



**KWAZULU-NATAL PROVINCE**

**EDUCATION**  
REPUBLIC OF SOUTH AFRICA

**NATIONAL  
SENIOR CERTIFICATE**

**GRADE 11**

**MATHEMATICS**

**COMMON TEST**

**JUNE 2022**


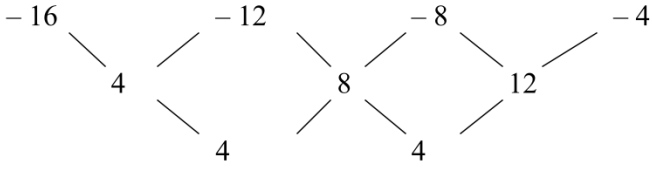
**MARKING GUIDELINE**

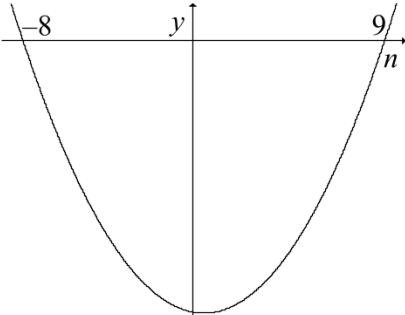
*Stanmorephysics.com*

**MARKS: 100**


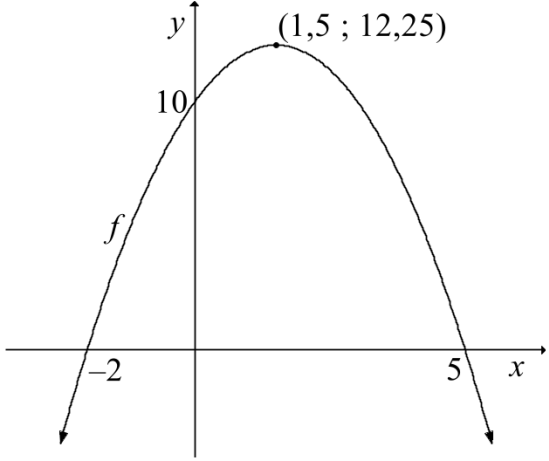
**These marking guideline consist of 8 pages.**

## QUESTION 1

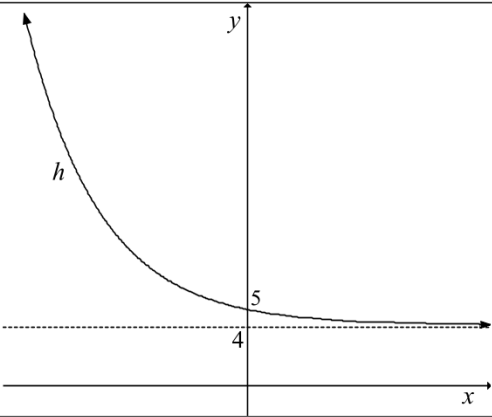
1.1.1	$T_n = an + b$ $T_n = 6n + b$ $T_1 = 6(1) + b = 11$ $b = 11 - 6 = 5$ $T_n = 6n + 5$ 	✓ ✓ $6n + 5$ (2)
1.1.2	$T_n = 6n + 5$ $T_{20} = 6(20) + 5$ $= 125$	✓ substitution ✓ answer (2)
1.1.3	$299 = 6n + 5$ $6n = 294$ $n = 49$ There are 49 terms in the pattern.	✓ substitution ✓ answer (2)
1.1.4	Quadratic number pattern: Term 1    Term 2    Term 3    Term 4    100 \    /    \    /    \    / 11    17    23    29 Term 2 = $100 - (17 + 23 + 29)$ $= 31$	✓ $100 - (17 + 23 + 29)$ ✓ answer (2)
1.2.1	24 ; 44	✓ 24 ✓ 44 (2)
1.2.2	 Second difference = 4 $a = \frac{2nd \text{ difference}}{2}$ $= 2$ first 1st difference = $3a + b = 4$ $3(2) + b = 4$ $b = -2$ Term 1 = $a + b + c = -16$ $2 - 2 + c = -16$ $c = -16$ Therefore: $T_n = 2n^2 - 2n - 16$	✓ value of $a$  ✓ value of $b$  ✓ value of $c$ ✓ answer (4)

1.2.3	$T_n = 2n^2 - 2n - 16$ $= 2(n^2 - n - 8)$ <p>Because <math>n</math> is a natural number, <math>n^2 - n - 8</math> will also be a natural number. And: <math>2(\text{a natural number})</math> will always be even.</p> <p><b>OR</b></p> <p>The given terms in the number pattern are even. The 1<sup>st</sup> differences between terms are also even. An even number plus an even number will always give an even number. Therefore all terms are even numbers.</p>	<p>✓ <math>2(n^2 - n - 8)</math></p> <p>✓ reasoning: multiples of 2 (2)</p> <p><b>OR</b></p> <p>✓ given terms are even</p> <p>✓ reasoning (2)</p>
1.2.4	$P_n = T_n - 128 = 2n^2 - 2n - 144$ <p>Let <math>P_n &lt; 0</math></p> $\therefore 2n^2 - 2n - 144 < 0$ $n^2 - n - 72 < 0$ $(n - 9)(n + 8) < 0$  <p><math>\therefore -8 &lt; n &lt; 9</math></p> <p>But <math>n \in \mathbb{N}</math>, so <math>n &gt; 0</math>: <math>\therefore 0 &lt; n &lt; 9</math></p> <p><math>\therefore</math> there are 8 negative terms.</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin-top: 10px;"> <p>Answer only: 1 mark only</p> </div>	<p>✓ expression for <math>P_n</math></p> <p>✓ <math>2n^2 - 2n - 144 &lt; 0</math></p> <p>✓ solution for inequality</p> <p>✓ answer (4)</p>
<b>[20]</b>		

## QUESTION 2

2.1	$x = -\frac{b}{2a}$ $= -\frac{-3}{2(-1)}$ $= \frac{3}{2}$ $f\left(\frac{3}{2}\right) = -\left(\frac{3}{2}\right)^2 + 3\left(\frac{3}{2}\right) + 10$ $= \frac{49}{4} = 12\frac{1}{4}$ <p>Turning point: <math>\left(\frac{3}{2}; 12\frac{1}{4}\right)</math></p>	 <p>✓ substitution</p> <p>✓ x-value of TP</p> <p>✓ y-value of TP</p> <p>(3)</p>
2.2	$y \leq 12\frac{1}{4}$ <b>OR</b> $y \in (-\infty; 12,25]$	<p>✓ answer</p> <p>(1)</p>
2.3	$-x^2 + 3x + 10 = 0$ $x^2 - 3x - 10 = 0$ $(x+2)(x-5) = 0$ $x = -2$ or $x = 5$	<p>✓ <math>f(x) = 0</math></p> <p>✓ factors</p> <p>✓ x-values</p> <p>(3)</p>
2.4		<p>✓ shape</p> <p>✓ x-intercepts</p> <p>✓ y-intercept</p> <p>✓ turning point</p> <p>(4)</p>
2.5	$10 < k < 12\frac{1}{4}$ <b>OR</b> $k \in \left(10; 12\frac{1}{4}\right)$	<p>✓ ✓ answer</p> <p>(2)</p>
2.6	$g(x) = -\left(x - \frac{7}{2}\right)^2 + 9\frac{1}{4}$	<p>✓ - (value of <math>a = -1</math>)</p> <p>✓ <math>-\frac{7}{2}</math> (value of <math>p = -\frac{7}{2}</math>)</p> <p>✓ <math>+9\frac{1}{4}</math> (value of <math>q = 9\frac{1}{4}</math>)</p> <p>(3)</p>
		[16]

## QUESTION 3

3.1.1	$y = 4$	✓ answer (1)
3.1.2		✓ shape ✓ asymptote ✓ y-intercept (3)
3.1.3	reflection in $x$ -axis reflection in $y$ -axis	✓ reflection in $x$ -axis ✓ reflection in $y$ -axis (2)
3.2.1	$p = -1$ $q = -2$	✓ $p = -1$ ✓ $q = -2$ (2)
3.2.2	$x \in R$ , but $x \neq 1$ <b>OR</b> $x \in (-\infty ; 1)$ or $(1 ; \infty)$	✓ $x \in R$ , but $x \neq 1$ (1) <b>OR</b> ✓ $x \in (-\infty ; 1)$ or $(1 ; \infty)$ (1)
3.2.3	Coordinates of D: $(0 ; -8)$ Equation of $f$ : $y = \frac{a}{x-1} - 2$ Substitute $(0 ; -8)$ : $-8 = \frac{a}{0-1} - 2$ $a = 8 - 2$ $a = 6$	✓ $D(0 ; -8)$ ✓ substitution ✓ answer (3)
3.2.4	C is the $x$ -intercept of $f$ . Substitute $y = 0$ : $0 = \frac{6}{x-1} - 2$ $2 = \frac{6}{x-1}$ $2x - 2 = 6$ $x = 4$ $m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-8 - 0}{0 - 4}$ $= 2$	✓ substitution ✓ $x$ -coordinate of C ✓ substitution ✓ answer (4)
3.2.5	$y = x + c$ Substitute $(1; -2)$ : $-2 = 1 + c$ $c = -3$ $y = x - 3$	✓ ✓ $x - 3$ (2)

GRADE 11  
Marking Guideline

3.2.6	$0 \leq x < 1$ or $x \geq 4$  <b>OR</b>  $x \in [0 ; 1)$ or $[4 ; \infty)$	$\checkmark \checkmark 0 \leq x < 1$ $\checkmark x \geq 4$ (3)  <b>OR</b>  $\checkmark \checkmark x \in [0 ; 1)$ $\checkmark [4 ; \infty)$ (3)
<b>[21]</b>		


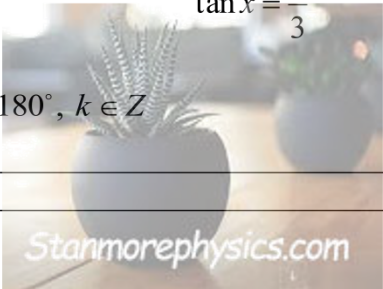
**QUESTION 4**

4.1	$C(6 ; -5)$	$\checkmark 6$ $\checkmark -5$ (2)
4.2	$E\left(\frac{x_1 + x_2}{2}; \frac{y_1 + y_2}{2}\right)$ $=\left(\frac{-10+2}{2}; \frac{-5+11}{2}\right)$ $=(-4 ; 3)$  <div style="border: 1px solid black; padding: 2px; display: inline-block;">Answer only: full marks</div>	$\checkmark$ substitution $\checkmark$ answer (2)
4.3	$m_{AD} = \frac{y_2 - y_1}{x_2 - x_1}$ $= \frac{9 - 11}{6 - 2}$ $= -\frac{1}{2}$  $m_{EF} = m_{AD} = -\frac{1}{2}$ Substitute $m_{EF}$ and coordinates of E: $y = mx + c$ $3 = \left(-\frac{1}{2}\right)(-4) + c$ $3 = 2 + c$ $c = 1$ $y = -\frac{1}{2}x + 1$	$\checkmark$ substitution in gradient formula   $\checkmark m_{EF}$   $\checkmark$ substitution in formula for equation of line   $\checkmark$ answer (4)
4.4	At F: $x = 6$ $y = -\frac{1}{2}(6) + 1$ $y = -2$ $F(6 ; -2)$	$\checkmark$ substitution of $x = 6$ in equation for EF. $\checkmark y = -2$ (2)
<b>[10]</b>		

## QUESTION 5

5.1	$m_{GH} = \frac{0 - (-2)}{-6 - (-3)}$ $= -\frac{2}{3}$	✓ substitution ✓ answer (2)
5.2	$m_{MK} = \frac{y_2 - y_1}{x_2 - x_1}$ $= \frac{4 - 0}{1 - (-6)}$ $= \frac{4}{7}$ $\tan \hat{KJO} = m_{MK} = \frac{4}{7}$ $\hat{KJO} = 29,74^\circ$	✓ substitution ✓ answer ✓ $\tan \hat{KJO} = \frac{4}{7}$ ✓ answer (4)
5.3	$\tan \hat{GJO} = m_{GH} = -\frac{2}{3}$ $\hat{GJO} = 180^\circ - 33,69^\circ$ $= 146,31^\circ$ $\alpha = \hat{GJO} - \hat{KJO}$ $= 146,31^\circ - 29,74^\circ$ $= 116,57^\circ$	✓ size of $\hat{GJO}$ ✓ subtracting ✓ answer (3)
5.4	$m_{KL} = \frac{4 - (-2)}{1 - (-3)}$ $= \frac{3}{2}$ $m_{KL} \times m_{JL} = -\frac{2}{3} \times \frac{3}{2} = -1$ <p>Therefore <math>KL \perp JL</math>.</p>	✓ substitution in gradient formula for KL ✓ gradient of KL ✓ multiplying gradients and getting a product of $-1$ (3)
5.5	$JL = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$ $= \sqrt{(-2 - 0)^2 + [-3 - (-6)]^2}$ $= \sqrt{13} \text{ units}$ $KL = \sqrt{(-2 - 4)^2 + (-3 - 1)^2}$ $= \sqrt{52} \text{ OR } 2\sqrt{13} \text{ units}$ <p>Area of <math>\Delta KJL = \frac{1}{2} \times \text{base} \times \text{height}</math></p> $= \frac{1}{2} \times JL \times KL$ $= \frac{1}{2} \times \sqrt{13} \times 2\sqrt{13}$ $= 13 \text{ square units}$	✓ substitution in distance formula for JL ✓ length of JL ✓ length of KL ✓ substitution in formula for area of triangle ✓ answer (5)
<b>[17]</b>		

## QUESTION 6

6.1	$\text{LHS} = (1 - \sin^2 \theta)(1 + \tan^2 \theta)$ $= (\cos^2 \theta) \left( 1 + \frac{\sin^2 \theta}{\cos^2 \theta} \right)$ $= \cos^2 \theta + \sin^2 \theta$ $= 1$ $= \text{RHS}$ 	$\checkmark 1 - \sin^2 \theta = \cos^2 \theta$ $\checkmark \tan^2 \theta = \frac{\sin^2 \theta}{\cos^2 \theta}$ $\checkmark \cos^2 \theta + \sin^2 \theta$ <div style="text-align: right;">(3)</div>
6.2	$\sin(2x + 30^\circ) = -0,4$ $\text{reference } \angle = 23,58^\circ$ $2x + 30^\circ = 180^\circ + 23,58^\circ + k \cdot 360^\circ, k \in \mathbb{Z}$ $2x = 173,58^\circ + k \cdot 360^\circ$ $x = 86,79^\circ + k \cdot 180^\circ$ <p>or</p> $2x + 30^\circ = 360^\circ - 23,58^\circ + k \cdot 360^\circ, k \in \mathbb{Z}$ $2x = 306,42^\circ + k \cdot 360^\circ$ $x = 153,21^\circ + k \cdot 180^\circ$ <p>In the interval <math>[-90^\circ; 90^\circ]</math>: <math>x = 86,79^\circ</math> or <math>-26,79^\circ</math></p>	$\checkmark \text{reference } \angle = 23,58^\circ$ $\checkmark 2x + 30^\circ = 180^\circ + 23,58^\circ + k \cdot 360^\circ$ $\checkmark x = 86,79^\circ + k \cdot 180^\circ$ $\checkmark 2x + 30^\circ = 360^\circ - 23,58^\circ + k \cdot 360^\circ$ $\checkmark x = 153,21^\circ + k \cdot 180^\circ$ $\checkmark 86,79^\circ$ $\checkmark -26,79^\circ$ <div style="text-align: right;">(7)</div>
6.3	$3 \sin x \cos x - 4 \cos^2 x = 0$ $\cos x(3 \sin x - 4 \cos x) = 0$ $\cos x = 0 \quad \text{or} \quad 3 \sin x - 4 \cos x = 0$ $x = 90^\circ + k \cdot 180^\circ, k \in \mathbb{Z} \quad \text{or} \quad 3 \sin x = 4 \cos x$ $\frac{\sin x}{\cos x} = \frac{4}{3}$ $\tan x = \frac{4}{3}$ $x = 53,13^\circ + k \cdot 180^\circ, k \in \mathbb{Z}$ 	$\checkmark \text{factorisation}$ $\checkmark \text{both equations}$ $\checkmark x = 90^\circ + k \cdot 180^\circ$ $\checkmark \tan x = \frac{4}{3}$ $\checkmark x = 53,13^\circ$ $\checkmark +k \cdot 180^\circ; k \in \mathbb{Z}$ <div style="text-align: right;">(6)</div>
		<b>[16]</b>

**TOTAL: 100**