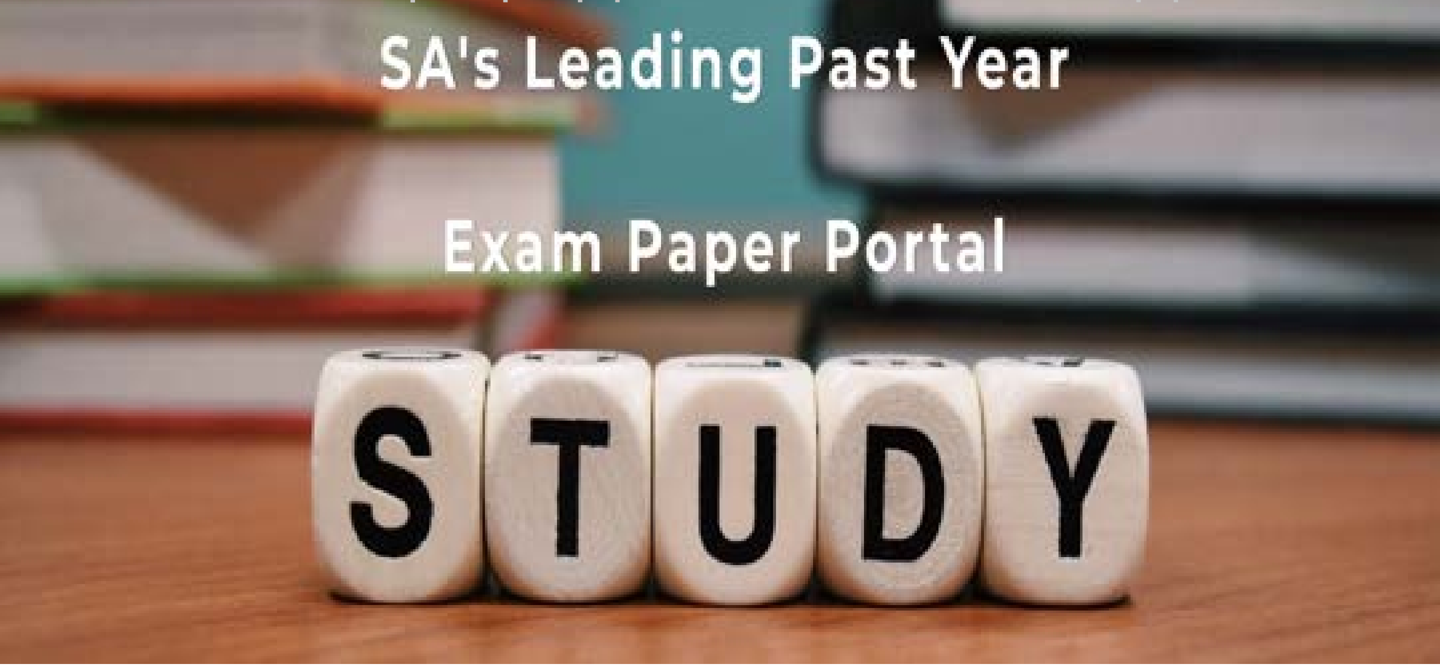
SA's Leading Past Year
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STUDY

KWAZULU-NATAL PROVINCE

EDUCATION
REPUBLIC OF SOUTH AFRICA

MATHEMATICS P2

JUNE 2025 EXAMINATION

MARKING GUIDELINES

NATIONAL SENIOR CERTIFICATE

GRADE 12

MARKS: 150

These marking guidelines consist of 13 pages.

Marking Guideline

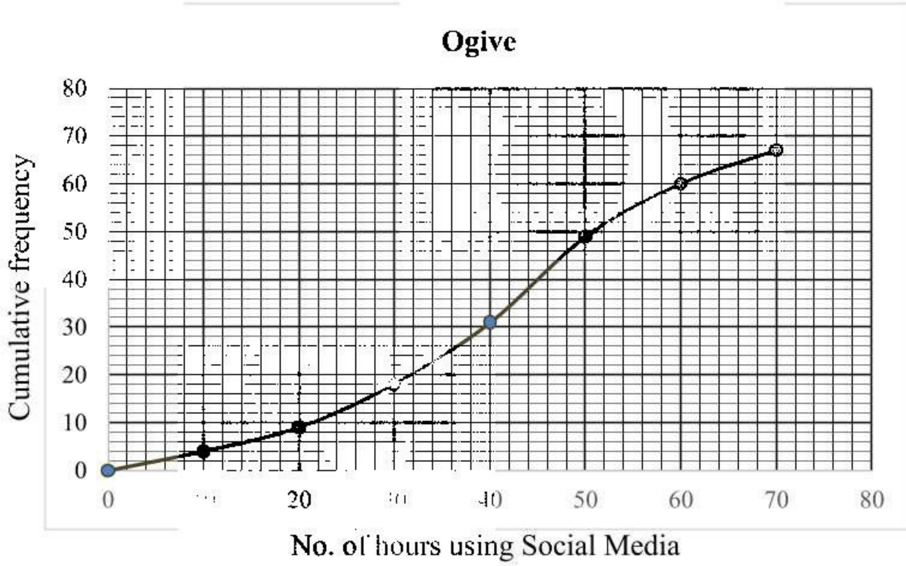
QUESTION 1

1.1	8 learners	✓A answer (1)
1.2	Skewed to the right **OR** positively skewed	✓A answer (1)
1.3	$\text{Range} = 125 - 34$ $= 91$ Answer only: Full marks	✓A $125-34$ ✓A answer (2)
1.4.1	$\text{median} = 65$ OR the value does not change	✓A answer (1)
1.4.2	Total of learners' marks = $71,75 \times 32 = 2296$ New total of learners' marks = $2296 + (142-125) = 2313$ New mean $= \frac{2313}{32} = 72,28$	✓A $71,75 \times 32 = 2296$ ✓CA new total of learners' marks ✓CA answer (3)
		[8]

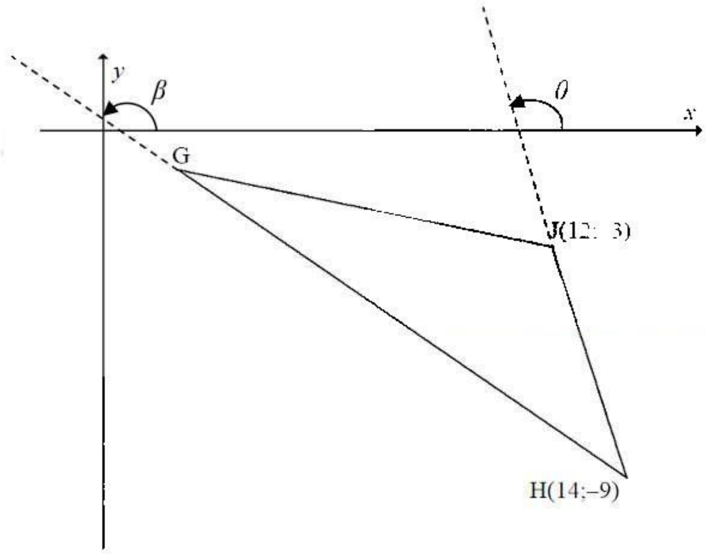
QUESTION 2

2.1	67	✓A answer (1)
2.2	$40 \leq x < 50$	✓A answer (1)
2.3	$\bar{x} = \frac{5\times4+15\times5+25\times9+35\times13+45\times18+55\times11+65\times7}{67}$ $\bar{x} = \frac{2645}{67}$ $= 39,48$ Answer only: Full marks	✓A numerator ✓CA denominator ✓CA answer (3)
2.4	(see table below)	✓A 9; 18; 31 ✓CA 49; 60; 67 (2)

NUMBER OF HOURS ON SOCIAL MEDIA	FREQUENCY	CUMULATIVE FREQUENCY
$0 \leq x < 10$	4	4
$10 \leq x < 20$	5	9
$20 \leq x < 30$	9	18
$30 \leq x < 40$	13	31
$40 \leq x < 50$	18	49
$50 \leq x < 60$	11	60
$60 \leq x < 70$	7	67
TOTAL	67	

2.5		✓A plotting all points correctly (at upper limits) ✓CA shape of an ogive ✓A grounding at (0 ; 0) (3)
2.6	Between 14 and 28 hours per week No. of teenagers $= 16 - 6$ $= 10$	✓CA 16 (accept: 15 to 17) ✓CA 6 (accept 5 to 7) ✓CA answer (3)
		[13]

QUESTION 3



3.1.1	$m_{JH}=\dfrac{-3-(-9)}{12-14}$ $=-3$ $\tan\theta=m_{JH}=-3$ $\therefore\theta=180°-71,57°=108,43°$	✓A substitution in gradient formula ✓CA gradient of JH ✓CA $\tan\theta=-3$ ✓CA answer (4)
3.1.2	$m_{GH}=\dfrac{-2}{3}=\tan\beta$ $\therefore\beta=180°-33,69°=146,31°$ $\hat{H}=146,31°-108,43°$ $=37,88°$	✓A $\tan\beta=\dfrac{-2}{3}$ ✓A $\beta=146,31°$ ✓CA answer (3)
3.2.1	$M(-4;5)$	✓A x-value ✓A y-value (2)
3.2.2	AC is a diameter, ∴ CM is a radius $CM=\sqrt{(-3-(-4))^2+(9-5)^2}$ $=\sqrt{17}$ **OR** AC is a diameter, ∴ AM is a radius $AM=\sqrt{(-5-(-4))^2+(1-5)^2}$ $=\sqrt{17}$ **OR** AC is a diameter $AC=\sqrt{(-3-(-5))^2+(9-1)^2}$ $=2\sqrt{17}$ $\therefore$ radius $=\sqrt{17}$ Don't penalise if it is not written that AC is the diameter, but it is used.	✓A identifying AC as diameter ✓CA substitution ✓CA answer (3) **OR** ✓A identifying AC as diameter ✓CA substitution ✓CA answer (3) **OR** ✓A identifying AC as diameter ✓A substitution ✓CA answer (3)

3.2.3	$m_{AD} \times m_{CD} = -1$ $\frac{1-y}{-5-0} \times \frac{9-y}{-3-0} = -1$ $(1-y)(9-y) = -15$ $y^2 - 10y + 24 = 0$ $(y-6)(y-4) = 0$ $y = 6$ or $y = 4$ $D(0;6)$	✓A $m_{AD} \times m_{CD} = -1$ ✓A substitution ✓CA standard form ✓CA factors ✓CA answer (5)
3.2.4	$B(0;4)$	✓✓CA answer (2)
		[19]

QUESTION 4

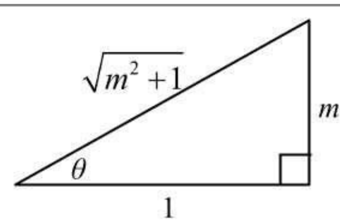
4.1.1	Equation of diameter (radius): $y = -\frac{3}{4}x - \frac{7}{4}$ $\therefore m_{radius} = -\frac{3}{4}$ $\therefore m_{tangent} = \frac{4}{3}$ Equation of tangent: $y = \frac{4}{3}x + c$ Substitute $(-1;-1)$: $-1 = \frac{4}{3}(-1) + c$ $c = \frac{1}{3}$ $\therefore y = \frac{4}{3}x + \frac{1}{3}$	✓A gradient of radius ✓CA gradient of tangent ✓CA substitution of m and point ✓CA answer (4)
4.1.2	y-coordinate of C = y-coordinate of A = 2 For x-coordinate of C, substitute $y = 2$ into $3x + 4y + 7 = 0$: $3x + 4(2) + 7 = 0$ $x = -5$ $\therefore C(-5;2)$ $r^2 = [-5-(-1)]^2 + [2-(-1)]^2 = 25$ Equation of the circle: $(x-a)^2 + (y-b)^2 = r^2$ $(x+5)^2 + (y-2)^2 = 25$	✓A y – coordinate of C ✓A substitution in $3x + 4y + 7 = 0$ ✓A x – coordinate of C ✓CA calculation of r^2 ✓CA answer (5)
4.1.3	Vertical distance from B to $y = 2$: 3 units Vertical distance from B′ to $y = 2$: 3 units $\therefore$ B′ is 6 units higher than B. Image of B: $(-1;5)$	✓A x-coordinate ✓A y-coordinate (2)

4.2.1	$x^2-4x+y^2+6y-51=0$ $(x-2)^2+(y+3)^2=51+4+9$ $(x-2)^2+(y+3)^2=64$ centre: $(2\,;-3)$ radius $=8$ units	✓A LHS of equation ✓A RHS of equation ✓CA coordinates of centre ✓CA length of radius (4)
4.2.2	Coordinates of centre of $x^2+y^2=r^2$: $(0\,;0)$ Distance between centres of two circles $=\sqrt{(2-0)^2+(-3-0)^2}$ $=\sqrt{13}$ When touching internally: Distance between centres = radius of circle$_1$ − radius of circle$_2$ $\sqrt{13}=8-r$ $r=8-\sqrt{13}$ $=4,39$ units	✓A substitution ✓CA distance between centres ✓CA $\sqrt{13}=8-r$ ✓CA answer (4)
		[19]

QUESTION 5

5.1.1 (a)	$y^2=r^2-x^2$ [Pythagoras] $=(\sqrt{13})^2-(-2)^2$ $=9$ $y=-3$	✓A substitution ✓CA answer (2)
5.1.1 (b)	$\sin\theta=\frac{-3}{\sqrt{13}}$	✓CA answer (1)
5.1.2	ref. $\angle$: $56,31°$ $\therefore\theta=180°+56,31°=236,31°$	✓CA 56,31° ✓CA answer (2)
5.2	$\frac{\tan(-60°).\cos(-156°).\cos 294°}{\sin 852°}$ $=\frac{-\tan 60°.\cos 204°.\cos 66°}{\sin 132°}$ $=\frac{-\tan 60°.-\cos 24°.\sin 24°}{\sin 48°}$ $=\frac{\tan 60°.\cos 24°.\sin 24°}{2\sin 24°\cos 24°}$ $=\frac{\tan 60°}{2}$ $=\frac{\sqrt{3}}{2}$	✓A $-\tan 60°$ ✓A $\cos 66°$ ✓A $-\cos 24°$ ✓A $\sin 24°$ ✓A $\sin 48°$ ✓A $2\sin 24°.\cos 24°$ ✓CA answer (7)

	OR $\frac{\tan(-60°).\cos(-156°).\cos 294°}{\sin 852°}$ $=\frac{-\tan 60°.\cos 204°.\cos 66°}{\sin 132°}$ $=\frac{-\tan 60°.-\cos 24°.\cos 66°}{\sin 132°}$ $=\frac{\tan 60°.\sin 66°.\cos 66°}{2\sin 66°.\cos 66°}$ $=\frac{\tan 60°}{2}$ $=\frac{\sqrt{3}}{2}$	**OR** ✓A $-\tan 60°$ ✓A $\cos 66°$ ✓A $-\cos 24°$ ✓A $\sin 132°$ ✓A $\sin 66°$ ✓A $2\sin 66°.\cos 66°$ ✓CA answer (7)
	OR $\frac{\tan(-60°).\cos(-156°).\cos 294°}{\sin 852°}$ $=\frac{-\tan 60°.\cos 204°.\cos 66°}{\sin 132°}$ $=\frac{-\tan 60°.-\cos 24°.\sin 24°}{\sin 48°}$ $=\frac{\tan 60°.\frac{1}{2}\sin 48°}{\sin 48°}$ $=\frac{\tan 60°}{2}$ $=\frac{\sqrt{3}}{2}$	**OR** ✓A $-\tan 60°$ ✓A $\cos 66°$ ✓A $-\cos 24°$ ✓A $\sin 24°$ ✓A $\sin 48°$ ✓A $\frac{1}{2}\sin 48°$ ✓CA answer (7)
5.3.1	$\frac{\cos x+\sin x}{\cos x-\sin x}-\frac{\cos x-\sin x}{\cos x+\sin x}$ $=\frac{(\cos x+\sin x)^2-(\cos x-\sin x)^2}{(\cos x-\sin x)(\cos x+\sin x)}$ $=\frac{\cos^2 x+2\sin x\cos x+\sin^2 x-(\cos^2 x-2\sin x\cos x+\sin^2 x)}{(\cos x-\sin x)(\cos x+\sin x)}$ $=\frac{4\sin x\cos x}{\cos^2 x-\sin^2 x}$ $=\frac{2\sin 2x}{\cos 2x}$ $=2\tan 2x$	✓A numerator ✓A denominator ✓A $\frac{4\sin x\cos x}{\cos^2 x-\sin^2 x}$ ✓A $\frac{2\sin 2x}{\cos 2x}$ (4)

5.3.2	$2\tan 2x$ is undefined when: $2x = 90° + k.180°,\ k \in Z$ $\therefore x = 45° + k.90°,\ k \in Z$ **OR** LHS is undefined when $\cos x - \sin x = 0$ or $\cos x + \sin x = 0$ $\tan x = 1$ or $\tan x = -1$ $\therefore x = 45° + k.180°,\ k \in Z$ or $\therefore x = 135° + k.180°,\ k \in Z$ Answer only: Full marks	✓A $2x = 90° + k.180°,\ k \in Z$ ✓A $x = 45° + k.90°,\ k \in Z$ (2) **OR** ✓A $\tan x = 1$ or $\tan x = -1$ ✓A $\therefore x = 45° + k.180°,\ k \in Z$ or $\therefore x = 135° + k.180°,\ k \in Z$ (2)
5.4	$\cos 10° + \cos 70°$ $= \cos(40° - 30°) + \cos(40° + 30°)$ $= \cos 40° \cos 30° + \sin 40° \sin 30° + \cos 40° \cos 30° - \sin 40° \sin 30°$ $= 2\cos 40° \cos 30°$ $= 2p\left(\frac{\sqrt{3}}{2}\right)$ $= \sqrt{3}p$	✓A $\cos(40° - 30°) + \cos(40° + 30°)$ ✓A compound ∠ expansions ✓A $2\cos 40° \cos 30°$ ✓A answer (4)
5.5	$4\sin x \cos x = 3\sin^2 x$ $4\sin x \cos x - 3\sin^2 x = 0$ $\sin x(4\cos x - 3\sin x) = 0$ $\therefore \sin x = 0$ or $4\cos x = 3\sin x$ $x = 0° + k.180°$ or $\frac{\sin x}{\cos x} = \frac{4}{3}$ $\tan x = \frac{4}{3}$ $x = 53{,}13° + k.180°,\ k \in Z$ For $x \in (-180°;180°]$: $x = 0°\ ;\ 180°$ or $x = -126{,}87°\ ;\ 53{,}13°$	✓A factorisation ✓CA both equations ✓A $x = 0° + k.180°$ ✓CA $\tan x = \frac{4}{3}$ ✓A $0°\ ;\ 180°$ ✓CA $-126{,}87°\ ;\ 53{,}13°$ (6)
5.6.1	$\tan\theta = m$ $r = \sqrt{m^2 + 1}$ [Pythagoras] $\sin 2\theta = 2\sin\theta\cos\theta$ $= 2\left(\frac{m}{\sqrt{m^2+1}}\right)\left(\frac{1}{\sqrt{m^2+1}}\right)$ $= \frac{2m}{m^2+1}$  	✓A $r = \sqrt{m^2 + 1}$ ✓A double angle expansion ✓A substitution into double angle expansion (3)

5.6.2	$\frac{(m+1)^2}{m^2+1}$ $=\frac{m^2+2m+1}{m^2+1}$ $=\frac{2m}{m^2+1}+\frac{m^2+1}{m^2+1}$ $=\sin 2\theta+1$ maximum value of $\sin 2\theta$ is 1 Maximum value of $\frac{(m+1)^2}{m^2+1}=1+1=2$	✓A $\sin 2\theta+1$ ✓A max. value of $\sin 2\theta$ ✓A answer (3)
		[34]

QUESTION 6

6.1.1	$a=1$	✓A answer (1)
6.1.2	$b=\frac{1}{2}$	✓A answer (1)
6.1.3	$Q(68,53°\ ;\ 0,68)$	✓A x-coordinate ✓A y-coordinate (2)
6.1.4	$f(x+k)=2\sin^2 x-1=-(1-2\sin^2 x)=-\cos 2x$ $\therefore f(x+k)$ is obtained by shifting $f(x)$ 45° to the right. $\therefore k=-45°$	✓A $-\cos 2x$ ✓A answer (2)
6.2	$x.\sqrt{g(x)-f(x)}>0$ $\therefore x>0$ and $\sqrt{g(x)-f(x)}>0$ $\therefore g(x)-f(x)>0$ $\therefore g(x)>f(x)$ $68,53°<x\leq 90°$ **OR** $x\in(68,53°;90°]$ Answer only: Full marks	✓A $g(x)>f(x)$ ✓CA ✓A answer (3)
		[9]

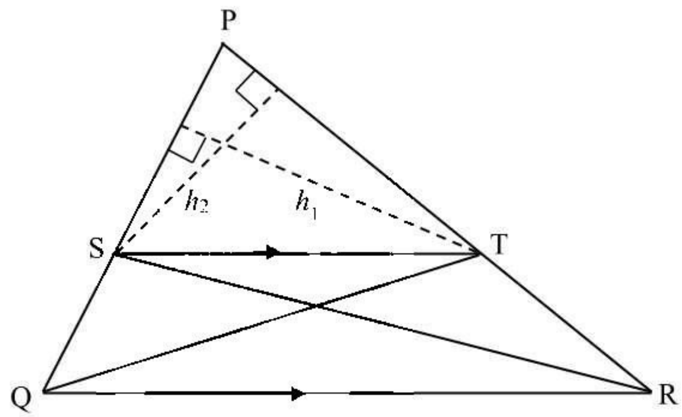
QUESTION 7

7.	$D\hat{B}C = 30°$ [alternate $\angle$s ; || lines]		
	$\frac{h}{BC} = \tan 30°$	✓A $\frac{h}{BC} = \tan 30°$	
	$BC = \frac{h}{\tan 30°} = \frac{h}{\frac{1}{\sqrt{3}}} = \sqrt{3}h$	✓A $BC = \sqrt{3}h$	
	$A\hat{C}B = 180° - (90° - \beta + 90° - \beta) = 2\beta$	✓A $A\hat{C}B = 2\beta$	
	$\frac{AB}{\sin A\hat{C}B} = \frac{BC}{\sin A}$		
	$\frac{AB}{\sin 2\beta} = \frac{\sqrt{3}h}{\sin(90° - \beta)}$	✓A substitution in sine rule	
	$AB = \frac{\sqrt{3}h.\sin 2\beta}{\sin(90° - \beta)}$	✓A AB subject of formula	
	$= \frac{\sqrt{3}h.2\sin\beta\cos\beta}{\cos\beta}$	✓A $\sin 2\beta = 2\sin\beta\cos\beta$ ✓A $\sin(90° - \beta) = \cos\beta$	
	$= 2\sqrt{3}.h\sin\beta$		(7)
	OR	**OR**	
	$D\hat{B}C = 30°$ [alternate $\angle$s ; || lines]		
	$\frac{h}{BC} = \tan 30°$	✓A $\frac{h}{BC} = \tan 30°$	
	$BC = \frac{h}{\tan 30°} = \frac{h}{\frac{1}{\sqrt{3}}} = \sqrt{3}h$	✓A $BC = \sqrt{3}h$	
	$A\hat{C}B = 180° - (90° - \beta + 90° - \beta) = 2\beta$	✓A $A\hat{C}B = 2\beta$	
	$AC = BC$ [$\angle$s opp. = sides]		
	$AB^2 = AC^2 + BC^2 - 2AB.BC.\cos A\hat{C}B$		
	$= (\sqrt{3}h)^2 + (\sqrt{3}h)^2 - 2(\sqrt{3}h)^2.(\sqrt{3}h)^2.\cos 2\beta$	✓A substitution in cosine rule	
	$= 6h^2 - 6h^2.\cos 2\beta$		
	$= 6h^2(1 - \cos 2\beta)$	✓A factorisation	
	$= 6h^2[1 - (1 - 2\sin^2\beta)]$	✓A $\cos 2\beta = 1 - 2\sin^2\beta$	
	$= 12h^2\sin^2\beta$	✓A $= 12h^2\sin^2\beta$	
	$\therefore AB = 2\sqrt{3}.h\sin\beta$		(7)
			[7]

QUESTION 8

8.1	$\hat{A}_2 = \hat{C} = 26°$ [alternate ∠s ; AB ‖ EC] $\hat{E}_2 = \hat{A}_2 = 26°$ [∠s in the same segment] $\hat{B}_1 = \hat{E}_2 = 26°$ [alternate ∠s ; AB ‖ EC] or [∠s in the same segment] $\hat{B}_2 = \hat{E}_2 = 26°$ [∠s opp. = sides] **Any 3 of the 4 angles mentioned above may be awarded marks.** Two of the three angles, will be awarded 2 marks each: ✓S ✓R The other angle will be awarded only 1 mark: ✓S	✓S ✓R or ✓S ✓S ✓R or ✓S ✓S ✓R or ✓S ✓S ✓R or ✓S A maximum of 5 marks to be awarded; as explained in the text box. (5)
8.2	$\hat{O}_1 = 2 \times \hat{E}_2$ [∠ at the centre = 2 × ∠ at the circumference] $= 52°$ **OR** $\hat{E}_2 = \hat{B}_2$ [∠s opp. = radii] $\hat{O}_1 = \hat{B}_2 + \hat{E}_2$ [ext. ∠ of ΔOBE] $= 52°$	✓S/R ✓answer (2) **OR** ✓S/R ✓answer (2)
8.3	$\hat{A}_1 = 90°$ [∠ in a semicircle] $B\hat{A}E = 90° + 26° = 116°$ $B\hat{D}E = 180° - 116° = 64°$ [opp. ∠s of a cyclic quad.] **OR** $E\hat{O}B = 128°$ [∠s on a straight line] or [sum of ∠s of Δ] $B\hat{D}E = 64°$ [∠ at the centre = 2 × ∠ at the circumference]	✓S/R ✓ S ✓R (3) **OR** ✓S/R ✓ S ✓R (3)
		[10]

QUESTION 9

<table>
<tr><td>9.1</td><td>Construction: Join SR and QT, and draw h_1 from S $\perp$ to PT and h_2 from T $\perp$ to PS.


Proof:
$\frac{\text{area } \Delta PST}{\text{area } \Delta QST} = \frac{\frac{1}{2} PS \times h_1}{\frac{1}{2} SQ \times h_1} = \frac{PS}{SQ}$

$\frac{\text{area } \Delta PST}{\text{area } \Delta RTS} = \frac{\frac{1}{2} PT \times h_2}{\frac{1}{2} TR \times h_2} = \frac{PT}{TR}$
area ΔPST = area ΔPST [common]
area ΔQST = area ΔRTS [same base; equal heights, because ST || QR]
$\therefore \frac{\text{area } \Delta PST}{\text{area } \Delta QST} = \frac{\text{area } \Delta PST}{\text{area } \Delta RTS}$
$\therefore \frac{PS}{SQ} = \frac{PT}{TR}$</td><td>✓ construction

✓ $\frac{\text{area } \Delta PST}{\text{area } \Delta QST} = \frac{\frac{1}{2} PS \times h_1}{\frac{1}{2} SQ \times h_1}$
✓ $\frac{PS}{SQ}$
✓ $\frac{\text{area } \Delta PST}{\text{area } \Delta RTS} = \frac{PT}{TR}$

✓S ✓R

(6)</td></tr>
<tr><td>9.2.1</td><td>$\frac{KL}{LM} = \frac{PN}{NM}$ [line || to one side of Δ]
$= \frac{12}{20} = \frac{3}{5}$</td><td>✓S/R
✓A answer
(2)</td></tr>
<tr><td>9.2.2</td><td>$\frac{KL}{LM} = \frac{PQ}{MP}$ [line || to one side of Δ]
$\frac{3}{5} = \frac{PQ}{32}$
$\therefore PQ = \frac{32 \times 3}{5} = 19,2$ units</td><td>✓S
✓CA substitution
✓CA answer
(3)</td></tr>
</table>

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9.2.3	$\Delta KQM \parallel\!\mid \Delta LPM$ [∠∠∠] $\therefore \frac{KQ}{LP} = \frac{QM}{PM}$ [‖| Δs] $= \frac{51,2}{32} = \frac{8}{5}$	✓S ✓S ✓CA answer (3)
		[14]

QUESTION 10

10.1.1	$\hat{B}_3 = 90°$ [∠ in a semicircle] $\therefore \hat{G}_1 = 90°$ [corresponding ∠s; AO ‖ BC] $\therefore BG = GE$ [line from centre ⊥ to chord]	✓ S/R ✓S ✓R (3)
10.1.2	Let $\hat{B}_4 = x$ $\hat{E} = \hat{B}_4 = x$ [tan-chord theorem] Also: $\hat{A} = \hat{B}_4 = x$ [corresponding ∠s; AO ‖ BC] $\hat{A} = \hat{E}$ ∴ AEOB is a cyclic quadrilateral [converse: ∠s in the same segment]	✓S ✓R ✓S ✓R (4)
10.1.3	In ΔOEG and ΔBAG: 1. $\hat{A} = \hat{E}$ [proved above] 2. $\hat{G}_1 = \hat{G}_3$ [vertically opposite ∠s] 3. $\hat{O}_2 = A\hat{B}G$ [sum of ∠s in Δ OR ∠s in the same segment] ∴ ΔOEG ||| ΔBAG [∠;∠;∠]	✓S ✓S ✓R (3)
10.2	$OG = \frac{1}{2}BC = 5$ units [midpoint theorem] $\frac{OG}{BG} = \frac{EG}{AG}$ [similar Δs] $\therefore BG.EG = OG.AG$ $EG^2 = OG.AG$ [BG = GE] $= 5 \times 35$ $= 175$ $\therefore EG = \sqrt{175} = 5\sqrt{7} = 13,23$ units $EO^2 = EG^2 + GO^2$ [Pythagoras] $= \left(\sqrt{175}\right)^2 + 5^2$ $= 200$ $EO = \sqrt{200} = 10\sqrt{2} = 14,14$ units	✓S/R ✓S ✓S ✓S ✓S/R ✓CA substitution ✓CA answer (7)
		[17]

TOTAL: 150