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MEMORANDUM / MARKING GUIDELINE

GRADE 11 · MATHEMATICS · TERM 3 · 2026

STATISTICS · ANALYTICAL GEOMETRY · TRIGONOMETRY

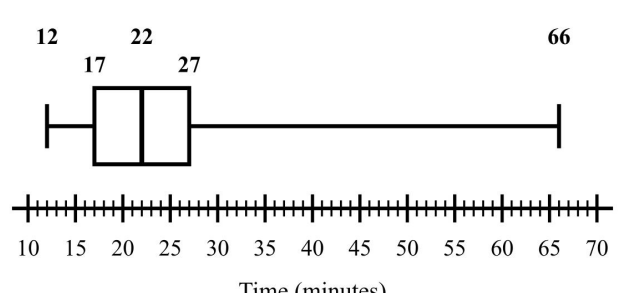
TOTAL: 100 MARKS

TIME: 2 HOURS

EXAMINER: MR SIMONS

Each ✓ = one mark. Accept any correct alternative method. Accept answers that differ in the last decimal place through rounding, provided the method is correct. Notes in [square brackets] are guidance to the marker and carry no marks of their own.

QUESTION 1

1.1	$\bar{x} = \frac{300}{12} \quad \checkmark$ $= 25 \text{ minutes} \quad \checkmark$	✓ correct substitution ✓ answer	(2)
1.2	$\sigma^2 = \frac{2172}{12} = 181 \quad \checkmark$ $\sigma = 13,45 \text{ minutes} \quad \checkmark$	✓ correct substitution ✓ answer	(2)
1.3	$\bar{x} - \sigma = 25 - 13,45 = 11,55 \quad \checkmark$ $\bar{x} + \sigma = 25 + 13,45 = 38,45 \quad \checkmark$ The interval is (11,55 ; 38,45); only 66 lies outside it, so 1 time lies outside. ✓ [Accept the interval given as $11,55 < x < 38,45$. Accept "one learner" or "66 minutes".]	✓ lower end point ✓ upper end point ✓ answer	(3)
1.4	minimum = 12 ✓ $Q_1 = \frac{16 + 18}{2} = 17 \quad M = \frac{21 + 23}{2} = 22 \quad \checkmark$ $Q_3 = \frac{26 + 28}{2} = 27 \quad \text{maximum} = 66 \quad \checkmark$ (12 ; 17 ; 22 ; 27 ; 66)	✓ minimum ✓ Q_1 and the median ✓ Q_3 and the maximum	(3)
1.5	box drawn from $Q_1 = 17$ to $Q_3 = 27$, with the median at 22 ✓ whiskers drawn to the minimum 12 and the maximum 66 ✓ 	✓ box with the median ✓ whiskers to the extremes	(2)

1.6	$IQR = Q_3 - Q_1 = 27 - 17 = 10 \quad \checkmark$ upper boundary = $Q_3 + 1,5(IQR)$ $= 27 + 1,5(10) = 42 \quad \checkmark$ $66 > 42, \therefore 66$ is an outlier $\checkmark$ <i>[The lower boundary is $Q_1 - 1,5(IQR) = 17 - 15 = 2$, and no value is below it, so 66 is the ONLY outlier.]</i>	$\checkmark$ IQR $\checkmark$ upper boundary $\checkmark$ conclusion	(3)
1.7	The data is skewed to the right (positively skewed). $\checkmark$ Reason: the mean (25) is greater than the median (22). $\checkmark$ <i>[Accept as the reason: the right whisker is much longer than the left whisker; or the outlier 66 pulls the mean up above the median.]</i>	$\checkmark$ skewed to the right $\checkmark$ reason	(2)
		TOTAL	[17]

QUESTION 2

2.1	$20 \leq d < 30 \quad \checkmark$	$\checkmark$ modal class	(1)
2.2	12 ; 30 ; 54 $\checkmark$ 68 ; 76 ; 80 $\checkmark$	$\checkmark$ first three values $\checkmark$ last three values	(2)
2.3	the curve starts at (0 ; 0) $\checkmark$ the six points (10 ; 12), (20 ; 30), (30 ; 54), (40 ; 68), (50 ; 76) and (60 ; 80) plotted $\checkmark\checkmark$ the points joined by a smooth increasing curve $\checkmark$ <i>[Each cumulative frequency must be plotted at the UPPER boundary of its class. Deduct one mark if the points are plotted at the class midpoints.]</i>	$\checkmark$ curve starts at (0 ; 0) $\checkmark\checkmark$ all six points, at the upper limits $\checkmark$ smooth increasing curve	(4)

Cumulative frequency

Distance (km)

2.4	midpoints: 5 ; 15 ; 25 ; 35 ; 45 ; 55 ✓ $\Sigma fx = 60 + 270 + 600 + 490 + 360 + 220 = 2\,000$ ✓ $\bar{x} = \frac{2\,000}{80} = 25 \text{ km}$ ✓	✓ midpoints ✓ Σfx ✓ answer	(3)
2.5	Q_1 is read at cumulative frequency $\frac{80}{4} = 20$: $Q_1 \approx 15 \text{ km}$ ✓ Q_3 is read at cumulative frequency $\frac{3(80)}{4} = 60$: $Q_3 \approx 34 \text{ km}$ ✓ $IQR = Q_3 - Q_1 \approx 34 - 15 = 19 \text{ km}$ ✓ <i>[Read ACROSS from 20 and from 60 on the cumulative frequency axis to the curve, then DOWN to the distance axis, as the dashed lines below show. These are readings off a hand-drawn curve: accept Q_1 from 13 to 17 and Q_3 from 32 to 36 (points joined with straight lines give about 14 and 34), and any IQR that follows correctly from the candidate's own two readings.]</i> Cumulative frequency Distance (km)	✓ reading Q_1 ✓ reading Q_3 ✓ answer	(3)

Completed table:

Distance (km)	Number of learners	Cumulative frequency
$0 \leq d < 10$	12	12
$10 \leq d < 20$	18	30
$20 \leq d < 30$	24	54
$30 \leq d < 40$	14	68
$40 \leq d < 50$	8	76
$50 \leq d < 60$	4	80

		TOTAL	[13]
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QUESTION 3

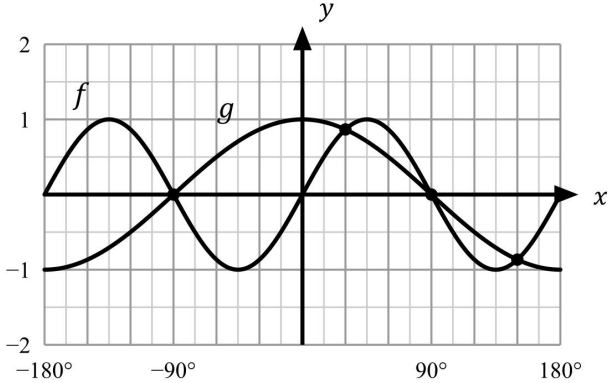
3.1	$AB = \sqrt{(-5+3)^2 + (3-9)^2} = \sqrt{4+36} \quad \checkmark$ $= \sqrt{40} = 2\sqrt{10} \text{ units} \quad \checkmark$	$\checkmark$ correct substitution $\checkmark$ simplest surd form	(2)
3.2	$M\left(\frac{-3+7}{2}; \frac{9+(-1)}{2}\right) \quad \checkmark$ $\therefore M(2; 4) \quad \checkmark$	$\checkmark$ correct substitution $\checkmark$ answer	(2)
3.3	$m_{AB} = \frac{3-9}{-5-(-3)} = \frac{-6}{-2} = 3 \quad \checkmark$ $m_{BC} = \frac{-1-3}{7-(-5)} = \frac{-4}{12} = \frac{-1}{3} \quad \checkmark$ $m_{AB} \times m_{BC} = 3 \times \frac{-1}{3} = -1$ $\therefore AB \perp BC \quad \checkmark$	$\checkmark$ gradient of AB $\checkmark$ gradient of BC $\checkmark$ product = -1	(3)
3.4	<i>The diagonals of a parallelogram bisect each other, so the midpoint of BD is the midpoint of AC.</i> $\checkmark$ $\frac{-5+x}{2} = 2 \quad \therefore x = 9 \quad \checkmark$ $\frac{3+y}{2} = 4 \quad \therefore y = 5 \quad \checkmark$ $\therefore D(9; 5)$ <i>[Accept the vector method for full marks: $D = A + C - B = (-3 + 7 + 5; 9 - 1 - 3) = (9; 5)$.]</i>	$\checkmark$ diagonals bisect each other $\checkmark$ x-value $\checkmark$ y-value	(3)
3.5	ABCD is a parallelogram $\checkmark$ and $\hat{ABC} = 90^\circ$ (proved in QUESTION 3.3) $\therefore$ ABCD is a rectangle (a parallelogram with one right angle) $\checkmark$ <i>[Accept instead: the diagonals are equal, $AC^2 = BD^2 = 200$, and bisect each other.]</i>	$\checkmark$ parallelogram $\checkmark$ conclusion with a reason	(2)
3.6	$m_{AC} = \frac{-1-9}{7-(-3)} = \frac{-10}{10} = -1 \quad \checkmark$ $y - 9 = -1(x - (-3)) \quad \checkmark$ $\therefore y = -x + 6 \quad \checkmark$	$\checkmark$ gradient of AC $\checkmark$ correct substitution $\checkmark$ answer	(3)
3.7	$\tan \theta = m_{AB} = 3 \quad \checkmark$ $\therefore \theta = 71,57^\circ \quad \checkmark$	$\checkmark$ $\tan \theta =$ gradient of AB $\checkmark$ answer	(2)

3.8	For AC: $\tan \theta_{AC} = -1$, so $\theta_{AC} = 180^\circ - 45^\circ = 135^\circ$ ✓ <i>AB and AC both cut the x-axis, and the angle between them at A is the difference of the two inclinations:</i> $\hat{BAC} = 135^\circ - 71,57^\circ$ ✓ = 63,43° ✓ <i>[Accept the cosine rule in $\triangle ABC$ for full marks. Or, since $\hat{ABC} = 90^\circ$, the tangent of $\hat{BAC}$ is the ratio BC : AB, which is 2. Both routes give 63,43°.]</i>	✓ inclination of AC ✓ difference of the inclinations ✓ answer	(3)
		TOTAL	[20]

QUESTION 4

4.1	$T\left(\frac{-1+5}{2}; \frac{5+(-1)}{2}\right)$ ✓ $\therefore T(2; 2)$ ✓	✓ correct substitution ✓ answer	(2)
4.2	$PR = \sqrt{(5+1)^2 + (-1-5)^2} = \sqrt{36+36}$ ✓ = $\sqrt{72} = 6\sqrt{2}$ units ✓	✓ correct substitution ✓ simplest surd form	(2)
4.3	$m_{PR} = \frac{-1-5}{5-(-1)} = \frac{-6}{6} = -1$ ✓ $ST \perp PR, \therefore m_{ST} = 1$ ✓ Through $T(2; 2)$: $y - 2 = 1(x - 2) \therefore y = x$ ✓	✓ gradient of PR ✓ gradient of ST ✓ equation of ST	(3)
4.4	$S(a; b)$ lies on ST, whose equation is $y = x$, $\therefore b = a$ ✓	✓ $b = a$	(1)
4.5	<i>T lies on PR and $ST \perp PR$, so ST is the perpendicular height of the triangle on base PR.</i> ✓ $\text{area} = \frac{1}{2} \cdot PR \cdot ST: 30 = \frac{1}{2} \cdot 6\sqrt{2} \cdot ST$ ✓ $\therefore ST = \frac{60}{6\sqrt{2}} = \frac{10}{\sqrt{2}} = 5\sqrt{2}$ ✓ S is $(a; a)$, so $ST^2 = (a-2)^2 + (a-2)^2 = 2(a-2)^2 = 50$ $(a-2)^2 = 25 \therefore a = 7 \text{ or } a = -3$ ✓ $a < 0, \therefore a = -3$ and S (-3; -3) ✓ <i>[a = 7 gives S(7; 7), which also has area 30 square units but is rejected by $a < 0$. A candidate who never finds the second root loses the final mark.]</i>	✓ ST is the height on PR ✓ substitution into the area ✓ length of ST ✓ both roots ✓ $a < 0$ rejects $a = 7$	(5)
		TOTAL	[13]

QUESTION 5

5.1.1	180° ✓	✓ period	(1)
5.1.2	correct cosine shape, one full period over the interval ✓ x-intercepts $(-90^\circ; 0)$ and $(90^\circ; 0)$ ✓ maximum turning point $(0^\circ; 1)$ ✓ end points $(-180^\circ; -1)$ and $(180^\circ; -1)$ ✓ <i>[The two end points are also the minimum turning points of g on this interval; award the mark once.]</i> 	✓ cosine shape, one full period ✓ x -intercepts ✓ turning point ✓ end points	(4)
5.1.3	$x = -90^\circ$ or $x = 30^\circ$ ✓ $x = 90^\circ$ or $x = 150^\circ$ ✓ $x \in \{-90^\circ; 30^\circ; 90^\circ; 150^\circ\}$	✓ $x = -90^\circ$ and $x = 30^\circ$ ✓ $x = 90^\circ$ and $x = 150^\circ$	(2)
5.1.4	The product is negative exactly where f and g have opposite signs. ✓ $-180^\circ < x < 0^\circ$ ✓ but $x \neq -90^\circ$, where $f(-90^\circ) = g(-90^\circ) = 0$ and the product is 0, not negative ✓ <i>[The excluded value is the whole point of the question. An answer of $-180^\circ < x < 0^\circ$ without $x \neq -90^\circ$ scores 2 of the 3. The end points are excluded because $f(-180^\circ) = 0$ and $f(0^\circ) = 0.$]</i>	✓ opposite signs ✓ the interval ✓ excluding $x = -90^\circ$	(3)
5.1.5	range of f : $-1 \leq y \leq 1$ ✓ $\therefore$ range of h : $-4 \leq y \leq -2$ ✓	✓ range of f ✓ range of h	(2)
5.2.1	$a = \frac{1 - (-3)}{2} = 2 \quad \checkmark$ $q = \frac{1 + (-3)}{2} = -1 \quad \checkmark$ the maximum is at $x = 30^\circ$, $\therefore p = 30^\circ$ ✓	✓ value of a ✓ value of q ✓ value of p	(3)

5.2.2	$2 \cos(x - 30^\circ) - 1 = 0 \quad \therefore \cos(x - 30^\circ) = \frac{1}{2}$ $\therefore x - 30^\circ = \pm 60^\circ \quad \checkmark$ $x = -30^\circ \text{ or } x = 90^\circ \quad \checkmark$	$\checkmark \cos(x - 30^\circ) = \frac{1}{2}$ $\checkmark \text{ both } x\text{-intercepts}$	(2)
		TOTAL	[17]

QUESTION 6

6.1.1	$\hat{S}\hat{P}\hat{R} = 44^\circ - 27^\circ = 17^\circ \quad \checkmark$ <i>(exterior angle of $\triangle PSR$)</i> $\checkmark$	$\checkmark$ answer $\checkmark$ reason: exterior angle	(2)
6.1.2	In $\triangle PSR$: $\frac{PS}{\sin \hat{P}\hat{R}\hat{S}} = \frac{SR}{\sin \hat{S}\hat{P}\hat{R}} \quad \checkmark$ $PS = \frac{12 \sin 27^\circ}{\sin 17^\circ} \quad \checkmark$ $= 18,63 \text{ cm} \quad \checkmark$	$\checkmark$ the sine rule $\checkmark$ correct substitution $\checkmark$ answer	(3)
6.1.3	In $\triangle PKS$: $PK^2 = KS^2 + PS^2 - 2(KS)(PS) \cos \hat{P}\hat{S}\hat{K} \quad \checkmark$ $PK^2 = 32^2 + 18,63^2 - 2(32)(18,63) \cos 44^\circ \quad \checkmark$ $\therefore PK = 22,66 \text{ cm} \quad \checkmark$	$\checkmark$ the cosine rule $\checkmark$ correct substitution $\checkmark$ answer	(3)
6.1.4	$\frac{\sin \hat{P}\hat{K}\hat{S}}{PS} = \frac{\sin \hat{P}\hat{S}\hat{K}}{PK}$ $\therefore \sin \hat{P}\hat{K}\hat{S} = \frac{18,63 \sin 44^\circ}{22,66} \quad \checkmark$ $\therefore \hat{P}\hat{K}\hat{S} = 34,84^\circ \quad \checkmark$ <i>[KS is the LONGEST side of $\triangle PKS$, so $\hat{K}\hat{P}\hat{S}$ is its largest angle. A triangle has at most one obtuse angle and it lies opposite the longest side, so $\hat{P}\hat{K}\hat{S}$ must be acute and the sine rule has no second solution here. ($\hat{K}\hat{P}\hat{S}$ itself is $101,16^\circ$, obtuse.)]</i>	$\checkmark$ correct substitution $\checkmark$ answer	(2)
6.2.1	In $\triangle AOB$: $OA = OB = r \quad (\text{radii}) \quad \checkmark$ $AB^2 = OA^2 + OB^2 - 2(OA)(OB) \cos \theta$ <i>(cosine rule)</i> $\checkmark$ $AB^2 = r^2 + r^2 - 2r^2 \cos \theta = r^2(2 - 2 \cos \theta) \quad \checkmark$ $\therefore AB = r \sqrt{2 - 2 \cos \theta} \quad (AB > 0)$ <i>[Accept $AB = 2r \sin \frac{1}{2}\theta$ as an equivalent result, but only if the candidate then shows that it equals the result above.]</i>	$\checkmark OA = OB = r$ (radii) $\checkmark$ the cosine rule $\checkmark$ factorising r^2	(3)
6.2.2	$AB = 25 \sqrt{2 - 2 \cos 68^\circ} \quad \checkmark$ $= 27,96 \text{ m} \quad \checkmark$	$\checkmark$ correct substitution $\checkmark$ answer	(2)

6.2.3	$\text{area } \triangle AOB = \frac{1}{2} (25)(25) \sin 68^\circ \quad \checkmark$ $= 289,74 \text{ m}^2 \quad \checkmark$	$\checkmark$ correct substitution $\checkmark$ answer	(2)
6.2.4	<i>The shortest distance from O to AB is the perpendicular height h of $\triangle AOB$ on base AB.</i> $\checkmark$ $\text{area} = \frac{1}{2} \cdot AB \cdot h: 289,74 = \frac{1}{2} \cdot 27,96 \cdot h \quad \checkmark$ $\therefore h = 20,73 \text{ m} \quad \checkmark$ <i>[Accept $h = r \cos \frac{1}{2}\theta = 25 \cos 34^\circ = 20,73 \text{ m}$ for full marks, since $OA = OB$ makes the perpendicular from O bisect both AB and θ.]</i>	$\checkmark$ h is the perpendicular height $\checkmark$ substitution into the area $\checkmark$ answer	(3)
		TOTAL	[20]

TOTAL: 100 MARKS

ANALYSIS OF THE PAPER

Cognitive levels, against the CAPS FET weighting for a Grade 11 Mathematics Paper 2 syllabus.

Cognitive level	Marks	%	CAPS target	Questions
Level 1: Knowledge	21	21%	20%	1.1, 1.2, 1.4, 2.1, 2.2, 3.1, 3.2, 4.1, 5.1.1, 6.2.2, 6.2.3
Level 2: Routine procedures	36	36%	35%	1.5, 2.3, 2.4, 3.3, 3.6, 3.7, 4.2, 4.4, 5.1.2, 5.1.3, 5.2.1, 6.1.1, 6.1.2, 6.1.4
Level 3: Complex procedures	29	29%	30%	1.3, 1.6, 1.7, 2.5, 3.4, 3.5, 4.3, 5.1.5, 5.2.2, 6.1.3, 6.2.4
Level 4: Problem solving	14	14%	15%	3.8, 4.5, 5.1.4, 6.2.1
Higher order (Levels 3 + 4)	43	43%	45%	
TOTAL	100	100%	100%	

Marks by topic.

Topic	Question	Marks	%
Statistics	Q1 and Q2	30	30%
Analytical Geometry	Q3 and Q4	33	33%
Trigonometry: Graphs	Q5	17	17%
Trigonometry: 2D Problems	Q6	20	20%
TOTAL		100	100%