



Education

KwaZulu-Natal Department of Education
REPUBLIC OF SOUTH AFRICA

MATHEMATICS P1

COMMON TEST

JUNE 2017

MARKING MEMORANDUM

**NATIONAL
SENIOR CERTIFICATE**

GRADE 12

MARKS: 125

This memorandum consists of 12 pages.

QUESTION 1

1.1.1	$x = 0$ or $x = -\frac{5}{2}$	AA✓✓ Answers	(2)
1.1.2	$2x^2 - 3x = 7$ $2x^2 - 3x - 7 = 0$ $x = \frac{-(-3) \pm \sqrt{(-3)^2 - 4(2)(-7)}}{2(2)}$ $x = 2,77$ or $x = -1,27$	A✓ equation in std. form CA✓ substitution CACA✓✓ answers (If non-real roots max 2/4) Penalize once for rounding off in this question	(4)
1.1.3	$x - 7 - \sqrt{x - 5} = 0$ $x - 7 = \sqrt{x - 5}$ $(x - 7)^2 = (\sqrt{x - 5})^2$ $x^2 - 14x + 49 = x - 5$ $x^2 - 15x + 54 = 0$ $(x - 9)(x - 6) = 0$ $x = 9$ or $x = 6$ n/a	A✓ squaring both sides CA✓ standard form CA✓ factors CA✓ answers and rejecting	(4)
1.1.4	$\frac{1}{2}x(3x + 1) < 0$ $-\frac{1}{3} < x < 0$ or $x \in \left(-\frac{1}{3}; 0\right)$	AA✓✓ $-\frac{1}{3} < x < 0$ [1 mark for end points 1 mark for interval]	(2)

	$T_k = 4k - 1$ $T_n = an^2 + bn + c$ $T_{51} = 51^2a + 51b + c \rightarrow (1)$ $T_{50} = 50^2a + 50b + c \rightarrow (2)$ $T_{52} = 52^2a + 52b + c \rightarrow (3)$ $T_{51} - \text{first diff} = 203$ $T_{50} - \text{first diff} = 199$ $T_{52} - \text{first diff} = 207$ $(1) - (2) :$ $101a + b = 199 \rightarrow (4)$ $(3) - (1)$ $103a + b = 203 \rightarrow (5)$ $(5) - (4)$ $2a = 4$ $a = 2$ $202 + b = 199$ $b = -3$ <p>But</p> $T_{51} = 5052$ $2601(2) + 51(-3) + c = 5052$ $5202 - 153 + c = 5052$ $c = 5052 - 5049$ $c = 3$ $T_n = 2n^2 - 3n + 3$	<p>A✓ a – value</p> <p>CA✓ b – value</p> <p>CA✓ substitution of a and b values into the 51st term</p> <p>CA✓ simplifying</p> <p>CA✓ c – value</p> <p>CA✓ nth term(provided quadratic)</p>	<p>(6)</p>
<p>2.2</p>	$T_n = 2n^2 - 3n + 3 = 20102$ $2n^2 - 3n - 20099 = 0$ $(n - 101)(2n + 199) = 0$ $n = 101 \quad \text{or} \quad n = -\frac{199}{2}$ <p style="text-align: center;">n/a</p>	<p>CA✓ equating nth term to 20102</p> <p>CA✓ standard form</p> <p>CA✓ factors</p> <p>CA✓ answer and rejecting ($n \in \mathbb{N}$)</p>	<p>(4)</p>
			<p>[10]</p>

4.3	$T_n = 5n - 1$ $5n - 1 > 2017$ $5n > 2018$ $n > \frac{2018}{5}$ $\therefore n > 403,6$ The 404 th term will be greater than 2017	M✓ $5n - 1 > 2017$ CA✓ 403,6 CA✓ conclusion($n \in \mathbb{N}$)	(3)
			[11]

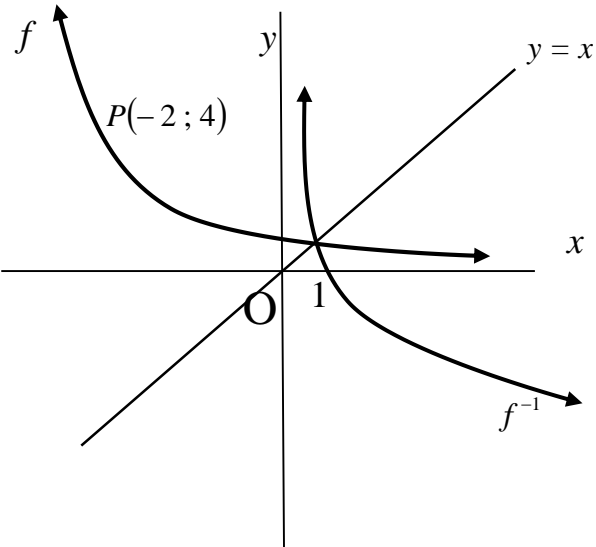
QUESTION 5

5.1	$P(-1; 1)$ $q = 1$	A✓ coordinates of P CA✓ q – value (positive) Answer only full marks	(2)
5.2	m of $g = 1$ $c = 0$ $y = x$	A✓ m of g A✓ answer	(2)
5.3	$OP = \sqrt{1+1} = \sqrt{2}$ $OT = \sqrt{1+1} = \sqrt{2}$ $\text{Area of } \Delta POT = \frac{1}{2} b \times h$ $= \frac{1}{2} \sqrt{2} \sqrt{2}$ $= 1 \text{ square unit}$	CA✓ OP value CA✓ OT value CA✓ substitution into formula CA✓ answer	(4)
			[8]

QUESTION 6

6.1	$p = -3$ $q = 1$	A✓ p value A✓ q value	(2)
6.2	$y = a(x - p)^2 + q$ $25 = a(3 + 3)^2 + 1$ $36a = 24$ $a = \frac{24}{36} = \frac{2}{3}$ $y = \frac{24}{36}(x + 3)^2 + 1 / y = \frac{2}{3}(x + 3)^2 + 1$	A✓substitution of Q(3 ; 25) A✓substitution of turning point CA✓ a value CA✓equation of $g.(a > 0)$	(4)
6.3	$t = 7$ $m = -1$	CA✓ t – value CA✓ m – value ($m < 0$)	(2)
6.4	At R : $y = -(3) + 7 = 4$ QR = $25 - 4$ = 21 units	CA✓ y – value CA✓length	(2)
6.5	New TP.(-3; 4)	AA✓✓answer	(2)
6.6	$k > 1$	AA✓✓answer	(2)
			[14]

QUESTION 7

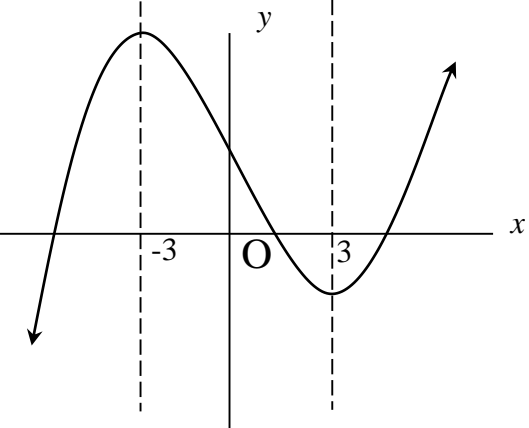
7.1	$y = a^x$ $4 = a^{-2}$ $2^2 = a^{-2}$ $a = \frac{1}{2}$	A✓ substitution of (-2 ; 4) A✓ writing in exponential form A✓ a – value	(3)
7.2	$y = \log_{\frac{1}{2}} x = -\log_2 x$	CACA✓✓ answer (2marks or 0)	(2)
7.3	$\log_{\frac{1}{2}} x = -2$ $x = \left(\frac{1}{2}\right)^{-2} = 4$ $0 < x < 4$	CA✓ equating log graph to -2 CA✓ x – value CA✓ answer	(3)
7.4	$g(x) = \log_{\frac{1}{2}} (-x)$	CACA✓✓ equation of g	(2)
7.5		A✓ y = x line (must pass through intersection point & origin) A✓ graph of inverse A✓ x – intercept = 1	(3)
			[14]

QUESTION 8 (PENALIZE ONCE FOR NOTATIONAL ERROR IN Q8,9 &10)

<p>8.1</p>	$f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $= \lim_{h \rightarrow 0} \frac{\frac{2}{3(x+h)} - \frac{2}{3x}}{h}$ $= \lim_{h \rightarrow 0} \frac{2x - 2(x+h)}{3x(x+h)h}$ $= \lim_{h \rightarrow 0} \frac{2x - 2x - 2h}{3x(x+h)} \times \frac{1}{h}$ $= -\frac{2}{3x^2}$ <p>OR</p> $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $= \lim_{h \rightarrow 0} \frac{\frac{2}{(x+h)} - \frac{2}{x}}{h}$ $= \lim_{h \rightarrow 0} \frac{\frac{2}{3}x - \frac{2}{3}(x+h)}{x(x+h)h}$ $= \lim_{h \rightarrow 0} \frac{\frac{2}{3}x - \frac{2}{3}x - \frac{2}{3}h}{x(x+h)} \times \frac{1}{h}$ $= \frac{-\frac{2}{3}}{x^2} / -\frac{2}{3x^2}$	<p>A✓ formula</p> <p>A✓ substitution</p> <p>A✓ LCD and numerator</p> <p>CA✓ simplification</p> <p>CA✓ answer</p> <p>OR</p> <p>A✓ formula</p> <p>A✓ substitution</p> <p>A✓ LCD and numerator</p> <p>CA✓ simplification</p> <p>CA✓ answer</p>	<p>(5)</p> <p>(5)</p>
<p>8.2.1</p>	$f(x) = 3(x^2 - 5)^2$ $f(x) = 3(x^4 - 10x^2 + 25)$ $f(x) = 3x^4 - 30x^2 + 75$ $f'(x) = 12x^3 - 60x$	<p>A✓ squaring the binomial</p> <p>CA✓ simplifying</p> <p>CACA✓✓ each answer</p>	<p>(4)</p>

8.2.2	$x^2 - 3 = \sqrt[3]{y}$ $y = (x^2 - 3)^3$ $y = x^6 - 9x^4 + 27x^2 - 27$ $\frac{dy}{dx} = 6x^5 - 36x^3 + 54x$	A✓ cube both sides A✓ expression for y CA✓ CA✓ CA✓ each term	(5)
			[14]

QUESTION 9

9.1		A✓ shape A✓ Max at $x = -3$ A✓ Min at $x = 3$ A✓ positive y intercept	(4)
9.2.1	$F(0 ; 26)$	A✓ answer	(1)
9.2.2	$D(2;54) :$ $54 = -(2)^3 + m(2)^2 + n(2) + 26$ $54 = -8 + 4m + 2n + 26$ $36 = 4m + 2n$ $18 = 2m + n \rightarrow (1)$ $f'(x) = -3x^2 + 2mx + n$ $f'(2) = -3(2)^2 + 2m(2) + n = 0$ $12 = 4m + n \rightarrow (2)$ $(2) - (1) : -6 = 2m$ $m = -3$ $Subst. in (1) : 18 = 2(-3) + n \therefore n = 24$	A✓ substituting $D(2 ; 54)$ A✓ $36 = 4m + 2n$ A✓ derivative A✓ substituting $x = 2$ into derivative and equating to 0 A✓ $-6 = 2m$ A✓ substituting into (1)	(6)

<p>9.2.3</p>	$f(x) = -x^3 - 3x^2 + 24x + 26$ $f'(x) = -3x^2 - 6x + 24 = 0$ $x^2 + 2x - 8 = 0$ $(x + 4)(x - 2) = 0$ $x = -4 \quad \text{or} \quad x = 2$ $y = -(-4)^3 - 3(-4)^2 + 24(-4) + 26$ $y = -54$ $E(-4; -54)$	<p>A✓ derivative and equal to 0</p> <p>CA✓ factors</p> <p>CA✓ x – values</p> <p>CA✓ y value of – 54 (negative)</p>	<p>(4)</p>
<p>9.2.4</p>	$f'(x) = -3x^2 - 6x + 24$ $f''(x) = -6x - 6 = 0$ $x = -1$ $y = 1 - 3 - 24 + 26 = 0$ $(-1; 0)$ <div style="border: 1px solid black; padding: 5px; display: inline-block; margin-top: 10px;"> $x = -\frac{b}{3a} = -\frac{(-3)}{3(-1)} = -1$ <p>OR</p> $x = \frac{-4 + 2}{2} = -1$ </div>	<p>CA✓ 2nd derivative and equal to 0</p> <p>CA✓ x – value</p> <p>CA✓ y – value</p>	<p>(3)</p>
<p>9.2.5</p>	$-6x - 6 > 0$ $x < -1$	<p>CA✓ $-6x - 6 > 0$</p> <p>CA✓ answer</p> <p>Answer only full marks</p>	<p>(2)</p>
			<p>[20]</p>

QUESTION 10

<p>10.1</p>	<p>(0; 4) and (80; 2)</p> $m = \frac{4 - 2}{0 - 80}$ $m = \frac{2}{-80} = -\frac{1}{40} = -0,025$	<p>A✓ substitution into gradient formula</p> <p>CA✓ answer(negative)</p>	<p>(2)</p>
<p>10.2</p>	<p>Since $-\frac{1}{40} = -0,025$, we know that the car is burning 0,025 litres of petrol for every kilometre that the car travels.</p> <p>The negative value of the gradient tells us that the amount of petrol in the tank is decreasing.</p>	<p>AA✓✓(petrol decreasing)</p> <p>A A✓✓(negative gradient)</p>	<p>(4)</p>
			<p>[6]</p>