GAUTENG PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

GAUTENG DEPARTMENT OF EDUCATION

PROVINCIAL EXAMINATION

JUNE 2017

GRADE 11

MATHEMATICS
PAPER 2

MEMORANDUM

10 pages

GAUTENG DEPARTMENT OF EDUCATION

PROVINCIAL EXAMINATION

MATHEMATICS Paper 2

MEMORANDUM

INSTRUCTIONS AND INFORMATION

A – Accuracy

CA – Consistent Accuracy

S – Statement

R – Reason

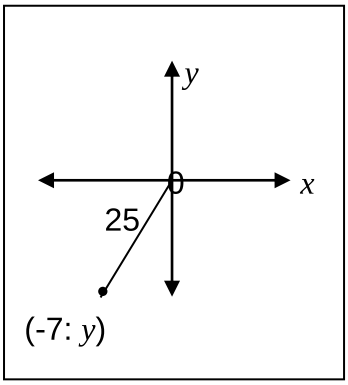
SR – Statement / Reason

NOTE:

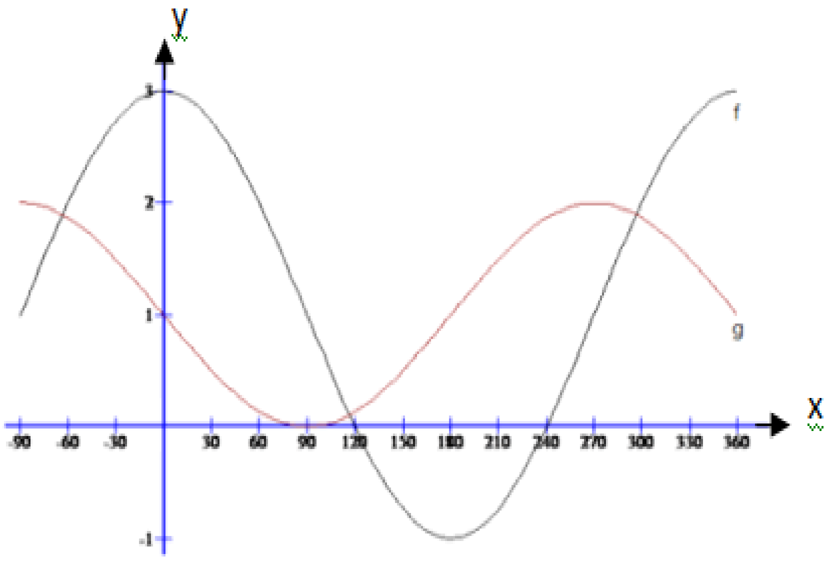
- If a candidate answered a question TWICE, mark only the first attempt.
- If a candidate CROSSED OUT an answer and did not redo it, mark the crossed out answer.
- Consistent accuracy applies to ALL aspects of the memorandum. Stop marking at the second calculation error.
- Assuming values/answers in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

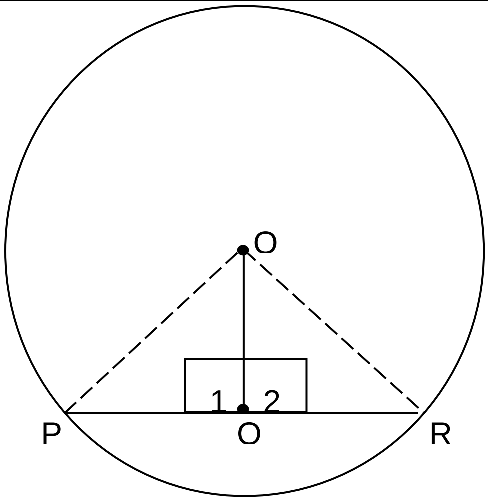
QUESTION 1			MARKS: 25
1.1	$M_{MR} = \frac{6-0}{4-0}$ $M_{MR} = \frac{6}{4} = \frac{3}{2}$ equation of line MR is: $y = \frac{3}{2}x$	✓ sub. into the gradient formula ✓ gradient of line MR ✓ equation of line MR	**(3)**
1.2	$y - 5x + 14 = 0$ $y = 5x - 14$ MS || PR $\therefore m_{PR} = 5$ equation of line PR: $y - y_1 = m(x - x_1)$ $y - 4 = 5(x + 2)$ $y = 5x + 14$	✓ $m_{MS} = 5$ ✓ $m_{PR} = 5$ ✓sub. $(-2 ; 4)$ ✓answer	**(4)**
1.3	$m_{PR} = 5$ $\therefore \tan\alpha = 5$ $\alpha = 78{,}69°$ $m_{MR} = \frac{3}{2}$ $\tan\beta = \frac{3}{2}$ $\beta = 56{,}31°$ $\therefore \quad \theta = \alpha - \beta$ $\theta = 22{,}38°$	✓$\tan\alpha = 5$ ✓$78{,}69°$ ✓$56{,}31°$ ✓$\therefore \theta = (\alpha - \beta)$..(sum of angles of Δ) ✓$22{,}38°$	**(5)**
1.4	$y = \frac{3}{2}x$ and $y = 5x + 14$ $5x + 14 = \frac{3}{2}x$ $10x + 28 = 3x$ $7x = -28$ $x = -4$ $y = -6$ R$(-4 ; -6)$	✓equating $5x + 14 = \frac{3}{2}x$ ✓$7x = -28$ ✓ $x = -4$ ✓ $y = -6$	**(4)**

1.5	$d_{MR} = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$ $= \sqrt{(4+4)^2 + (6+6)^2}$ $= \sqrt{64 + 144}$ $= 4\sqrt{13}$	✓sub. into dist. formula ✓answer	**(2)**
1.6	$d_{PR} = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$ $= \sqrt{(-4+2)^2 + (-6-4)^2}$ $= \sqrt{104}$ or $2\sqrt{26}$ Area of ΔPMR $= \frac{1}{2}\text{PR}.\text{MR}.\sin\theta$ $= \frac{1}{2} 2\sqrt{26}.4\sqrt{13}.\sin 22{,}38^\circ$ **OR** $\frac{1}{2}\sqrt{104}.4\sqrt{13}.\sin 22{,}38^\circ$ $= 28$ units^2	✓ sub. into dist. formula ✓$\sqrt{104}$ **OR** $2\sqrt{26}$ ✓$\frac{1}{2} 2\sqrt{26}.4\sqrt{13}.\sin 22{,}38^\circ$ **OR** $\frac{1}{2}\sqrt{104}.4\sqrt{13}.\sin 22{,}38^\circ$ (✓ rounding-off) answer ✓	**(5)**
1.7	S(2 ; –4)	✓ $x = 2$ ✓ $y = -4$	**(2)**

QUESTION 2			**MARKS: 26**
2.1	$y^2 = r^2 - x^2$ $\therefore y^2 = (25)^2 - (-7)^2$ $\therefore y^2 = 576$ $\therefore \ y = -24$ $\therefore 14\tan\theta = 14\left(\frac{-24}{-7}\right)$ $= 48$ 	✓diagram correct in correct quad. ✓ $y = -24$ ✓$\tan\theta = \frac{-24}{-7}$ ✓answer	**(4)**
2.2	$\frac{\cos(90^\circ+x).\sin(180^\circ+x)}{\tan 225^\circ - \cos^2(-x)}$ $= \frac{(-\sin x)(-\sin x)}{\tan 45^\circ - \cos^2 x}$ $= \frac{\sin^2 x}{1-\cos^2 x}$ $= \frac{\sin^2 x}{\sin^2 x}$ $= 1$	✓ (-sin$x$) (-sin$x$) ✓ $\tan 45^\circ$ ✓ $\cos^2 x$ ✓ $\tan 45^\circ = 1$ ✓ $1 - \cos^2 x = \sin^2 x$ ✓ answer	**(6)**

2.3	$2\cos 2\theta = -0{,}44$ $\therefore \cos 2\theta = -0{,}22$ $\therefore$ Ref. angle $= 77{,}2909\ldots^\circ$ $2\theta = 180^\circ - 77{,}2909\ldots^\circ + k.360^\circ$ $\therefore \theta = 51{,}35^\circ + k.180, k \in Z$ or $2\theta = 180^\circ + 77{,}2909\ldots^\circ + k.360^\circ$ $\therefore \theta = 128{,}65^\circ + k.180^\circ, k \in Z$	✓ $\cos 2\theta = -0{,}22$ ✓ $77{,}2909^\circ$ ✓ $2\theta = 180^\circ - 77{,}2909^\circ + k.360^\circ$ ✓ $\theta = 51{,}35^\circ + k.180, k \in Z$ ✓ $2\theta = 180^\circ + 77{,}2909^\circ + k.360^\circ$ ✓ $\therefore \theta = 128{,}65^\circ + k.180^\circ, k \in Z$	**(6)**
2.4	$\therefore$ LHS: $\dfrac{\tan\theta - \sin\theta}{1-\cos\theta}$ $= \dfrac{\frac{\sin\theta}{\cos\theta} - \frac{\sin\theta}{1}}{1-\cos\theta}$ $= \dfrac{\frac{\sin\theta - \sin\theta.\cos\theta}{\cos\theta}}{1-\cos\theta}$ $= \dfrac{\sin\theta(1-\cos\theta)}{\cos\theta} \times \dfrac{1}{1-\cos\theta}$ $= \dfrac{\sin\theta}{\cos\theta}$ $= \tan\theta$	✓ $\tan\theta = \frac{\sin\theta}{\cos\theta}$ ✓ $\frac{\sin\theta - \sin\theta.\cos\theta}{\cos\theta}$ ✓ $\sin\theta(1-\cos\theta)$ ✓ $\times \frac{1}{1-\cos\theta}$ ✓ $\frac{\sin\theta}{\cos\theta} = \tan\theta$	**(5)**
2.5	$\alpha = 90^\circ - \beta$ $\therefore \dfrac{\cos 20^\circ}{\sin 70^\circ} - \dfrac{\sin(90^\circ-\beta)}{\sin(90^\circ-\beta)}$ $= \dfrac{\sin 70^\circ}{\sin 70^\circ} - 1$ $= 1 - 1$ $= 0$	✓ $\cos 20^\circ$ ✓ $\sin\alpha = \sin(90^\circ - \beta)$ ✓ $\cos 20^\circ = \sin 70^\circ$ ✓ $1 - 1$ ✓ answer	**(5)**

QUESTION 3			MARKS:14
3.1		✓ y-intercepts of f ✓ y-intercepts of g ✓✓ both turning points of g ✓ both x-intercepts of f ✓ both turning points of f	**(6)**
3.2	2	✓✓ answer	**(2)**
3.3	$2\cos x + 1 = 1 - \sin x$ $\therefore \quad \sin x = -2\cos x$ $\therefore \quad \tan x = -2$ $\therefore$ Ref. angle = 63, 4349....° $\therefore \quad x = 180° - 63,4349....° + k.\ 180°$ $\therefore \quad x = 116,57° + k.180°$ with $k \in Z$ $\therefore \quad x = -63,43°$ **OR** 116,57° **OR** 296,57°	✓ $\tan x = -2$ ✓ 63, 4349° ✓ $x = 116,57° + k.180°$ with $k \in Z$ ✓ -63,43° ✓ 116, 57° ✓ 296,57°	**(6)**

	QUESTION 4	**MARKS: 13**
4.1	 Construction: Join PO and OR In ΔPOQ and Δ ROQ 1) OQ = OQ..... common 2) PO = OR ......radii 3) $\hat{Q}_1 = \hat{Q}_2 = 90°$ .. given ∴ ΔPOQ ≡ ΔROQ ... 90°HS ∴ PQ = RQ	✓ construction (radii, OP and OR) ✓SR ie (PO = OR ..... radii) ✓S ie ($\hat{Q}_1 = \hat{Q}_2 = 90°$) ✓ S R ✓ PQ =RQ **(5)**
4.2.1	$\hat{A}_1 = 90°$..line from centre to midpt. of chord $\hat{B} = 180° - (\hat{O}_1 + \hat{A}_1)$ .... sum of angles of a Δ = 50°	✓ S R ✓ answer **(2)**

4.2.2	$\hat{C} = 90°$ ... angle in a semi-circle $\hat{D} = 180° - (\hat{C} + \hat{B})$ ... sum of angles of Δ $= 40°$	✓ S R ✓ answer **(2)**
4.2.3	$BD = \sqrt{CD^2 + BC^2}$......Th. of Pyth. $= \sqrt{40^2 + 30^2}$ $= 50$ BO = $\frac{1}{2}BD$ .....radii $= 25$ OA = $\frac{1}{2}CD$...Midpt. Th. $= 20$ AE = OE – OA = 25 – 20 = 5 units	✓ BD = 50 ✓ BO = 25 ✓ SR ie (OA = 20 .. Midpt.Th.) ✓ AE = 5 **(4)**

	QUESTION 5	MARKS: 10
5.1	$\hat{L} = \hat{J}_1 = x$ ... angles opp. = sides $\hat{N}_1 = \hat{L} = x$ ...= chords subtend = angles	✓ S R ✓ S ✓ R **(3)**
5.2	$\hat{M} = \hat{J}_3 = y$ .... angles opp. = sides $\hat{K}_1 = \hat{M} = y$ ....= chords subtend = angles $\hat{Q}_2 = \hat{K}_1 + \hat{J}_1$... ext. angle of Δ $= x + y$ $\hat{P}_2 = \hat{N}_1 + \hat{J}_3$... ext. angle of Δ $= x + y$ $\therefore \quad \hat{Q}_2 = \hat{P}_2 = x + y$	✓ S R ✓ S R ✓ S R ✓ S R **(4)**
5.3	$\hat{P}_4 = \hat{P}_2$ .... vert. opp. angles $\hat{Q}_4 = \hat{Q}_2$ .... vert. opp. angles but $\hat{Q}_2 = \hat{P}_2$........proved in Q5.2 $\therefore \quad \hat{P}_4 = \hat{Q}_4$ $\therefore$ JQ = JP...... sides opp = angles **OR** isos. Δ	✓ S R for $\hat{P}_4 = \hat{P}_2$ **OR** $\hat{Q}_4 = \hat{Q}_2$ ✓ $\hat{P}_4 = \hat{Q}_4$ ✓ R **(3)**

	QUESTION 6	MARKS: 12
6.1	$\hat{K}_2 = \hat{T}_1$ ...... angles opp. = sides **OR** equal radii $\hat{T}_1 = \hat{C}$ .... angles in same segment $\therefore \quad \hat{K}_2 = \hat{C}$	✓ S R ✓ $\hat{T} = \hat{C}$ ✓ R **(3)**
6.2	$\hat{T}_2 = \hat{A}$ ...... angles opp. = sides **OR** equal radii $P_2 = \hat{T}_2 + \hat{A}$ ... ext. angle of Δ $= 2\hat{T}_2$ $\hat{K}_1 = \hat{P}_2$ .... angles in same segment $\hat{K}_1 = 2\hat{T}_2$	✓ S R ✓ S R ✓ $\hat{K}_1 = \hat{P}_2$ ✓ R **(4)**
6.3	$\hat{P}_4 = 2\hat{T}$ .... angle at centre = twice angle at circumference $\hat{T} = \hat{T}_1 + \hat{T}_2$ $\hat{T}_1 = \hat{C}$ .... angles in same segment $\hat{T}_2 = \frac{1}{2}\hat{K}_1$ ..... proved in Q6.2 $\hat{P}_4 = 2(\hat{C} + \frac{1}{2}\hat{K}_1)$ $= 2\hat{C} + \hat{K}_1)$	✓ $\hat{P}_4 = 2\hat{T}$ ✓ R ✓ S R ✓ $\hat{T}_2 = \frac{1}{2}\hat{K}_1$ ✓ $\hat{P}_4 = 2(\hat{C} + \frac{1}{2}\hat{K}_1)$ **(5)**
		TOTAL: 100