



# basic education

Department:  
Basic Education  
**REPUBLIC OF SOUTH AFRICA**

**NATIONAL  
SENIOR CERTIFICATE**

**GRADE 12**

**TECHNICAL MATHEMATICS P2**

**MARKING GUIDELINES**

**EXEMPLAR 2018**

**MARKS: 150**

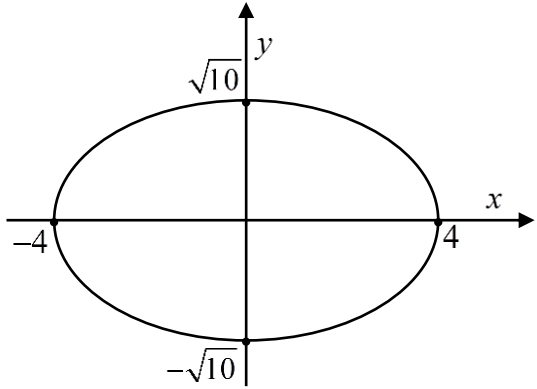
**These marking guidelines consist of 14 pages**

**QUESTION 1**

<p>1.1</p>	$AD = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$ $= \sqrt{(5-1)^2 + (-2-4)^2}$ $= \sqrt{52}$ $= 2\sqrt{13}$	<p>✓ Substitution in correct formula                  ✓ Simplification                  ✓ <math>2\sqrt{13}</math> simplified surd                  (3)</p>
<p>1.2</p>	$M\left(\frac{x_1 + x_2}{2}; \frac{y_1 + y_2}{2}\right)$ $M\left(\frac{1 + 5}{2}; \frac{4 - 2}{2}\right)$ $M(3; 1)$	<p>✓ Substitution                  ✓ M(3; 1)                  (2)</p>
<p>1.3</p>	$m_{AB} = \frac{y_2 - y_1}{x_2 - x_1}$ $= \frac{1-4}{-3-1}$ $= \frac{3}{4}$ <p>AB    MC</p> $m_{MC} = \frac{3}{4}$ <p><math>y - y_1 = m(x - x_1)</math>      or      <math>y = mx + c</math></p> $y - 1 = \frac{3}{4}(x - 3)$ $-3x + 4y + 5 = 0$ <p style="text-align: center;">or <math>3x + -4y - 5 = 0</math></p> $1 = \frac{3}{4}(3) + c$ $c = \frac{4-9}{4} = -\frac{5}{4}$ $y = \frac{3}{4}x - \frac{5}{4}$ $-3x + 4y + 5 = 0$	<p>✓ Substitution in correct formula                  ✓ Gradient of MC                  ✓ Substitution in correct formula                  ✓ Simplification                  ✓ Correct answer in correct form                  (5)</p>
<p>1.4</p>	$\tan \alpha = \frac{3}{4}$ $\alpha \approx 36,87^\circ$	<p>✓ <math>\tan \alpha = \frac{3}{4}</math>                  ✓ <math>36,87^\circ</math>                  (2)</p>

<p>1.5</p>	$m_{AD} = \frac{y_2 - y_1}{x_2 - x_1}$ $= \frac{-2 - 4}{5 - 1}$ $= \frac{-3}{2}$ $\tan \beta = \frac{-3}{2}$ $\beta \approx 123,69^\circ$ $\hat{B}AD = 123,69^\circ - 36,87^\circ \quad \text{ext } \angle \text{ of } \Delta$ $= 86,82^\circ$	$\checkmark \frac{-3}{2}$ $\checkmark \beta = 123,69^\circ$ $\checkmark 123,69^\circ - 36,87^\circ$ $\checkmark 86,82^\circ$ <p style="text-align: right;">(4)</p>
		<b>[16]</b>

**QUESTION 2**

<p>2.1.1</p>	$x^2 + y^2 = r^2$ $r^2 = (10)^2 + (-4)^2$ $\therefore r = \sqrt{116} = 2\sqrt{29}$	<p>✓ Substitution.</p> <p>✓ <math>\sqrt{116} = 2\sqrt{29}</math></p> <p>(2)</p>
<p>2.1.2</p>	$m_{OH} = m_{OF} = \frac{0 - (-4)}{0 - 10}$ $= -\frac{4}{10}$ $= -\frac{2}{5}$	<p>✓ Substitution.</p> <p>✓ <math>-\frac{2}{5}</math></p> <p>(2)</p>
<p>2.1.3</p>	$m_{GH} = \frac{5}{2} \quad (m_{GH} \times m_{OH} = -1)$ <p>By symmetry H(-10; 4)</p> $y - y_1 = m(x - x_1) \quad \text{or} \quad y = mx + c$ $y - 4 = \frac{5}{2}(x + 10) \quad 4 = \frac{5}{2}(-10) + c$ $y = \frac{5}{2}x + 29 \quad c = 29$ $y = \frac{5}{2}x + 29$	<p>✓ <math>m_{GH}</math></p> <p>✓ H(-10; 4)</p> <p>✓ Substitution of H</p> <p>✓ Equation</p> <p>(4)</p>
<p>2.2</p>		<p>✓ Both x-intercepts</p> <p>✓ Both y-intercepts</p> <p>✓ Shape</p> <p>(3)</p>
		<p>[11]</p>

**QUESTION 3**

3.1.1	$OP^2 = (12)^2 + (-5)^2$ $\therefore OP = 13 \text{ units}$	$\checkmark OP = 13 \text{ units}$ <p style="text-align: right;">(1)</p>
3.1.2	$5 \cot \theta - 13 \cos \theta$ $= 5 \left( \frac{12}{-5} \right) - 13 \left( \frac{12}{13} \right)$ $= -24$	$\checkmark \frac{12}{-5} \quad \checkmark \frac{12}{13}$ $\checkmark \text{Simplification}$ <p style="text-align: right;">(3)</p>
3.1.3	$\operatorname{cosec}^2 x - 1$ $= \left( \frac{13}{-5} \right)^2 - 1$ $= \frac{144}{25}$ <p style="text-align: center;"><i>or</i></p> $\operatorname{cosec}^2 x - 1 = \cot^2 x$ $= \left( \frac{12}{-5} \right)^2$ $= \frac{144}{25}$	$\checkmark \left( \frac{13}{-5} \right)^2 \text{ or } \left( \frac{12}{-5} \right)^2$ $\checkmark \text{Simplification}$ <p style="text-align: right;">(2)</p>
3.2	$\sec(a - b)$ $= \sec(2,659 - 1,112)$ $= \sec 1,547$ $= \frac{1}{\cos 1,547}$ $\approx 42,03$	$\checkmark \text{Substitution}$ $\checkmark \text{Reciprocal}$ $\checkmark \text{Simplification using radians}$ <p style="text-align: right;">(3)</p>
		<b>[9]</b>

**QUESTION 4**

<p>4.1</p>	$\frac{\sin(360^\circ - x) \cdot \cos(180^\circ - x) \cdot \tan 120^\circ}{\cos^2 x \cdot \sin \frac{5\pi}{6}}$ $= \frac{(-\sin x) \cdot (-\cos x) \cdot (-\tan 60^\circ)}{\cos^2 x \cdot \sin \frac{\pi}{6}}$ $= \frac{-\sin x \cdot \cos x \cdot -\sqrt{3}}{\cos^2 x \cdot \frac{1}{2}}$ $= \frac{2\sqrt{3} \sin x}{\cos x}$ $= 2\sqrt{3} \tan x$	<p>✓ <math>-\sin x</math>                  ✓ <math>-\cos x</math>                  ✓ <math>-\tan 60^\circ</math></p> <p>✓ <math>\sin \frac{\pi}{6}</math></p> <p>✓ <math>-\sqrt{3}</math> and <math>\frac{1}{2}</math></p> <p>✓ simplification</p> <p>✓ <math>\tan x</math></p> <p>(7)</p>
<p>4.2</p>	<p><math>\cos^2 3x</math></p>	<p>✓ <math>\cos^2 3x</math></p> <p>(1)</p>
<p>4.3</p>	<p><math>LHS = \frac{\sin x}{\cos x} (\sin x)</math></p> $= \frac{\sin^2 x}{\cos x}$ <p><math>RHS = \sec x - \cos x</math></p> $= \frac{1}{\cos x} - \cos x$ $= \frac{1 - \cos^2 x}{\cos x}$ $= \frac{\sin^2 x}{\cos x}$ <p><math>= LHS</math></p>	<p>✓ <math>\frac{\sin x}{\cos x}</math></p> <p>✓ <math>\frac{1}{\cos x}</math></p> <p>✓ <math>\frac{1 - \cos^2 x}{\cos x}</math></p> <p>✓ <math>\sin^2 x</math></p> <p>(4)</p>
<p>4.4</p>	<p><math>\operatorname{cosec} 2x = 2,114</math></p> $\sin 2x = \frac{1}{2,114}$ $2x = \sin^{-1}\left(\frac{1}{2,114}\right)$ $2x = \sin^{-1}\left(\frac{1}{2,114}\right)$ <p><math>2x \approx 28,23^\circ</math> or <math>2x \approx 180^\circ - 28,23^\circ</math></p> <p><math>x \approx 14,12^\circ</math> or <math>x \approx 75,89^\circ</math></p>	<p>✓ using reciprocal</p> <p>✓ inverse</p> <p>✓ value of <math>x</math>                  ✓ another value of <math>x</math></p> <p>(4)</p>
		<p>[16]</p>

**QUESTION 5**

5.1	$\sin 55^\circ = \frac{50}{AC}$ $AC = \frac{50}{\sin 55^\circ}$ $\approx 61 \text{ m}$	✓ Definition ✓ AC subject ✓ 61 m (3)
5.2	$AD \approx 61 \text{ m}$ $DC^2 = AC^2 + AD^2 - 2AC \cdot AD \cos 65^\circ$ $DC^2 = (61)^2 + (61)^2 - 2(61)(61) \cos 65^\circ$ $DC \approx 66 \text{ m}$	✓ $AD \approx 61 \text{ m}$ ✓ Using cosine rule ✓ Substitution ✓ 66 m (4)
5.3	$BD = \sqrt{AD^2 - AB^2} \qquad \tan 55^\circ = \frac{50}{BD}$ $= \sqrt{(61)^2 - (50)^2} \qquad \text{OR} \qquad BD = \frac{50}{\tan 55^\circ}$ $\approx 35 \text{ m} \qquad \qquad \qquad = 35 \text{ m}$ $\therefore \text{area of } \triangle BDC = \frac{1}{2}(35)(66) \sin \hat{BDC} = 563$ $\sin \hat{BDC} = \frac{563}{\frac{1}{2}(35)(66)}$ $\therefore \hat{BDC} = \sin^{-1}\left(\frac{563}{\frac{1}{2}(35)(66)}\right)$ $= 29,17^\circ$	✓ Using Pythagoras theorem or tan ✓ $BD = 35 \text{ m}$ ✓ Substitution in area formula ✓ Area = 563 $\checkmark \sin \hat{BDC} = \frac{563}{\frac{1}{2}(35)(66)}$ ✓ Simplification (6)
		<b>[13]</b>

**QUESTION 6**

6.1		<p><math>f(x)</math>                  ✓ <math>x</math>-intercepts                  ✓ <math>y</math>-intercept                  ✓ Shape</p> <p><math>g(x)</math>                  ✓ <math>y</math>-intercept                  ✓ Turning points                  ✓ Shape</p> <p style="text-align: right;">(6)</p>
6.2	2	<p>✓2</p> <p style="text-align: right;">(1)</p>
6.3	$360^\circ$	<p>✓ <math>360^\circ</math></p> <p style="text-align: right;">(1)</p>
6.4	$60^\circ < x < 240^\circ$	<p>✓✓ Answer with correct notation</p> <p style="text-align: right;">(2)</p>
		<b>[10]</b>



**QUESTION 7**

7.1	the angle in the alternate segment	✓ Correct statement (1)
7.2.1	$\hat{R}_2 = \hat{S}_1 = 38^\circ$ tan – chord theorem	✓ Statement ✓ Reason (2)
7.2.2	$\hat{M}_1 = 2\hat{R}_2 = 76^\circ$ $\angle$ at center = 2 $\angle$ at circum	✓ Statement ✓ Reason (2)
7.2.3.	$\hat{S}_2 = 90^\circ - 38^\circ = 52^\circ$ tan $\perp$ radius	✓ Statement ✓ Reason (2)
7.2.4	$\hat{R}_1 = 90^\circ$ $\angle$ in a semi – circle $\hat{Q}_1 = \hat{S}_1 = 38^\circ$ tan– chord theorem $\therefore \hat{Q}_2 = 180^\circ - (17^\circ + 90^\circ + 38^\circ)$ sum of $\angle$ 's of a $\Delta$ = $35^\circ$	✓ Statement ✓ Reason ✓ Reason ✓ Statement ✓ Statement (5)
7.2.5	$\hat{R}_2 = 38^\circ$ and $\hat{P}_1 = 17^\circ$ $\therefore \hat{R}_2 \neq \hat{P}_1$ (alternate angles are not equal)	✓ Alternate angles are not equal or $\hat{R}_2 \neq \hat{P}_1$ or $\hat{R}_2 = 38^\circ$ and $\hat{P}_1 = 17^\circ$ (1)
		<b>[13]</b>

**QUESTION 8**

8.1	divides the other two sides proportionally	✓ Answer (1)
8.2.1	$\frac{x}{8} = \frac{4}{10}$ $10x = 32$ $x = 3,2$	✓ Prop. ✓ Simplification ✓ Value of $x$ (3)
8.2.2	RTSP is a parallelogram (both pairs of opposite sides of a quadrilateral are parallel )	✓ Statement ✓ Reason (2)
8.2.3	$\frac{y}{9} = \frac{3,2}{8}$ Prop. Theorem ; TS  MP $y = 3,6$	✓ Statement ✓ Reason ✓ Value of $y$ (3)
8.2.4	$\frac{MR}{TS} = \frac{10}{4} = 2,5$ $\frac{RT}{SN} = \frac{9}{3,6} = 2,5$ $\frac{MT}{TN} = \frac{8}{3,2} = 2,5$ $\Delta MRT \parallel \Delta TSN$ sides of triangle are in the same proportion	✓ Ratio ✓ Ratio ✓ Ratio ✓ Reason (4)
		<b>[13]</b>

**QUESTION 9**

9.1	$\hat{K}_1 = \hat{LHF}$ ext $\angle$ of cyclic quad $= \hat{GFK}$ corres. angles LK // GF	✓ Statement ✓ Reason ✓ Statement/Reason (3)
9.2	$\hat{MFG} = \hat{K}_1 = 104^\circ$ <i>corres</i> $\angle$ s; FG $\square$ KL $\hat{G} + 104^\circ + 20^\circ = 180^\circ$ <i>angles of</i> $\Delta$ $\hat{G} = 56^\circ$ $\hat{MFG} = \hat{K}_1 = 104^\circ$ <i>corres.</i> $\angle$ s; FG // KL $\hat{G} + 104^\circ + 20^\circ = 180^\circ$ <i>angles of</i> $\Delta$ $\hat{G} = 56^\circ$ <b>OR</b> $\hat{MLK} + 104^\circ + 20^\circ = 180^\circ$ <i>angles of</i> $\Delta$ $\angle$ s; FG // KL $\hat{MLK} = 56^\circ$ $\hat{MLK} = \hat{G}$ <i>corresp</i> $\angle$ s; FG // KL $\hat{G} = 56^\circ$	✓ Statement ✓ Statement ✓ Reason  ✓ Statement ✓ Statement ✓ Reason (3)
9.3.1	$\frac{10}{30} = \frac{12}{MG}$ (Prop. Theorem; KL // FG ) $MG = \frac{360}{10} = 36$ units	✓ Statement ✓ Reason ✓ 36 units (3)
9.3.2	$\hat{MHF} = \hat{GFM} = 104^\circ$ proved in question 9.1. $\hat{M}$ is common $\hat{G} = \hat{F}_2$ sum of angles of a $\Delta$ $\Delta MFH \parallel \Delta MGF$ $\angle$ ; $\angle$ ; $\angle$	✓ Statement ✓ Statement and reason ✓ Reason (3)
9.3.3	$\Delta MFH \parallel \Delta MGF \parallel \Delta MLK$	✓ $\Delta MLK$ (1)
<b>[13]</b>		

**QUESTION 10**

10.1	$x^2 - 4dh + 4h^2 = 0$ $x^2 - (4 \times 220 \text{ mm} \times 60 \text{ mm}) + 4(60 \text{ mm})^2 = 0$ $x^2 = \sqrt{67200 \text{ mm}^2}$ $\therefore x = 259,23 \text{ mm}$	✓Formula ✓Substitution.  ✓Simplifying ✓Length (4)
10.2.1	$v = \pi Dn$ $= \pi(18 \text{ m})\left(\frac{225}{60 \text{ s}}\right)$ $\approx 212,06 \text{ m/s}$	✓Correct formula ✓Correct diameter  ✓Substitution  ✓212,06 m/s (4)
10.2.2	$\omega = 2\pi n$ $= 2\pi\left(\frac{225}{60 \text{ s}}\right)$ $\approx 23,56 \text{ rad/s}$	✓Correct formula  ✓Substitution ✓23,56 rad/s (3)
10.3.1	$\hat{LBA} = 180^\circ - 70^\circ = 110^\circ$ co-int.angles; AK // BL	✓Statement ✓Reason (2)
10.3.2	$\hat{KAD} = 360^\circ - 140^\circ = 220^\circ$ $\approx 3,84 \text{ rad}$ $s_1 = r\theta = 50(3,84)$ $\approx 192 \text{ cm}$ $s_2 = 48,8 \text{ cm}$ $\text{Length of belt} = 110 + 192 + 110 + 48,80$ $= 460,80 \text{ cm}$	✓Size of $\hat{KAD}$ ✓Conversion to radians ✓Correct substitution in arc length formula ✓Arc length $s_1$  ✓Length of DE = 110  ✓Length of belt (6)
		<b>[19]</b>

**QUESTION 11**

<p>11.1.1</p>	<p>Volume of pyramid  <math>= \frac{1}{3} (\text{area of base})(\text{height})</math>  <math>= \frac{1}{3} (4m \times 4m)(1,1m)</math>  <math>= 5,87m^3</math>                      Volume of Cube  <math>= (l)(b)(h)</math>  <math>= (4m)(4m)(4m)</math>  <math>= 64m^3</math>                      Total Volume = <math>5,87 m^3 + 64 m^3</math>  <math>\approx 69,87m^3</math></p>	<p>✓ Substitution in correct formula                      ✓ Height                      ✓ <math>5,87m^3</math>                      ✓ Substitution in correct formula                      ✓ <math>64m^3</math>                      ✓ <math>69,87m^3</math>                      (6)</p>
<p>11.1.2</p>	<p>total surface area                      = surface area of cube base + surface area of pyramid  <math>= 4 (\text{side} \times \text{side}) + 4 \left( \frac{1}{2} \times \text{base} \times \text{slant height} \right)</math>  <math>= 4(4m \times 4m) + 4 \left( \frac{1}{2} \times 4m \times \sqrt{1,1+2^2} m \right)</math>  <math>= 64m^2 + 4(2m \times \sqrt{5,1} m)</math>  <math>= 82,07m^2</math></p>	<p>✓ Slant height                      ✓ Correct substitution into area of a cube                      ✓ Correct substitution into area of pyramid                      ✓ Simplification                      ✓ Total area                      (5)</p>
<p>11.1.3</p>	<p>Cost of paint = <math>82,07 \times R30,50</math>  <math>= R2503,14</math></p>	<p>✓ <math>82,07 \times R30,50</math>                      ✓ <math>R2503,14</math>                      (2)</p>

<p>11.2</p>	$A_T = a \left( \frac{o_1 + o_n}{2} + o_2 + o_2 + o_3 + \dots + o_{n-1} \right)$ $= 4 \left( \frac{6,2 + 2}{2} + y + 5,1 + 4,9 \right)$ $= 4(14,1 + y)$ $= 56,4 + 4y$ $\therefore 72 = 56,4 + 4y$ $\Rightarrow y = \frac{15,6}{4}$ $= 3,9m$ <p><b>OR</b></p> $A_T = a(m_1 + m_2 + m_3 + \dots + m_n)$ $72 = 4 \left( \frac{6,2 + y}{2} + \frac{y + 5,1}{2} + \frac{5,1 + 4,9}{2} + \frac{4,9 + 2}{2} \right)$ $18 = \frac{11,3 + 2y}{2} + 8,45$ $9,55 = \frac{11,3 + 2y}{2}$ $19,1 = 11,3 + 2y$ $\therefore y = 3,9m$	<p>✓Formula</p> <p>✓Substitution</p> <p>✓Simplification</p> <p>✓ 3,9m</p> <p><b>OR</b></p> <p>✓Formula</p> <p>✓Substitution</p> <p>✓Simplification</p> <p>✓ 3,9m</p> <p>(4)</p>
		<p>[17]</p>

**TOTAL: 150**