



**GAUTENG PROVINCE**  
EDUCATION  
REPUBLIC OF SOUTH AFRICA

**GAUTENG DEPARTMENT OF EDUCATION**

**PROVINCIAL EXAMINATION**

**2016**

**GRADE 11**

**MATHEMATICS**  
**Second Paper**

**MEMORANDUM**

**11 pages**

**GAUTENG DEPARTMENT OF EDUCATION  
PROVINCIAL EXAMINATION**

**MATHEMATICS  
(Second Paper)**

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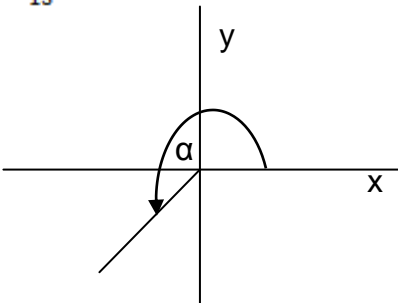
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**INFORMATION:**

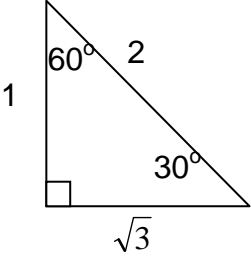
- A – Accuracy
- C.A. – Continued Accuracy
- S – Statement
- R – Reason
- S and R – Statement and Reason

	QUESTION 1	MARKS : 16
1.1	$KT = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$ $= \sqrt{(-5 - 1)^2 + (1 - 6)^2}$ $= \sqrt{61}$	✓ Distance formula ✓ subst. in corr. formula ✓ answer  [2/3 if answer not in surd form] <b>(3)</b>
1.2	$m_{KP} = \frac{y_2 - y_1}{x_2 - x_1}$ $= -\frac{1}{4}$ $(y - y_1) = m(x - x_1)$ $(y - 1) = -\frac{1}{4}(x - (-5))$ $y = -\frac{1}{4}x - \frac{1}{4}$ <p style="text-align: center;"><b>OR</b></p> $m_{KP} = \frac{y_2 - y_1}{x_2 - x_1}$ $= -\frac{1}{4}$ $(y - (-2)) = -\frac{1}{4}(x - 7)$ $y = -\frac{1}{4}x - \frac{1}{4}$	✓ answer $m_{KP}$  ✓ subst. (-5 ; 1) into str. line eq. ✓ answer (C.A)  <b>OR</b>  ✓ answer $m_{KP}$  ✓ subst. (7 ; -2) into str. line eq. ✓ answer (C.A)  <b>(3)</b>
1.3	$m_{KT} = \frac{6-1}{1-(-5)}$ $= \frac{5}{6}$ $(y - 6) = \frac{5}{6}(x - 1)$ $y = \frac{5}{6}x + 5\frac{1}{6}$ <p>A (0 ; <math>5\frac{1}{6}</math>)            B (0 ; <math>-\frac{1}{4}</math>)</p> $AB = 5\frac{1}{6} + \frac{1}{4}$ $= 5\frac{5}{12} \quad \text{OR} \quad 5,42 \quad \text{OR} \quad \frac{65}{12}$	✓ answer $m_{KT}$ (A)  ✓ eq. of Line KT. (A) <b>OR</b> y-int of line KT.  ✓ add of y co-ord. of A and B ✓ answer (A)  <b>(4)</b>

1.4	$\tan \beta = m_{KT}$ $\tan \beta = \frac{5}{6}$ $\beta = 39,81^\circ$ $m_{PT} = -\frac{4}{3}$ $\tan \alpha = -\frac{4}{3}$ $\alpha = 180^\circ - 53,13^\circ$ $= 126,87^\circ$ $\theta = \alpha - \beta \dots\dots \text{ext. } \angle \text{ of } \Delta$ $= 126,87^\circ - 39,81^\circ$ $= 87,06^\circ$ <p>ANY other valid solution</p>	$\checkmark \tan \beta = \frac{5}{6}$ $\checkmark \beta = 39,81^\circ$ $\checkmark \tan \alpha = -\frac{4}{3}$ $\checkmark \alpha = 126,87^\circ$ $\checkmark 126,87^\circ - 39,81^\circ$ $\checkmark \text{ answer}$ <p>(PENALISE once for rounding off , either <math>\alpha</math> or <math>\beta</math>)</p> <p style="text-align: right;"><b>(6)</b></p>
	<b>QUESTION 2</b>	<b>MARKS : 14</b>
2.1	<p>Let M (x ; y)</p> $OM^2 = MB^2 \dots\dots \text{radii)}$ $(0 - x)^2 + (0 - y)^2 = (8 - x)^2 + (0 - y)^2$ $x^2 + y^2 = 64 - 16x + x^2 + y^2$ $x = 4$	$\checkmark OM^2 = MB^2$ $\checkmark \text{ corr. Subst. in dist. formula}$ $\checkmark \text{ simplification (C.A)}$ $\checkmark \text{ answer}$ <p>Answer only 0</p> <p style="text-align: right;"><b>(4)</b></p>
2.2	$A(x ; y)$ $x = 0$ $\frac{0+y}{2} = 2$ $y = 4$ $A(0 ; 4)$	$\checkmark \text{ subst. in midpt. formula}$ $\checkmark y = 0$ $\checkmark \text{ co-ord. of A}$ <p>[2/3 if not in co-ordinate form]</p> <p style="text-align: right;"><b>(3)</b></p>
2.3	$m_{AB} = -\frac{1}{2}$ <p>Eq. of line OK:</p> $y - y_1 = m(x - x_1)$ $y - 0 = -\frac{1}{2}(x - 0)$ $y = -\frac{1}{2}x$	$\checkmark m_{AB}$ $\checkmark \text{ corr. subst. in str. line formula}$ $\checkmark \text{ answer (C.A)}$ <p style="text-align: right;"><b>(3)</b></p>

2.4	<p>Let T (x ; y)</p> $m_{AT} = \frac{4-y}{-x}$ $\frac{4-y}{-x} \times -\frac{1}{2} = -1 \dots\dots \perp \text{ lines}$ $y = 2x + 4 \dots\dots\dots(1)$ <p>Eq. of line OK</p> $y = -\frac{1}{2} x \dots\dots\dots(2)$ $2x + 4 = -\frac{1}{2} x$ $x = -\frac{8}{5}$ <p>Any other valid method</p>	$\checkmark \frac{4-y}{-x} \times -\frac{1}{2} = -1$ $\checkmark y = 2x + 4$ $\checkmark \text{ equating (1) and (2)}$ $\checkmark \text{ answer (C.A)}$ <p style="text-align: right;"><b>(4)</b></p>
<b>QUESTION 3</b>		<b>MARKS 28</b>
3.1	$13\sin\alpha = -5$ $\sin\alpha = -\frac{5}{13}$  $x = -\sqrt{13^2 - (-5)^2}$ $= -12$ $3\cos\alpha$ $= 3\left(-\frac{12}{13}\right)$ $= -\frac{36}{13}$	$\checkmark \sin\alpha = -\frac{5}{13}$ $\checkmark \text{ cartesian plane with terminal arm in 3rd quad.}$ $\checkmark x = -12$ $\checkmark \text{ subst. } \cos\alpha = -\frac{12}{13}$ $\checkmark \text{ answer}$ <p style="text-align: right;"><b>(5)</b></p>

3.2.1	$\frac{\sin(\theta - 180^\circ) \cdot \tan(360^\circ - \theta) \cdot \sin(90^\circ - \theta)}{\cos^2(\theta + 180^\circ)}$ $= \frac{-\sin \theta \times -\tan \theta \times \cos \theta}{\cos^2 \theta}$ $= \frac{-\sin \theta \times -\frac{\sin \theta}{\cos \theta} \times \cos \theta}{\cos^2 \theta}$ $= \frac{\sin^2 \theta}{\cos^2 \theta}$ $= \tan^2 \theta$	<p>✓ <math>-\sin \theta</math> ; ✓ <math>-\tan \theta</math> ; ✓ <math>\cos \theta</math> ;          ✓ <math>\cos^2 \theta</math></p> <p>✓ <math>-\tan \theta = -\frac{\sin \theta}{\cos \theta}</math></p> <p>✓ <math>\frac{\sin^2 \theta}{\cos^2 \theta}</math> or <math>\tan^2 \theta</math></p> <p style="text-align: right;">(6)</p>
3.2.2	$\frac{\sin 210^\circ \cdot \cos 400^\circ}{\sin(-50^\circ) \times \cos 120^\circ}$ $= \frac{\sin(180^\circ + 30^\circ) \times \cos(360^\circ + 40^\circ)}{-\sin 50^\circ \times \cos(180^\circ - 60^\circ)}$ $= \frac{-\sin 30^\circ \times \cos 40^\circ}{-\cos 40^\circ \times -\cos 60^\circ}$ $= -1$	<p>✓ <math>-\sin 50^\circ</math></p> <p>✓ <math>-\sin 30^\circ</math> ;          ✓ <math>\cos 40^\circ</math> ;          ✓ <math>-\cos 40^\circ</math> or <math>\cos 40^\circ = \sin 50^\circ</math>          ✓ <math>-\cos 60^\circ</math>          ✓ answer</p> <p style="text-align: right;">(6)</p>
3.3	$(4\theta - 8) \sin 30^\circ = \theta^3 - 8$ $(4\theta - 8) \sin 30^\circ = (\theta - 2)(\theta^2 + 2\theta + 4)$ $(4\theta - 8) \sin 30^\circ = (\theta - 2)(2)$ $\sin 30^\circ = \frac{(\theta - 2)(2)}{(4\theta - 8)}$ $= \frac{(\theta - 2)(2)}{4(\theta - 2)}$ $= \frac{1}{2}$	<p>✓ factorization</p> <p>✓ factorization of denominator</p> <p>✓ answer</p>

	 <p> <math>\tan 240^\circ = \tan (180^\circ + 60^\circ)</math>  <math>= \tan 60^\circ</math>  <math>= \sqrt{3}</math> </p>	<p> <math>\checkmark \tan 60^\circ</math>  <math>\checkmark</math> answer            Full marks if <math>\tan 60^\circ = \sqrt{3}</math> or            Show sketch to determine sol.            Answer only max 1 mark(surd form)         </p> <p style="text-align: right;">(5)</p>
3.4.1	<p>           L.H.S: <math>\frac{1}{\tan x} (\sin \alpha \tan \alpha + \cos \alpha)</math>  <math>= \sin \alpha + \frac{\cos \alpha}{\tan \alpha}</math>  <math>= \sin \alpha + \frac{\cos \alpha}{\frac{\sin \alpha}{\cos \alpha}}</math>  <math>= \sin \alpha + \frac{\cos^2 \alpha}{\sin \alpha}</math>  <math>= \frac{\sin^2 \alpha + \cos^2 \alpha}{\sin \alpha}</math>  <math>= \frac{1}{\sin \alpha} = \text{R.H.S}</math>            Any other valid method         </p>	<p> <math>\checkmark \sin \alpha + \frac{\cos \alpha}{\tan \alpha}</math>  <math>\checkmark</math> subst. <math>\tan \alpha = \frac{\sin \alpha}{\cos \alpha}</math>  <math>\checkmark \frac{\cos^2 \alpha}{\sin \alpha}</math>  <math>\checkmark \frac{\sin^2 \alpha + \cos^2 \alpha}{\sin \alpha}</math> </p> <p style="text-align: right;">(4)</p>
3.4.2	$\alpha = \{0^\circ; 90^\circ; 180^\circ; 270^\circ; 360^\circ\}$	<p> <math>\checkmark 0^\circ; 180^\circ; 360^\circ</math>  <math>\checkmark 90^\circ; 270^\circ</math> </p> <p style="text-align: right;">(2)</p>

	QUESTION 4	MARKS 12
4.1	$180^\circ$	✓ answer (1)
4.2	$y \in [-1;1]$  <b>OR</b>  $-1 \leq y \leq 1, y \in \mathbb{R}$	✓ -1 ;1 ✓ corr. brackets <b>OR</b>  ✓ -1 ;1 ✓ corr. inequalities (2)
4.3	$\theta = 40^\circ$ $a = 2$	✓ $40^\circ$ ✓ 2 (2)
4.4	$g(180^\circ) = -0,77$	✓ answer (C.A) (1)
4.5.1	$f(x) - g(x) > 0$ $f(x) > g(x)$ $-180^\circ \leq x < -103,3^\circ$ <b>OR</b> $[-180^\circ ; -103,3^\circ)$	✓ $-180^\circ ; -103,3^\circ$ ✓ corr. inequality <b>OR</b> corr. bracket <b>OR</b> $(16,7^\circ ; 130^\circ)$ or $(136,7^\circ ; 180^\circ]$ (2)
4.5.2	$g(x).f(x) \geq 0$  $[-130^\circ ; -90^\circ]$ <b>OR</b> $-130^\circ \leq x \leq -90^\circ$	✓ $[-130^\circ ; -90^\circ]$ ✓ corr brackets <b>OR</b> corr. inequalities $[0^\circ ; 50^\circ]$ or $[90^\circ ; 180]$ (2)
4.6	$3^{\cos(90^\circ - 2x)}$ $= 3^{\sin 2x}$  $= 3^{-1}$ <b>OR</b> $= \frac{1}{3}$	✓ $3^{\sin 2x}$  ✓ answer (2)



QUESTION 5		MARKS 8
5.1	is perpendicular to the chord	✓ answer (1)
5.2.1	$AD = \sqrt{AB^2 + BD^2}$ ... th. of pyth. $= \sqrt{24^2 + 16^2}$ $= 28,84$ cm	✓ Subst. ✓ answer (2)
5.2.2	$OD = x + 16$	✓ answer (1)
5.2.3	$OC^2 = BC^2 + OB^2$ ..... th. of pyth $OD^2 = 24^2 + x^2$ $(x + 16)^2 = 24^2 + x^2$ $x^2 + 32x + 256 = 576 + x^2$ $32x = 320$ $x = 10$	$OC^2 = BC^2 + OB^2$ $OC = OD$ .....radii ✓ $(x + 16)^2$ ✓ $24^2 + x^2$ ✓ simplification ✓ answer (4)
QUESTION 6		MARKS 8
6.1	$PT = \frac{1}{2}KT$ ..... line from centre $\perp$ to ch.	✓ S ✓ R (2)
6.2	$KC^2 = PC^2 + KP^2$ ..... th. of pyth. but $KP^2 = OK^2 - OP^2$ ..... th. of pyth. $KC^2 = PC^2 + OK^2 - OP^2$ but $OK = OC$ ..... radii $= PC^2 + OC^2 - (OC - PC)^2$ $= PC^2 + OC^2 - (OC^2 - 2OC.PC + PC^2)$ $= 2(OC.PC)$ $= 2(x + y)(y)$ $= 2xy + 2y^2$	✓ S ✓ $KP^2 = OK^2 - OP^2$ ✓ subst. $OK = OC$ ✓ subst. $OP = OC - PC$ ✓ simplification ✓ subst. for $OC$ and $PC$ (6)

	QUESTION 7	MARKS 14
7.1	$\hat{U} = \frac{1}{2} \widehat{VSR} \dots\dots\dots \angle \text{at centre} = 2 \times \angle \text{on circum.}$ $= \frac{1}{2} (110^\circ)$ $= 55^\circ$	✓ Reason  ✓ answer  <b>(2)</b>
7.2	$\hat{V}_2 = \frac{180^\circ - \widehat{VSR}}{2} \dots\dots\dots \angle \text{s opp} = \text{sides, radii}$ $= \frac{180^\circ - 110^\circ}{2}$ $= 35^\circ$	✓ S ✓ R  ✓ answer Answer with reason full marks  <b>(3)</b>
7.3	$\hat{R}_2 = (\hat{R}_3 + \hat{R}_2) - \hat{R}_3 \quad \angle \text{s opp} = \text{sides}$ $\hat{R}_2 = 35^\circ - 20^\circ$ $= 15^\circ$ $\hat{Q} = \hat{R}_2 + \hat{R}_1 \dots\dots\dots \angle \text{s in same seg}$ $= 15^\circ + 30^\circ$ $= 45^\circ$	✓ answer $\hat{R}_2 = 15^\circ$  ✓ S and R  ✓ answer  <b>(3)</b>
7.4	$\hat{K}_4 = \hat{K}_2 \dots\dots\dots \text{vert opp. } \angle \text{s}$ $= 90^\circ$ $\hat{P} = 180^\circ - (\hat{Q} + \hat{K}_4) \dots\dots\dots \angle \text{s of a } \Delta$ $= 180^\circ - (45^\circ + 90^\circ)$ $= 45^\circ$ <p style="text-align: center;"><b>OR</b></p> $\hat{T} = 180^\circ - (\hat{K}_2 + \hat{TKK}) \dots\dots\dots \angle \text{s of a } \Delta$ $= 180^\circ - (90^\circ + 45^\circ)$ $= 45^\circ$ $\hat{P} = \hat{T} \dots\dots\dots \angle \text{s in the same seg.}$ $= 45^\circ$	✓ S and R ✓ answer  ✓ S and R  ✓ answer <b>OR</b> ✓ S and R  ✓ answer  ✓ S and R ✓ answer  <b>(4)</b>

7.5	$\hat{T} = 45^\circ$ $\hat{T} = \hat{Q} = 45^\circ$ $\therefore TR \parallel PQ$ ..... alt. $\angle$ s =  <p style="text-align: center;"><b>OR</b></p> $\widehat{TRP} = 45^\circ$ $\widehat{TRP} = \widehat{P} = 45^\circ$ $\therefore TR \parallel PQ$ ..... alt. $\angle$ s =	$\checkmark \hat{T} = 45^\circ$ $\checkmark R$  <p style="text-align: center;"><b>OR</b></p> $\checkmark \widehat{TRP} = \widehat{P}$ $\checkmark R$  <p style="text-align: right;"><b>(2)</b></p>
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