



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:

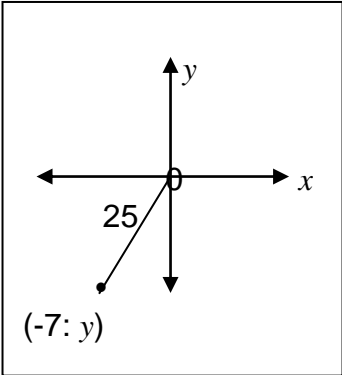
- If a candidate answered a question TWICE, mark only the first attempt.
- If a candidate CROSSED OUT an answer and did not redo it, mark the crossed out answer.
- Consistent accuracy applies to ALL aspects of the memorandum. Stop marking at the second calculation error.
- Assuming values/answers in 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 \parallel 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	$m_{PR} = 5$ $\therefore \tan \alpha = 5$ $\alpha = 78,69^\circ$ $m_{MR} = \frac{3}{2}$ $\tan \beta = \frac{3}{2}$ $\beta = 56,31^\circ$ $\therefore \theta = \alpha - \beta$ $\theta = 22,38^\circ$	✓ $\tan \alpha = 5$ ✓ $78,69^\circ$ ✓ $56,31^\circ$ ✓ $\therefore \theta = (\alpha - \beta)$..(sum of angles of Δ) ✓ $22,38^\circ$	(5)
1.4	$y = \frac{3}{2}x \text{ and } y = 5x + 14$ $5x + 14 = \frac{3}{2}x$ $10x + 28 = 3x$ $7x = -28$ $x = -4$ $y = -6$ 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	$d_{PR} = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$ $= \sqrt{(-4 + 2)^2 + (-6 - 4)^2}$ $= \sqrt{104} \text{ or } 2\sqrt{26}$ <p>Area of ΔPMR</p> $= \frac{1}{2} PR \cdot MR \cdot \sin \theta$ $= \frac{1}{2} 2\sqrt{26} \cdot 4\sqrt{13} \cdot \sin 22,38^\circ \text{ OR}$ $\frac{1}{2} \sqrt{104} \cdot 4\sqrt{13} \cdot \sin 22,38^\circ$ $= 28 \text{ units}^2$	✓ sub. into dist. formula ✓ $\sqrt{104}$ OR $2\sqrt{26}$ ✓ $\frac{1}{2} 2\sqrt{26} \cdot 4\sqrt{13} \cdot \sin 22,38^\circ$ OR $\frac{1}{2} \sqrt{104} \cdot 4\sqrt{13} \cdot \sin 22,38^\circ$ (✓ rounding-off) answer ✓	(5)
1.7	S(2 ; -4)	✓ $x = 2$ ✓ $y = -4$	(2)

QUESTION 2

MARKS: 26

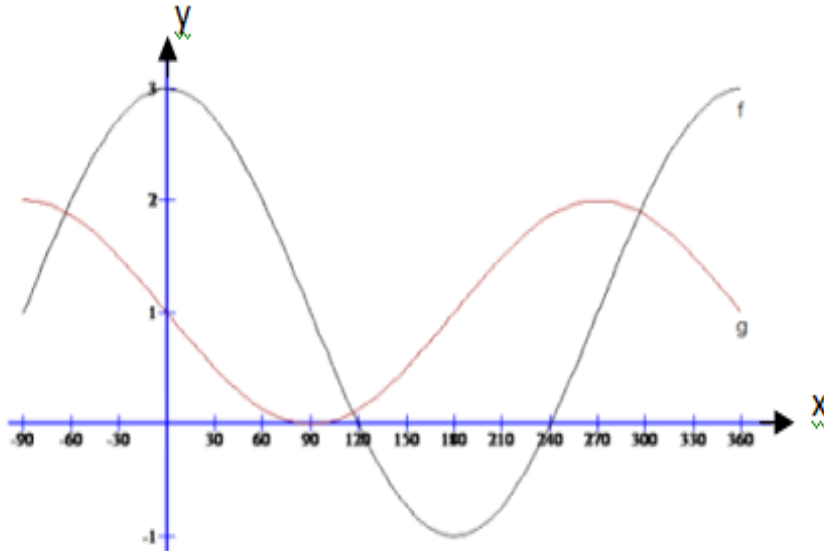
2.1	$y^2 = r^2 - x^2$ $\therefore y^2 = (25)^2 - (-7)^2$ $\therefore y^2 = 576$ $\therefore y = -24$ $\therefore 14 \tan \theta = 14 \left(\frac{-24}{-7} \right)$ $= 48$		✓ diagram correct in correct quad. ✓ $y = -24$ ✓ $\tan \theta = \frac{-24}{-7}$ ✓ answer	(4)
2.2	$\frac{\cos(90^\circ + x) \cdot \sin(180^\circ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

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

$$2 \cos x + 1 = 1 - \sin x$$

$$\therefore \sin x = -2 \cos x$$

$$\therefore \tan x = -2$$

$$\therefore \text{Ref. angle} = 63, 4349\dots^\circ$$

$$\therefore x = 180^\circ - 63, 4349\dots^\circ + k \cdot 180^\circ$$

$$\therefore x = 116, 57^\circ + k \cdot 180^\circ \text{ with } k \in \mathbb{Z}$$

$$\therefore x = -63, 43^\circ \text{ OR } 116, 57^\circ \text{ OR } 296, 57^\circ$$

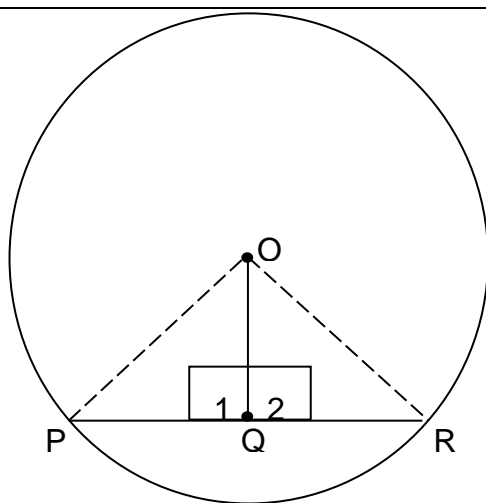
- ✓ $\tan x = -2$
- ✓ $63, 4349^\circ$
- ✓ $x = 116, 57^\circ + k \cdot 180^\circ$ with $k \in \mathbb{Z}$
- ✓ $-63, 43^\circ$
- ✓ $116, 57^\circ$
- ✓ $296, 57^\circ$

(6)

QUESTION 4

MARKS: 13

4.1



Construction: Join PO and OR

In $\triangle POQ$ and $\triangle ROQ$

- 1) $OQ = OQ$ common
- 2) $PO = OR$ radii
- 3) $\hat{Q}_1 = \hat{Q}_2 = 90^\circ$.. given

$$\therefore \triangle POQ \cong \triangle ROQ \dots 90^\circ \text{HS}$$

$$\therefore PQ = RQ$$

✓ construction
(radii, OP and OR)

✓ SR ie ($PO = OR$ radii)
✓ S ie ($\hat{Q}_1 = \hat{Q}_2 = 90^\circ$)

✓ S R
✓ $PQ = RQ$

(5)

4.2.1

 $\hat{A}_1 = 90^\circ$..line from centre to midpt. of chord

$$\hat{B} = 180^\circ - (\hat{O}_1 + \hat{A}_1) \dots \text{sum of angles of a } \triangle$$

$$= 50^\circ$$

✓ S R

✓ answer

(2)

4.2.2	$\hat{C} = 90^\circ$... angle in a semi-circle $\hat{D} = 180^\circ - (\hat{C} + \hat{B})$... sum of angles of Δ $= 40^\circ$	✓ 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	\checkmark S R \checkmark S \checkmark 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 $= x + y$ $\therefore \hat{Q}_2 = \hat{P}_2 = x + y$	\checkmark S R \checkmark S R \checkmark S R \checkmark 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 $\therefore \hat{P}_4 = \hat{Q}_4$ $\therefore JQ = JP$ sides opp = angles OR isos. Δ	\checkmark S R for $\hat{P}_4 = \hat{P}_2$ OR $\hat{Q}_4 = \hat{Q}_2$ $\checkmark \hat{P}_4 = \hat{Q}_4$ \checkmark 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 $\therefore \hat{K}_2 = \hat{C}$	✓ 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