



Education

KwaZulu-Natal Department of Education

MATHEMATICS P2

MARKING GUIDELINE

PREPARATORY EXAMINATION

SEPTEMBER 2018

**NATIONAL
SENIOR CERTIFICATE**

GRADE 12

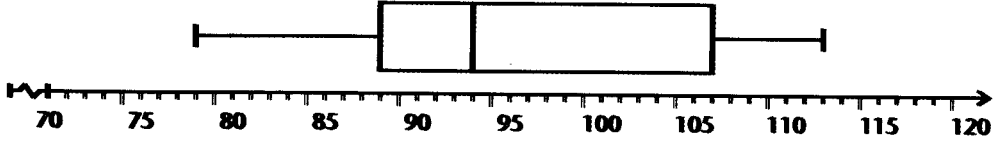
MARKS: 150

This marking guideline consists of 14 pages.

QUESTION 1

1.1	strong positive trend	✓ A strong positive	(1)
1.2	(38; 127)	✓ A answer	(1)
1.3	$a = 68,66$ $b = 2,46$ $y = 68,66x + 2,46x$	✓ A $a = 68,66$ ✓ A $b = 2,46$ ✓ CA equation	(3)
1.4	$y = 68,66 + 2,46 (24)$ $= 127,7$ $= 127$	✓ CA ✓ CA answer	(2)
			[7]

QUESTION 2

2.1	$\text{Mean weight} = \bar{x} = \frac{1443}{15}$ $= 96,2 \text{ kg}$	✓ A sum divided by 15 ✓ CA answer (only if dividing by 15)	(2)
2.2	$\sigma = \text{standard deviation} = 11,27$	✓✓ AA answer	(2)
2.3	$(\bar{x} - \sigma; \bar{x} + \sigma)$ $= (84,93 ; 107,47)$ Therefore 2 scores are less than the standard deviation	✓ CA identify range ✓ CA answer	(2)
2.4		✓ A min value 79 ✓ A Q ₁ = 89 ✓ A Q ₂ = 94 ✓ A Q ₃ = 107 ✓ A max value = 113	(5)
2.5	$\text{IQR} = Q_3 - Q_1$ $= 107 - 89$ $= 18$	✓ CA difference ✓ CA answer	(2)
2.6	$\bar{x} - \text{median} = 96,2 - 94,00$ $= 2,2$ Data is positively skewed.	✓ CA answer	(1)
			[14]

QUESTION 3

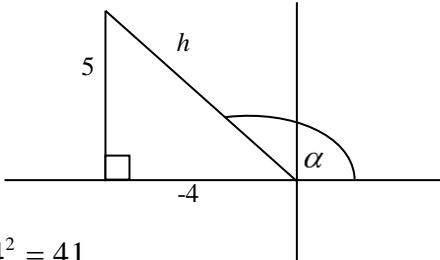
<p>3.1.1</p>	$m_{AB} = \frac{y_2 - y_1}{x_2 - x_1}$ $= \frac{1 - 5}{4 - (-4)}$ $= \frac{-4}{8}$ $= \frac{-1}{2}$	<p>✓ A substitution into gradient formula</p> <p>✓ CA answer (provided – answer)</p>	<p>(2)</p>
<p>3.1.2</p>	$y = mx + c$ $5 = -\frac{1}{2}(-4) + c$ $c = 3$ $y = -\frac{1}{2}x + 3$	<p>✓ CA substituting point and gradient of line AB</p> <p>✓ CA answer</p>	<p>(2)</p>
<p>3.1.3</p>	$m_{CD} = 2 \quad CD \perp AB$ $y = mx + c$ $-4 = 2(-1) + c$ $c = -2$ $y = 2x - 2$	<p>✓ CA $CD \perp AB$</p> <p>✓ A substituting point (-1;-4)</p> <p>✓ CA answer</p>	<p>(3)</p>
<p>3.1.4</p>	$\therefore 2x - 2 = -\frac{1}{2}x + 3$ $\frac{5}{2}x = 5$ $\therefore x = 2$ $\therefore y = 2(2) - 2$ $= 2$ $\therefore E(2; 2)$	<p>✓ CA Equating</p> <p>✓ CA $x = 2$</p> <p>✓ CA $y = 2$ (CA if both co-ordinates are positive)</p>	<p>(3)</p>

<p>3.1.5</p>	$m_{CB} = \frac{1 - (-4)}{4 - (-1)}$ $= 1$ <p>Equation of line passing through A parallel to BC = 1</p> $y = mx + c$ $5 = 1(-4) + c$ $c = 9$ $y = x + 9$	<p>✓ A substitution into gradient formula</p> <p>✓ CA gradient value</p> <p>✓ CA gradient of Line parallel</p> <p>✓ A substitution of point (- 4 ; 5)</p> <p>✓ CA answer</p>	<p>(5)</p>
<p>3.2</p>	<p>$\tan \theta = 1$</p> <p>$\theta = 45^\circ$</p>	<p>✓ CA $\tan \theta = 1$</p> <p>✓ CA answer</p>	<p>(2)</p>
<p>3.3</p>	$CE = \sqrt{(2 - (-1))^2 + (2 - (-4))^2}$ $= \sqrt{9 + 36}$ $= \sqrt{45}$ $= 3\sqrt{5}$ $AE = \sqrt{(2 - (-4))^2 + (2 - 5)^2}$ $= \sqrt{36 + 9}$ $= \sqrt{45}$ $= 3\sqrt{5}$ <p>Area of $\Delta AEC = \frac{1}{2}$ base x height</p> $= \frac{1}{2} \cdot 3\sqrt{5} \times 3\sqrt{5}$ $= \frac{1}{2} \cdot 9 \times 5$ $= \frac{45}{2}$ $= 22,5 \text{ units}^2$	<p>✓ CA answer</p> <p>✓ CA answer</p> <p>✓ CA Correct substitution into Area formula</p> <p>✓ CA Answer</p>	<p>(4)</p> <p>[21]</p>

QUESTION 4

4.1	P(6 ; - 2)	✓ A x – value ✓ A y - value	(2)
4.2	$2x - 4 = 0$ $x = 2$ S(2 ; 0)	✓ A equating to 0 ✓ A x – value	(2)
4.3	$\hat{A}BC = 90^\circ$ Angle in a semi-circle $m_{BC} = -\frac{1}{2}$ AB \perp BC $y = mx + c$ $2 = -\frac{1}{2}(3) + c$ $c = \frac{7}{2}$ $y = -\frac{1}{2}x + \frac{7}{2}$	✓ A Statement ✓ A gradient of BC ✓ A substitution of point (3 ;2) ✓ CA answer	(4)
4.4	R(7 ; 0) x int of BC $BR^2 = (7 - 3)^2 + (0 - 2)^2 = 20$ $(x - 7)^2 + (y - 0)^2 = 20$	✓ CA for 7 ✓ A for 0 coordinates of R ✓ CA subst. into distance formula ✓ CA radius value ✓ CA answer	(5)
4.5	$m_{PS} = -\frac{1}{2}$ $\therefore PS \parallel CB$ equal gradients A(1; - 2) midpoint formula Since the y – coordinates of A and P is – 2 Therefore AC//SR OR $m_{AC} = 0$... (both y values are the same) $m_{SR} = 0$... (x–axis) $\therefore m_{AC} = m_{SR}$ $\therefore AC//SR$	✓ A ✓ A gradient of PS ✓ A PS//CB ✓ A coordinates of A ✓ A Reasoning ✓ A Statement ✓ A Reason ✓ A Statement ✓ A Reason ✓ A $m_{AC} = m_{SR}$	(5) [18]

QUESTION 5

5.1	$4 \tan \alpha + 5 = 0$ $\tan \alpha = \frac{-5}{4}$  $h^2 = 5^2 + 4^2 = 41$ $\therefore h = \sqrt{41}$ $\cos 180^\circ = -1$ $\sin(-150^\circ) = -\sin 30^\circ$ $= -\frac{1}{2}$ $\sqrt{41} \left(\frac{-4}{\sqrt{41}} \right) - 4 \left(-\frac{1}{2} \right) (-1) = -4 - 2 = -6$	<p>✓ A diagram in the correct quadrant</p> <p>✓ A $\sqrt{41}$</p> <p>✓ A -1</p> <p>✓ A $-\frac{1}{2}$</p> <p>✓ CA answer</p>	(5)
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<p>5.2.1</p>	$\frac{\cos 99^\circ}{\cos 33^\circ} - \frac{\sin 99^\circ}{\sin 33^\circ}$ $= \frac{\cos 99^\circ \sin 33^\circ - \sin 99^\circ \cos 33^\circ}{\cos 33^\circ \sin 33^\circ}$ $= \frac{-[\sin 99^\circ \cos 33^\circ - \cos 99^\circ \sin 33^\circ]}{\cos 33^\circ \sin 33^\circ}$ $= \frac{-\sin(99^\circ - 33^\circ)}{\cos 33^\circ \sin 33^\circ}$ $= \frac{-\sin 66^\circ}{\cos 33^\circ \sin 33^\circ}$ $= \frac{-2 \sin 33^\circ \cos 33^\circ}{\cos 33^\circ \sin 33^\circ}$ $= -2$	<p>✓ A Simplification</p> <p>✓ A Taking negative sign out</p> <p>✓ A $\sin(99^\circ - 33^\circ)$</p> <p>✓ A $\sin 66^\circ$</p> <p>✓ A $2 \sin 33^\circ \cos 33^\circ$</p> <p>✓ A answer</p>	<p>(6)</p>
<p>5.2.2</p>	$= \frac{-\cos 40^\circ - (\cos \theta)}{\sin 50^\circ + \cos \theta}$ $= \frac{-\cos 40^\circ - (\cos \theta)}{\cos 40^\circ + \cos \theta} = \frac{-(\cos 40^\circ + \cos \theta)}{(\cos 40^\circ + \cos \theta)}$ $= -1$	<p>✓ A $-\cos 40^\circ$</p> <p>✓ A $\cos \theta$ (numerator)</p> <p>✓ A $\sin 50^\circ$</p> <p>✓ $\cos \theta$ (denominator)</p> <p>✓ CA answer</p>	<p>(5)</p>
<p>5.3</p>	$\frac{2 \sin^2 x}{2 \tan x - \sin 2x} = \frac{\cos x}{\sin x}$ <p><i>LHS</i></p> $= \frac{2 \sin^2 x}{\frac{2 \sin x}{\cos x} - 2 \sin x \cos x}$ $= \frac{2 \sin^2 x}{\frac{2 \sin x - 2 \sin x \cos^2 x}{\cos x}}$ $= \frac{2 \sin^2 x \cdot \cos x}{2 \sin x - 2 \sin x \cos^2 x}$ $= \frac{2 \sin^2 x \cos x}{2 \sin x [1 - \cos^2 x]}$ $= \frac{2 \sin x \cos x}{\sin^2 x}$ $= \frac{\cos x}{\sin x}$ <p><i>= RHS</i></p>	<p>✓ A $2 \sin x \cos x$</p> <p>✓ A $\frac{\sin x}{\cos x}$</p> <p>✓ A Simplification</p> <p>✓ A removal of common factor of $2 \sin x$</p> <p>✓ A $\frac{\sin x \cos x}{\sin^2 x}$</p>	<p>(5)</p>

<p>5.4</p>	$8 \sin \theta \cos \theta = -2\sqrt{3}$ $\frac{8 \sin \theta \cos \theta}{4} = \frac{-2\sqrt{3}}{4}$ $2 \sin \theta \cos \theta = \frac{-\sqrt{3}}{2}$ $\sin 2\theta = \frac{-\sqrt{3}}{2}$ <p>reference angle = 60°</p> $2\theta = (180^\circ + 60^\circ) + k \cdot 360^\circ, k \in \mathbb{Z}$ $2\theta = 240^\circ + k \cdot 360^\circ, k \in \mathbb{Z}$ $\theta = 120^\circ + k \cdot 180^\circ, k \in \mathbb{Z}$ <p style="text-align: center;">OR</p> $2\theta = (360^\circ - 60^\circ) + k \cdot 360^\circ, k \in \mathbb{Z}$ $2\theta = 300^\circ + k \cdot 360^\circ, k \in \mathbb{Z}$ $\theta = 150^\circ + k \cdot 180^\circ, k \in \mathbb{Z}$	<p>✓ A dividing by 4 both sides</p> <p>✓ A $2 \sin \theta \cos \theta = \sin 2\theta$</p> <p>✓ A 60°</p> <p>✓ CA 240°</p> <p>✓ CA $\theta = 120^\circ + k \cdot 180^\circ, k \in \mathbb{Z}$</p> <p>✓ CA 300°</p> <p>✓ CA $\theta = 150^\circ + k \cdot 180^\circ, k \in \mathbb{Z}$</p>	<p>(7)</p> <p>[29]</p>
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QUESTION 6

6.1

- ✓ A shape of f
- ✓ A shape of g
- ✓✓ A A asymptotes
- ✓ A x -intercepts of f
- ✓ A Turning points of f
- ✓ A x -intercepts of g

- ✓ A 3 intersection points

(8)

<p>6.2</p>	<p>the graphs intersect at A, B and C. At A we have $x = 34^\circ$, at C we have $x = 90^\circ$ and by using symmetry we get at B, $x = 180^\circ - 34^\circ = 146^\circ$.</p>	<p>✓ A using symmetry</p> <p>✓ A answer</p> <p>Answer only full marks</p>	<p>(2)</p> <p>[10]</p>
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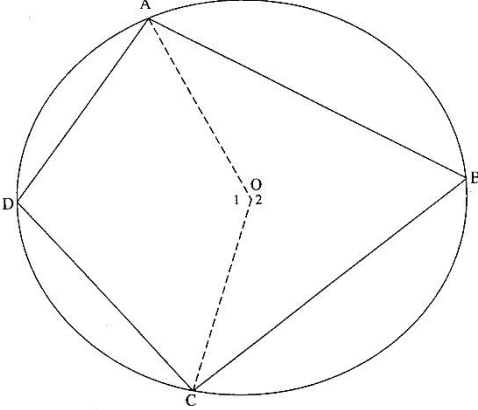
QUESTION 7 As a result of the typographical error in the question paper this question will not be marked – Total of paper will now be 144 marks but must be converted to 150 for recording purposes)

7.	<p>In Δ PQS</p> $\tan y = \frac{h}{PQ}$ $\therefore PQ = \frac{h}{\tan y}$ $= \frac{h \cos y}{\sin y}$ <p>In Δ PQR</p> $\widehat{PQR} = \frac{180^\circ - 2y}{2}$ $= 90^\circ - y$ $\therefore \frac{PR}{\sin(90^\circ - y)} = \frac{PQ}{\sin 2y}$ $\therefore PR = \frac{PQ \cos y}{\sin 2y}$ $= \frac{h \cos y}{\sin y} \cdot \frac{\cos y}{\sin 2y}$ $= \frac{h \cos^2 y}{\sin y \cdot \sin 2y}$	<p>✓ $\tan y = \frac{h}{PQ}$</p> <p>✓ $PQ = \frac{h \cos y}{\sin y}$</p> <p>✓ $\widehat{PQR} = 90^\circ - 2y$</p> <p>✓ applying sine rule</p> <p>✓ $\sin(90^\circ - y) = \cos y$</p> <p>✓ subt $PQ = \frac{h \cos y}{\sin y}$</p>	[6]
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QUESTION 8

8.1	BC = 15 cm line from centre \perp chord	✓✓ A A S & R	(2)
8.2	OC = 2a	✓ A answer	(1)
8.3	OB = 3a	✓ CA answer	(1)
8.4	$\therefore (3a)^2 = (2a)^2 + (15)^2$ (Pythagoras) $\therefore 9a^2 = 4a^2 + 225$ $\therefore 5a^2 = 225$ $\therefore a^2 = 45$ $\therefore a = \sqrt{45}$	<p>✓ CA applying Pythagoras</p> <p>✓ CA $a = \sqrt{45}$</p>	
	$AB^2 = 15^2 + (5a)^2$ (Pythagoras) $= 225 + 25(45)$ $\therefore AB = \sqrt{1350} = 15\sqrt{6}$		

QUESTION 9

<p>9.1</p>	 <p>Construction: Draw AO and CO</p> <p><u>Proof:</u> $\hat{O}_1 = 2\hat{B} \dots \angle \text{ at centre} = 2 \angle \text{ at circle}$ $\hat{O}_2 = 2\hat{D} \dots \angle \text{ at centre} = 2 \angle \text{ at circle}$</p> <p>$\hat{O}_1 + \hat{O}_2 = 360^\circ$ $2\hat{B} + 2\hat{D} = 360^\circ$ $\hat{B} + \hat{D} = 180^\circ$</p>	<p>✓ A Construction</p> <p>✓ A S/R</p> <p>✓ A S/R</p> <p>✓ A $\hat{O}_1 + \hat{O}_2 = 360^\circ$ (revolution)</p> <p>✓ A Substitute for \hat{O}_1 and \hat{O}_2</p>	<p>(5)</p>
<p>9.2.1</p>	<p>$\hat{K}_1 = x = \hat{K}_2 \dots$ KM bisects $L\hat{K}N$</p> <p>$\hat{O}_1 = 2x$ angles opp = sides</p> <p>$\therefore \hat{L} = x$ $\angle \text{ at centre} = 2 \angle \text{ at circumference}$</p> <p>$\therefore \hat{K}_1 = \hat{L} = x$</p> <p>$\therefore TK = TL$ (sides opposite equal angles)</p>	<p>(All Accuracy Marks)</p> <p>✓ S ✓ R</p> <p>✓ S ✓ R</p> <p>✓ R</p>	<p>(5)</p>

<p>9.2.2</p>	<p>$\hat{T}_1 = 2x$... ext \angle of Δ QKL $\hat{T}_1 = \hat{O}_1 = 2x$ \therefore KOTP is a cyclic quadrilateral ... converse of \angle's on the same segment equal.</p>	<p>✓ S ✓R ✓ R (All Accuracy Marks)</p>	<p>(3)</p>
<p>9.2.3</p>	<p>$\hat{P}_1 = \hat{LKN}$... Angles in the same segment $= 2x$ $\therefore \hat{P}_1 = \hat{T} = 2x$ \therefore PN // MK ... alt \angle's proved equal</p>	<p>✓ S ✓R ✓ R (All Accuracy Marks)</p>	<p>(3)</p>
			<p>[16]</p>

QUESTION 10

<p>10.1</p>	<p>$\frac{AS}{SP} = \frac{AR}{RB}$... RS // BP $= \frac{3}{2}$ $\therefore \frac{AS}{SC} = \frac{3}{7}$</p>	<p>✓ S/R ✓ $\frac{3}{2}$ ✓ $\frac{3}{7}$ (All Accuracy Marks)</p>	<p>(3)</p>
<p>10.2</p>	<p>$\frac{RT}{TC} = \frac{SP}{PC}$... RS//TP $= \frac{2}{5}$</p>	<p>✓ S/R ✓ $\frac{2}{5}$</p>	<p>(2)</p>
<p>10.3</p>	<p>$\frac{\Delta ARS}{\Delta ABC} = \frac{\Delta ARS}{\Delta ARC} \times \frac{\Delta ARC}{\Delta ABC}$ $= \frac{3}{10} \times \frac{3}{5}$ $= \frac{9}{50}$</p>	<p>✓ ratio of Δ's ✓ substitution ✓ CA answer (All Accuracy Marks if not indicated)</p>	<p>(3)</p>
			<p>[8]</p>

QUESTION 11

<p>11.1 In $\triangle PAT$ and $\triangle PCA$</p> <p>1. \hat{P} is common</p> <p>2. $\hat{A}_1 = \hat{C}_1$ tan chord thm.</p> <p>3 $P\hat{T}A = P\hat{A}C$ sum of angles in triangle</p> <p>$\therefore \triangle PAT \parallel \triangle PCA$ ($\angle\angle\angle$)</p> <p>$\therefore \frac{PA}{PC} = \frac{PT}{PA}$ ($\parallel \Delta$'s)</p> <p>$\therefore PA^2 = PC \cdot PT$</p>	<p>✓ S (identifying triangles)</p> <p>✓ S</p> <p>✓ S</p> <p>✓ S/R</p> <p>✓ S</p> <p>All accuracy marks</p>	<p>(5)</p>
<p>11.2 $PA^2 = PC \cdot PT$</p> <p>$\therefore 36 = (x + 5) x$</p> <p>$\therefore 36 = x^2 + 5x$</p> <p>$\therefore x^2 + 5x - 36 = 0$</p>	<p>✓ A subst.</p> <p>✓ A simplifying</p>	<p>(2)</p>
<p>11.3 $(x + 9)(x - 4) = 0$</p> <p>$x = -9$ or $x = 4$</p> <p>N/A</p> <p>$\therefore PT = 4$ units</p>	<p>✓ A factorising</p> <p>✓ A $PT = 4$</p>	<p>(2)</p>
<p>11.4 $\frac{PD}{PA} = \frac{PT}{PC}$ (AC//DB; prop. theorem)</p> <p>$DP = \frac{4}{9} \cdot 6$</p> <p>$= \frac{8}{3}$</p>	<p>✓S ✓R</p> <p>✓CA answer</p>	<p>(3)</p> <p>[12]</p>

TOTAL MARKS: 150