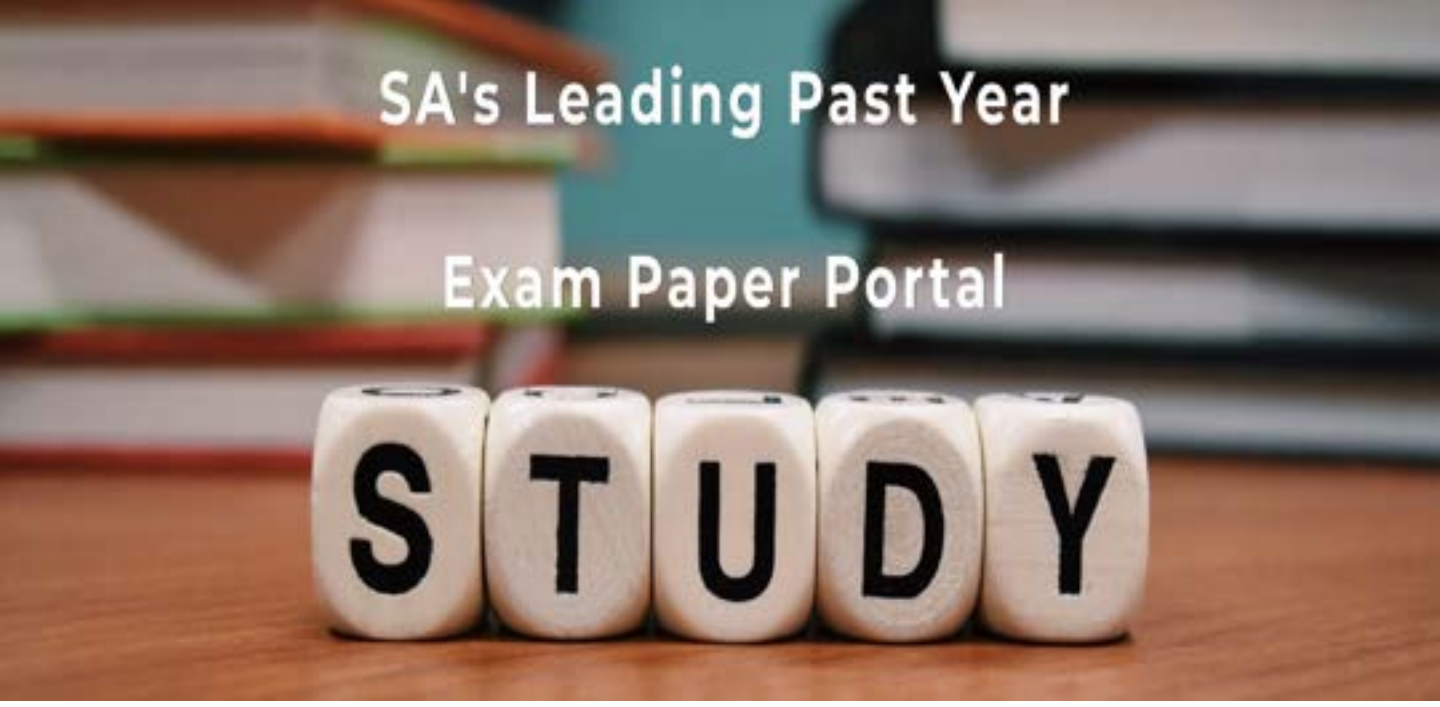

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GRADE 12

MATHEMATICS P2

MARKING GUIDELINE

PREPARATORY EXAMINATION

SEPTEMBER 2019

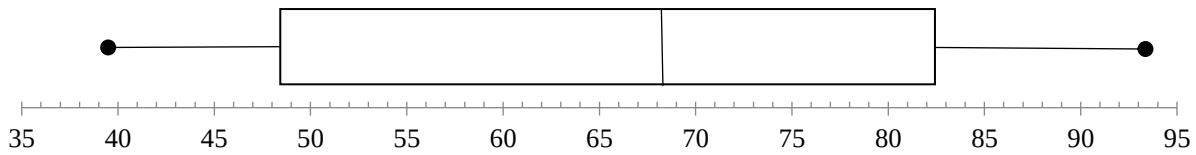
MARKS: **150**

TIME: **3 hours**

This memorandum consists 15 of pages.

QUESTION 1

39	42	48	54	62	68	78	78	82	91	93

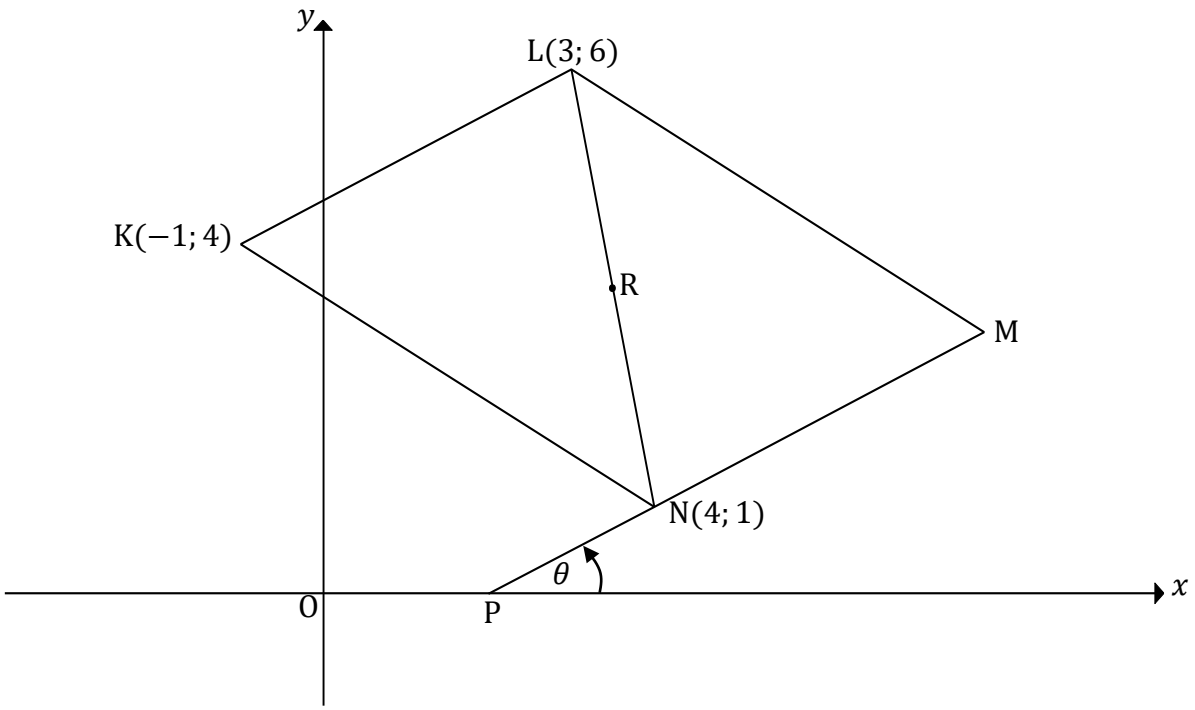
1.1	$\bar{x}$ = 66,82 or 66,82 thousands	A ✓calculation CA ✓ answer	(2)
1.2	σ = 18,3	AA ✓✓answer If formula is used CA will apply.	(2)
1.3	$(\bar{x} - \sigma; \bar{x} + \sigma)$ = (48,52 ; 85,12) ∴ 6 countries	CA✓ substitution CA✓ answer	(2)
1.4	 A✓min & max values A✓quartile 1 value A✓median value & form A✓quartile 3 value		(4)
1.5	The data is skewed to the left/negatively skewed	CA✓answer	(1)
1.6.1	The sum of the data provided for the years must increase.	A✓answer	(1)
1.6.2	IQR will remain the same or change.	A✓answer (both same or change)	(1)
			[13]

QUESTION 2

YEAR	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Agriculture (*x*)	4.2	3,4	3,1	2,7	2,9	3,0	2,9	3,0	2,6	2,5	2,6
Mining (*y*)	19,2	19,4	19,2	18,5	17,5	17,0	16,8	15,2	14,2	12,8	12,4

2.1	a= 5,65 *and* b= 3,65 y= 5,65 +3,65x	A✓ a – value A✓ b – value CA✓ equation	(3)
2.2	y= 5,65+3,65x = 5,65+3,65(1,2) =10,03%	A✓ substitution of 1,2 CA✓ answer	(2)
2.3	strong positive correlation of the data r = 0,7	CA✓ strong positive A✓ value of correlation coefficient	(2)
			[7]

QUESTION 3



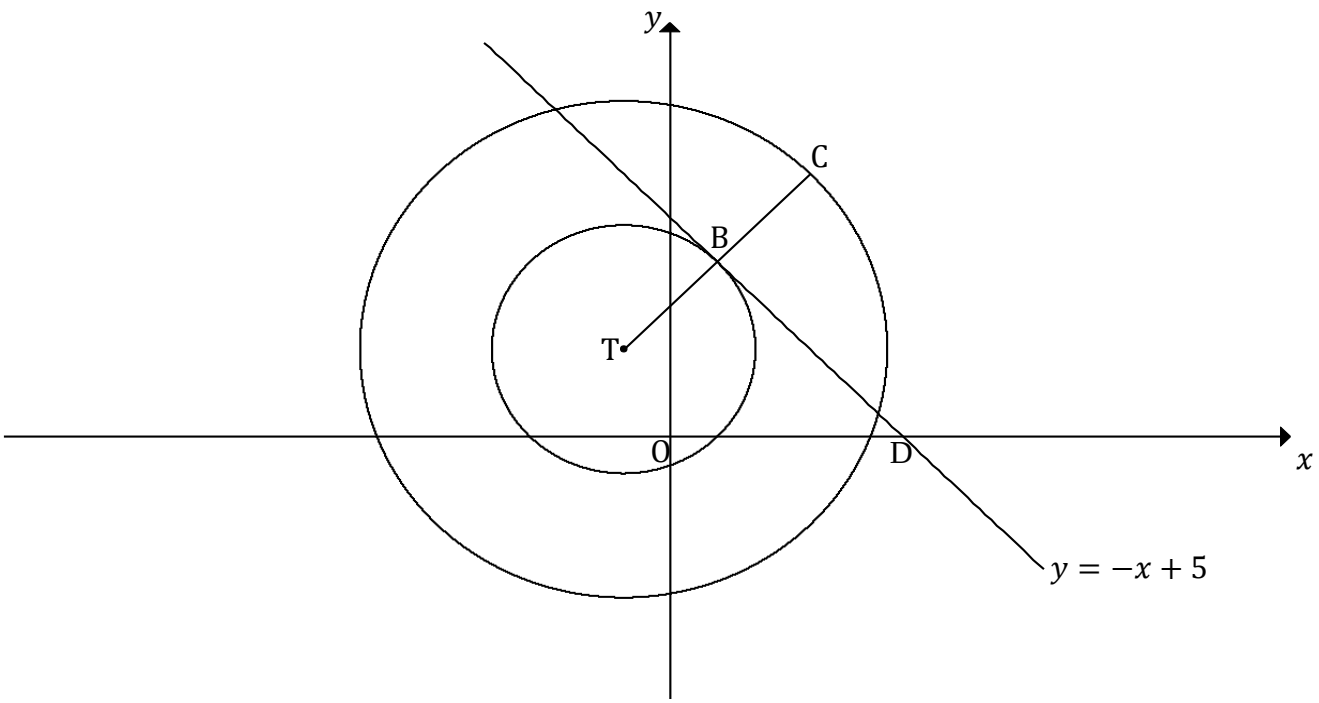
3.1

3.1.1	$m_{KL} = \frac{6-4}{3-(-1)}$ $= \frac{2}{4}$ or $\frac{1}{2}$ answer only: full marks	A✓ substitution in the correct formula CA✓ answer	(2)
3.1.2	midpoint of R : $\left(\frac{x_N + x_L}{2}; \frac{Y_N + Y_L}{2}\right)$: $\left(\frac{3+4}{2}; \frac{6+1}{2}\right)$ R $\left(\frac{7}{2}; \frac{7}{2}\right)$ answer only: full marks	A✓ substitution in the correct formula CA✓ x CA✓ y	(3)
3.1.3	co-ordinates of M: $\frac{x-1}{2} = \frac{7}{2}$ $x - 1 = 7 \quad \therefore x = 8$ $\frac{y+4}{2} = \frac{7}{2}$ answer only: full marks $y = 7 - 4 \quad \therefore y = 3$ $\therefore$ M $(8; 3)$	CA✓ $\frac{x-1}{2} = \frac{7}{2}$ CA✓ $\frac{y+4}{2} = \frac{7}{2}$ CA✓ x CA✓ y	(4)
3.2	The equation of NM $m_{NM} = \frac{1}{2}$ [NM ‖ KL] $y - y_1 = m(x - x_1)$ $y - 1 = \frac{1}{2}(x - 4)$ $y = \frac{1}{2}x - 2 + 1 \therefore y = \frac{1}{2}x - 1$	CA✓ gradient CA✓ correct subst. of m and N(4 ; 1) CA✓ equation	(3)

3.3

3.3.1	$0 = \frac{1}{2}x - 1$ $x = 2$ $\therefore$ P (2; 0) answer only: full marks	A✓ y = 0 CA✓ x	(2)
3.3.2	$\tan\theta = \frac{1}{2}$ $\theta = 26{,}57^{o}$ answer only: full marks	CA✓ $\tan\theta = m$ CA✓ answer	(2)
3.3.3	$m_{KP} = \frac{0-4}{2-(-1)} = -\frac{4}{3}$ $\tan^{-1}\left(\frac{-4}{3}\right) = 180° - 53{,}13° = 126{,}87°$ $K\hat{P}N = 126{,}87° - 26{,}57°$ $= 100{,}3°$	CA✓ m_{KP} CA✓ inclination of KP A✓ method CA✓ answer	(4)
			[20]

QUESTION 4



4.1.	$x^2 + 2x + y^2 - 4y = 27$ $x^2 + 2x + 1 + y^2 - 4y + 4 = 27 + 1 + 4$ $(x+1)^2 + (y-2)^2 = 32$ $\therefore$ T (–1; 2) **OR** $x = \frac{2}{-2} = -1$ $y = \frac{-4}{-2} = 2$	A✓ completing square LHS A✓ LHS CA✓ x CA✓ y AA✓✓ x AA✓✓ y	(4) (4)
4.2	$m_{TB} \times m_{BD} = -1$ [tangent $\perp$ radius] $m_{TB} = 1$ $y = mx + c$ $2 = 1 . (-1) + c$ $\therefore c = 3$ $\therefore$ Equation of TB is $y = x + 3$	A✓ $m_{TB} = 1$ A✓ subst of m andT A✓ value of c	(3)
4.3	equating TB and BD: $x + 3 = -x + 5$ $2x = 2$ $x = 1$ $y = 1 + 3$ *or* $y = -1 + 5$ $\therefore$B(1 ; 4)	A✓equating CA✓ $x = 1$ CA✓ $y = 4$ CA provided first quadrant.	(3)

4.4	$(x+1)^2+(y-2)^2=r^2$ $(1+1)^2+(4-2)^2=r^2$ $8=r^2$ $(x+1)^2+(y-2)^2=8$	CA✓ subst T in circle eq CA ✓ subst B CA✓equation	(3)
4.5	Draw a horizontal line TE with E on BD: Point D(5 ; 0) and Point E: $2 = -x + 5$ $\therefore$ E(3 ; 2) Area of trap TEDO $= \frac{1}{2}(\text{TE}+\text{OD})\times \perp h$ $=\frac{1}{2}(4+5)\times 2$ $=9$ units Area of ΔTBE $=\frac{1}{2}$ (TB $\times$ BE) $=\frac{1}{2}\left(\sqrt{8}\right)\left(\sqrt{8}\right)$ $=4$ units Area of OTBD = 9 + 4 = 13 units^2	A✓ coordinates of D CA✓coordinates of E CA✓ length of TE CA✓ subst in area of trap CA✓subst in correct area of Δ formula A✓ method CA✓ answer	(7)
			[20]

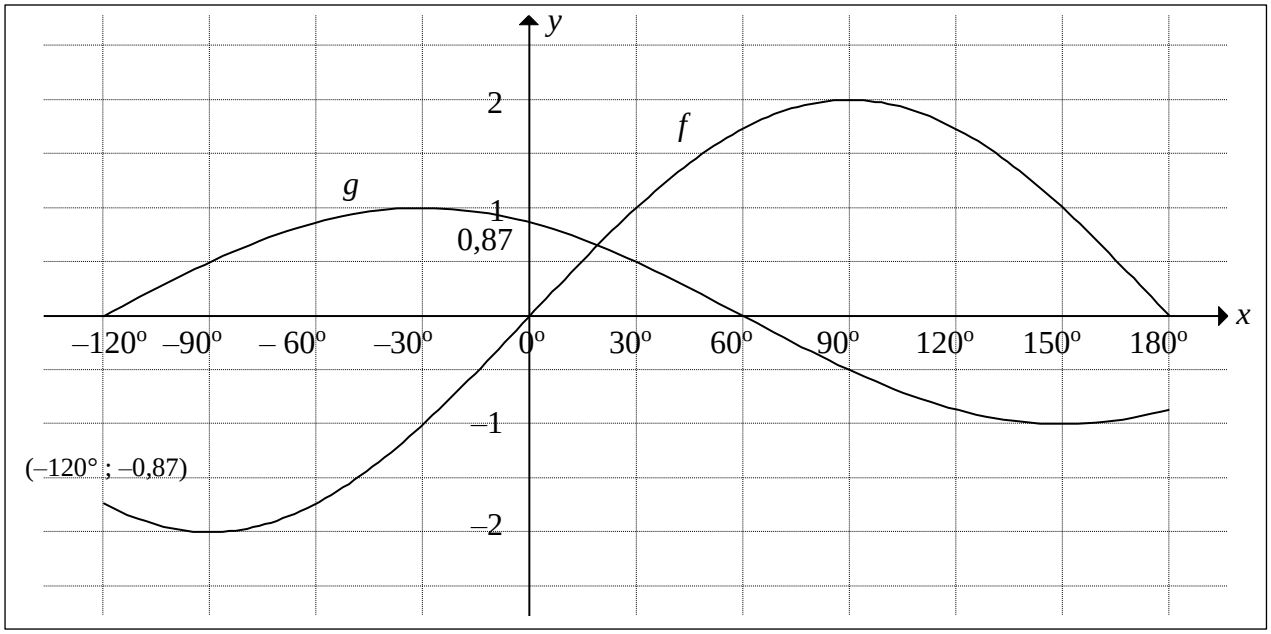
QUESTION 5

5.1.1	$\tan\theta = \frac{-\sqrt{3}}{1} = -\sqrt{3}$	A✓ answer	(1)
5.1.2	$r^2 = (1)^2 + \left(-\sqrt{3}\right)^2$ Pyth $r^2 = 4$ $r = 2$ $\sin(-\theta) = -\sin\theta$ $= -\left(\frac{-\sqrt{3}}{2}\right)$ *or* $\frac{\sqrt{3}}{2}$	A✓$r = 2$ A✓ reduction CA✓ answer	(3)
5.1.3	$\sin(\theta - 60°)$ $= \sin\theta\cos 60° - \cos\theta\sin 60°$ $= \left(-\frac{\sqrt{3}}{2}\right)\left(\frac{1}{2}\right) - \left(\frac{1}{2}\right)\left(\frac{\sqrt{3}}{2}\right)$ $= \frac{-\sqrt{3}}{4} - \frac{\sqrt{3}}{4} = \frac{-2\sqrt{3}}{4} = \frac{-\sqrt{3}}{2}$	A✓expansion CA✓ both special ratios CA✓ value of cos θ CA✓answer	(4)
5.2	$\frac{\tan(180° - \theta)\sin(90° + \theta)}{\cos 300°\sin(\theta - 360°)}$ $= \frac{-\tan\theta . cos\theta}{\cos 60° . \sin\theta}$ $= \frac{-\frac{\sin\theta}{\cos\theta}.\cos\theta}{\frac{1}{2}.\sin\theta}$ $= -2$	A✓ $-\tan\theta$ A✓ $cos\theta$ A✓ $\cos 60°$ A✓ $sin\theta$ A✓identity CA✓ answer	(6)
5.3.1	$LHS = \frac{\cos 2x - 1}{\sin 2x}$ $= \frac{1 - 2\sin^2 x - 1}{2\sin x\cos x}$ $= -\frac{\sin x}{\cos x}$ $= -\tan x$ $= RHS$	A✓ $1 - 2sin^2x$ A✓ $2\sin x\cos x$ A✓ simplification	(3)
5.3.2	$x = 90°$; $180°$; $270°$	A✓ 90° A✓ 180° A✓ 270°	(3)

5.3.3	$-\tan 2x = \frac{1}{4}$ $\tan 2x = -\frac{1}{4}$ $2x = 165{,}96° + k.180°$ $x = 82{,}98° + k.90° \ ; k \in Z$	A✓ $\tan 2x = -\frac{1}{4}$ A✓165,96° CA✓ 82,98° A✓$k \in Z$	(4)
			[24]

QUESTION 6

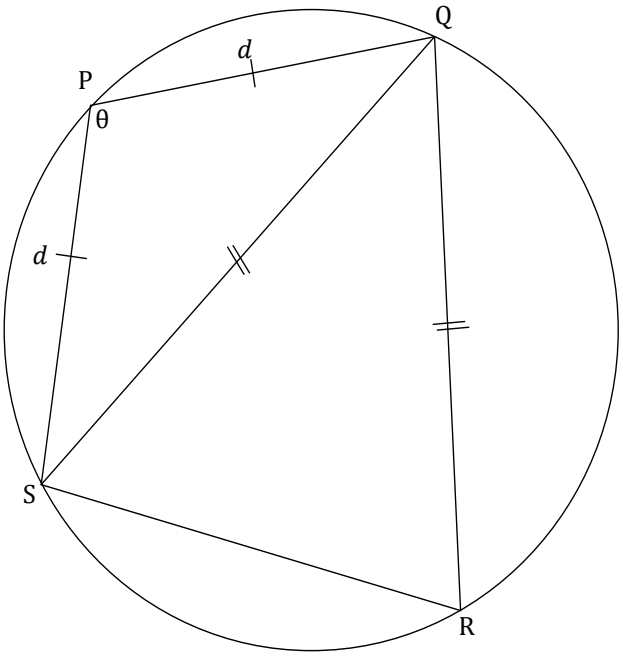
6.1



A✓ x-intercepts
A✓ shape
A✓ (–30° ; 1) & (150° ; -1)
A✓ (–120° ; 0) & (180° ; -0,87)
(4)

6.2	Period $= 360^o$	A✓ answer (1)
6.3.1	$-30^o < x < 150^o$	CA✓ endpoints A✓ correct interval (2)
6.3.2	$x \in (0^o ; 60^o)$	CA✓ endpoints A✓ correct interval (2)
6.4	$y = \cos\left(x + 30^o + 60^o\right)$ $y = \cos(x + 90^o)$ $y = -\sin x$	A✓ $\cos(x + 90^o)$ CA✓ answer (2)
		[11]

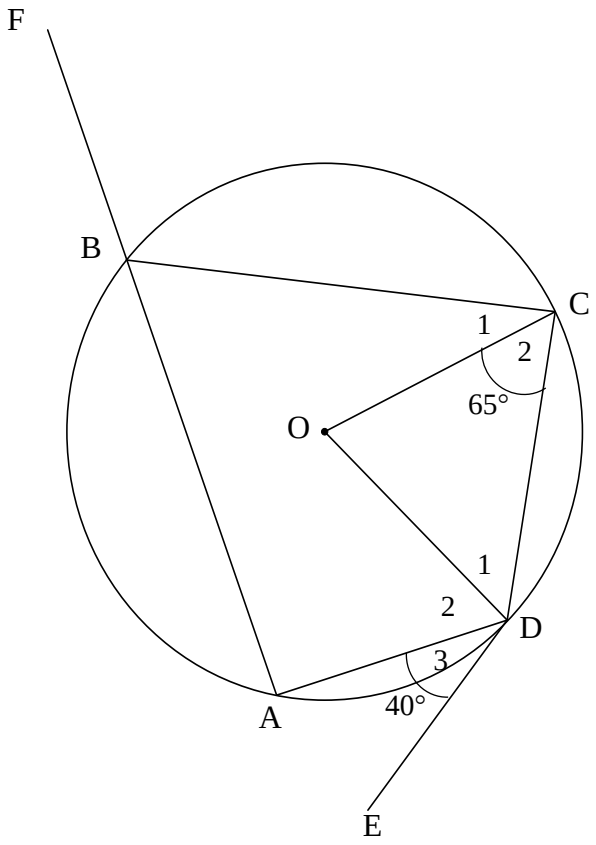
QUESTION 7



7.1	$QS^2 = d^2 + d^2 - 2d.d.\cos\theta$ $QS^2 = 2d^2 - 2d^2.\cos\theta$ $QS^2 = 2d^2(1-\cos\theta)$ $QS = d\sqrt{2(1-\cos\theta)}$	A✓ subst into cos-rule A✓ common factor	(2)
7.2	$\hat{R} = 180° - \theta$ opp. $\angle^s$cyclic quad suppl $= Q\hat{S}R$ equal sides, equal angles $S\hat{Q}R = 2\theta - 180°$ sum $\angle^s\Delta$ $\Delta QRS = \frac{1}{2}.QS.QR\sin S\hat{Q}R$ $= \frac{1}{2}.d\sqrt{2(1-\cos\theta)}.d\sqrt{2(1-\cos\theta)}\sin(2\theta - 180°)$ $= \frac{1}{2}d^2.2(1-\cos\theta)(-\sin 2\theta)$ $= -d^2(1-\cos\theta).\sin 2\theta$	A✓ $S\hat{Q}R$ A✓subst into area rule A✓simplify & reduction	(3)
			[5]

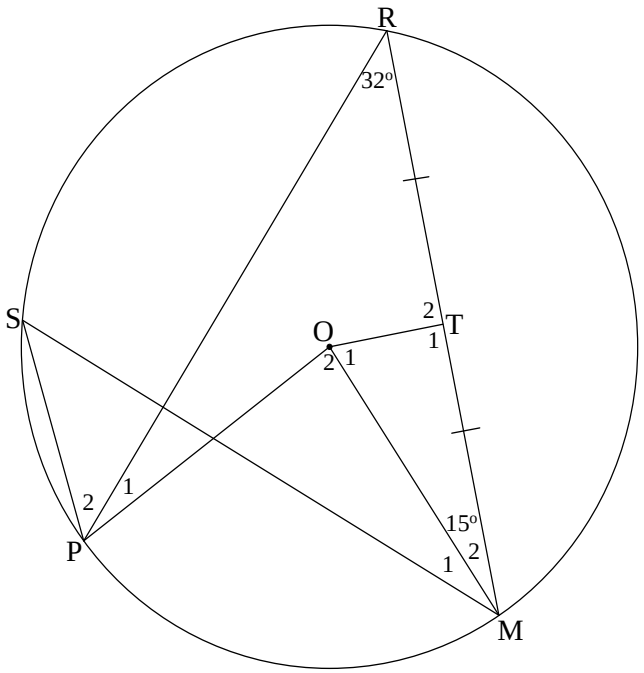
QUESTION 8

8.1



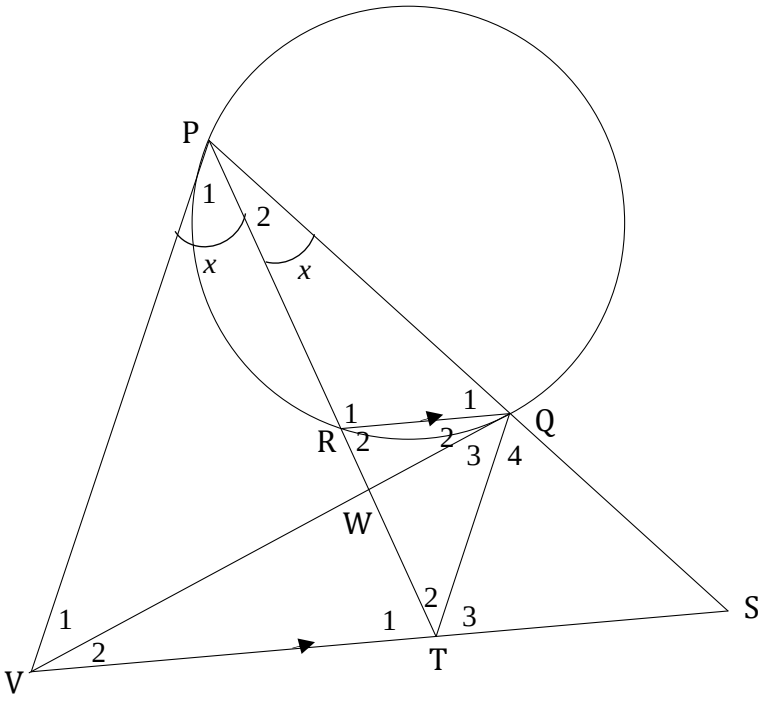
8.1.1	$\hat{D}_2 + \hat{D}_3 = 90^O$ (tan ⊥ radius) $\therefore\ \hat{D}_2 = 90^o - 40^o = 50^o$	A✓S A✓R A ✓answer	(3)
8.1.2	$\hat{D}_1 = \hat{C}_2 = 65^o$ (angles opposite equal sides) $\hat{D}_1 + \hat{D}_2 = F\hat{B}C$ (ext angle of a cyclic quad) $65^o + 50^o = F\hat{B}C$ $\therefore F\hat{B}C = 115^o$	A✓S/R A✓S A✓R CA✓answer	(4)

8.2



8.2.1	$\hat{S} = 32^o$ ($\angle$s in the same segment)	A✓S A✓R	(2)
8.2.2	$\hat{O}_2 = 64^o$ ($\angle$ at centre = 2 × $\angle$ at circumference)	A✓S A✓R	(2)
8.2.3	$\hat{T}_1 = 90^o$ (line from centre to midpoint of chord) $\hat{O}_1 + \hat{T}_1 + \hat{M}_2 = 180^O$ (sum of angles of Δ) $\hat{O}_1 + 90° + 15° = 180°$ $\hat{O}_1 = 75°$	A✓S/R A✓Method A✓answer	(3)
			[14]

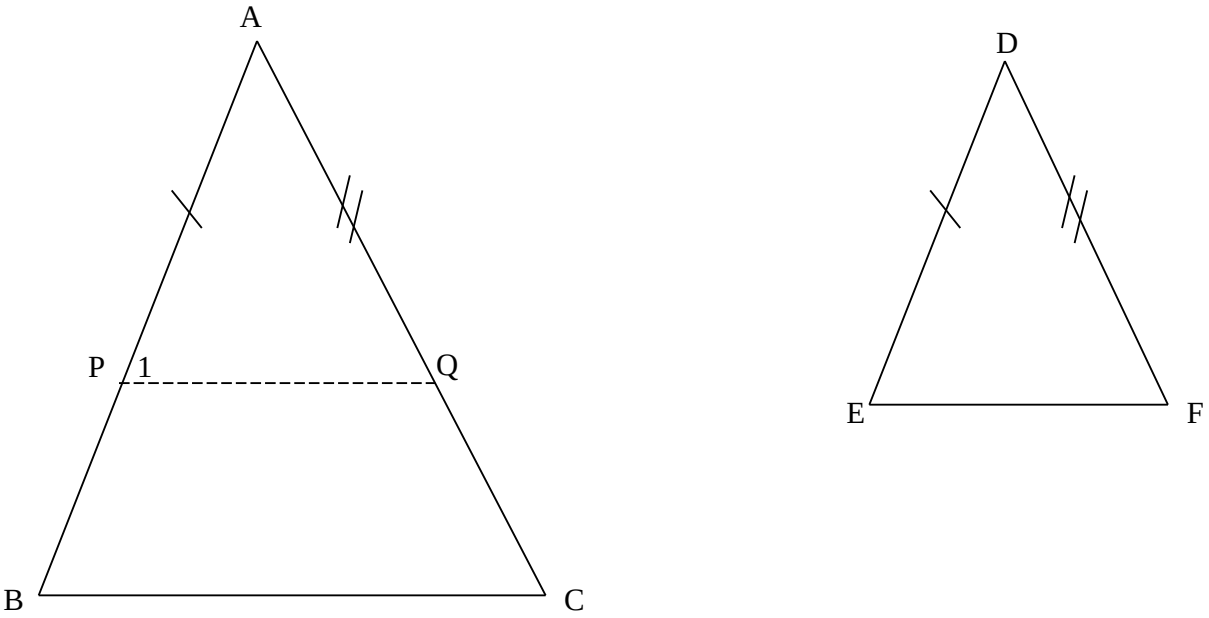
QUESTION 9



9.1	$\hat{P}_1 = \hat{Q}_1 = x$ (tan chord theorem) $\hat{Q}_1 = S = x$ (corresp ∠'s (PQ//VS) $\hat{S} = x$	A✓S A ✓R A✓ S A✓R	(4)
9.2	$\hat{P}_2 = \hat{Q}_2$ (tan chord theorem) $\hat{Q}_2 = \hat{V}_2$ (alt ∠'s (PQ//VS) $\therefore \hat{P}_2 = \hat{V}_2$ $\therefore$ PQTV is a cyclic quadrilateral (converse of angles in the same seg.)	A✓ S A✓R A✓ S A✓R A✓ R	(5)
9.3	$\hat{Q}_3 = \hat{P}_1$ (∠'s in the same segment) $\therefore \hat{Q}_3 = \hat{P}_2$ $\therefore$ TQ is a tangent (converse: tan chord theorem)	A✓ S A✓R A✓ R	(3)
			[12]

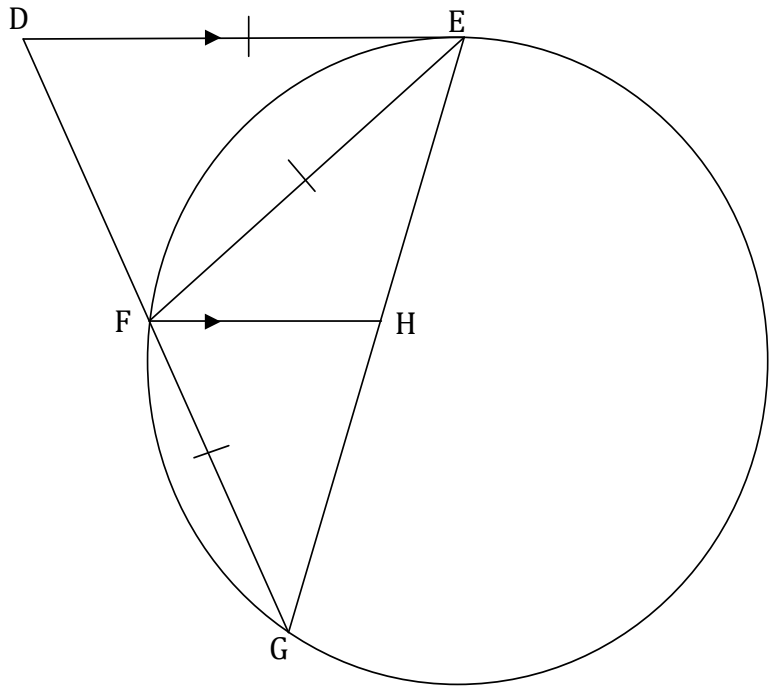
QUESTION 10

10.1



Construct AP = DE and AQ = DF and draw PQ In Δ APQ and ΔDEF: AP = DE AQ = DF $\hat{A} = \hat{D}$ $\therefore \Delta APQ \equiv \Delta DEF$ (SAS) $\hat{P}_1 = \hat{E}$, But $\hat{B} = \hat{E}$ … (given) $\hat{P}_1 = \hat{B}$ PQ || BC (corresponding angles =) $\therefore \frac{AB}{AP} = \frac{AC}{AQ}$ (proportionality theorem; PQ || BC) $\therefore \frac{AB}{DE} = \frac{AC}{DF}$ (construction)	A✓ construction A✓ ΔAPQ ≡ ΔDEF A✓ SAS A✓S A✓R A✓S A✓R	(7)

10.2



10.2.1	$\hat{G}$ (tan chord theorem) $E\hat{F}H$ (alt ∠'s, DE||FH) $F\hat{E}H = \hat{G}$ (∠'s opposite = sides)	A✓ S/R A✓ S ✓R A✓ S/R	(4)
10.2.2(a)	In Δ's DEF and DGE: 1) $\hat{D}$ is common 2) $D\hat{E}F = \hat{G}$ (proven) 3) $D\hat{F}E = D\hat{E}G$ (sum of angles in triangle) ΔDEF ||| ΔDGE (∠∠∠)	 A✓ S A✓ S A✓ R	(3)
10.2.2(b)	Let $D\hat{E}F = x$: $E\hat{F}D = 2x$ (ext . angle of Δ) $\hat{D} = 2x$ (∠s opposite = sides) $\therefore 2x + 2x + x = 180°$ $x = 36°$ $\therefore \hat{D} = 2x = 72^o$	 A✓ S A✓ R A✓ S A✓ Equation A✓ value of x	(5)

10.2.3	$\frac{DE}{DG} = \frac{DF}{DE}$ ($\Delta DEF \text{ ||| } \Delta DGE$) $\frac{FG}{DG} = \frac{DF}{FG}$ $(DE = FG)$ $\frac{2}{k+2} = \frac{k}{2}$ $k^2 + 2k = 4$	A✓ S A✓ S A✓ substitution	(3)
10.2.4	$\frac{GH}{GE} = \frac{GF}{GD} = \frac{2}{k+2}$ (Prop. Intercept theorem DE//FH)	A✓ S A✓R	(2)
			[24]

TOTAL: 150