



KWAZULU-NATAL PROVINCE

EDUCATION
REPUBLIC OF SOUTH AFRICA

**NATIONAL
SENIOR CERTIFICATE**

GRADE 11

MATHEMATICS

COMMON TEST

JUNE 2022

MARKING GUIDELINE

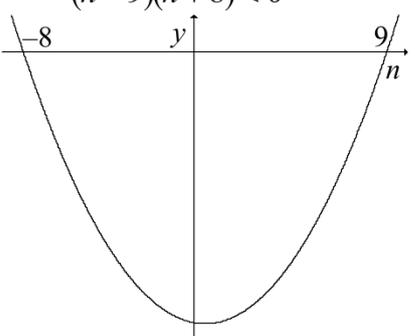
Stanmorephysics.com

MARKS: 100

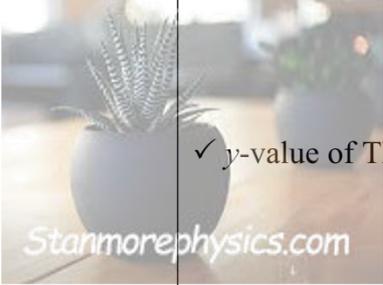
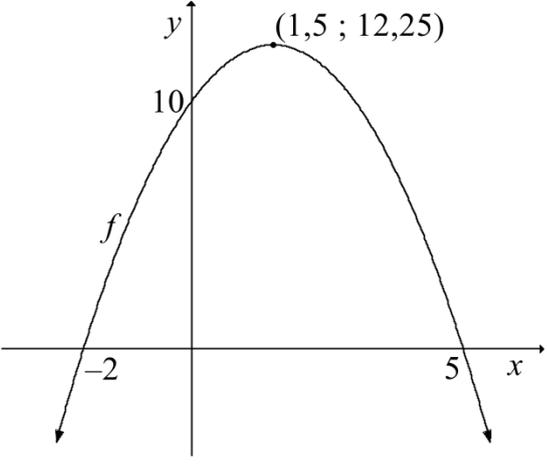
These marking guideline consist of 8 pages.

QUESTION 1

<p>1.1.1</p>	$T_n = an + b$ $T_n = 6n + b$ $T_1 = 6(1) + b = 11$ $b = 11 - 6 = 5$ $T_n = 6n + 5$ 	<p>✓ ✓ $6n + 5$</p> <p>(2)</p>
<p>1.1.2</p>	$T_n = 6n + 5$ $T_{20} = 6(20) + 5$ $= 125$	<p>✓ substitution</p> <p>✓ answer</p> <p>(2)</p>
<p>1.1.3</p>	$299 = 6n + 5$ $6n = 294$ $n = 49$ <p>There are 49 terms in the pattern.</p>	<p>✓ substitution</p> <p>✓ answer</p> <p>(2)</p>
<p>1.1.4</p>	<p>Quadratic number pattern:</p> <p>Term 1 Term 2 Term 3 Term 4 100</p> <p style="margin-left: 40px;"> \diagdown \diagup \diagdown \diagup \diagdown 11 17 23 29 </p> $\text{Term 2} = 100 - (17 + 23 + 29)$ $= 31$	<p>✓ $100 - (17 + 23 + 29)$</p> <p>✓ answer</p> <p>(2)</p>
<p>1.2.1</p>	<p>24 ; 44</p>	<p>✓ 24</p> <p>✓ 44</p> <p>(2)</p>
<p>1.2.2</p>	$-16 \quad -12 \quad -8 \quad -4$ <p style="margin-left: 40px;"> \diagdown \diagup \diagdown \diagup \diagdown 4 8 12 \diagup \diagdown \diagup \diagdown 4 4 4 </p> <p>Second difference = 4</p> $a = \frac{\text{2nd difference}}{2}$ $= 2$ <p>first 1st difference = $3a + b = 4$</p> $3(2) + b = 4$ $b = -2$ <p>Term 1 = $a + b + c = -16$</p> $2 - 2 + c = -16$ $c = -16$ <p>Therefore: $T_n = 2n^2 - 2n - 16$</p>	<p>✓ value of a</p> <p>✓ value of b</p> <p>✓ value of c</p> <p>✓ answer</p> <p>(4)</p>

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

QUESTION 2

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

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 $x \neq 1$ OR $x \in (-\infty ; 1)$ or $(1 ; \infty)$	✓ $x \in R$, but $x \neq 1$ (1) OR ✓ $x \in (-\infty ; 1)$ 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)

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

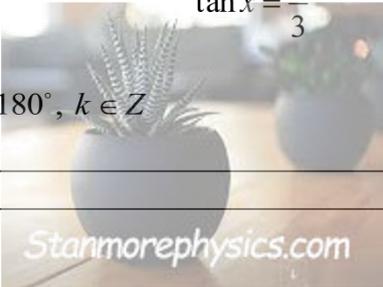
QUESTION 4

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: 5px; width: fit-content; margin-top: 10px;"> Answer only: full marks </div>	\checkmark substitution \checkmark answer (2)
4.3	$m_{AD} = \frac{y_2 - y_1}{x_2 - x_1}$ $= \frac{9 - 11}{6 - 2}$ $= -\frac{1}{2}$ $m_{EF} = m_{AD} = -\frac{1}{2}$ <p>Substitute m_{EF} and coordinates of E:</p> $y = mx + c$ $3 = \left(-\frac{1}{2}\right)(-4) + c$ $3 = 2 + c$ $c = 1$ $y = -\frac{1}{2}x + 1$ 	\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)
		[10]

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	$m_{KL} = \frac{4 - (-2)}{1 - (-3)}$ $= \frac{3}{2}$ $m_{KL} \times m_{JL} = -\frac{2}{3} \times \frac{3}{2} = -1$ Therefore $KL \perp JL$.	✓ substitution in gradient formula for KL ✓ gradient of KL ✓ multiplying gradients and getting a product of -1 (3)
5.5	$JL = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$ $= \sqrt{(-2 - 0)^2 + [-3 - (-6)]^2}$ $= \sqrt{13} \text{ units}$ $KL = \sqrt{(-2 - 4)^2 + (-3 - 1)^2}$ $= \sqrt{52} \text{ OR } 2\sqrt{13} \text{ units}$ Area of $\Delta KJL = \frac{1}{2} \times \text{base} \times \text{height}$ $= \frac{1}{2} \times JL \times KL$ $= \frac{1}{2} \times \sqrt{13} \times 2\sqrt{13}$ $= 13 \text{ square units}$	✓ substitution in distance formula for JL ✓ length of JL ✓ length of KL ✓ substitution in formula for area of triangle ✓ answer (5)

QUESTION 6

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

TOTAL: 100