



Province of the  
**EASTERN CAPE**  
EDUCATION

**NATIONAL  
SENIOR CERTIFICATE**

**GRADE 12**

**SEPTEMBER 2015**

**MATHEMATICS P2  
MEMORANDUM**

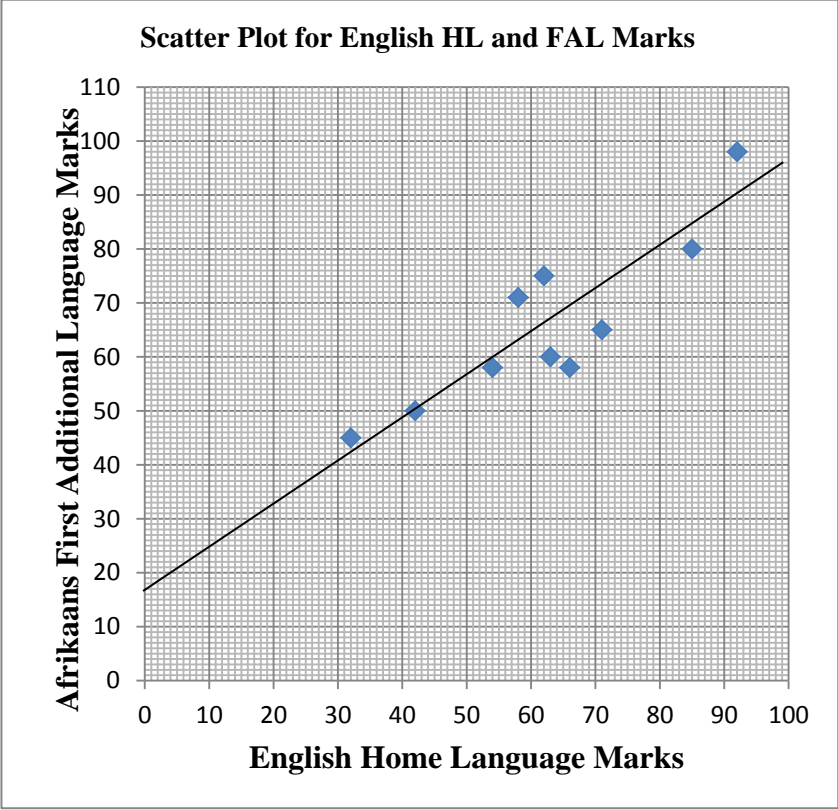
**MARKS: 150**

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This memorandum consists of 14 pages.

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QUESTION 1

1.1	<table border="1"> <tr> <td>English HL</td> <td>42</td> <td>54</td> <td>85</td> <td>32</td> <td>63</td> <td>71</td> <td>92</td> <td>62</td> <td>58</td> <td>66</td> </tr> <tr> <td>Afrikaans FAL</td> <td>50</td> <td>58</td> <td>80</td> <td>45</td> <td>60</td> <td>65</td> <td>98</td> <td>75</td> <td>71</td> <td>58</td> </tr> </table>	English HL	42	54	85	32	63	71	92	62	58	66	Afrikaans FAL	50	58	80	45	60	65	98	75	71	58	 <p>✓✓✓ plotting all ten points</p> <p>✓ regression line</p>	(4)
English HL	42	54	85	32	63	71	92	62	58	66															
Afrikaans FAL	50	58	80	45	60	65	98	75	71	58															
1.2	$a = 18,03563\dots$ $b = 0,76\ 7429\dots$ $y = 18,04 + 0,77x$	✓ value for A ✓ value for B ✓ equation	(3)																						
1.3	$r = 0,88$	✓✓ Answer	(2)																						
1.4	Strong positive correlation. OR Linear trend OR If learner got high marks in English then they would achieve similar marks in Afrikaans	✓ Answer	(1)																						
1.5	74% Accept answers from 73 to 75	✓✓ Answer	(2)																						
			<b>[12]</b>																						

**QUESTION 2**

2.1	$\bar{x} = \frac{\sum x}{n}$ $= \frac{1155}{20}$ $= 57,75$ $\sigma = (6,737 \dots)^2$ $= 45,39$ <p>Answer only: Full Marks</p>	✓ Answer ✓ square of variance ✓ Answer	(3)
2.2.1	22 students	✓ Answer	(1)
2.2.2	$\bar{x} = \frac{\sum x}{n}$ $= \frac{1320}{22}$ $= 60$ <p>Answer only: Full Marks</p>	✓ substitution ✓ Answer	(2)
2.2.3	$\sigma = \sqrt{\frac{1012}{22}}$ $= 6,782$ <p>Answer only: Full Marks</p>	✓ substitution ✓ Answer	(2)
2.3	$\frac{1155 + 5x}{25} = 60$ $1155 + 5x = 1500$ $5x = 345$ $x = 69$ <p>Each boy must be 69 kg</p>	$\checkmark \frac{1155 + 5x}{25}$ $= 60$ ✓ Answer	(2)
			<b>[10]</b>

## QUESTION 3

3.1.1	$E = \left[ \frac{x_1 + x_2}{2}; \frac{y_1 + y_2}{2} \right]$ $= \left[ \frac{3+5}{2}; \frac{5+3}{2} \right]$ $E = (4; 4)$	✓ substitution into correct formula  ✓ co-ordinates of E.	(2)
3.1.2	$m_{AB} = m_{DC}$ $\frac{y - y_1}{x - x_1} = \frac{3 - 1}{5 + 1}$ $\frac{y - 5}{x - 3} = \frac{2}{6}$ $\therefore y - 5 = 2 \text{ \& } x - 3 = 6$ $\therefore y = 7 \text{ \& } x = 9$ <p>B(9; 7) OR</p> $\frac{-1 + x}{x} = 4, \quad \frac{1 + y}{x} = 4$ <p><math>x = 9, y = 7</math> B(9; 7)</p>	✓ equating two gradients. ✓ simplification ✓ co-ordinates for B  $\checkmark \frac{-1+x}{x} = 4$ $\checkmark \frac{1+y}{x} = 4$ ✓ co-ordinates for B	(3)
3.1.3	$F = \frac{-1+5}{2}; \frac{1+3}{2}$ $F = [2; 2]$ $y - y_1 = m(x - x_1)$ $y - 2 = 1(x - 2)$ $y = x - 2 + 2$ $y = x$	✓ co-ordinates of F ✓ formula ✓ correct value of m ✓ correct substitution into formula ✓ Answer	(5)
3.2	$m_{DE} = m_{EG}$ $\frac{2,5 - 4}{t + 1 - 4} = \frac{3}{5}$ $\frac{-1,5}{t - 3} = \frac{3}{5}$ $3t - 9 = -7,5$ $3t = 1,5$ $t = 0,5$	✓ equating gradients  ✓ correct substitution  ✓ simplification  ✓ answer	(4)

<p>3.3</p>	$AB = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$ $= \sqrt{(9 - 3)^2 + (7 - 5)^2}$ $= \sqrt{40}$ $= \sqrt{(-1 - 3)^2 + (1 - 5)^2}$ $= \sqrt{32}$ <p><math>\therefore</math> ABCD is NOT a rhombus because <math>AB \neq AD</math></p> <p style="text-align: center;">OR</p> $m_{AC} = \frac{y_2 - y_1}{x_2 - x_1}$ $= \frac{5 - 3}{3 - 5}$ $= -\frac{2}{3}$ $m_{DB} = \frac{3}{5}$ $m_{AC} \times m_{DB} = -\frac{2}{3} \times \frac{3}{5}$ $= -\frac{2}{5}$ $\neq -1$ <p><math>\therefore</math> ABCD is not a rhombus because:  <math>m_{AC} \times m_{DB} \neq -1</math></p>	<p>✓ substitution in formula                  ✓ answer</p> <p>✓ answer                  ✓ statement                  ✓ reason</p> <p>✓ substitution in formula</p> <p>✓ answer</p> <p>✓ answer</p> <p>✓ statement                  ✓ reason</p>	<p>(5)</p> <p>[19]</p>
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## QUESTION 4

4.1	$r^2 = (3 + 1)^2 + (1 - 4)^2$ $= 16 + 9$ $r^2 = 25$ $r = 5$ $(x - a)^2 + (y - b)^2 = r^2$ $(x + 1)^2 + (y - 4)^2 = 25$	✓ use of distance formula ✓ $r^2 = 25$ ✓✓ substituting values into formula	(4)
4.2	$\widehat{NQM} = 90^\circ$ [angle subtended by diameter]	✓ answer	(1)
4.3	$(m_{NQ}) \cdot (m_{QM}) - 1$ $\frac{y - 7}{x + 5} \times \frac{y - 1}{x - 3} = -1$ $\frac{0 - 7}{x + 5} \times \frac{0 - 1}{x - 3} = -1$ $\frac{7}{x + 5} \times \frac{-1}{x + 5} = -1$ $x^2 + 2x - 15 = -7$ $x^2 + 2x - 8 = 0$ $(x + 4)(x - 2) = 0$ $x = -4, x = 2$ Q(-4; 0)	✓ substitution into formula for perpendicular gradients  ✓ simplification and solving trinomial  ✓ coordinates of Q	(3)
4.4	$m_{MN} = \frac{y_2 - y_1}{x_2 - x_1}$ $= \frac{7 - 1}{-5 - 3}$ $= \frac{6}{-8} = -\frac{3}{4}$	✓ substitution in formula  ✓ answer	(2)
4.5	$m_{MN} = -\frac{3}{4}$ $\tan \theta = -\frac{3}{4}$ $\theta = 180^\circ - 36,86^\circ$ $\theta = 143,13^\circ$ $m_{QM} = \frac{1 - 0}{3 + 4}$ $\tan \beta = \frac{1}{7}$ $\beta = 8,13^\circ$ $\alpha = 143,13^\circ - 98,13^\circ$ $\alpha = 45^\circ$	✓ Gradient of MN  ✓ value of $\theta$  ✓ Gradient of QM  ✓ value of $\beta$  ✓ value of $\alpha$	(5)

4.6	$m_{MP} = \frac{4-1}{-1-3}$ $= -\frac{3}{4}$ $m_{\tan} = \frac{4}{3}$ $y - y_1 = m(x - x_1)$ $y - 1 = \frac{4}{3}(x - 3)$ $y = \frac{4}{3}x - 4 + 1$ $y = \frac{4}{3}x - 3$	✓ $m_{MP}$  ✓ $m_{\tan}$  ✓ substitution in formula ✓ simplification  ✓ answer	(5)
			<b>[20]</b>

**QUESTION 5**

5.1	$\cos 75^\circ + \cos 15^\circ = \cos(45^\circ + 30^\circ) + \cos(45^\circ - 30^\circ)$ $= 2 \cos 45^\circ \cdot \cos 30^\circ$ $= 2 \left( \frac{\sqrt{2}}{2} \times \frac{\sqrt{3}}{2} \right)$ $= \frac{\sqrt{6}}{2}$	✓ expression in terms of 30 and 45° ✓ use of compound identity ✓ substitution of values ✓ answer.	(4)
5.2	$1 + 4 \sin^2 A - 5 \sin A + \cos 2A = 0$ $1 + 4 \sin^2 A - 5 \sin A + 1 - 2 \sin^2 A = 0$ $2 \sin^2 A - 5 \sin A + 2 = 0$ $(2 \sin A - 1)(\sin A - 2) = 0$ $2 \sin A = 1 \text{ or } \sin A = 2 \text{ (no solution)}$ $\sin A = \frac{1}{2}$ $A = 30^\circ + k \cdot 360$ $A = 150^\circ + k \cdot 360^\circ; k \in \mathbb{Z}$	✓ $\cos 2A$ in terms of $\sin A$ ✓ standard form ✓ factors ✓ for each value of $\sin A$ ✓ gen. sol in 1 <sup>st</sup> quadrant ✓ gen. sol in 2 <sup>nd</sup> quadrant ✓ gen. sol notation	(7)

5.3	$\frac{\sin 2A}{1 + \cos 2A} = \tan A$ $\text{LHS} = \frac{2 \sin A \cdot \cos A}{1 + 2 \cos^2 A - 1}$ $= \frac{2 \sin A \cdot \cos A}{2 \cos^2 A}$ $= \frac{\sin A}{\cos A}$ $= \tan A$ $\text{LHS} = \text{RHS}$	<p>✓ double angle identity for <math>\sin 2A</math></p> <p>✓ double angle identity for <math>\cos 2A</math></p> <p>✓ LHS = RHS</p>	(3)
5.4	$\frac{\cos x \tan x \sin 23^\circ \cos 23^\circ}{\sin 46^\circ (-\sin x)}$ $\cos x \cdot \frac{\sin x}{\cos x} \cdot \sin 23^\circ \cdot \cos 23^\circ$ $\frac{-2 \sin 23^\circ \cos 23^\circ \cdot \sin x}{1}$ $-\frac{1}{2}$	<p>✓ <math>\cos x</math></p> <p>✓ <math>\tan x</math></p> <p>✓ <math>\sin 46^\circ</math></p> <p>✓ <math>-\sin x</math></p> <p>✓ <math>\frac{\sin x}{\cos x}</math></p> <p>✓ <math>2 \sin 23^\circ \cos 23^\circ</math></p>	(6)
			<b>[20]</b>



QUESTION 6

6.1	120°		✓ answer.	(1)
6.2			<i>f</i> ✓ x-int ✓ y-int ✓ turning point  <i>g</i> ✓ x-int ✓ y-int ✓ turning point	(6)
6.3	6.3.1	$x \in (30^\circ ; 90]$	✓ both values correct ✓ correct notation	(2)
	6.3.2	$x \in (-90^\circ ; -30^\circ)$	✓ both values correct ✓ correct notation	(2)
6.4	$-4 \leq y \leq 0,5$ OR $[-4 ; 0,5]$		✓ interval ✓ values	(2)
				<b>[13]</b>

## QUESTION 7

7.1	$\text{In } \triangle CBE$ $\frac{CE}{BC} = \sin \hat{C}BE$ $BC = \frac{CE}{\sin \hat{B}}$ $= \frac{3}{\sin 16,7^\circ}$ $BC = 10,44$	<p>✓ ratio for sin</p> <p>✓ simplification and substitution</p> <p>✓ Answer</p>	(3)
7.2	$\text{In } \triangle ABC$ $\frac{AB}{\sin \hat{C}} = \frac{BC}{\sin A}$ $AB = \frac{BC \cdot \sin \hat{C}}{\sin \hat{A}}$ $AB = \frac{10,44 \cdot \sin 32,3^\circ}{\sin 18,1}$ $AB = 17,96^0$	<p>✓ use of sine rule</p> <p>✓ simplification and substitution</p> <p>✓ answer</p>	(3)
7.3	$\frac{AD}{AB} = \sin \hat{C}BD$ $AD = AB \cdot \sin \hat{C}BD$ $= 17,96 \sin 33,7^\circ$ $AD = 9,96\text{m}$ $AD = 10\text{m}$	<p>✓ ratio for sin</p> <p>✓ simplification &amp; substitution</p> <p>✓ answer</p>	(3)
			<b>[9]</b>

**QUESTION 8**

8.1.1	$\hat{T}_2 = x$ [OS = OT, radii] $\hat{O}_1 = 180^\circ - 2x$ [sum of $\angle$ 's of $\Delta$ ]	✓S/R ✓S/R	(2)
8.1.2	$\hat{P} = \frac{\hat{O}_1}{2}$ [ $\angle$ at centre = $2 \times \angle$ at circumference] $= \frac{180-2x}{2}$ $= 90^\circ - x$	✓ statement and reason ✓ answer	(2)
8.1.3	$\hat{O}_1 = \hat{R}$ [SOQR is parallelogram]or [ opp angles of parallelogram] $\hat{R} = 180^\circ - 2x$	✓ statement & reason ✓ answer	(2)
8.2	$\hat{O}_1 = \hat{R}$ [ opp angles of parallelogram] $180^\circ - 2x = 90^\circ + x$ $3x = 90^\circ$ $x = 30^\circ$	✓ statement and reason ✓ substitution of values ✓ Answer	(3)
			<b>[9]</b>

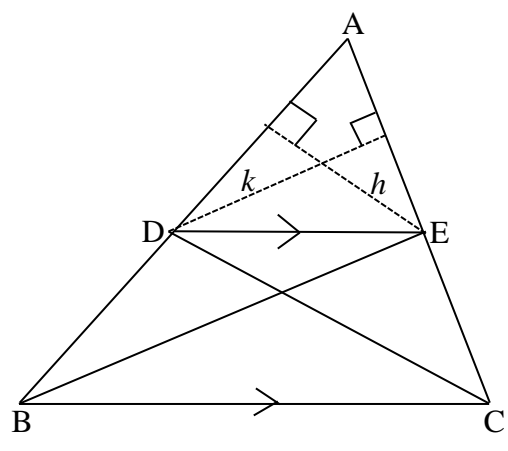
**QUESTION 9**

9.1	$\hat{M}_1 = \hat{M}_2 = 90^\circ$ [line from centre to midpoint of chord] $\hat{M}_2 = \hat{A}$ [given $QA \perp TA$ ] $\hat{M}_2 + \hat{A} = 180^\circ$ $\therefore$ MTAR is a cyclic quad [opp $\angle$ 's are supplementary]	✓ $M_2 = 90^\circ$ ✓ reason ✓ $M_2 = A$ & reason ✓ conclusion and reason	(4)
9.2	In $\Delta PMR$ & $\Delta TMR$ (i) $M_1 = M_2$ [OR bisects PT] (ii) $PM = MT$ [M is midpoint of PT] (iii) $MR = MR$ [common] $\therefore \Delta PMR \equiv \Delta TMR$ [S A S] $\therefore PR = TR$	✓ statement and reason ✓ statement and reason ✓ statement and reason ✓ SAS ✓ conclusion	(5)
9.3	$\hat{T}_2 = \hat{P}$ [Tan chord theorem] $\hat{T}_1 = \hat{T}_2$ [Both equal to P]	✓ $\hat{T}_2 = \hat{P}$ ✓ Tan chord ✓ conclusion	(3)
			<b>[12]</b>

## QUESTION 10

10.1	Proportional	✓ Answer	(1)
10.2.1	$A_4 = D_1$ [tan chord theorem] $D_1 = x$  $D_1 = E_2$ [angles in same segment] $E_2 = x$  $A_4 = C_2$ [alt int.]	✓ statement and reason  ✓ statement and reason  ✓ statement and reason	(3)
10.2.2	In $\triangle ACF$ & $\triangle ADC$ i) $A_3 = A_3$ [common] ii) $C_2 = D_1$ $\triangle ACF \sim \triangle ADC$ [equiangular]	✓ statement and reason ✓ statement and reason ✓ statement and reason	(3)
10.2.3	$\triangle ACF \sim \triangle ADC$  $\frac{AC}{AD} = \frac{AF}{AC} = \frac{CF}{DC}$  $\frac{AC}{AD} = \frac{AF}{AC}$  $AF = \frac{AC \cdot AC}{AD}$ But $AC = AO$  $AF = \frac{AO^2}{AD}$	✓ sides in proportion  ✓ choosing correct proportion  ✓ simplification  ✓ answer	(4)
			<b>[11]</b>

QUESTION 11

<p>11.1</p>	 <p>RTP: <math>\frac{AD}{DB} = \frac{AE}{EC}</math></p> <p>Constr: Draw height <math>h</math> from <math>E</math> to <math>AD</math>          Draw height <math>k</math> from <math>D</math> to <math>AE</math>.          Join <math>BE</math> and <math>DC</math></p> <p>PROOF:</p> $\frac{\text{area } \triangle ADE}{\text{area } \triangle BDE} = \frac{\frac{1}{2} \cdot AD \cdot h}{\frac{1}{2} \cdot DB \cdot h}$ $= \frac{AD}{BD}$ $\frac{\text{area } \triangle ADE}{\text{area } \triangle CED} = \frac{\frac{1}{2} \cdot AE \cdot k}{\frac{1}{2} \cdot EC \cdot k}$ $= \frac{AE}{EC}$ <p>But Area <math>\triangle BDE = \text{Area } \triangle CED</math> (same base and same height)</p> $\therefore \frac{\text{area } \triangle ADE}{\text{area } \triangle BDE} = \frac{\text{area } \triangle ADE}{\text{area } \triangle CED}$ $\therefore \frac{AD}{DB} = \frac{AE}{EC}$	<p>✓ constr</p> <p>✓ ratio of area of <math>\triangle ADE</math>:  <math>\triangle BDE</math></p> <p>✓ <math>\frac{AD}{BD}</math></p> <p>✓ ratio of area of <math>\triangle ADE</math> :  <math>\triangle CED</math></p> <p>✓ <math>\frac{AE}{EC}</math></p> <p>✓ equating two areas</p> <p>✓ conclusion <math>\frac{AD}{DB} = \frac{AE}{EC}</math></p>	<p>(6)</p>
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11.2.1	$\frac{AD}{DB} = \frac{AM}{MN} = \frac{3}{2}$ [Prop. theorem; DE $\parallel$ BC]	<ul style="list-style-type: none"> <li>✓ answer</li> <li>✓ reason</li> </ul>	(2)
11.2.2	<p>In <math>\triangle ADE</math> &amp; <math>\triangle ABC</math></p> <p>i) <math>\hat{A} = \hat{A}</math> [common]</p> <p>ii) <math>\hat{ADE} = \hat{ABC}</math> [corresponding; DE <math>\parallel</math> BC]</p> <p><math>\therefore \triangle ADE \sim \triangle ABC</math> [equiangular]</p> <p><math>\therefore \frac{AD}{AB} = \frac{DE}{BC} = \frac{AE}{AC}</math></p> <p><math>\frac{AD}{BC} = \frac{DE}{BC} = \frac{3}{2}</math></p>	<ul style="list-style-type: none"> <li>✓ Corresponding angles equal</li> <li>✓ showing <math>\triangle ADE \sim \triangle ABC</math></li> <li>✓ sides in proportion</li> <li>✓ answer</li> </ul>	(4)
11.2.3	$\frac{\text{area } \triangle ADE}{\text{area } \triangle ABC} = \frac{\frac{1}{2} DE \cdot AM}{\frac{1}{2} BC \cdot AN}$ $= \frac{3 \times 3}{5 \times 5}$ $= \frac{9}{25}$	<ul style="list-style-type: none"> <li>✓ Ratio of areas</li> <li>✓ substitution of values in denominator and numerator</li> <li>✓ simplification and answer</li> </ul>	(3)
			[15]
<b>TOTAL:</b>			<b>150</b>