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MATHEMATICS

JUNE CONTROL TEST

MEMORANDUM

**NATIONAL
SENIOR CERTIFICATE**

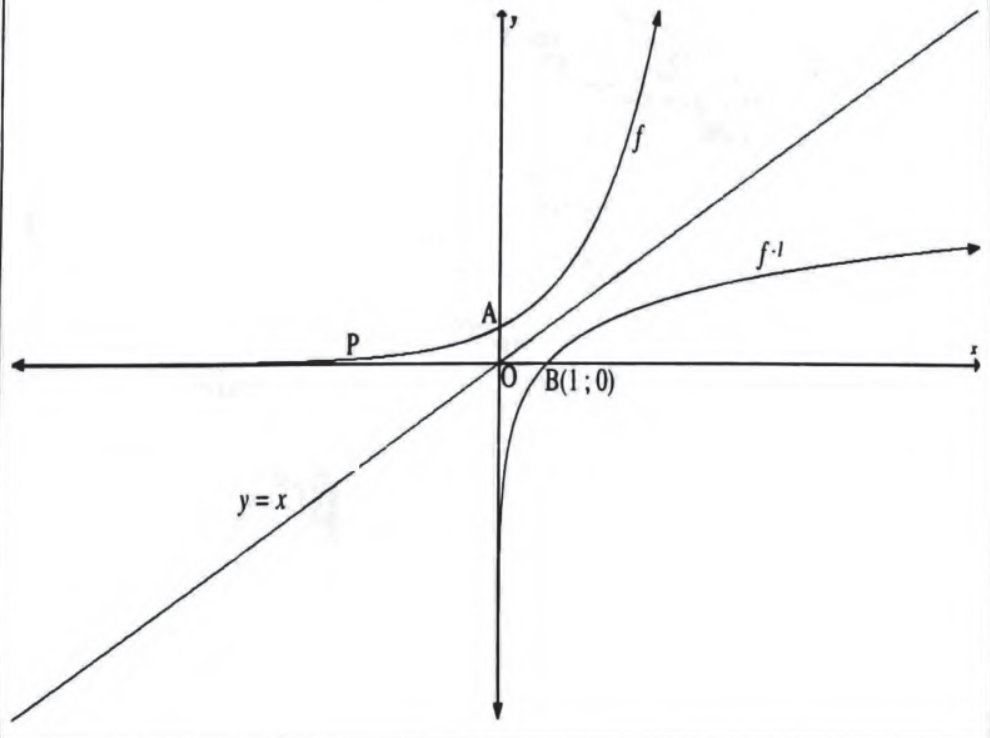
GRADE 12

MARKS: 75

TIME: 1.5 hours

This memorandum consists of 7 pages.

QUESTION 1

1.1	$y = 0$	AA✓✓ asymptote equation	(2)
1.2	$y = a^x$ $\frac{1}{8} = a^{-3}$ $2^{-3} = a^{-3}$ $a = 2$	A✓ substitution of $P(-3; \frac{1}{8})$ A✓ exponential form CA✓ a - value	(3)
1.3	$A(0; 1)$	AA✓✓ answer	(2)
1.4	$y = 2^x$ Interchanging x and y $x = 2^y$ $y = \log_2 x$	A✓ x form CA✓ answer	(2)
1.5	$P(\frac{1}{8}; -3)$	A✓A✓ answer	(2)
1.6		A✓ shape A✓ coordinates of B A✓ $y = x$ line	(3)

1.7	$\frac{1}{3} \log_2 x \leq 1$ $\log_2 x = 3$ $x = 2^3$ $x = 8$ $0 < x \leq 8$	A✓ Equating CA✓ value 8 CA✓CA✓ answer (4)	
			[18]

QUESTION 2

2.1.1	$A = P(1 + i)^n$ $82\,000 = 45\,000 \left(1 + \frac{i}{12}\right)^{84}$ $\left(1 + \frac{i}{12}\right)^{84} = \frac{82\,000}{45\,000}$ $i = 12 \left(\sqrt[84]{\frac{82\,000}{45\,000}} - 1 \right)$ $i = 0,0860 \dots$ 8.6 % p.a. compounded monthly.	A✓ substitution into formula CA✓ i – value CA✓ conclusion (3)	
2.1.2	$A = P(1 + i)^{n_1}(1 + i)^{n_2}$ $A = \left[45\,000 \left(1 + \frac{8.6\%}{12}\right)^{36} + 20\,000 \right] \left(1 + \frac{8.6\%}{12}\right)^{48}$ $A = R\,110\,160,28$ OR $A = \left[45\,000 \left(1 + \frac{8.6\%}{12}\right)^{84} \right] + 20\,000 \left(1 + \frac{8.6\%}{12}\right)^{48}$ $A = R\,110\,160,28$	AA✓✓ substitution into formula CA✓ answer (3) OR AA✓✓ substitution into formula CA✓ answer (3)	
2.2	$A = P(1 - i)^n$ $A = 900\,000(1 - 9.2\%)^9$ $A = R\,377\,585,36$	AA✓✓ substitution into formula CA✓ answer (3)	
			[9]

QUESTION 3 (penalize 1 mark once for incorrect notation in this question)

<p>3.1</p>	$f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{2 - 5(x+h)^2 - (2 - 5x^2)}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{2 - 5x^2 - 10xh - 5h^2 - 2 + 5x^2}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{-10xh - 5h^2}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{h(-10x - 5h)}{h}$ $f'(x) = -10x$ <p>OR</p> $f(x+h) = 2 - 5(x+h)^2$ $= 2 - 5x^2 - 10xh - 5h^2$ $f(x+h) - f(x) = -10xh - 5h^2$ $\frac{f(x+h) - f(x)}{h} = \frac{h(-10x - 5h)}{h} = (-10x - 5h)$ $f'(x) = \lim_{h \rightarrow 0} (-10x - 5h)$ $f'(x) = -10x$	<p>A✓ formula</p> <p>A✓ substitution</p> <p>CA✓ simplification of numerator</p> <p>CA✓ factorization</p> <p>CA✓ answer</p> <p>OR</p> <p>A✓ $f(x+h)$ value</p> <p>CA✓ $f(x+h) - f(x)$ value</p> <p>CA✓ $\frac{f(x+h)}{h}$ value</p> <p>A✓ formula</p> <p>CA✓ answer</p>	<p>(5)</p> <p>(5)</p>
<p>3.2.1</p>	$g(x) = (7x - 3)^2$ $g(x) = 49x^2 - 42x + 9$ $g'(x) = 98x - 42$	<p>A✓ squaring</p> <p>CACA✓✓ derivatives</p>	<p>(3)</p>

3.2.2	$D_x \left[\frac{x^3 + 4x^2 - 5}{\sqrt{x}} \right]$ $= D_x \left[x^{\frac{5}{2}} + 4x^{\frac{3}{2}} - 5x^{-\frac{1}{2}} \right]$ $= \frac{5}{2}x^{\frac{3}{2}} + 6x^{\frac{1}{2}} + \frac{5}{2}x^{-\frac{3}{2}}$	<p>A✓ writing in exponential form</p> <p>CACACA✓✓✓ answers</p>	(4)
3.2.3	$y = \left[\frac{x^3 - 125}{5 - x} \right]$ $y = \left[\frac{(x - 5)(x^2 + 5x + 25)}{-(x - 5)} \right]$ $= -x^2 - 5x - 25$ $\frac{dy}{dx} = -2x - 5$	<p>A✓ factorizing numerator</p> <p>CA✓ simplifying</p> <p>CACA✓✓ answers</p>	(4)
3.3	$\frac{d}{dx} [0 + x^2 + 2x^1 + 3]$ $= 2x + 2$	<p>AA✓✓ generating terms (1 mark for 2 terms and 1 mark for all terms correct)</p> <p>CACA✓✓</p>	(4)
			[20]

QUESTION 4

4.1	$\frac{y}{AB} = \tan \theta$ $AB = \frac{y}{\tan \theta}$	A✓trig. equation	(1)
4.2	$AC^2 = \frac{y^2}{\tan^2 \theta} + y^2 - 2\left(\frac{y}{\tan \theta}\right)(y) \cos 120^\circ$	AA✓✓Substitution into cosine formula	(2)
4.3.1	$AC^2 = \frac{(15)^2}{\tan^2 22^\circ} + (15)^2 - 2\left(\frac{15}{\tan 22^\circ}\right)(15) \cos 120^\circ$ $AC = 46,5 \text{ m}$	CA✓Substitution CA✓answer	(2)
4.3.2	$\frac{15}{46,5} = \tan M\hat{C}A$ $M\hat{C}A = 17,9^\circ$	CA✓trig. Equation CA✓answer	(2)
			[7]

QUESTION 5

5.1.1	$x^2 + y^2 - 6x - 2y + 1 = 0$ $x^2 - 6x + 9 + y^2 - 2y + 1 = -1 + 9 + 1 = 9$ $(x - 3)^2 + (y - 1)^2 = 9$ <p>Centre (3 ; 1) and Radius : 3 units</p>	A✓Completing the square CA✓Equation in centre – radius form CA✓Centre CA✓radius	(4)
5.1.2	<p>NT1TM ... (radius perp. tangent)</p> $MN^2 = 3^2 + (2\sqrt{13})^2 = 9 + 52 = 61$ $MN = \sqrt{(p - 3)^2 + (7 - 1)^2}$ $(p - 3)^2 + 36 = 61$ $(p - 3)^2 = 25$	A✓S/R CA✓ $MN^2 = 61$ CA✓length of MN in terms of p CA✓equating	

