KWAZULU-NATAL PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

MATHEMATICS P2

NOVEMBER 2023

MARKING GUIDELINE

NATIONAL SENIOR CERTIFICATE

GRADE 11



MARKS: 150

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This marking guideline consists of 14 pages.

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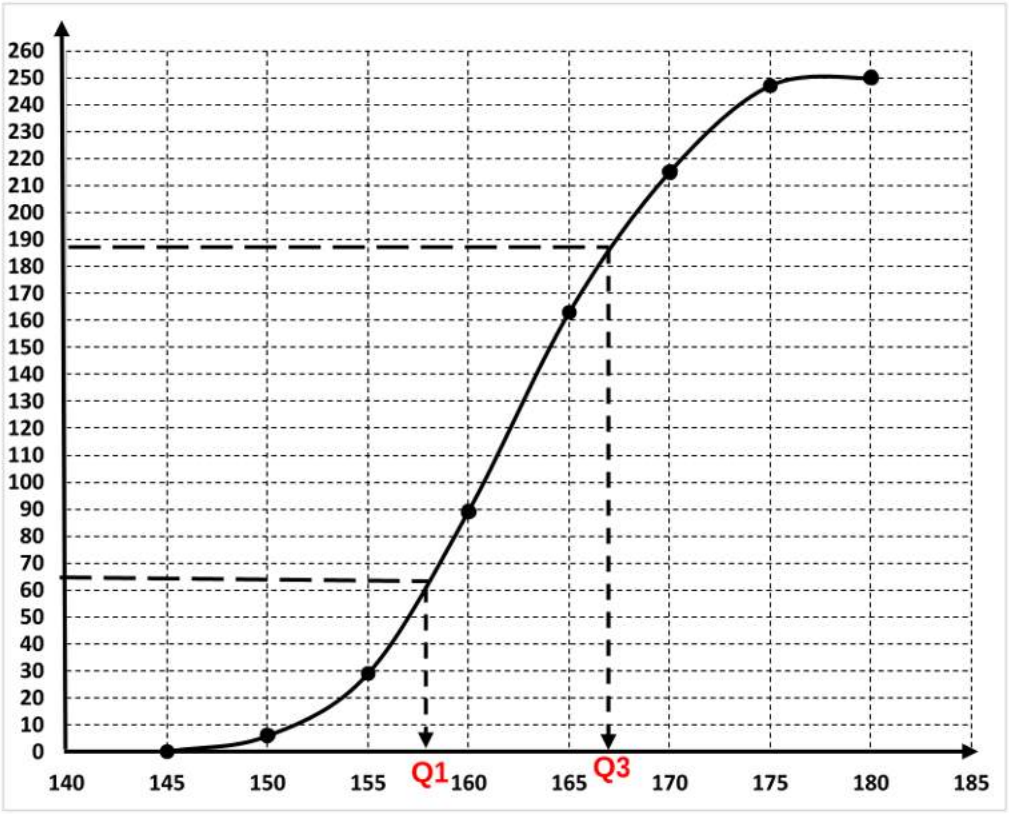
GRADE 11
Marking Guideline

QUESTION 1

1.1	$\bar{x} = \frac{21+8+19+7+15+32+14+12}{8}$ $= \frac{128}{8}$ $=16$	✓ $\frac{128}{8}$ ✓ answer (2)
1.2	$\delta = 7.55$	✓ answer (1)
1.3	Two standard deviation above the mean: $\bar{x}-2\delta$ $\bar{x}-1\delta$ $\bar{x}$ $\bar{x}+1\delta$ $\bar{x}+2\delta$ 0.9 8,45 16 23.55 31,1 $\bar{x}+2\delta = 16+2\times 7.55 = 31{,}1$ Yes, he will make it to the trials, he has one score (32) that is more than two standard deviations above the mean	✓31,1 ✓yes and motivation (2)
1.4	Total number of runs in 8 games = 128 Total number of runs in 13 games $=13\times 20 = 260$ Average in last 5 games = $\frac{260-128}{5}$ $= 26,4$ His average must be 26,4 or approximately 26 runs in his last 5 games.	✓ 260 ✓ $\frac{260-128}{5}$ ✓ 26,4 or 26 (3)
1.5	Increase. Both 0 and 20 are further than one standard deviation from the mean, and will therefore cause an increase in standard deviation.	✓ increase ✓ both 0 and 20 are further than one standard deviation from the mean (2)
		[10]

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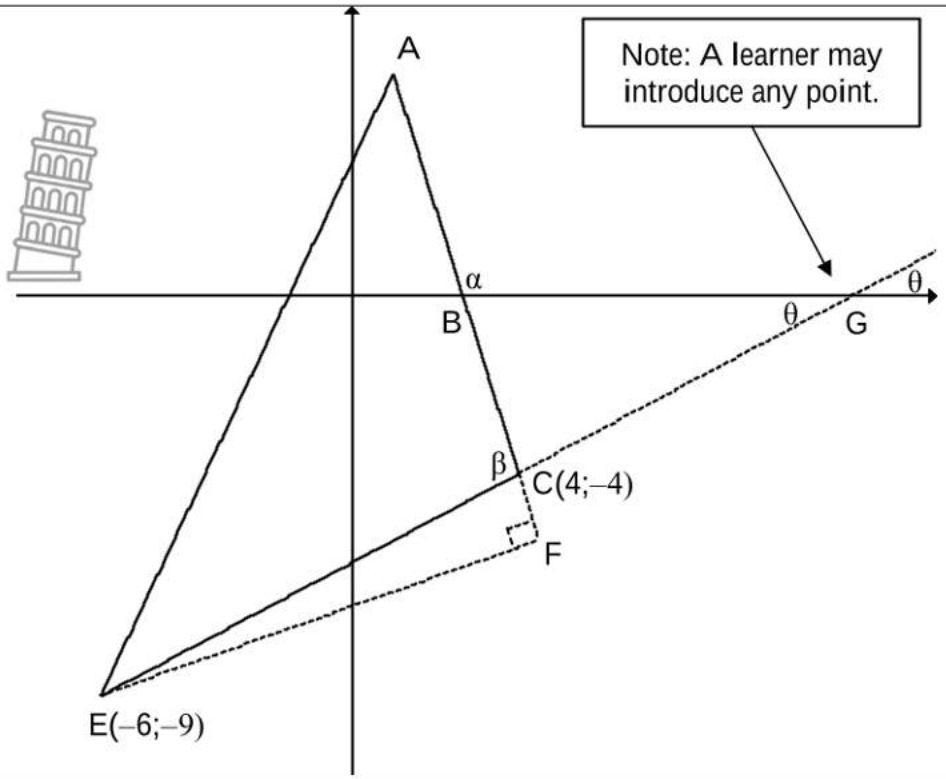
QUESTION 2

2.1	$A = 29 - 6 = 23$ $B = 89 + 74 = 163$	✓ A = 23 ✓ B = 163 (2)
2.2	Estimated mean $= \frac{40630}{250}$ $= 162{,}52$ cm	✓ 40630 ✓ 250 ✓answer (3)
2.3	$160 < x \leq 165$	✓ answer (1)
2.4		✓A all points correctly plotted ✓grounding ✓shape (3)
2.5	Position Q1: $\frac{1}{4}(250) = 63^{rd}$ score Position Q3: $\frac{3}{4}(250) = 188^{th}$ score $Q_1 = 158$ $Q_3 = 167$ $\therefore$ IQR $= 167 - 158$ $= 9$ **Note:** **Q_1 accept 157 – 159** **Q_3 accept 166 – 168** **IQR accept 7, 8, 9, 10 and 11**	✓Q_1 ✓Q_3 ✓answer (3)
		[12]

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QUESTION 3

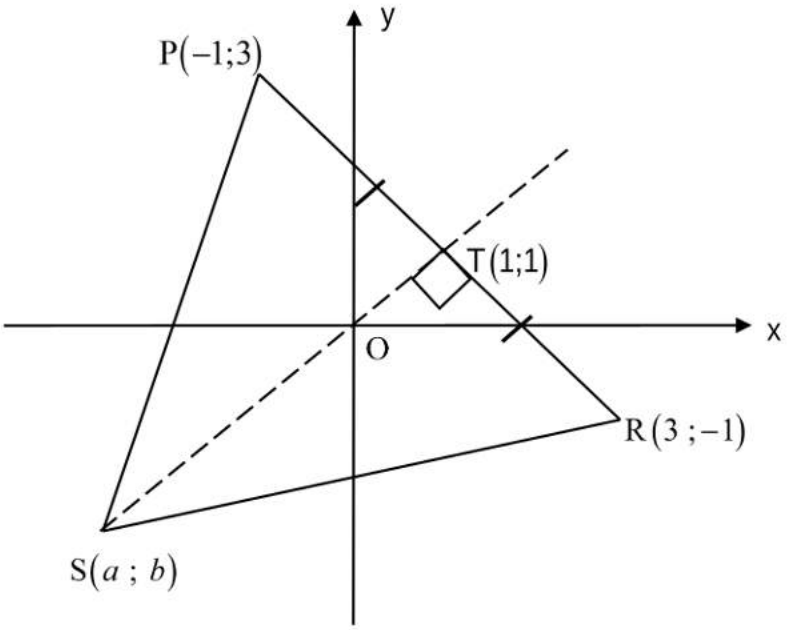


3.1	$y = -3x + 8$ $\therefore m_{AC} = -3$	✓ answer (2)
3.2	$\tan\alpha = m_{AC} = -3$ $\alpha = 180^\circ - 71,57^\circ$ $= 108,43^\circ$	✓ $\tan\alpha = m_{AC}$ ✓answer (2)
3.3	$m_{EC} = \frac{-4-(-9)}{4-(-6)}$ $= \frac{1}{2}$ Let θ be the angle of inclination of EC. $\tan\theta = \frac{1}{2}$ $\theta = 26,57^\circ$ $O\hat{G}C = \theta = 26,57^\circ$ [vertically opp. ∠s] $C\hat{B}G = 180^\circ - \alpha$ [∠s on a straight line] $= 180^\circ - 108,43^\circ = 71,57^\circ$ $\beta = C\hat{B}G + O\hat{G}C = 71,57^\circ + 26,57^\circ$ [ext. ∠ of ΔBCG] $= 98,14^\circ$	✓ substitution ✓ value of m_{EC} ✓ $26,57^\circ$ ✓ $180^\circ - 108,43^\circ = 71,57^\circ$ ✓answer (5)

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3.4	$m_{AC} = -3$ $\therefore m_{EF} = \frac{1}{3}$ [AC ⊥ EF] Equation of EF: $y = \frac{1}{3}x + c$ Substitute E(−6;−9): $-9 = \frac{1}{3}(-6) + c$ $c = -7$ $y = \frac{1}{3}x - 7$	✓ $m_{EF} = \frac{1}{3}$ ✓ substitution ✓ value of c ✓ answer (4)
3.5	To determine coordinates of F: $-3x + 8 = \frac{1}{3}x - 7$ $\frac{10}{3}x = 15$ $x = 4,5$ $y = -3x + 8 = -3(4,5) + 8 = -5,5$ $EF = \sqrt{[4,5-(-6)]^2 + [-5,5-(-9)]^2}$ $= 11,07\text{cm}$	✓ equating the equations of EF and AF ✓ x-coordinate of F ✓ y-coordinate of F ✓ substitution in distance formula ✓ answer (5)
		[18]

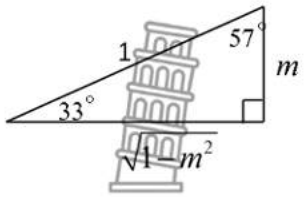
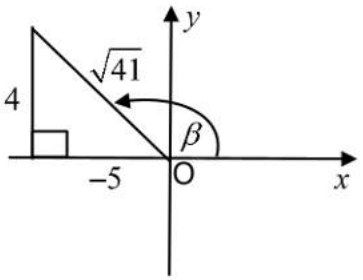
QUESTION 4

		
4.1	$T\left(\frac{3-1}{2};\frac{-1+3}{2}\right)$ $T(1;1)$	✓ substitution in midpt. formula ✓answer (2)

4.2	$m_{PR} = \frac{3+1}{-1-3}$ $= -1$ $\therefore m_{\perp \text{bisector}} = 1$ Subst. $T(1;1)$ and $m = 1$ in $y = mx + c$: $1 = 1 + c$ $c = 0$ $y = x$ $\therefore a = b$	✓ gradient of PR ✓ gradient of $\perp$ bisector ✓ subst. S(a ; b) and m = 1 ✓ $y = x$ (4)
4.3	$PR = \sqrt{(-1-3)^2 + (3+1)^2}$ $= 4\sqrt{2}$ $ST = \sqrt{(a-1)^2 + (b-1)^2}$ But $a = b$, $\therefore ST = \sqrt{(a-1)^2 + (a-1)^2}$ $ST = \sqrt{2(a-1)^2}$ Area $\Delta PSR = 12$ square units $\therefore \frac{1}{2} \times \text{base} \times \text{height} = 12$ $\frac{1}{2} \times PR \times ST = 12$ $\frac{1}{2}\left(4\sqrt{2}\right)\left(\sqrt{2(a-1)^2}\right) = 12$ $\frac{1}{2} \times 4\sqrt{2} \times \sqrt{2} \times \sqrt{(a-1)^2} = 12$ $\sqrt{(a-1)^2} = 3$ $(a-1)^2 = 9$ $a - 1 = \pm 3$ $a = 4$ (N/A) or $a = -2$ $\therefore b = -2$ $\therefore S(-2;-2)$	✓ length of PR ✓length of ST i.t.o. a and b ✓length of ST i.t.o. a (or b) only ✓ $\frac{1}{2} \times \text{base} \times \text{height} = 12$ ✓substitution of PR and ST ✓ values of a and rejection ✓answer (7)
		[13]

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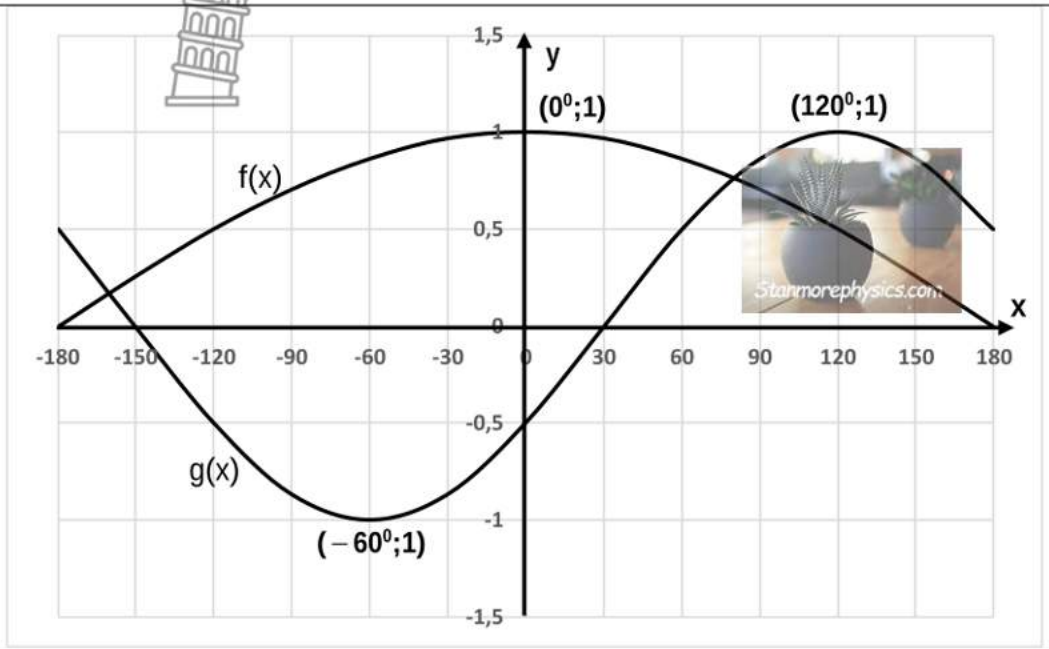
QUESTION 5

5.1.1	 $\tan 33° = \frac{m}{\sqrt{1-m^2}}$	✓ $\sqrt{1-m^2}$ ✓ answer (2)
5.1.2	$\cos 777° = \cos\left[2(360°)+57°\right]$ $= \cos 57°$ $= \sin 33°$ $= m$	✓ $\cos\left[2(360°)+57°\right]$ ✓ $\cos 57°$ ✓ answer (3)
5.1.3	$\sin(-237°) = -\sin 237°$ $= -(-\sin 57°)$ $= \sqrt{1-m^2}$ **OR** $\sin(-237°) = \sin 123°$ $= \sin 57°$ $= \sqrt{1-m^2}$	✓ $-\sin 237°$ ✓ $-\sin 57°$ ✓ answer (3) **OR** ✓ $\sin 123°$ ✓ $\sin 57°$ ✓ answer (3)
5.2.	$4\tan\beta + 5 = 0$ $\tan\beta = -\frac{5}{4}$  $r^2 = x^2 + y^2$ $= (-5)^2 + (4)^2$ $r = \sqrt{41}$ $\sqrt{41}\cos\beta = \frac{\sqrt{41}}{1} \times \frac{-4}{\sqrt{41}}$ $= -4$ Stanmorephysics.com	✓ $\tan\beta = -\frac{5}{4}$ ✓ $r = \sqrt{41}$ ✓ value of $\cos\beta$ ✓ answer (4)

5.3.1	$\frac{\sin(180°-\beta).\cos(90°-\beta)-1}{\cos(-\beta)}$ $=\frac{\sin\beta.\sin\beta-1}{\cos\beta}$ $=\frac{\sin^2\beta-1}{\cos\beta}$ $=\frac{-(1-\sin^2\beta)}{\cos\beta}$ $=\frac{-\cos^2\beta}{\cos\beta}$ $=-\cos\beta$	✓ simplification (numerator) ✓ simplification (denominator) ✓ use of square identity ✓ answer (4)
5.3.2	If $\cos(-\beta)=0$ $\cos\beta=0$ $\beta=90°$ or $\beta=270°$	✓ $\cos(-\beta)=0$ ✓ 90°; ✓ 270° (3)
5.4.1	$\tan\alpha.\sin\alpha+\cos\alpha$ $=\frac{\sin\alpha}{\cos\alpha}.\sin\alpha+\cos\alpha$ $=\frac{\sin^2\alpha}{\cos\alpha}+\cos\alpha$ $=\frac{\sin^2\alpha+\cos^2\alpha}{\cos\alpha}$ $=\frac{1}{\cos\alpha}$	✓ $\frac{\sin\alpha}{\cos\alpha}$ ✓ simplification (2)
5.4.2	$\frac{1}{\cos\alpha}=\frac{3}{\sin\alpha}$ $\sin\alpha=3\cos\alpha$ $\tan\alpha=3$ ref $\angle=\tan^{-1}(3)$ $=71.57°$ $\alpha=71.57°+k.180,\ k\in\mathbb{Z}$	✓ $\frac{1}{\cos\alpha}=\frac{3}{\sin\alpha}$ ✓ $\tan\alpha=3$ ✓ $\alpha=71.57°+k.180°$ ✓ $k\in\mathbb{Z}$ (4)
		[25]

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QUESTION 6

6.1.1	1	✓ answer (1)
6.1.2	period = 720°	✓ answer (1)
6.2		✓ Shape ✓ x &y - intercepts ✓ turning points (3)
6.3	$-180° \le x < -150°$ or $30° \le x < 180°$	✓ $-180° \le x < -150°$ ✓ $30° \le x < 180°$ (2)
6.4	$x = 120°$ or $x = 180°$	✓ 120° ✓ 180° (2)
6.5	$h(x) = \sin(-x - 30°)$ $= -\sin(x + 30°)$	✓ ✓ $\sin(-x - 30°)$ OR $\sin(x + 30°)$ (2)
		[11]

QUESTION 7

7.1	$AC^2 = AB^2 + BC^2 - 2(AB)(BC)\cos\hat{B}$ $15^2 = 11^2 + 6^2 - 2(11)(6)\cos\hat{B}$ $\cos\hat{B} = \frac{11^2 + 6^2 - 15^2}{2(11)(6)}$ $= -\frac{17}{33}$ OR $-0,5151.....$ $\hat{B} = 180° - 58,99°$ $= 121,01°$	✓ applying the cosine rule ✓ substitution ✓ value of $\cos\hat{B}$ ✓ answer (4)

7.2	In ΔQRS: $Q_1 = \hat{QSP} = \theta$ [alt ∠'s =] $\therefore \hat{QSR} = (\alpha + \theta)$ $\frac{SR}{\sin(\alpha+\theta)} = \frac{QS}{\sin\beta}$ $SR = \frac{QS.\sin(\alpha+\theta)}{\sin\beta}$ In ΔQPS: $\cos\theta = \frac{PS}{QS}$ $\cos\theta = \frac{x}{QS}$ $QS = \frac{x}{\cos\theta}$ $\therefore SR = \frac{x}{\cos\theta} \times \frac{\sin(\alpha+\theta)}{\sin\beta}$ $SR = \frac{x\sin(\alpha+\beta)}{\cos\theta\sin\beta}$	✓S ✓substitution in sine rule ✓ $SR = \frac{QS.\sin(\alpha+\theta)}{\sin\beta}$ ✓correct ratio ✓ $QS = \frac{x}{\cos\theta}$ ✓substitution of QS (6)
		[10]

QUESTION 8

8.1	Total surface area $= (\text{length} \times \text{breadth}) + 2(\text{length} \times \text{height}) + 2(\text{breadth} \times \text{height})$ $= (27 \times 24) + 2(27 \times 10) + 2(24 \times 10)$ $= 1668\ cm^2$	✓ formula for surface area ✓ substitution ✓ answer (3)
8.2	$\text{Volume} = \text{length} \times \text{breadth} \times \text{height}$ $4500\,cm^3 = 27\,cm \times 24\,cm \times \text{height}$ $\text{height} = \frac{4500}{24 \times 27}$ $= 6,94\,cm$	✓ formula for volume ✓ substitution ✓ answer (3)
		[6]

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QUESTION 9

9.1	$\hat{C} = 90°$	[∠ in a semi-circle]	✓ S/R
	$\hat{E}_1 = \hat{C} = 90°$	[corr. ∠'s, OE∥BC]	✓ S/R
	$AE = \frac{1}{2}(AC)$	[line from centre ⊥ to chord]	✓ S/R
	$AE = \frac{1}{2}(12)$		
	$AE = 6$ cm		
	In ΔOAE:		
	$OA^2 = AE^2 + OE^2$	[Pythagoras]	✓ S/R
	$10^2 = 6^2 + OE^2$		
	$OE^2 = 64$		
	$OE = 8$ cm		✓S (length of OE)
	$ED = OD - OE$		
	$ED = 10 - 8$		
	$ED = 2$ cm		✓ answer (6)
9.2	$\hat{H} = F\hat{G}J$	[tan-chord-theorem]	✓ S ✓R
	$= x - 5°$		
	$\hat{H} = \hat{F}$	[∠s opposite = sides]	✓ S/R
	$= x - 5°$		
	$\hat{F} + F\hat{G}H + \hat{H} = 180°$	[sum of ∠s of ΔFGH]	✓ S
	$x - 5° + 3x + x - 5° = 180°$		
	$5x = 190°$		
	$x = 38°$		✓ answer (5)
			[11]

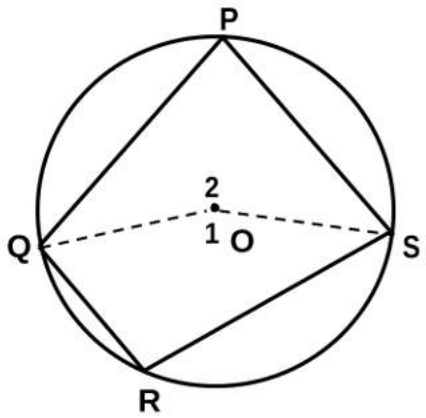
QUESTION 10

10.1.1	$\hat{R}_1 + \hat{R}_2 = 90°$	[radius ⊥ to tangent]	✓ S ✓ R
	$\hat{R}_2 = 40°$		✓ answer (3)
10.1.2	$\hat{S}_1 + \hat{S}_2 = 50°$	[tan chord theorem]	✓ S ✓ R
	$\hat{W} + W\hat{R}S + \hat{S} = 180°$	[sum of ∠s of ΔWSR]	
	$\hat{W} + 90° + 50° = 180°$		
	$\hat{W} = 40°$		✓answer (3)
	OR		**OR**
	$\hat{T}_1 = 90°$	[∠ in semi-circle]	✓ S ✓ R
	$\hat{W} = \hat{T}_1 - \hat{R}_1$	[exterior ∠ of ΔWTR]	
	$= 90° - 50° = 40°$		✓answer (3)

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10.1.3	$\hat{P}_1 = \hat{R}_2 = 40°$	[∠s in the same segment]	✓ S ✓ R (2)
10.2	$\hat{T}_1 = 90°$ $P\hat{T}S = \hat{T}_1 + T_2 = 90° + T_2$ $\hat{V}_1 = W\hat{R}S + \hat{S}_1 = 90° + \hat{S}_1$ But: $\hat{T}_2 = \hat{S}_1$ $\therefore \hat{V}_1 = P\hat{T}S$	[∠ in a semi-circle] [ext ∠ of Δ = sum of int opp ∠s] [∠s in the same segment]	✓ S/R ✓ S/R ✓ S ✓ R (4)
10.3	$\hat{V}_1 = P\hat{T}S$ $\therefore$ WVPT is a cyclic quadrilateral	[converse: exterior ∠ = int opp ∠]	✓ R (1)
			[13]

QUESTION 11

11.1			**Note:** **No construction: $\frac{0}{5}$**
	Construction: Draw OQ and OS		✓ construction
	$\hat{O}_1 = 2\hat{P}$	[∠ @ centre = 2×∠ @ circumf.]	✓ S/R
	$\hat{O}_2 = 2\hat{R}$	[∠ @ centre = 2×∠ @ circumf.]	✓ S
	$\hat{O}_1 + \hat{O}_2 = 360°$	[∠'s around a point]	✓ S/R
	$\therefore 2\hat{P} + 2\hat{R} = 360°$		
	$2(\hat{P} + \hat{R}) = 360°$		✓ S
	$\therefore \hat{P} + \hat{R} = 180°$		(5)
11.2.1	$\hat{B}_3 = \hat{A}_1 = x$	[∠s in the same segment]	✓S
	$\hat{D}_2 = \hat{B}_3 = x$	[∠s opp. = radii]	✓S ✓R
	$\hat{A}_2 = \hat{D}_2 = x$	[∠s in the same segment]	✓S/R (4)
	OR		**OR**
	$\hat{B}_3 = \hat{A}_1 = x$	[∠s in the same segment]	✓S
	$\hat{D}_2 = \hat{B}_3 = x$	[∠s opp. = radii]	✓S ✓R
	$\hat{A}_2 = \hat{A}_1 = x$	[equal chords; equal ∠s]	✓S/R (4)

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11.2.2	$\therefore B\hat{O}D = 180^\circ - 2x$	[sum of ∠s of Δ BOD]	✓S ✓R
	$\hat{C} = \frac{1}{2}B\hat{O}D$	[∠ at centre = 2× ∠ at circumference]	✓R
	$= 90^\circ - x$		✓answer (4)
11.2.3	$\hat{E}_2 = \hat{C} = 90^\circ - x$	[ext. ∠ of cyclic quadrilateral]	✓S ✓R
	$\hat{F}_2 = \hat{E}_2 + \hat{A}_1$	[ext ∠ of Δ FEA]	✓S
	$= (90^\circ - x) + x = 90^\circ$		
	$\therefore \hat{B}_1 = 180^\circ - (\hat{F}_2 + \hat{A}_2)$	[sum of ∠s of Δ BFA]	✓S
	$= 90^\circ - x$		
	$\therefore$ AB = AE	[sides opp. = ∠s]	✓R (5)
	OR		**OR**
	$\hat{E}_2 = \hat{C} = 90^\circ - x$	[ext. ∠ of cyclic quadrilateral]	✓S ✓R
	$\hat{F}_1 = 180^\circ - (\hat{E}_2 + \hat{A}_1)$	[sum of ∠s of Δ EFA]	✓S
	$= 90^\circ$		
	In Δ ABF and Δ AEF:		
	1. BF = FE	[line from centre ⊥ to chord]	✓S/R
	2. AF = AF	[common]	
	3. $\hat{F}_2 = \hat{F}_1$	[∠s on a straight line]	
	$\therefore \Delta ABF \equiv \Delta AEF$	[s ; ∠ ; s]	
	$\therefore$ AB = AE	[$\equiv \Delta$s]	✓R (5)
11.2.4	$\hat{B}_1 + \hat{B}_3 = (90^\circ - x) + x = 90^\circ$		✓✓showing that $O\hat{B}A > 90^\circ$
	$\therefore O\hat{B}A = \hat{B}_1 + \hat{B}_2 + \hat{B}_3 = 90^\circ + \hat{B}_2 > 90^\circ$		
	For AB to be a tangent to circle BCDE, $O\hat{B}A$ should be equal to 90°. [converse: tangent ⊥ radius]		✓For AB to be a tangent, $O\hat{B}A$ should be = 90°
	$\therefore$ AB is not a tangent to circle BCDE.		(3)
	OR		**OR**
	For AB to be a tangent to circle BCDE, $D\hat{B}A$ should be equal to $\hat{C} = 90^\circ - x$ [converse: tan-chord-theorem].		✓ AB will be a tangent if $D\hat{B}A = \hat{C} = 90^\circ - x$
	But: $D\hat{B}A = \hat{B}_1 + \hat{B}_2$		
	$= 90^\circ - x + \hat{B}_2$		
	$= \hat{C} + \hat{B}_2$		✓✓showing that $D\hat{B}A > \hat{C}$
	$\therefore D\hat{B}A > \hat{C}$		
	$\therefore$ AB is not a tangent to circle BCDE.		(3)
			[21]

TOTAL: 150

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