{ OR } 2\sqrt{10} \checkmark CA$ $TR = 2RM = 2\sqrt{40} \text{ OR } 4\sqrt{10} \checkmark CA$ <p style="text-align: center;">OR</p> $x_M = \frac{x_T + x_R}{2} \quad y_M = \frac{y_T + y_R}{2} \checkmark M$ $x_T = 2(3) - 1 \quad y_T = 2(3) + 3 \checkmark A$ $= 5 \quad = 9$ $TR^2 = (5 - 1)^2 + (9 + 3)^2 \checkmark CA$ $= 160$ $TR = \sqrt{160} = 4\sqrt{10} \checkmark CA \quad (4)$	<p>Correct distance formula and substitution</p> <p>Simplification</p> <p>Answer</p> <p>Correct midpoint formula</p> <p>Substitution</p> <p>Correct substitution into distance formula</p> <p>Answer</p>
1.1.2	$\tan \alpha = \frac{3 + 3}{3 - 1} = \frac{6}{2} = 3 \quad \checkmark M \checkmark A$ <p style="text-align: right;">$\checkmark CA$</p> $\alpha = 71,6^\circ$ $\tan \theta = \frac{-3 - 3}{1 + 3} = \frac{-6}{4} = -\frac{3}{2} \quad \checkmark A$ $\theta = 123,7^\circ \quad \checkmark CA$ $\therefore \hat{R} = 123,7^\circ - 71,6^\circ = 52,1^\circ \quad \checkmark CA$ <p style="text-align: center;">OR</p> $\tan(\theta - \alpha) = \frac{\tan \theta - \tan \alpha}{1 + \tan \theta \cdot \tan \alpha} \quad \checkmark M$ <p style="text-align: center;">$\checkmark A \quad \checkmark A$</p>	<p>Correct inclination formula and substitution</p> <p>Value of α</p> <p>Correct gradient</p> <p>Value of θ</p> <p>Answer</p> <p>Correct use of $\tan(\theta - \alpha)$</p> <p>Correct value of $\tan \theta$; $\tan \alpha$</p> <p>Substitution</p> <p>value of $\tan(\theta - \alpha)$</p>

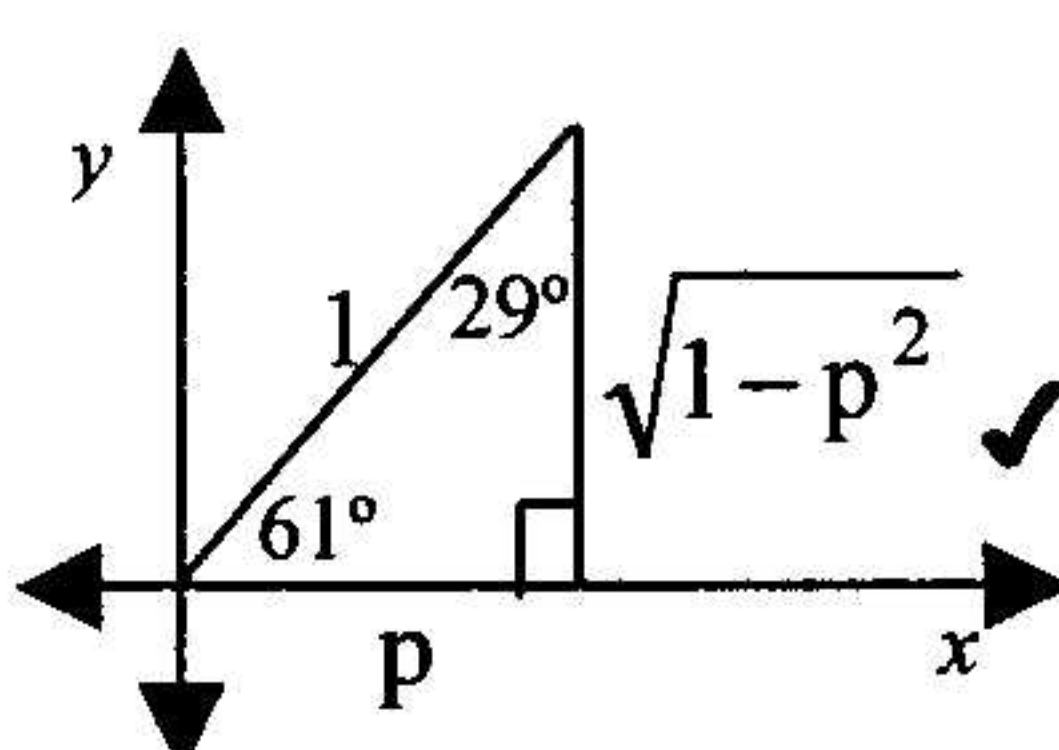
	$= \frac{-\frac{3}{2} - 3}{1 + (-\frac{3}{2})(3)} = \frac{9}{7} \quad \checkmark \text{CA}$ $\therefore \hat{R} = 52,1^\circ \quad \checkmark \text{CA} \quad (6)$	Answer
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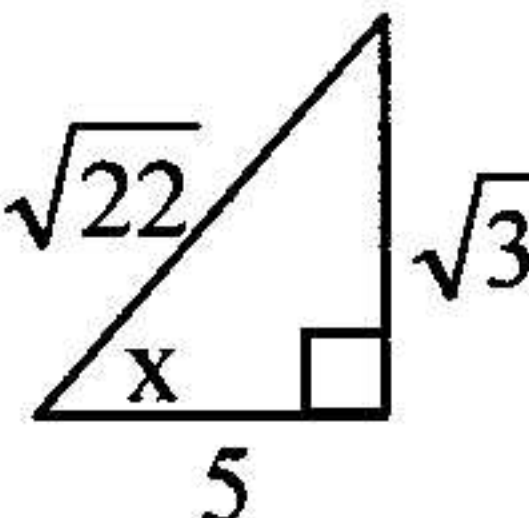
1.2.1	<p>Midpoint of RQ = $\left(\frac{-3+1}{2}; \frac{3+(-3)}{2}\right)$ ✓ M</p> <p>Midpoint of RQ = K(-1; 0) ✓ A ✓ A</p> <p>∴ T(5; 9) ✓ CA ✓ CA</p> <p>∴ $m_{TK} = \frac{9-0}{5+1} = \frac{9}{6} = \frac{3}{2}$ ✓ CA</p> <p>∴ $y = \frac{3}{2}x + c$ ✓ M OR $y - y_1 = m(x - x_1)$ ✓ M</p> <p>$0 = \frac{3}{2}(-1) + c$ ✓ CA $y - 0 = \frac{3}{2}(x + 1)$ ✓ CA</p> <p>$y = \frac{3}{2}x + \frac{3}{2}$ ✓ CA $2y = 3x + 3$ ✓ CA</p> <p>(9)</p>	<p>Correct midpoint formula</p> <p>x-value K; y-value K</p> <p>x-value T ; y-value T</p> <p>Gradient of TK</p> <p>Correct equation of line formula</p> <p>Substitution</p> <p>Answer</p>
1.2.2	<p>Equation of median from Q to M is $y = 3$ ✓ A</p> <p>✓ M</p> <p>∴ $2(3) = 3x + 3$</p> <p>$6 = 3x + 3$ ✓ CA</p> <p>$3x = 3$</p> <p>$x = 1$ ✓ CA</p> <p>concurrency point is (1; 3)</p> <p>OR</p> <p>Point = $\left(\frac{x_1 + x_2 + x_3}{3}; \frac{y_1 + y_2 + y_3}{3}\right)$ ✓ M</p> <p>$= \left(\frac{-3 + 1 + 5}{3}; \frac{3 - 3 + 9}{3}\right)$ ✓ A</p> <p>$= (1; 3)$ ✓ CA ✓ CA</p> <p>(4)</p>	<p>Correct equation median QM</p> <p>Substitution</p> <p>Simplification</p> <p>Answer</p> <p>Correct formula</p> <p>Substitution</p> <p>Simplification / Answer</p> <p>Correct answer only – full marks</p>

QUESTION 2		[25]
2.1.1	$(x-2)^2 + (y+3) = r^2 \quad \checkmark M$ $r^2 = (6-2)^2 + (-1+3)^2 \quad \checkmark M$ $= 16 + 4 \quad \checkmark A$ $= 20$ $\therefore (x-2)^2 + (y+3)^2 = 20 \quad \checkmark CA$ (4)	Correct formula Correct substitution distance formula Simplification Answer
2.1.2	$m_{AC} = \frac{-3+1}{2-6} = \frac{2}{4} = \frac{1}{2} \quad \checkmark M$ $m_{PA} = -2 \quad \checkmark M$ $y = -2x + c \quad \text{OR} \quad y - y_1 = -2(x - x_1)$ $-1 = -2(6) + c \quad \checkmark A \quad y + 1 = -2(x - 6) \quad \checkmark A$ $c = 11$ $\therefore y = -2x + 11 \quad \checkmark CA$ $y = -2x + 12 - 1 \quad \checkmark CA$ $y = -2x + 11 \quad \checkmark CA$ (4)	Correct formula Gradient of PA Substitution into line formula Simplification
2.1.3	$y = -2x + 11$ $k = -2(4) + 11 \quad \checkmark M$ $= 3 \quad \checkmark A$ OR $m_{CA} \cdot m_{PA} = \left(\frac{1}{2}\right)\left(\frac{k+1}{4-6}\right) = -1 \quad \checkmark M$ $\frac{k+1}{-4} = -1$ $k = 3 \quad \checkmark A$ (2)	Substitution Simplification Correct slopes Simplification

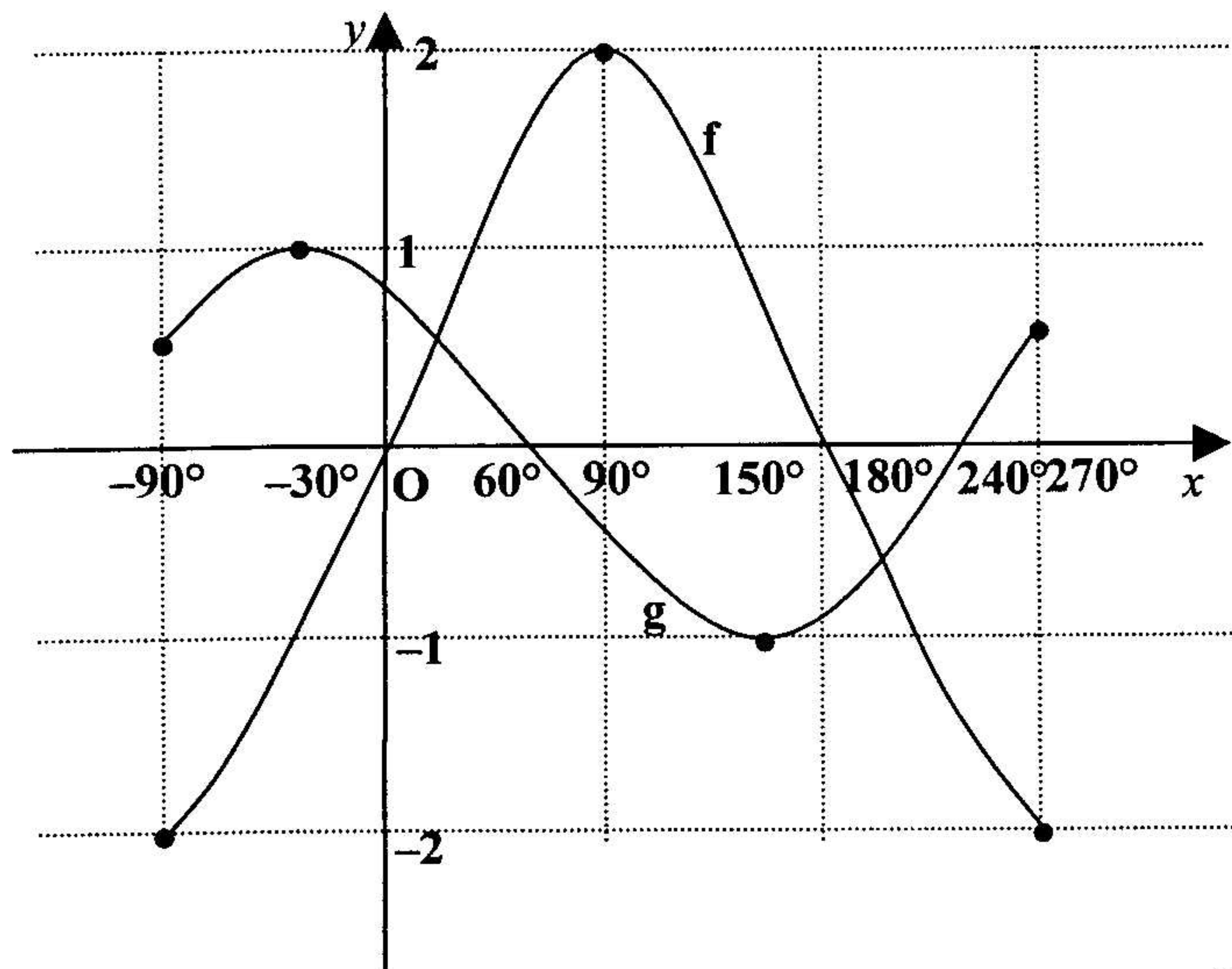
2.1.4	<p>For y_B: $(0-2)^2 + (y+3)^2 = 20$</p> <p>$4 + y^2 + 6y + 9 - 20 = 0$ OR $(y+3)^2 = 16$ ✓ A</p> <p>$y^2 + 6y - 7 = 0$ ✓ A $y+3 = 4$ or $y+3 = -4$</p> <p>$(y-1)(y+7) = 0$ $y = 1$ or $y = -7$ ✓ CA</p> <p>$y = 1$ or $y = -7$ ✓ CA</p> <p>$\therefore B(0; 1)$ ✓ CA</p> <p>$m_{BC} = \frac{1+3}{0-2} = \frac{4}{-2} = -2$ ✓ CA</p> <p>$m_{BP} = \frac{1-3}{0-4} = \frac{-2}{-4} = \frac{1}{2}$ ✓ CA</p> <p>$m_{BC} \cdot m_{BP} = -2 \cdot \frac{1}{2} = -1$ ✓ M</p> <p>$\therefore BC \perp BP,$ ✓ A</p> <p>PB is a tangent to the circle.</p> <p style="text-align: center;">OR</p> <p>For y_B: $(0-2)^2 + (y+3)^2 = 20$</p> <p>$4 + y^2 + 6y + 9 - 20 = 0$ OR $(y+3)^2 = 16$ ✓ A</p> <p>$y^2 + 6y - 7 = 0$ ✓ A $y+3 = 4$ or $y+3 = -4$</p> <p>$(y-1)(y+7) = 0$ $y = 1$ or $y = -7$ ✓ CA</p> <p>$y = 1$ or $y = -7$ ✓ CA</p> <p>$B(0; 1)$ ✓ CA</p> <p>$PB^2 = (4-0)^2 + (3-1)^2$ ✓ M</p> <p>$= 20$</p> <p>$PB = \sqrt{20} = 2\sqrt{5}$ ✓ CA</p> <p>$PA^2 = (6-4)^2 + (-1-3)^2$</p> <p>$= 20$</p> <p>$PA = \sqrt{20} = 2\sqrt{5}$ ✓ A</p> <p>$PB = PA$ ✓ CA</p> <p>\therefore PB is a tangent to the circle.</p> <p style="text-align: center;">OR</p>	<p>Correct substitution</p> <p>Standard form</p> <p>Correct y-values</p> <p>Substitution and simplification (from Q.2.1.3)</p> <p>Substitution and simplification</p> <p>Justification</p> <p>Conclusion</p> <p>Correct substitution</p> <p>Standard form</p> <p>Correct co-ordinates of B</p> <p>Substitution in distance formula</p> <p>Simplification</p> <p>Simplification</p> <p>Conclusion</p>
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	<p>OR</p> <p>For y_B: $(0-2)^2 + (y+3)^2 = 20$</p> <p>$4 + y^2 + 6y + 9 - 20 = 0$ OR $(y+3)^2 = 16$ ✓ A</p> <p>$y^2 + 6y - 7 = 0$ ✓ A $y+3 = 4$ or $y+3 = -4$</p> <p>$(y-1)(y+7) = 0$ $y = 1$ or $y = -7$ ✓ CA</p> <p>$y = 1$ or $y = -7$ ✓ CA</p> <p>$B(0; 1)$ ✓ CA</p> <p>$PC^2 = (3+3)^2 + (4-2)^2$</p> <p>$= 36 + 4$</p> <p>$= 40$ ✓ CA</p> <p>$BP^2 + BC^2 = (-3-1)^2 + 2^2 + 4^2 + 2^2$</p> <p>$= 40$ ✓ A</p> <p>$\therefore PC^2 = BC^2 + BP^2$ ✓ CA</p> <p>$\therefore \angle PBC = 90^\circ$ ✓ CA</p> <p>$\therefore PB$ is a tangent to the circle (7)</p>	<p>Substitution</p> <p>Simplification</p> <p>Co-ordinates of B</p> <p>Length of PC</p> <p>Pythagoras</p> <p>Conclusion</p>
2.2.1	<p>centre $P(x;y)$ $K(3;0)$ and $N(-3;y)$</p>  <p>$PK^2 = PN^2$ ✓ M</p> <p>$(x-3)^2 + (y-0)^2 = (x+3)^2 + (y-y)^2$ ✓ CA ✓ A</p> <p>$x^2 - 6x + 9 + y^2 = x^2 + 6x + 9$ ✓ CA</p> <p>$y^2 = 12x$ ✓ CA (7)</p>	<p>Sketch</p> <p>Coordinates of N</p> <p>(If no sketch, coordinates of N)</p> <p>Equating lengths</p> <p>lengths</p> <p>Simplification</p> <p>equation</p>
2.2.2	<p>parabola ✓ CA (1)</p>	<p>Correct shape</p>

QUESTION 3		[18]
3.1	$\frac{\cos(\theta - 90^\circ)}{\operatorname{cosec}(\theta - 180^\circ)} + \cos(360^\circ + \theta) \cdot \operatorname{cosec}(90^\circ - \theta)$ $= \frac{\check{A} \sin \theta}{- \operatorname{cosec} \theta \check{A}} + \cos \theta \cdot \sec \theta \check{A} \check{A}$ $= -\sin^2 \theta + 1 \check{A} \check{A}$ $= \cos^2 \theta \check{A}$ <p style="text-align: right;">(7)</p>	<p>One mark for each correct reduction</p> <p>Simplification</p> <p>Correct identity</p>
3.2.1	$\sin 209^\circ = -\sin 29^\circ \check{A}$ $= -\cos 61^\circ \check{CA}$ $= -p \check{CA}$ <p style="text-align: right;">(3)</p>	<p>Correct reduction</p> <p>Correct substitution</p>
3.2.2	$\operatorname{cosec}(-421^\circ) = -\operatorname{cosec} 61^\circ \check{A}$ $= -\frac{1}{\sqrt{1-p^2}} \check{CA}$  <p style="text-align: right;">(3)</p>	<p>Correct reduction</p> <p>Sketch or value of y in terms of p</p> <p>Substitution</p>
3.2.3	$\cos 1^\circ = \cos(61^\circ - 60^\circ) \check{M}$ $= \cos 61^\circ \cdot \cos 60^\circ + \sin 61^\circ \cdot \sin 60^\circ \check{M}$ $= p \cdot \left(\frac{1}{2}\right) + \sqrt{1-p^2} \left(\frac{\sqrt{3}}{2}\right) \check{A} \check{CA}$ $= \frac{1}{2}p + \frac{\sqrt{3}}{2}\sqrt{1-p^2}$ <p style="text-align: center;">OR</p> $\cos 1^\circ = \sin 89^\circ \check{M}$ $= \sin(60^\circ + 29^\circ)$ $= \cos 60^\circ \sin 29^\circ + \sin 60^\circ \cos 29^\circ \check{M}$ $= \frac{1}{2} \cdot \frac{p}{1} + \frac{\sqrt{3}}{2} \cdot \frac{\sqrt{1-p^2}}{1} \check{A} \check{A} \check{CA}$ <p style="text-align: right;">(6)</p>	<p>Changing angle</p> <p>Expansion</p> <p>Correct substitution</p> <p>Co-functions</p> <p>Compound angle expansion</p> <p>Correct substitutions</p>

QUESTION 4		[23]
4.1	$2\sin x = \cos(x + 30^\circ)$ $= \cos x \cos 30^\circ - \sin x \sin 30^\circ \quad \checkmark M$ $2\sin x + \frac{1}{2}\sin x = \frac{\sqrt{3}}{2}\cos x \quad \checkmark A$ $\frac{5}{2}\sin x = \frac{\sqrt{3}}{2}\cos x \quad \checkmark A$ $\checkmark A \quad \checkmark A$ $5\sin x = \sqrt{3}\cos x \quad \text{OR} \quad \frac{\sin x}{\cos x} = \frac{\frac{\sqrt{3}}{2}}{\frac{5}{2}}$ $\tan x = \frac{\sqrt{3}}{5}$ <p style="text-align: center;">OR</p> $\tan x = \frac{\sqrt{3}}{5}$ <div style="display: flex; align-items: center; justify-content: center;">  </div> $2\sin x = 2 \cdot \frac{\sqrt{3}}{\sqrt{22}} = \frac{2\sqrt{3}}{\sqrt{22}} \quad \checkmark A$ $\cos(x + 30^\circ) = \cos x \cdot \cos 30^\circ - \sin x \cdot \sin 30^\circ \quad \checkmark M$ $= \frac{\checkmark A}{\sqrt{22}} \cdot \frac{\sqrt{3}}{2} - \frac{\checkmark A}{\sqrt{22}} \cdot \frac{1}{2} \quad \checkmark A$ $= \frac{5\sqrt{3} - \sqrt{3}}{2\sqrt{22}}$ $= \frac{2\sqrt{3}}{\sqrt{22}} \quad \checkmark A$ <p style="text-align: right;">(6)</p>	<p>Correct expansion</p> <p>Correct substitution</p> <p>Simplification</p> <p>Simplification</p> <p>substitution</p> <p>expansion</p> <p>substitution</p> <p>simplification</p>
4.2	$\tan x = \frac{\sqrt{3}}{5} \quad \checkmark A$ $x = 19,1^\circ \quad \checkmark A \text{ or } 199,1^\circ \quad \checkmark CA$ <p style="text-align: right;">(3)</p>	<p>Correct equation</p> <p>Correct values</p>

4.3



(9)

	f	g
x-intercept	✓ A	✓ A ✓ A
y-intercept	✓ A	✓ A
shape	✓ A	✓ A
turning points	✓ A	✓ A

If graphs outside domain – Penalty 1 mark

Note: y-intercept of g clearly below 1

4.4.1

(19,1° ; 199,1°) ✓ N
✓ CA OR 19,1° < x < 199,1°

(2)

1 Mark for endpoints
1 mark for correct notation

4.4.2

✓ CA ✓ CA ✓ Notation
(60°;180°) ; (240°;270°)

(3)

1 mark for each correct pair of endpoints
1 mark for notation

QUESTION 5		[21]
5.1.1	$\sin(x + y) = \cos x \sin y + \sin x \cos y$ ✓ A (1)	Correct expansion
5.1.2	$\cos(A + B) = \sin[90^\circ - (x + y)]$ ✓ M $= \sin[(90^\circ - x) + (-y)]$ ✓ A $= \sin(90^\circ - x) \cos(-y) + \cos(90^\circ - x) \sin(-y)$ $= \cos x \cos y - \sin x \sin y$ ✓ A (3)	Correct use of co-functions Correct expansion Simplification
5.2.1	$\cos(x - y) - \cos(x + y)$ $= \cos x \cos y + \sin x \sin y - (\cos x \cos y - \sin x \sin y)$ $= \cos x \cos y + \sin x \sin y - \cos x \cos y + \sin x \sin y$ $= 2 \sin x \sin y$ (3)	Correct expansions Simplification
5.2.2	$2 \sin 195^\circ \sin 45^\circ = -2 \sin 15^\circ \sin 45^\circ$ ✓ M $= -[\cos(15^\circ - 45^\circ) - \cos(15^\circ + 45^\circ)]$ ✓ M ✓ CA $= -[\cos 30^\circ - \cos 60^\circ]$ ✓ CA $= -\frac{\sqrt{3}}{2} + \frac{1}{2}$ OR $\frac{-\sqrt{3} + 1}{2}$ OR $\cos(195^\circ - 45^\circ) - \cos(195^\circ + 45^\circ)$ ✓ M $= \cos 150^\circ - \cos 240^\circ$ $= \frac{-\sqrt{3}}{2} - \frac{-1}{2}$ $= \frac{-\sqrt{3} + 1}{2}$ ✓ CA (6)	Correct reduction Correct application of formula Correct simplification Correct substitution Expansion simplification substitution simplification
5.3.1	LHS: $\frac{\cos 2\theta + 1}{\sin 2\theta \tan \theta} = \frac{2\cos^2 \theta - 1 + 1}{2 \sin \theta \cos \theta (\frac{\sin \theta}{\cos \theta})}$ ✓ A $= \frac{\cos^2 \theta}{\sin^2 \theta}$ ✓ A $= \cot^2 \theta$ (4)	Correct identities Simplification
5.3.2	undefined for $\tan \theta = 0$ ✓ M and $\sin 2\theta = 0$ ✓ M $\therefore \theta = k \cdot 180^\circ$ ✓ A $\therefore \theta = k \cdot 90^\circ, k \in \mathbb{Z}$ ✓ M (4)	Restrictions Correct value of θ ; Restrictions on k

QUESTION 6

[25]

6.1

Construction : Draw $AD \perp CB$ extended ✓ M

$$\begin{aligned} CA^2 &= CD^2 + AD^2 \quad \checkmark A \\ &= (CB + BD)^2 + AD^2 \quad \checkmark A \\ &= CB^2 + 2CB \cdot BD + BD^2 + AD^2 \\ &= CB^2 + AB^2 + 2CB \cdot BD \quad \checkmark A \end{aligned}$$

$$\text{But } \frac{BD}{AB} = -\cos \hat{B}_1$$

$$BD = -AB \cdot \cos \hat{B}_1 \quad \checkmark A$$

$$\therefore CA^2 = CB^2 + AB^2 - 2 \cdot CB \cdot AB \cdot \cos \hat{B}_1 \quad \checkmark A$$

$$\therefore b^2 = a^2 + c^2 - 2ac \cdot \cos B$$

OR

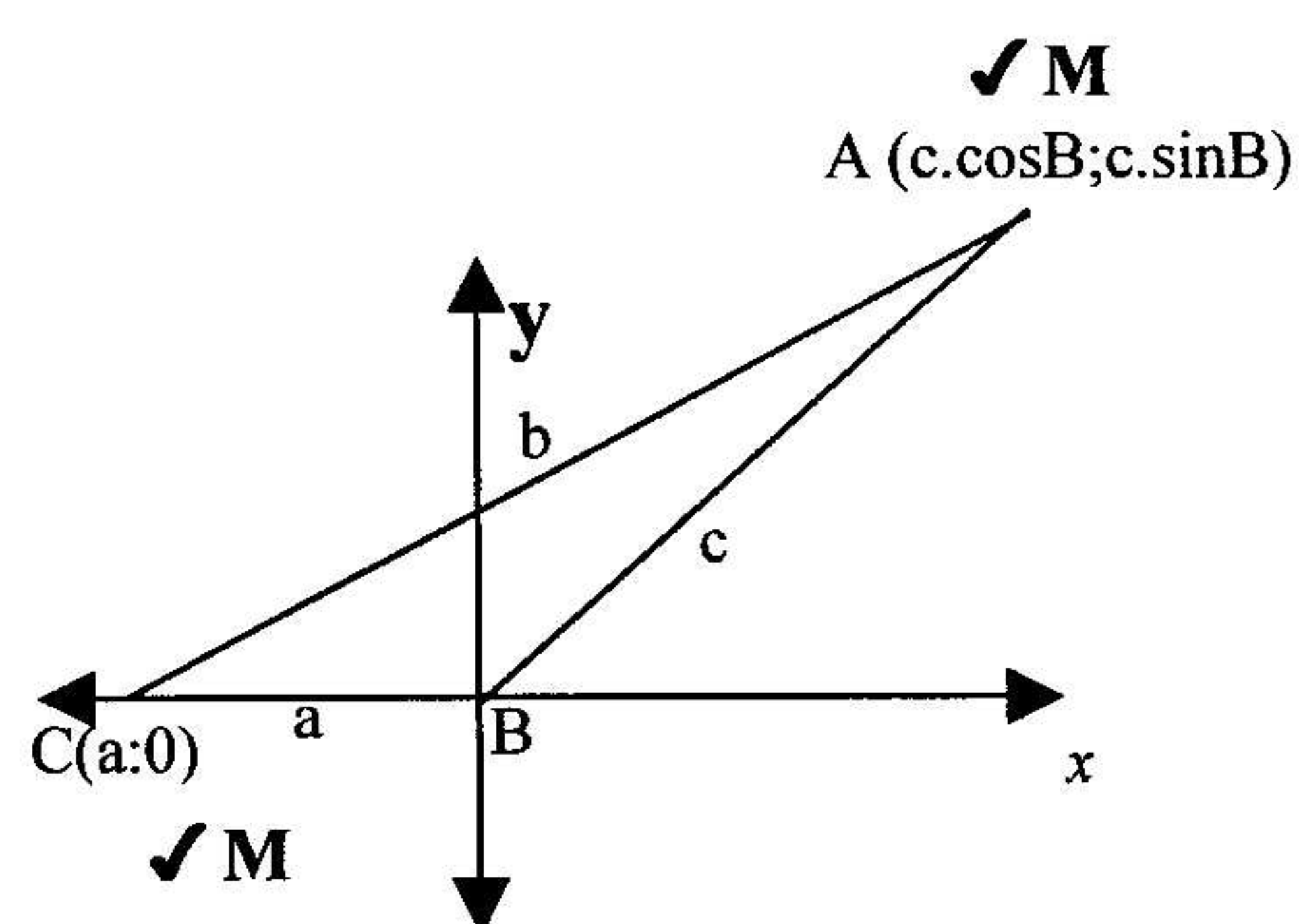
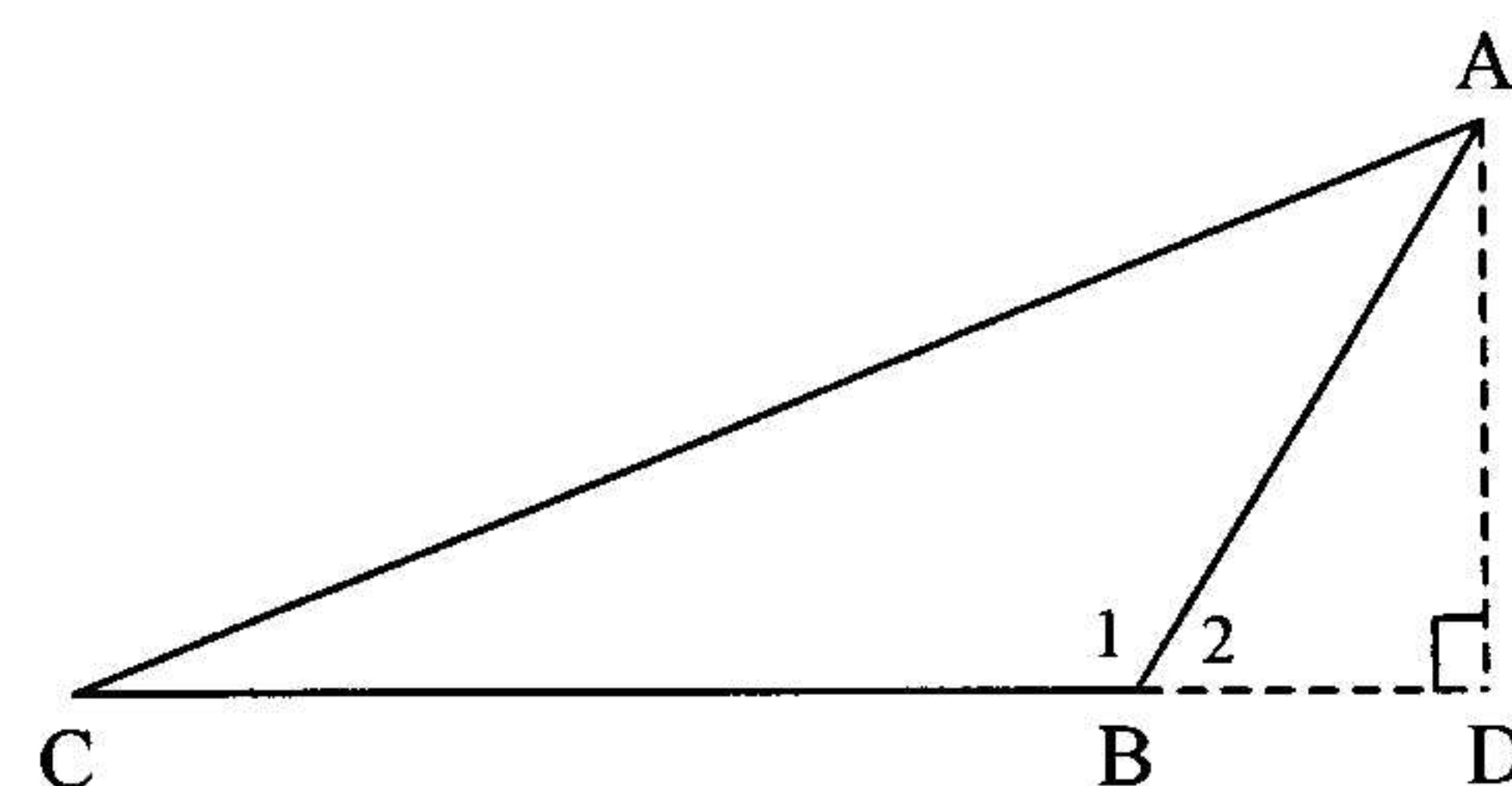
Draw ΔABC with \hat{B} at the origin and BC on the x-axis. ✓ M

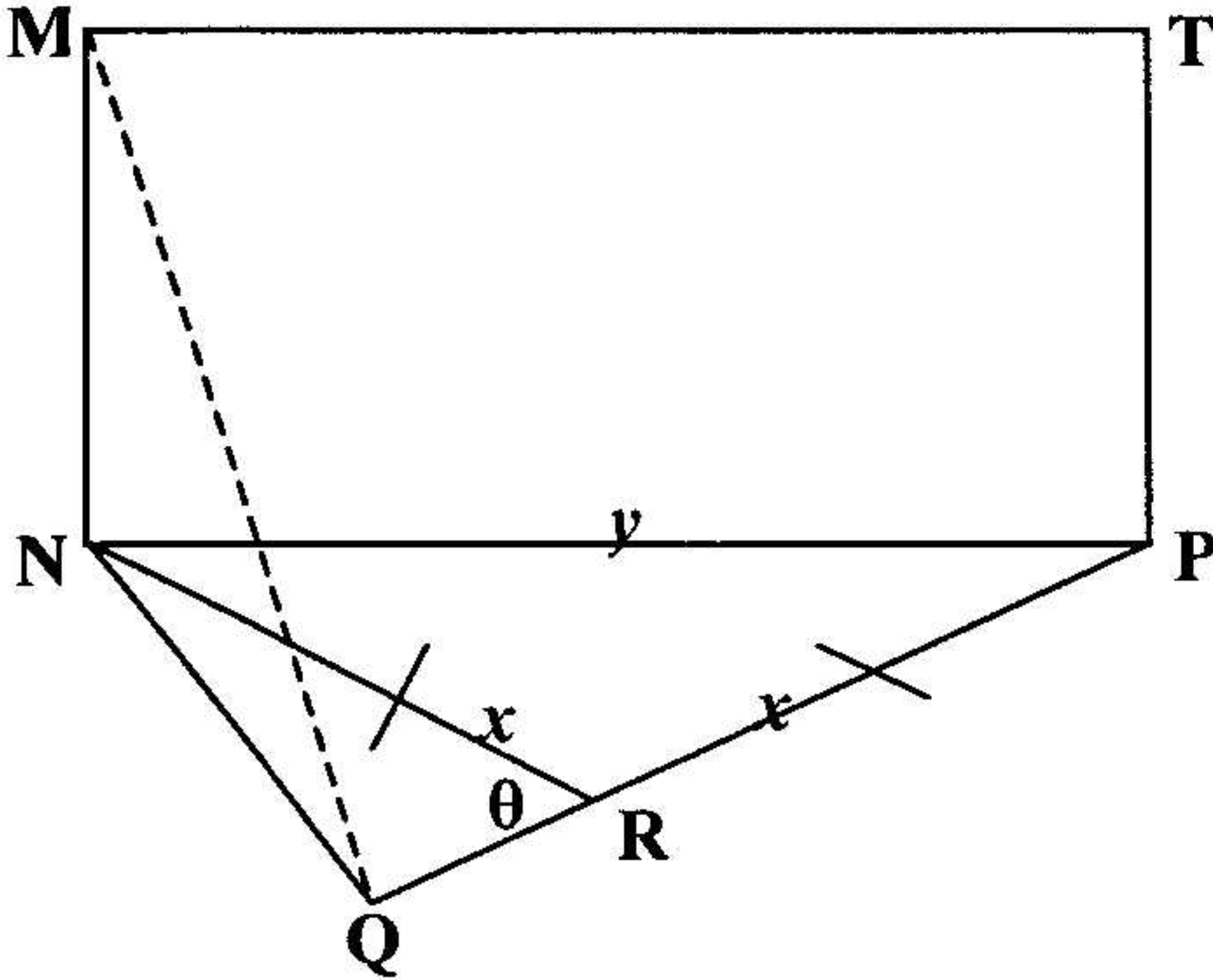
$$b^2 = (a - c \cdot \cos B)^2 + (0 - c \sin B)^2 \quad \checkmark CA \text{ (distance formula)}$$

$$= a^2 - 2ac \cdot \cos B + c^2 \cos^2 B + c^2 \sin^2 B \quad \checkmark CA$$

$$= c^2 (\cos^2 B + \sin^2 B) - 2ca \cdot \cos B + a^2 \quad \checkmark A$$

$$= c^2 + a^2 - 2ca \cdot \cos B \quad (\cos^2 B + \sin^2 B = 1) \quad (6)$$



6.2.1	 <p> $\hat{NRP} = 180^\circ - \theta$ ✓ M $NP^2 = NR^2 + RP^2 - 2NR.RP.\cos(180^\circ - \theta)$ $y^2 = 2x^2 + 2x^2\cos\theta$ ✓ CA $y^2 = 2x^2(1 + \cos\theta)$ ✓ A $(1 + \cos\theta) = \frac{y^2}{2x^2}$ ✓ A $\therefore \cos\theta = \frac{y^2}{2x^2} - 1$ (5) </p>	<p>Correct form of \hat{NRP} ✓ M Correct use of cosine formula Reduction Simplification Simplification</p>
6.2.2(a)	<p> $\cos\theta = \frac{(2,3)^2}{2(1,5)^2} - 1$ ✓ A $= 0,176$ $\theta = 79,9^\circ$ ✓ CA (2) </p>	<p>Substitution Solution</p>
6.2.2(b)	<p> $QR = 0,75$ ✓ M $NQ^2 = NR^2 + QR^2 - 2.NR.QR.\cos\theta$ ✓ M $= (1,5)^2 + (0,75)^2 - 2(1,5)(0,75)\cos 79,9^\circ$ ✓ CA $= 2,4185$ ✓ CA $NQ = 1,6m$ ✓ CA OR $\hat{NPQ} = 39,95^\circ$ ✓ M $NQ^2 = NP^2 + QP^2 - 2.NP.QP.\cos\hat{NPQ}$ ✓ M $= 2,3^2 + 2,25^2 - 2.2,3.2,25.\cos 39,95^\circ$ ✓ CA $= 2,4185$ ✓ CA $NQ = 1,6 m$ ✓ CA (5) </p>	<p> Value of QR Cosine formula and substitution Simplification Simplification Answer Using ΔNPQ value of \hat{NPQ} cosine formula and substitution simplification simplification Answer </p>

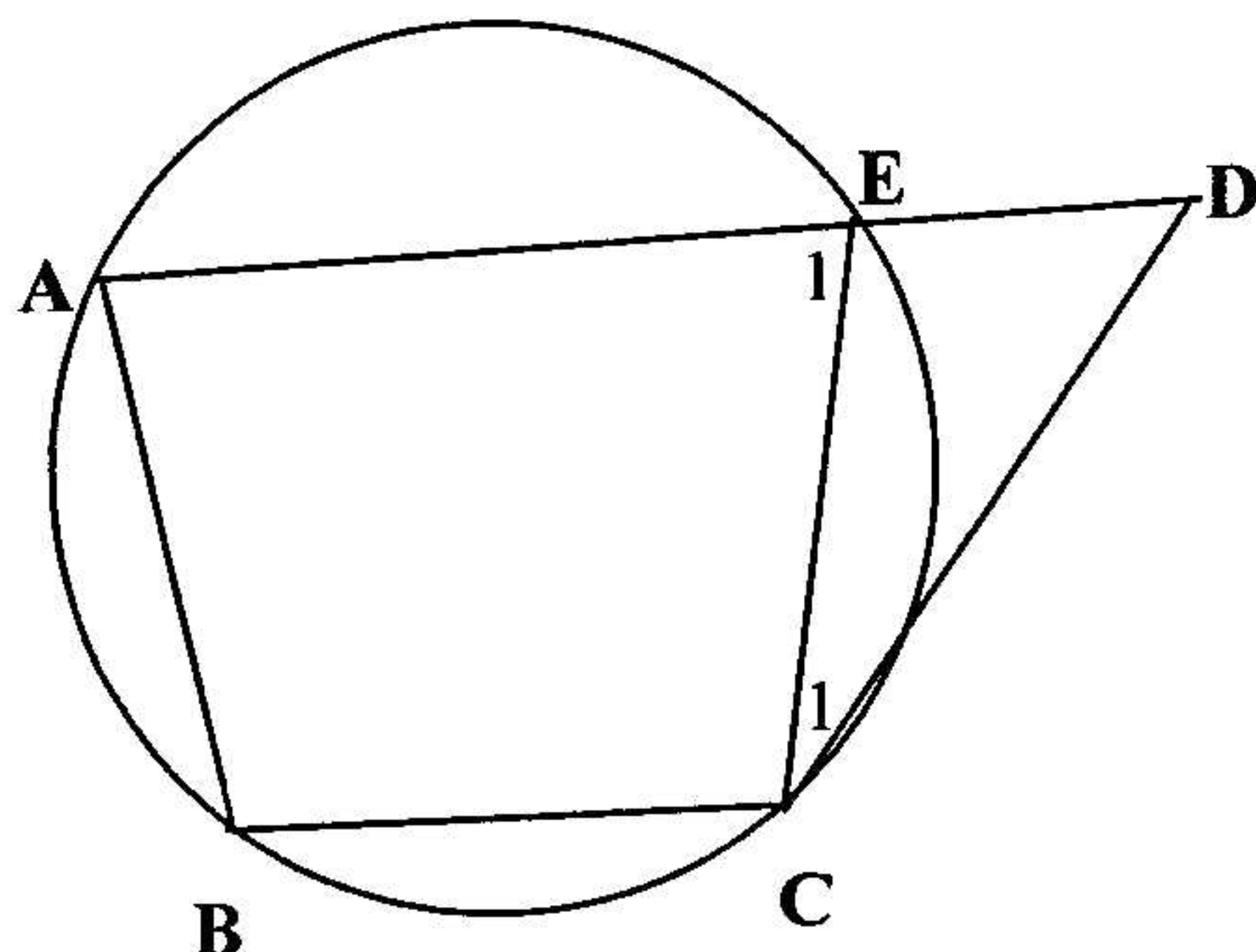
6.2.2(c)	$\frac{\sin \hat{NQR}}{1,5} = \frac{\sin 79,9^\circ}{1,6} \quad \checkmark M \quad \checkmark CA$ $\sin \hat{NQR} = \frac{1,5 \sin 79,9^\circ}{1,6} \quad \checkmark CA$ $= 0,923$ $\hat{NQR} = 67,4^\circ \quad \checkmark CA$ <p>OR (using ΔNQP)</p> $\frac{\sin \hat{NQP}}{2,3} = \frac{\sin 39,95^\circ}{1,6} \quad \checkmark M \quad \checkmark CA$ $\sin \hat{NQP} = \frac{2,3 \sin 39,95^\circ}{1,6} \quad \checkmark CA$ $= 0,923$ $\hat{NQP} = 67,4^\circ \quad \checkmark CA$ <div>(4)</div>	sine formula and substitution simplification Simplification
6.2.2(d)	$\tan 38^\circ = \frac{MN}{NQ} \quad \checkmark M$ $MN = (1,6)\tan 38^\circ \quad \checkmark CA$ $= 1,3 \text{ m} \quad \checkmark CA$ <div>(3)</div>	Correct ratio substitution Simplification

QUESTION 7		[7]
	<div> $\hat{T}_1 = 90^\circ \quad \checkmark S$ <div>(tan \perp radius) $\checkmark R$</div> </div> <div> $XT = \frac{3}{4}r \quad \checkmark S$ <div>(line from centre bisects chord) $\checkmark R$</div> </div> <div> $OT^2 = r^2 - \frac{9}{16}r^2 \quad \checkmark CA$ $= \frac{7}{16}r^2$ $OT = \frac{\sqrt{7}}{4}r \quad \checkmark A$ $CT = CO + OT$ $= r + \frac{\sqrt{7}}{4}r \quad \checkmark CA$ $= \frac{(4 + \sqrt{7})r}{4}$ <div>(7)</div> </div>	

QUESTION 8

[20]

8.1



Construction : Draw a circle through A, B and C and suppose it does not pass through D but through E on AD or AD produced. Draw EC. ✓ S

Proof : $\hat{B} + \hat{E}_1 = 180^\circ$ opp. \angle s cycl. quad ✓ S/R

$\hat{B} + \hat{D} = 180^\circ$ given ✓ S

$\therefore \hat{D} = \hat{E}_1$ ✓ S

Which is impossible since

$\hat{E}_1 = \hat{D} + \hat{C}_1$ ext \angle of Δ = sum int opp ✓ S

\therefore circle must pass through D

\therefore ABCD is a cyclic quadrilateral (6)

8.2

If a line is drawn through the endpoint of a chord of a circle and the angle between the line and the chord is equal to the angle in the alternate segment then the line is a tangent. ✓ A ✓ A (2)

<p>8.3</p>	
<p>8.3.1</p>	<p>$\hat{QBA} = x$ ✓S.....tan-chord ✓R</p> <p>$\hat{T}_1 = x$alt \angles // lines ✓S/R</p> <p>(3)</p>
<p>8.3.2(a)</p>	<p>Let $\hat{B}_1 = y$</p> <p>$\hat{Q}_1 = x + y$ ext \angle of $\Delta = \text{sum int opp } \angle$ ✓S/R</p> <p>$\hat{Q}_1 = \hat{R}_1$ ✓S \angles in same segment ✓R</p> <p>$= x + y$</p> <p>$\hat{PBA} = x + y = \hat{R}_1$ ✓S</p> <p>\therefore PRAB is a cyclic quad. ext. \angle cycl. quad = int. opp \angle (5) ✓R</p> <p>OR</p> <p>$\hat{R}_1 = \hat{Q}_1$ ✓S \angles in same segment ✓R</p> <p>$\hat{Q}_1 = x + \hat{B}_1$ext. \angle ✓S/R</p> <p>$= \hat{B}_2 + \hat{B}_3 + \hat{B}_1$ ✓S</p> <p>$\therefore \hat{R}_1 = \hat{B}_2 + \hat{B}_3 + \hat{B}_1$</p> <p>$\therefore$ PRAB is a cyclic quadrilateral . Exterior angle = interior opp. ✓R</p>
<p>8.3.2(b)</p>	<p>$\hat{B}_3 = \hat{P}_2$ ✓S \angle in same segment ✓R</p> <p>$= \hat{T}_2$ ✓S \angle in same segment ✓R</p> <p>\therefore AB is a tangent to circle TRB \angle betw line & chord = \angle subt. by chord ✓R (5)</p>

QUESTION 9

[12]

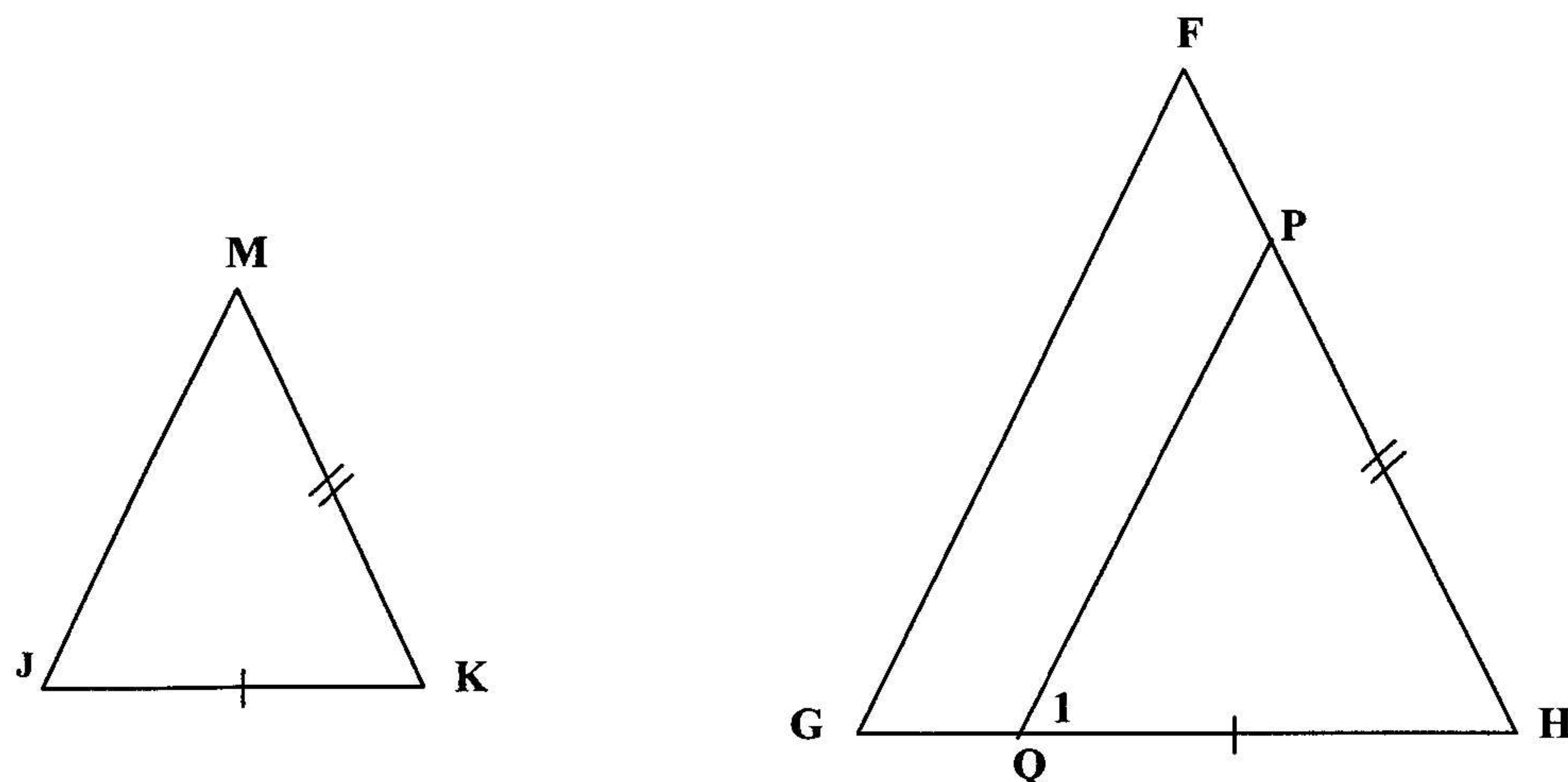
<p>9.1</p>	<p> $\hat{S}_1 = \hat{T}_1 = 90^\circ$ ✓S∠ in semi circle ✓R $\therefore CS$ and BT are altitudes ✓S $\therefore AP$ is an altitude (concurrency) ✓R </p>	
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<p>9.2</p>	<p> $\triangle ATR \equiv \triangle ASR$ ✓SSAA ✓R $\therefore AT = AS$ ✓S $\triangle ACP \equiv \triangle ABP$ ✓SSAA ✓R $\therefore AC = AB$ ✓S $\therefore \frac{AT}{AC} = \frac{AS}{AB}$ ✓S $\therefore TS \parallel CB$line dividing sides of \triangle in prop ✓R OR $\hat{T}_2 = \hat{S}_2 = 90^\circ$ ✓Sext. \angles of cycl. quad $\therefore TSBC$ is a cyclic quad ✓R $\therefore \hat{C}_2 = \hat{STB}$ ✓S\angles in same segment but $\therefore \hat{STB} = \hat{A}_1$ ✓S\angles in same segment ✓R and $\hat{TSC} = \hat{A}_2$ ✓S\angles in same segment ✓R $\therefore \hat{STB} = \hat{TSC}$$\hat{A}_1 = \hat{A}_2$ $\therefore \hat{C}_2 = \hat{TSC}$ $\therefore TS \parallel CB$alt \angles = ✓R OR $\hat{A}_1 = \hat{STB}$ ✓S\angles in same segment ✓R $\hat{A}_2 = \hat{TSC}$ ✓S\angles in same segment ✓R But $\hat{T}_2 = \hat{S}_2$ $= 90^\circ$ $\therefore TSBC$ is a cyclic quad. ✓S s in same segment equal $\therefore \hat{STB} = \hat{C}_2$ ✓S/R\angles in same segment $\therefore \hat{TSC} = \hat{STB}$ $= \hat{C}_2$ ✓S $\therefore TS \parallel CB$alt. \angles = ✓R (8) </p>	
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QUESTION 10

[24]

10.1



10.1

Constr : On FH and GH cut off HP = MK and HQ = JK ✓ M

Proof : $\therefore \triangle HQP \equiv \triangle KJM$ s, \angle , s ✓ S ✓ R

$$\therefore \hat{Q}_1 = \hat{J} \quad \checkmark S$$

$$\therefore \hat{Q}_1 = \hat{G} \quad \dots\dots\dots \hat{G} = \hat{J}$$

$$\therefore PQ \parallel FG \quad \dots\dots\dots \text{corr. } \angle s = \quad \checkmark S/R$$

$$\therefore \frac{FH}{HP} = \frac{GH}{HQ} \quad \checkmark S \dots\dots\dots \text{line } \parallel \text{ to one side of } \triangle \quad \checkmark R$$

But HQ = JK and HP = MK

$$\therefore \frac{FH}{HM} = \frac{GH}{JK} \quad (7)$$

10.2.3	<p>$\triangle ACK \parallel \triangle CTO$</p> <p>$\therefore \frac{AC}{CT} = \frac{CK}{TO} \quad \checkmark S \text{ from 9.2.3}$</p> <p>$CK = \frac{AC \cdot TO}{CT}$</p> <p>$CK^2 = \frac{TO^2 \cdot CA^2}{CT^2} \quad \checkmark S$</p> <p>In $\triangle CKB \parallel \triangle AKC \quad \checkmark S$ from 9.2.3</p> <p>$\frac{CK}{AK} = \frac{KB}{CK} \quad \checkmark S$</p> <p>$\therefore CK^2 = BK \cdot AK \quad \checkmark S$</p> <p>$\therefore BK \cdot AK = \frac{OT^2 \cdot CA^2}{CT^2} \quad (5)$</p>	
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