GAUTENG PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

PROVINCIAL EXAMINATION

NOVEMBER 2022

GRADE 11

MARKING GUIDELINES

MATHEMATICS (PAPER 2)

22 pages

MARKING GUIDELINES	MATHEMATICS (PAPER 2) GRADE 11

INSTRUCTIONS AND INFORMATION

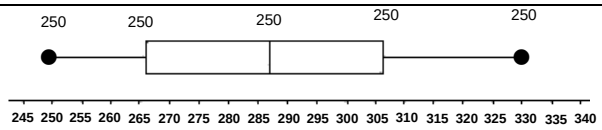
- **A** – ACCURACY
- **CA** – CONSISTENT ACCURACY
- **S** – STATEMENT
- **R** – REASON
- **S/R** – STATEMENT with REASON

NOTES:

- If a candidate answered a question TWICE, mark only the first attempt.
- If a candidate crossed OUT an answer and did not redo it, mark the crossed-out answer.
- Consistent accuracy applies to ALL aspects of the marking guidelines.
- Assuming values/answers in order to solve a question is UNACCEPTABLE.

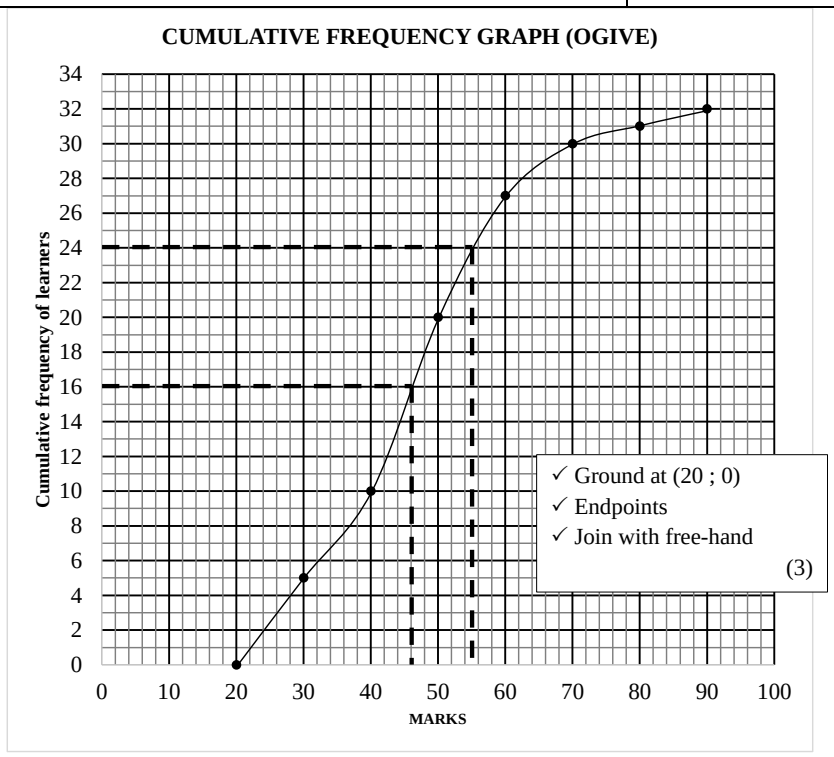
MARKING GUIDELINES	MATHEMATICS (PAPER 2) GRADE 11

QUESTION 1

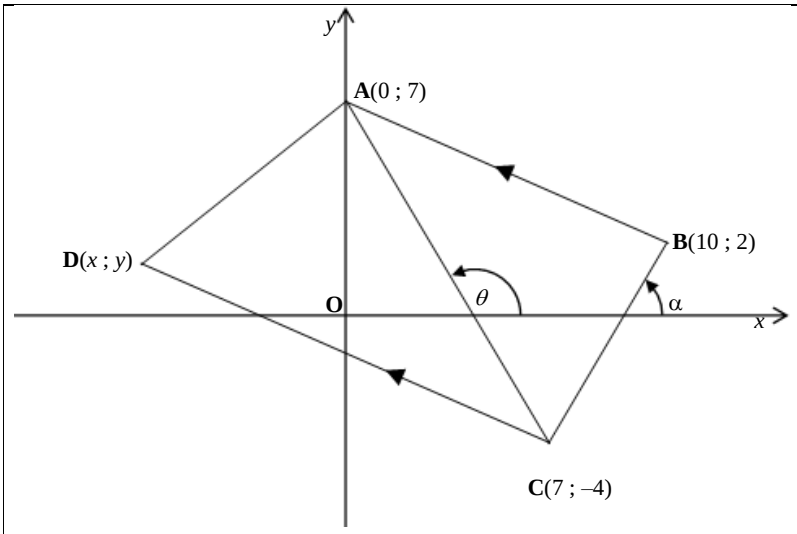
1.1		✓ Box (Q1 and Q3) ✓ Whiskers (Min. and Max.) ✓ Median	(3)
1.2	The data is distributed symmetrically, a normal distribution. **OR** The date is slightly skewed to the right.	✓ Explanation	(1)
1.3	$\sigma = 23{,}77$	✓✓ σ	(2)
1.4	$(\bar{x} - \sigma\,;\, \bar{x} + \sigma)$ $= (287 - 23{,}77\,;\, 287 + 23{,}77)$ $= (263{,}23\,;\, 310{,}77)$ $\therefore$ 6 municipalities are within one standard deviation.	✓ $\bar{x} = 287$ ✓ Interval ✓ 6	(3)
1.5	S-IQR $= \frac{1}{2}(Q_3 - Q_1)$ $= \frac{1}{2}(306 - 266)$ $= 20$	✓ $Q_3 - Q_1$ ✓ $\frac{1}{2}\times$ ✓ Answer	(3)
			[12]

Commented [BK1]: Wrong values on Box and Whisker

QUESTION 2

2.1	$p = 5$ $q = 27$ $r = 1$	✓ p ✓ q ✓ r	(3)
2.2			
2.3	M = 46	✓✓ M = 46(± 2)	(2)
2.4	32 – 24 = 8 ∴ 8 learners achieved a mark of greater than 55.	✓ $CF = 24(\pm 1)$ ✓ $32 - CF$	(2)
			[10]

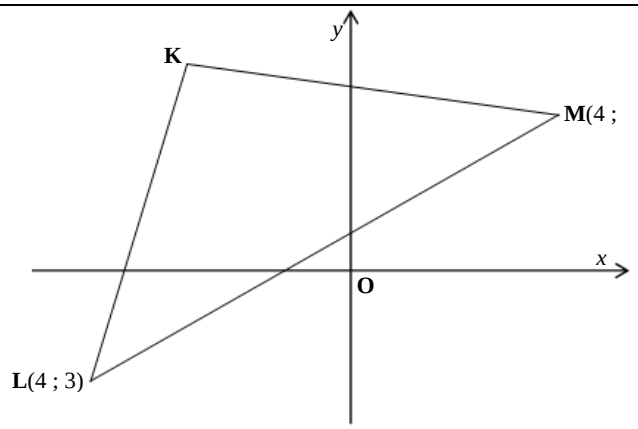
QUESTION 3



3.1	AB = $\sqrt{(0-10)^2+(7-2)^2}$ AB = $\sqrt{125}$ AB = $5\sqrt{5}$	✓ Substitute into correct formula ✓ AB ✓ Simplified surd	(3)
3.2	$m_{AC} = \frac{7-(-4)}{0-7}$ $m_{AC} = -\frac{11}{7}$	✓ Gradient substitute ✓ m_{AC}	(2)
3.3	$\tan\theta = -\frac{11}{7}$ $RA = 57{,}528\ldots°$ $\theta = 180° - 57{,}528\ldots°$ $\theta = 122{,}47°$	✓ Angle of inclination substitute (CA 4.2) ✓ RA ✓ θ (subtract RA from 180°)	(3)

3.4	$\tan \alpha = 2$	α	
	$\alpha = 63{,}434\ldots°$	$A\hat{C}B$	
	$A\hat{C}B = 122{,}47° - 63{,}434\ldots°$	$C\hat{A}B$	
	$A\hat{C}B = 59{,}04°$	$B\hat{C}D$	
	$m_{AB} = \frac{1}{2}$		
	$C\hat{A}B = 180° - \tan^{-1}\left(\frac{1}{2}\right) - 122{,}74°$		
	$C\hat{A}B = 30{,}69°$		
	$A\hat{C}D = 30{,}69°$ [alt ∠'s, AB ∥ CD]		
	$B\hat{C}D = 30{,}69° + 59\ 04°$		
	$B\hat{C}D = 89{,}73°$		
	OR	**OR**	
	IF θ is not rounded		
	$\tan \alpha = 2$	✓ α	
	$\alpha = 63{,}434\ldots°$	✓ $A\hat{C}B$	
	$A\hat{C}B = 122{,}4711\ldots° - 63{,}434\ldots°$	✓ $C\hat{A}B$	
	$A\hat{C}B = 59{,}036\ldots°$	✓ $B\hat{C}D$	
	$m_{AB} = \frac{1}{2}$		
	$C\hat{A}B = 180° - \tan^{-1}\left(\frac{1}{2}\right) - 122{,}74\ldots°$		
	$C\hat{A}B = 30{,}963°$		
	$A\hat{C}D = 30{,}963°$ [alt ∠'s, AB || CD]		
	$B\hat{C}D = 30{,}963° + 59\ 036\ldots°$		
	$B\hat{C}D = 90°$		(4)
			[12]

QUESTION 4



4.1	$y = 5x + 9$ and $y = 5(-1) + 9$ $y = 5$ $\therefore$ K(–1 ; 4)		$5y + x - 19 = 0$ $5(5x + 9) + x = 19$ $26x = -26$ $x = -1$	✓ Sub y ✓ Solve for x ✓ Sub x back NO MARK for coordinates (given)	(3)
4.2	$m_{KL} = 5$ and $\therefore\ m_{KL} \times m_{KM} = -1$ KL $\perp$ KM $\therefore$ L$\hat{K}$M = 90°		$m_{KM} = -\frac{1}{5}$	✓ m_{KL} ✓ m_{KL} ✓ Definition of perpendicular gradients	(3)

4.3	KL = $\sqrt{((-1-(-2))^2+(4-(-1))^2}$ KL = $\sqrt{26}$ KN = $\sqrt{(-1-4)^2+(4-3)^2}$ KN = $\sqrt{26}$ Area ΔKML = $\frac{1}{2}\left(\sqrt{26}\right)\left(\sqrt{26}\right)$ Area ΔKML = 13 units^2	✓ KL length ✓ KN length ✓ Sub Area formula ✓ Area ΔKML	(4)
4.4	$M\left(\frac{-2+4}{2};\frac{3+(-1)}{2}\right)$ $M(1\ ;\ 1)$ $m_{NL} = \frac{3-(-1)}{4-(-2)}$ $m_{NL} = \frac{2}{3}$ $y-y_1 = -\frac{2}{3}(x-x_1)$ $y-1 = -\frac{2}{3}(x-1)$ $y = -\frac{2}{3}x+\frac{5}{2}$	✓ Midpoint of NL ✓ Gradient of NL ✓ Perpendicular gradient ✓ Substitute Midpoint ✓ Equation	(5)
4.5	$m_{NL} = m_{NP} = m_{LP}$ $\frac{2}{3} = \frac{y-3}{7-4}$ $y = 5$	✓ Definition of collinear ✓ Sub P(7 ; y)	(2)

Commented [BK2]: KL not ML

4.6	Q(3 ; –2)		✓ x_Q ✓ y_Q	(2)
4.7	$\hat{K}$ = 90°	[proven in 4.1]	✓ Interior angle of 90°	
	KL = KN = $\sqrt{26}$	[proven in 4.2]	✓ Adjacent sides equal	
	∴ KLQN is a square	[a parallelogram with an interior ∠ of 90° and adjacent sides equal]		(2)
				[21]

QUESTION 5

5.1	$\frac{\tan(180°-x)\cos(360°+x)}{2\cos(90°+x)}$	✓ – tan x	
	$= \frac{-\tan x.\cos x}{-2\sin x}$	✓ cos x ✓ –2 sin x	
	$= \frac{-\frac{\sin x}{\cos x}.\cos x}{-2\sin x}$	✓ – tan x identity	
	$= \frac{-\sin x}{-2\sin x}$	✓ simplify	
	$= \frac{1}{2}$	✓ answer	(6)
5.2	5.2.1 LHS = $\frac{\sin\theta - 2\sin\theta\cos\theta}{2\cos^2\theta + \cos\theta - 1}$	✓ sin θ(1–2 cosθ) ✓ (2cosθ – 1)(cosθ + 1)	
	$= \frac{\sin\theta(1-2\cos\theta)}{(2\cos\theta-1)(\cos\theta+1)}$	✓ Sign change/negative factor	
	$= \frac{-\sin\theta(2\cos\theta-1)}{(2\cos\theta-1)(\cos\theta+1)}$	✓ Simplify *with* conclusion	
	$= \frac{-\sin\theta}{\cos\theta+1}$		
	= RHS		(4)

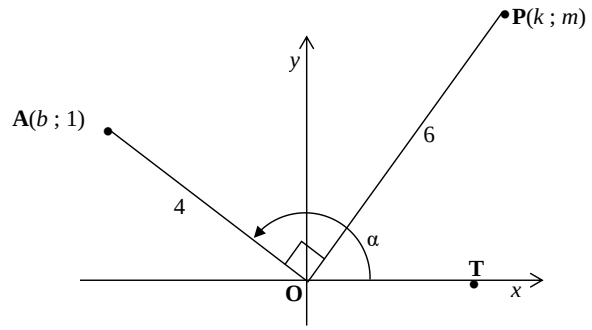
	5.2.2	Undefined when $2\cos\theta - 1 = 0$ $\cos\theta = \frac{1}{2}$ RA = 60° QI : $\theta = 60° + k.360°$; $k \in Z$ QIV : $\theta = 300° + k.360°$ **OR** when $\cos\theta = -1$ $\theta = 180° + k.360°$; $k \in Z$ **NOTE: Accept other equivalent general solutions.** $\cos\theta - 1$ $\theta = 180° + k.360°$; $k \in Z$	✓ $2\cos\theta - 1 = 0$ ✓ QI general solution ✓ QII general solution ✓ $k \in Z$ ✓ $\cos\theta = -1$ general solution	(5)

Commented [BK3]: QIV not QII

Commented [BK4]: K element of integers Z

Commented [BK5]: equation

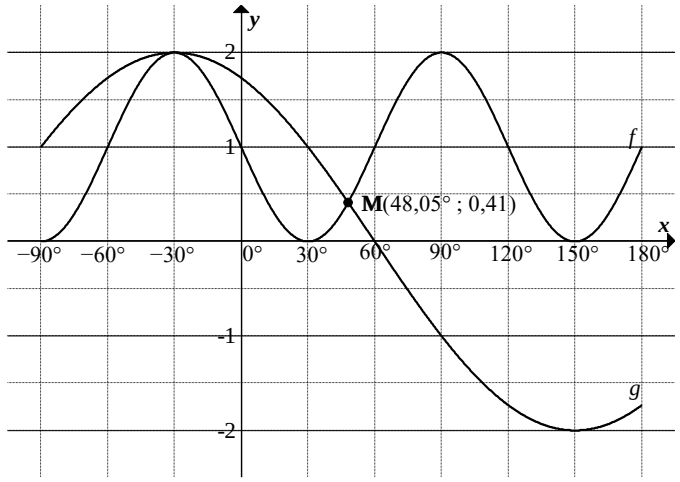
5.3



	5.3.1		$b^2 + 1^2 = 4^2$ $b = \pm\sqrt{15}$ $b = -\sqrt{15}$ (QII)	✓ Pythagoras substitution ✓ $b = -\sqrt{15}$	(2)
	5.3.2	(a)	$\tan\alpha = -\frac{1}{\sqrt{15}}$	✓ $\frac{y}{x}$ ✓ CA x	(2)
		(b)	$\sin(-\alpha - 180°) + \cos(-\alpha)$ $= \sin\alpha + \cos\alpha$ $= \left(\frac{1}{4}\right) + \left(\frac{-\sqrt{15}}{4}\right)$ $= \left(\frac{1-\sqrt{15}}{4}\right)$	✓ $\sin\alpha$ ✓ $\cos\alpha$ ✓ Substitute x ; y and r	(3)

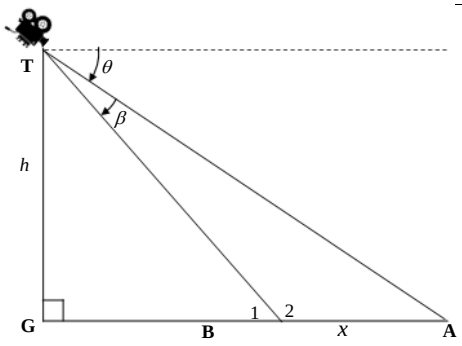
	5.3.3	$\cos(\alpha - 90) = \frac{k}{6}$	$\sin(\alpha - 90) = \frac{m}{6}$	✓ $\cos(\alpha - 90) = \frac{k}{6}$	
		$\sin\alpha = \frac{k}{6}$	$-\cos\alpha = \frac{m}{6}$	✓ $\sin(\alpha - 90) = \frac{m}{6}$	
		$\therefore \frac{k}{6} = \frac{1}{4}$	$\cos\alpha = -\frac{m}{6}$	✓ Complementary reductions	
		$\therefore k = \frac{3}{2}$	$\therefore \frac{m}{6} = \left(\frac{-\sqrt{15}}{4}\right)$	✓ Equate ratios	
			$\therefore m = \frac{3\sqrt{15}}{2}$	✓ Values of k and m	
		OR		**OR**	
		P lies in QI, therefore both k and m are positive		✓ P in QI	
		A 90º rotation means $(x\ ;\ y) \rightarrow (y\ ;\ x)$		✓ $(x\ ;\ y) \rightarrow (y\ ;\ x)$ idea	
		$\frac{r_2}{r_1}$		✓ Ratio of radii	
		$\frac{6}{4}$		✓ Apply scale to x and y	
		$\frac{3}{2}$		✓ Values of k and m	
		$\therefore P\left(\frac{3}{2}.1; \frac{3}{2}.\sqrt{15}\right) = P(k\ ;\ m)$		**Do NOT award full marks for answer only.**	
		$\therefore k = \frac{3}{2}$ and $m = \frac{3\sqrt{15}}{2}$			(5)
					[27]

QUESTION 6



6.1	A = 2		✓ Answer	(1)
6.2	120º		✓ Answer	(1)
6.3	$a = -1$ $b = 3$ $p = 30°$		✓ a ✓ b ✓ p	(3)
6.4	6.4.1	$-90° \leq x < 60°$	✓ Interval	(1)
	6.4.2	$x = -30°$ or $48{,}05° \leq x \leq 180°$	✓ Interval ✓ $x = -30°$	(2)
	6.4.3	$60° < x < 150°$ or $150° < x \leq 180°$	✓ 60º and 180º ✓ Not incl. 150º but incl. 180º	(2)
6.5	$t = -30° + k.\,360°$; $k \in$		✓✓ $t = -30°$ ✓ $k.\,360°$	(3)
				[13]

QUESTION 7

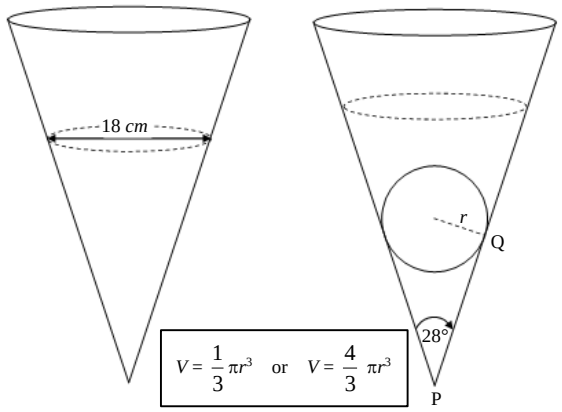


7.1	$\hat{B}_1 = \theta = \beta$	✓ Answer	(1)
7.2	In ΔTBG $\sin(\theta+\beta) = \frac{h}{BT}$ $BT = \frac{h}{\sin(\theta+\beta)}$ In ΔABT $\hat{A} = \theta$ $\frac{x}{\sin\beta} = \frac{BT}{\sin\theta}$ $\frac{x}{\sin\beta} = \frac{h}{\sin(\theta+\beta)\sin\theta}$ $x = \frac{h\sin\beta}{\sin(\theta+\beta)\sin\theta}$	✓ Correct ratio in ΔTBG ✓ BT ✓ Sine rule substitution ✓ BT substitution ✓ simplification	(5)
7.3	$x = \frac{h\sin\beta}{\sin(\theta+\beta)\sin\theta}$ $x = \frac{20\sin 37°}{\sin(65°+37°)\sin 65°}$ $x = 13{,}58\ m$ The cat travelled 13,58 *m*	✓ Substitution ✓ Answer	(2)
			[8]

Commented [BK6]: Not = but +

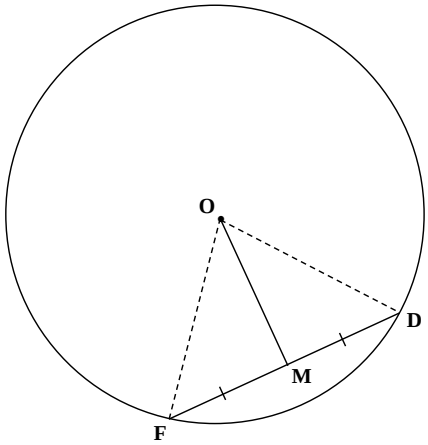
QUESTION 8

FIGURE A **FIGURE B**



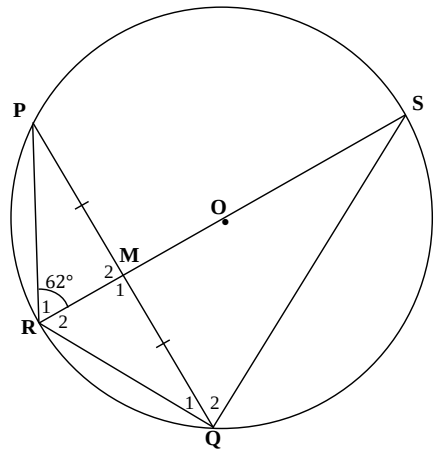
8.1	$V = \frac{1}{3}\pi(9)^3$ $V = 763{,}41 cm^3$	✓ Substitution ($r = 9$) ✓ Answer	(2)
8.2	$V = \frac{4}{3}\pi r$ $268.08 = \frac{4}{3}\pi r$ $\sqrt[3]{\frac{3 \times 286{,}08}{4\pi}} = r$ $r = 4$ $\tan 14° = \frac{4}{PQ}$ $PQ = \frac{4}{\tan 14°}$ $PQ = 16{,}04\ cm$	✓ Substitute volume into correct formula ✓ Subject of the formula ✓ r ✓ $\tan 14°$ ✓ PQ	(5)
			[7]

QUESTION 9

9.1		✓ Construction	
	Construction: ***Join OF and OD***		
	In ΔOFM and ΔODM		
	i. FM = MD **[GIVEN]**		
	ii. OM is a common side		
	iii. OF = OD **[*Radii*]**		
	∴ ΔOFM ≡ ΔODM **[*SSS*]**	✓ R	
	$\hat{M}_1 = \hat{M}_2$ [ΔOFM ≡ ΔODM]	✓ R	
	But $\hat{M}_1 = \hat{M}_2 = 180°$ [∠'s on a straight line]	✓ S	
	∴ $\hat{M}_1 = \hat{M}_2 = 90°$		
	∴ OM ⊥ FD		(4)

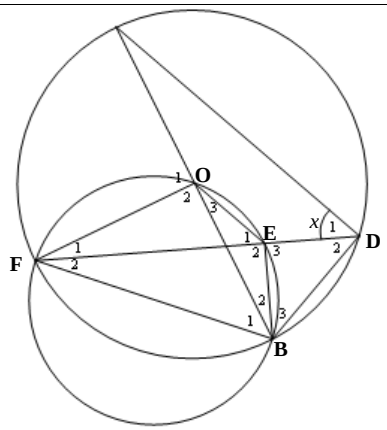
Commented [BK7]: + not =

9.2



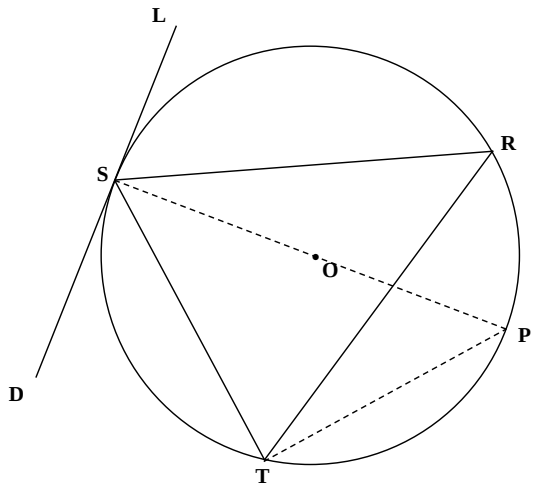
	9.2.1	$\hat{M}_2 = 90°$ [line from centre to midpoint of chord]	✓ S ✓ R	(2)
	9.2.2	$\hat{Q}_1 + \hat{Q}_2 = 90°$ [∠'s in a semi-circle]	✓ S ✓ R	(2)
	9.2.3	$\hat{P} = 28°$ [int ∠'s of a Δ]	✓ S/R	
		$\hat{S} = \hat{P} = 28°$ [∠'s in the same segment]	✓ R	(2)
				[10]

QUESTION 10



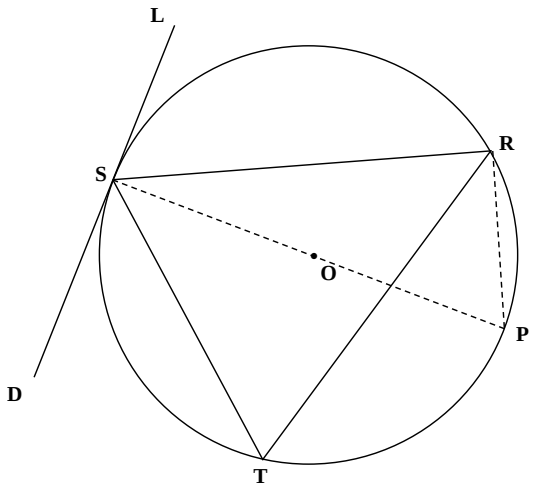
10.1	$\hat{B}_1 = \hat{D}_1 = x$	[∠'s in the same segment]	✓ S	
	$\hat{B}_1 = \hat{E}_1 = x$	[∠'s in the same segment]	✓ S	(2)
10.2	10.2.1 $\hat{O}_1 = 2x$	[∠ at centre = 2 × ∠ at the circumf]	✓ S ✓ R	(2)
	10.2.2 $\hat{O}_1 = O\hat{F}B + \hat{B}_1$	[ext ∠ of Δ]	✓ R	
	$2x = O\hat{F}B + x$		✓ $O\hat{F}B = x$	
	$O\hat{F}B = x$			(2)
	10.2.3 $\hat{D}_2 = 90° - x$	[∠'s in a semi circle]	✓ S ✓ R	(2)
	10.2.4 $\hat{O}_2 = 180° - 2x$	[∠'s on a strt line]	✓ S ✓ R	
	$\hat{O}_2 = \hat{E}_2 = 180° - 2x$	[∠'s in the same segment]	✓ S ✓ R	(4)
10.3	$\hat{E}_2 = \hat{B}_3 + \hat{D}_2$	[ext ∠ of Δ]	✓ R	
	$\therefore \hat{B}_3 = 90° - x$		✓ $\hat{B}_3 = 90° - x$	
	$\therefore \hat{B}_3 = \hat{D}_2$	[both $90° - x$]	✓ S	
	∴ EB = ED	[sides opp equal ∠s]	✓ R	(4)
				[16]

QUESTION 11



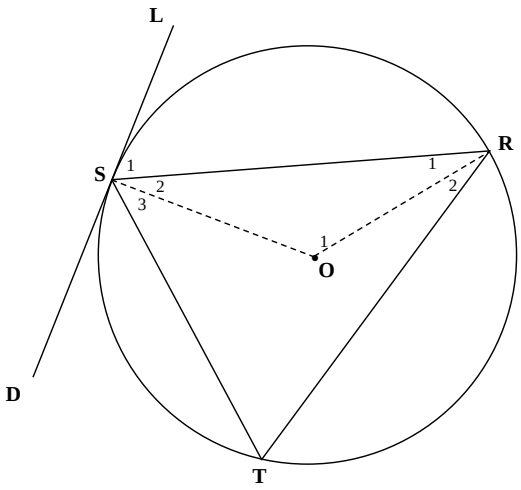
11.1	Construction: Draw diameter SP and join PT		✓ Construction
	$L\hat{S}R = 90° - R\hat{S}P$	[tan ⊥ rad]	✓ S ✓ R
	$S\hat{T}R = 90° - R\hat{T}P$	[∠'s in a semi circle]	✓ S ✓ R
	$R\hat{S}P = R\hat{T}P$	[∠'s in the same segment]	
	$\therefore L\hat{S}R = S\hat{T}R$		✓ S ✓ R

OR



	Construction: Draw diameter SP and join PR		✓ Construction	
	$L\hat{S}R = 90° - R\hat{S}P$	[tan ⊥ rad]	✓ S/R	
	$S\hat{R}P = 90°$	[∠'s in a semi circle]	✓ S ✓ R	
	$S\hat{P}R = 90° - R\hat{S}P$	[int ∠'s of Δ]		
	$L\hat{S}R = S\hat{P}R$	[both $90° - R\hat{S}P$]	✓ S	
	$S\hat{P}R = S\hat{T}R$	[∠'s in the same segment]	✓ S/R	
	$\therefore L\hat{S}R = S\hat{T}R$			

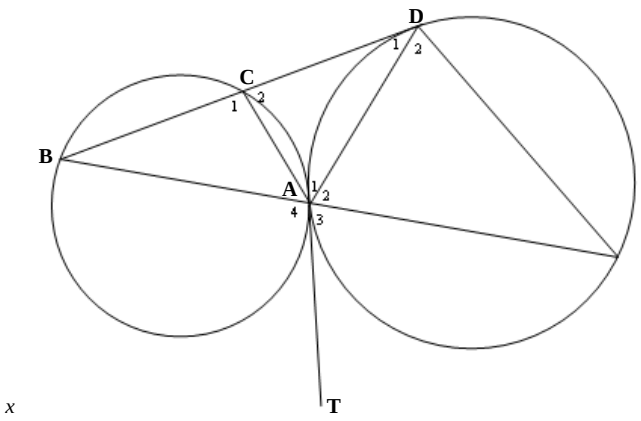
OR



	Construction: Join OS and OR		✓ Construction	
	$\hat{S}_1 + \hat{S}_2 = 90°$	[tan ⊥ radius]	✓ S ✓ R	
	$\hat{S}_2 = 90° - \hat{S}_1$			
	$\hat{R}_1 = \hat{S}_2 = 90° - \hat{S}_1$	[∠'s opp equal radii]	✓ S/R	
	$\hat{O}_1 = 180° - 2[90° - \hat{S}_1] = 2\hat{S}_1$	[int ∠'s of Δ]	✓ S	
	$\hat{O}_1 = \hat{S}_1$	[at centre = 2 × ∠ at circumf]	✓ S ✓ R	
	∴ $L\hat{S}R = S\hat{T}R$			(6)

Commented [BK8]: Not S but 2T

11.2



	11.2.1	tan chord theorem	✓ R	(1)
	11.2.2	$\hat{A}_4 = 180° - \hat{A}_3$ [∠'s strt line]	✓ SR	
		$\hat{C}_1 = 180° - \hat{A}_3$ [tan chord theorem]	✓ S ✓ R	
		$\hat{C}_2 = \hat{A}_3$ [∠'s strt line]	✓ SR	
		$\hat{D}_2 = \hat{A}_3$ [tan chord theorem]	✓ SR	
		$\therefore \hat{C}_2 = \hat{D}_2$ [both equal $\hat{A}_3$]	✓ S	
		$\hat{D}_1 = \hat{F}$ [tan chord theorem/proven in 11.2.1]	✓ R	
		$\hat{A}_1 = \hat{A}_2$ [int ∠'s in Δ/3rd ∠ in Δ]		(7)
				[14]
			TOTAL:	**150**