



education

Department:
Education
REPUBLIC OF SOUTH AFRICA

**NATIONAL
SENIOR CERTIFICATE**

GRADE 12

MATHEMATICS P1

NOVEMBER 2008

MEMORANDUM

MARKS: 150

This memorandum consists of 23 pages.

- Continued Accuracy will apply as a general rule.
- If a candidate does a question twice and does not delete either, only mark the FIRST attempt.
- If a candidate does a question, crosses it out and does not re-do it, mark the deleted attempt.

QUESTION 1

1.1.1	$x^2 = 5x - 4$ $x^2 - 5x + 4 = 0$ $(x - 4)(x - 1) = 0$ $x = 4 \text{ or } x = 1$	<p>– 1 for not equal to zero in this question only. If = 0 appears once in this question then full marks</p>	<p>✓ standard form = 0 ✓ factorisation ✓ both answers (3)</p> <p>OR</p> <p>By the formula ✓ standard form = 0 ✓ substitution ✓ both answers</p>
1.1.2	$x(3 - x) = -3$ $3x - x^2 = -3$ $x^2 - 3x - 3 = 0$ $x = \frac{3 \pm \sqrt{(-3)^2 - 4(1)(-3)}}{2(1)}$ $x = \frac{3 \pm \sqrt{21}}{2}$ $x = 3,79 \text{ or } x = -0,79$ <p>OR</p> $x(3 - x) = -3$ $3x - x^2 = -3$ $-x^2 + 3x + 3 = 0$ $x = \frac{-3 \pm \sqrt{(3)^2 - 4(-1)(3)}}{2(-1)}$ $x = \frac{-3 \pm \sqrt{21}}{-2}$ $x = 3,79 \text{ or } x = -0,79$	<p>– 1 for inaccurate rounding off for both answers.</p>	<p>✓ simplification ✓ standard form ✓ substitution into formula ✓✓ answers (5)</p> <p>✓ simplification ✓ standard form ✓ substitution into formula ✓✓ answers (5)</p> <p>Note: If negative discriminant: max 2 / 5</p>

1.1.3

$$3 - x < 2x^2$$

$$-2x^2 - x + 3 < 0$$

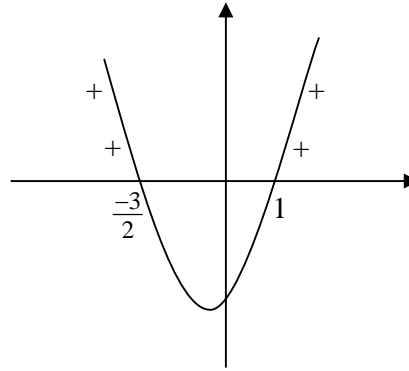
$$2x^2 + x - 3 > 0$$

$$(2x + 3)(x - 1) > 0$$

$$x < -\frac{3}{2} \text{ or } x > 1$$

OR

$$x \in (-\infty; -\frac{3}{2}) \cup (1; \infty)$$



OR

$$3 - x < 2x^2$$

$$0 < 2x^2 + x - 3$$

$$0 < (2x + 3)(x - 1)$$

$$x < -\frac{3}{2} \text{ or } x > 1$$

Note:

4 / 5 Inaccurate inequality in the beginning
 2 / 5 If final answer does not have inequality signs
 (ie. question has been changed to an equation)
 4 / 5 If the candidate has used AND or \cap instead of
 OR or \cup

If Answer is

$$(2x + 3)(x - 1) > 0$$

$$-\frac{3}{2} < x < 1 \quad \text{then: } 2 / 5$$

✓ standard form
 ✓ factorisation

✓ OR / \cup

✓ $x < -\frac{3}{2}$

✓ $x > 1$

(5)

✓ standard form
 ✓ factorisation

✓ OR / \cup

✓ $x < -\frac{3}{2}$

✓ $x > 1$

(5)

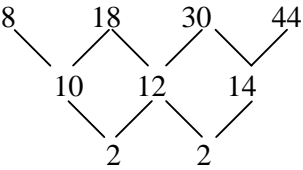
<p>1.2</p>	$y = 3 - 2x$ $x^2 + (3 - 2x) + x = (3 - 2x)^2$ $x^2 + 3 - 2x + x = 9 - 12x + 4x^2$ $3x^2 - 11x + 6 = 0$ $(3x - 2)(x - 3) = 0$ $x = \frac{2}{3} \quad \text{or} \quad x = 3$ $\therefore y = \frac{5}{3} \quad \quad \quad \therefore y = -3$ <p style="text-align: center;">OR</p>	<p>✓ $y = 3 - 2x$</p> <p>✓ substitution ✓ simplification of $(3 - 2x)^2$ ✓ standard form ✓ factorisation ✓ both x values</p> <p>✓✓ y values</p> <p style="text-align: right;">(8)</p>
	$x = \frac{3 - y}{2}$ $\left(\frac{3 - y}{2}\right)^2 + y + \frac{3 - y}{2} = y^2$ $\frac{9 - 6y + y^2}{4} + y + \frac{3 - y}{2} = y^2$ $9 - 6y + y^2 + 4y + 6 - 2y = 4y^2$ $0 = 3y^2 + 4y - 15$ $0 = (3y - 5)(y + 3)$ $y = \frac{5}{3} \quad \text{or} \quad y = -3$ $\therefore x = \frac{2}{3} \quad \quad \quad \therefore x = 3$ <p style="text-align: center;">OR</p> $y = 3 - 2x$ $x^2 - y^2 + x + y = 0$ $(x + y)(x - y) + (x + y) = 0$ $(x + y)(x - y + 1) = 0$ $y = x + 1$ $y = -x \quad \quad \quad 3 - 2x = x + 1$ $3 - 2x = -x \quad \quad \quad \text{or} \quad x = \frac{2}{3}$ $x = 3 \quad \quad \quad y = \frac{5}{3}$ $y = -3 \quad \quad \quad y = \frac{5}{3}$ <p style="text-align: center;">OR</p>	<p>✓ $x = \frac{3 - y}{2}$ ✓ substitution</p> <p>✓ simplification of $\left(\frac{3 - y}{2}\right)^2$ ✓ standard form ✓ factorisation ✓ both y values</p> <p>✓✓ x values</p> <p style="text-align: right;">(8)</p> <p>✓ $y = 3 - 2x$</p> <p>✓ common factor ✓ common bracket</p> <p>✓ $y = -x$</p> <p>✓ $3 - 2x = -x$ ✓ both x-values ✓✓ y-values</p> <p style="text-align: right;">(8)</p>

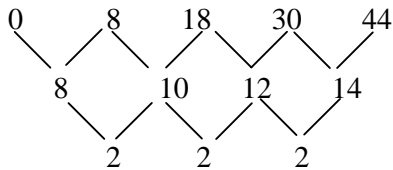
	$x = \frac{3-y}{2}$ $x^2 - y^2 + x + y = 0$ $(x+y)(x-y) + (x+y) = 0$ $(x+y)(x-y+1) = 0$ $y = x+1$ $y = -x$ $y = \frac{3-y}{2} + 1$ $y = -\frac{3-y}{2}$ $2y = 3 - y + 2$ $2y = -3 + y \quad \text{or} \quad 3y = 5$ $y = -3$ $y = \frac{5}{3}$ $x = 3$ $x = \frac{2}{3}$	$\checkmark x = \frac{3-y}{2}$ $\checkmark \text{ common factor}$ $\checkmark \text{ common bracket}$ $\checkmark y = -x$ $\checkmark y = -\frac{3-y}{2}$ $\checkmark \text{ both } y\text{-values}$ $\checkmark \checkmark x\text{-values}$ <p style="text-align: right;">(8)</p>
<p>1.3</p>	$\frac{x^2 - 4}{x - 2} = \frac{(x+2)(x-2)}{(x-2)} = x + 2$ <p>Therefore when $x = 999\,999\,999\,999$, the value is $999\,999\,999\,999 + 2 = 1\,000\,000\,000\,001$.</p> <p>OR</p> $\frac{x^2 - 4}{x - 2} = \frac{(x+2)(x-2)}{(x-2)} = x + 2$ $999\,999\,999\,999 = 10^{12} - 1$ $x + 2 = 999\,999\,999\,999 + 2$ $= 10^{12} + 1$	$\checkmark \text{ factorisation}$ $\checkmark \text{ simplification}$ $\checkmark \text{ answer}$ <p style="text-align: right;">(3)</p> <p>Note: If candidate has substituted directly, 0/3 (answer would be 1×10^{12} by substitution) Answer only: 2 / 3 Correct answer but incorrect mathematics 0 / 3</p>
<p>1.4</p>	$\frac{x^4 + 1}{x^4} = 1 + \frac{1}{x^4} > 1 \text{ since } \frac{1}{x^4} > 0$ $\therefore \frac{x^4 + 1}{x^4} \text{ can never be equal to } \frac{1}{2}$ <p style="text-align: center;">OR</p> $2x^4 + 2 = x^4$ $\frac{1}{x^4} = -\frac{1}{2}$ <p>Which has no real solution since $\frac{1}{x^4} > 0$ for all $x \in R - \{0\}$</p> <p style="text-align: center;">OR</p>	$\checkmark \text{ inequality}$ $\checkmark \text{ conclusion}$ <p style="text-align: right;">(2)</p> $\checkmark \text{ equation}$ $\checkmark \text{ conclusion}$ <p style="text-align: right;">(2)</p>

	$2x^4 + 2 = x^4$ $x^4 + 2 = 0$ $x^4 + 0x^2 + 2 = 0$ $b^2 - 4ac = 0 - 4(1)(2)$ $= -8$ < 0 <p>\therefore no real roots</p>	<p>✓ calculation</p> <p>✓ $\Delta < 0$ or $\Delta = -8$</p> <p>(2)</p>
	$2x^4 + 2 = x^4$ <p>$\therefore x^4 = -2$</p> <p>Which has no real solution since $x^4 \geq 0$ for all $x \in R$</p>	<p>✓ equation</p> <p>✓ conclusion</p> <p>(2)</p> <p>[26]</p>

QUESTION 2

<p>2.1.1</p>	$\frac{1}{16}; 13$	<p>✓✓ answers</p> <p>(2)</p>
<p>2.1.2</p>	$\left(\frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \dots \text{to } 25 \text{ terms}\right) \quad (4 + 7 + 10 + 13 + \dots \text{to } 25 \text{ terms})$ $\frac{a(r^n - 1)}{r - 1} = \frac{n}{2}[2a + (n - 1)d]$ $= \frac{\frac{1}{2}\left(\left(\frac{1}{2}\right)^{25} - 1\right)}{\frac{1}{2} - 1} = \frac{25}{2}[2(4) + 24(3)]$ $= 0,9999999 \quad = 1\ 000$ <p style="text-align: center;">OR</p> <p>$S_{50} = 25 \text{ terms of } 1^{\text{st}} \text{ sequence} + 25 \text{ terms of } 2^{\text{nd}} \text{ sequence}$</p> $S_{50} = \left(\frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \dots \text{to } 25 \text{ terms}\right) + (4 + 7 + 10 + 13 + \dots \text{to } 25 \text{ terms})$ $S_{50} = \frac{\frac{1}{2}\left(\left(\frac{1}{2}\right)^{25} - 1\right)}{\frac{1}{2} - 1} + \frac{25}{2}[2(4) + 24(3)]$ $S_{50} = 0,9999999\dots + 1000$ $S_{50} = 1001,00$	<p>✓ formula for geometric series</p> $\frac{\frac{1}{2}\left(\left(\frac{1}{2}\right)^{25} - 1\right)}{\frac{1}{2} - 1}$ <p>✓ answer for geometric series</p> <p>✓ formula for linear series</p> $\frac{25}{2}[2(4) + 24(3)]$ <p>✓ 1000</p> <p>✓ answer</p> <p>(7)</p> <p>Note: If used 50 terms in each series: max 5/7 (answer then is 3876)</p> <p>Answer only: 6 / 7 Write out series and then correct answer: full marks</p> <p>Write out both series and not add them: 6 / 7</p>

2.2.1	60 ; 78	✓✓ answers (2)
2.2.2	 <p> $2a = 2$ $a = 1$ $T_n = n^2 + bn + c$ $8 = 1 + b + c$ $7 = b + c \quad \dots(i)$ $18 = 4 + 2b + c$ $14 = 2b + c \quad \dots(ii)$ $(ii) - (i): \quad 14 = 2b + c$ $\quad \quad \quad 7 = b + c$ $\quad \quad \quad \therefore 7 = b$ $\quad \quad \quad \quad \quad c = 0$ $T_n = n^2 + 7n$ </p> <p style="text-align: center;">OR</p>	<p>✓ $a = 1$</p> <p>✓ substitution</p> <p>✓ solving simultaneously</p> <p>✓ $b = 7$ ✓ $c = 0$</p> <p>✓ general term (6)</p>
	<p> $T_1 = 8$ $T_2 - T_1 = 10$ $T_3 - T_2 = 12$ $T_n - T_{n-1} = nth \text{ term of sequence with } a = 8 \text{ and } d = 2$ Add both sides $T_n = 8 + 10 + 12 + \dots + \text{to } 25 \text{ terms}$ $T_n = \frac{n}{2}[16 + 2(n - 1)]$ $T_n = n(n + 7)$ </p> <p style="text-align: center;">OR</p>	<p> ✓ $T_1 = 8$ ✓ $T_2 - T_1 = 10$ ✓ $T_3 - T_2 = 12$ ✓ Add both sides </p> <p> ✓ sequence ✓ substitution (6) </p>

<p> T_0 T_1 T_2 T_4 T_5  $T_0 = 0$ $a(0)^2 + b(0) + c = 0$ $c = 0$ constant second difference = 2 $a = 1$ $T_1 = 1 + b = 8$ $b = 7$ $T_n = n^2 + 7n$ $T_n = n(n + 7)$ </p> <p style="text-align: center;">OR</p> <p> $T_n = \frac{n-1}{2} [2(\text{first first difference}) + (n-2)(\text{second difference})] + T_1$ $T_n = \frac{n-1}{2} [2(10) + (n-2)(2)] + 8$ $T_n = 10(n-1) + (n-2)(n-1) + 8$ $T_n = 10n - 10 + n^2 - 3n + 2 + 8$ $T_n = n^2 + 7n$ </p> <p style="text-align: center;">OR</p> <p> $T_n = (n-1)T_2 - (n-2)T_1 + 2nd \text{ difference} \frac{(n-1)(n-2)}{2}$ $T_n = (n-1)(18) - (n-2)(8) + 2 \frac{(n-1)(n-2)}{2}$ $T_n = 18n - 18 - 8n + 16 + n^2 - 3n + 2$ $T_n = n^2 + 7n$ </p> <p style="text-align: center;">OR</p>	<p>✓ finding T_0</p> <p>✓ $c = 0$</p> <p>✓ second difference = 2</p> <p>✓ $a = 1$</p> <p>✓ substitution</p> <p>✓ $b = 7$</p> <p style="text-align: right;">(6)</p> <p>✓ formula</p> <p>✓✓ substitution</p> <p>✓✓ simplification</p> <p>✓ answer</p> <p style="text-align: right;">(6)</p> <p>✓✓ formula</p> <p>✓✓ substitution</p> <p>✓ simplification</p> <p>✓ answer</p> <p style="text-align: right;">(6)</p>
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	$T_n = \frac{(n-2)(n-3)T_1 - 2(n-1)(n-3)T_2 + (n-2)(n-1)T_3}{2}$ $T_n = \frac{(n^2 - 5n + 6)(8) - 2(n^2 - 4n + 3)(18) + (n^2 - 3n + 2)(30)}{2}$ $T_n = 4n^2 - 20n + 24 - 18n^2 + 72n - 54 + 15n^2 - 45n + 30$ $T_n = n^2 + 7n$ <p style="text-align: center;">OR</p> $T_1 = 8 = 1.8$ $T_2 = 18 = 2.9$ $T_3 = 30 = 3.10$ $T_4 = 44 = 4.11$ $T_n = n^2 + 7n$	<p>✓ formula ✓✓ substitution ✓✓ simplification ✓ answer (6)</p> <p>✓✓✓✓✓ observation ✓ answer (6)</p> <p>Note: By trial and error: 6 / 6 Answer only: 6 / 6</p>
<p>2.2.3</p>	$n(n+7) = 330$ $n^2 + 7n - 330 = 0$ $(n+22)(n-15) = 0$ $n = -22 \text{ or } n = 15$ $n = 15$ $\therefore 15^{\text{th}} \text{ term is } 330.$	<p>Note: 3 / 4 if did not reject $n = -22$ Answer only: 4 / 4 By trial and error and then write $n = 15$: 4 / 4 1 / 4 if just equate T_n that they found If linear T_n and valid answer : 2 / 4</p> <p>✓ substitution ✓ standard form ✓ factorisation ✓ answer (4)</p> <p style="text-align: right;">[21]</p>

QUESTION 3

<p>3.1</p>	$T_n = (8x^2)\left(\frac{x}{2}\right)^{n-1}$ <p style="text-align: center;">OR</p> $T_n = 8\left(\frac{1}{2}\right)^{n-1} \cdot x^{n+1}$ <p style="text-align: center;">OR</p> $T_n = 16x\left(\frac{x}{2}\right)^n$ <p style="text-align: center;">OR</p> $T_n = 2^{4-n} x^{n+1}$	<p>✓ answer (1)</p>
<p>3.2</p>	$ratio = \frac{x}{2}$ $-1 < \frac{x}{2} < 1$ $-2 < x < 2$	<p>✓ ratio</p> <p>✓ inequality</p> <p>✓ answer (3)</p>
<p>3.3</p>	$S_\infty = \frac{a}{1-r}$ $S_\infty = \frac{8x^2}{1-\frac{x}{2}}$ $S_\infty = \frac{8\left(\frac{3}{2}\right)^2}{1-\frac{1}{2}\left(\frac{3}{2}\right)}$ $S_\infty = 72$ <p style="text-align: center;">OR</p> $18 + \frac{27}{2} + \frac{81}{8} + \dots$ $S_\infty = \frac{18}{1-\frac{3}{4}}$ $S_\infty = \frac{18}{\frac{1}{4}}$ $S_\infty = 72$	<p>✓ substitution into formula for S_∞</p> <p>✓ substitution of $x = \frac{3}{2}$</p> <p>✓ answer (3)</p> <p>✓ series</p> <p>✓ substitution</p> <p>✓ answer (3)</p> <p>Formula Incorrect: 0 / 3</p> <p style="text-align: right;">[7]</p>

QUESTION 4

4.1	$p = 4$ $q = 2$ $3 = \frac{a}{5-4} + 2$ $1 = \frac{a}{1}$ $a = 1$	✓ answer p ✓ answer q ✓ substitution of (5; 3) ✓ answer (4) Answer for p 1 mark Answer for q 1 mark Answer for a 2 marks
4.2	$y = -x + c$ substitute (4 ; 2) $2 = -4 + c$ $c = 6$ <p style="text-align: center;">OR</p> Translation of the line $y = -x$ 2 units up and 4 units right $y = -(x-4) + 2$ $y = -x + 6$	✓ correct point (4 ; 2) ✓ substitution ✓ answer (3) ✓ substitution of $x - 4$ ✓ adding 2 ✓ answer (3) Substitution of T(3 ; 5): 0 / 3 Answer only: 3 / 3 [7]

QUESTION 5

<p>5.1 & 5.2</p>		<p>EXPONENTIAL ✓ shape (must be increasing above x-axis) ✓ y-int PARABOLA ✓ shape ✓✓ turning point ✓ y-intercept ✓✓ x-intercepts</p> <p>(8)</p> <p>INVERSE/LOG ✓ x-int ✓ shape (must be increasing on the right of the y-axis)</p> <p>(2)</p> <p>Note: If x-intercepts not shown but correct on graph 2/2 for x-intercepts.</p>
	<p>Calculation of x-intercepts of parabola</p> $0 = 2(x - 1)^2 - 8$ $8 = 2(x - 1)^2$ $4 = (x - 1)^2$ $2 = x - 1 \text{ or } -2 = x - 1$ $x = 3 \text{ or } x = -1$ <p style="text-align: center;">OR</p> $0 = 2(x - 1)^2 - 8$ $0 = 2(x^2 - 2x + 1) - 8$ $0 = 2x^2 - 4x - 6$ $0 = x^2 - 2x - 3$ $0 = (x - 3)(x + 1)$ $x = 3 \text{ or } x = -1$	
<p>5.3</p>	<p>$y = 2(x + 1)^2 - 8$</p> <p style="text-align: center;">OR</p> <p>$y = 2x^2 + 4x - 6$</p>	<p>✓ -8 ✓ +1</p> <p>(2)</p> <p>✓ -6 ✓ +4</p> <p>(2)</p>

5.4	$h\left(x + \frac{1}{2}\right) = 4^{x + \frac{1}{2}}$ $= 4^x \cdot 4^{\frac{1}{2}}$ $= 2(4^x)$ $= 2h(x)$ <p style="text-align: center;">OR</p> $h\left(x + \frac{1}{2}\right) = 4^{x + \frac{1}{2}}$ $= (2^2)^{x + \frac{1}{2}}$ $= 2^{2x+1}$ $= 2^{2x} \cdot 2$ $= 2(4^x)$ $= 2h(x)$	<p>✓ substitution</p> <p>✓ $4^x \cdot 4^{\frac{1}{2}}$</p> <p>✓ $2(4^x)$</p> <p style="text-align: right;">(3)</p> <p>✓ substitution</p> <p>✓ $(2^2)^{x + \frac{1}{2}}$</p> <p>✓ $2(4^x)$</p> <p style="text-align: right;">(3)</p> <p>Note: If numerical examples are used : 1 / 3</p> <p style="text-align: right;">[15]</p>
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QUESTION 6

6.1	$x = -45^\circ$ $x = 135^\circ$	✓ answer ✓ answer (2) Note: If correct numbers but not writing as an equation 1 / 2 If units left out: 2 / 2
6.2	$h(x) = \tan(45^\circ - x)$ $h(x) = -\tan(x - 45^\circ) = -f(x)$ h is the reflection of f about the x -axis <p style="text-align: center;">OR</p> h is the reflection of f about the line $y = 0$	✓✓ reflection about x -axis (2) ✓✓ reflection about $y = 0$ (2) Note: If calculation only: 1 / 2 If answer is: Reflection only: 0 / 2 If do calculation and say reflection: 1 / 2 Only $h(x) = \tan(45^\circ - x)$ $h(x) = -\tan(x - 45^\circ) = -f(x)$ 1 / 2
6.3	$y = 3 \sin 2x$	✓ 3 ✓ $2x$ (2) [6]

QUESTION 7

Penalise ONCE in question 7 for early rounding off.

<p>7.1</p>	<p> $A = P(1 + i)^n$ $23000 = 1570(1.12)^n$ $(1.12)^n = 14,64968153..$ $n \log(1,12) = \log 14,64968153..$ $n = 23,69$ years (23,68701...) or $n = 24$ years or $n = 23$ years 8 months or $n = 23,7$ years </p> <p style="text-align: center;">OR</p> <p> $A = P(1 + i)^n$ $23000 = 1570\left(1 + \frac{12}{100}\right)^n$ $(1.12)^n = 14,64968153..$ $n \log(1,12) = \log 14,64968153..$ $n = 23,69$ years (23,68701...) or $n = 24$ years or $n = 23$ years 8 months or $n = 23,7$ years </p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> <p>Note: Accept 24 years : 4 / 4 Incorrect Formula: 0/4</p> </div>	<p> ✓ formula ✓ substitution ✓ apply log function ✓ answer (4) </p> <p> ✓ formula ✓ substitution of $\frac{12}{100}$ ✓ apply log function ✓ answer (4) </p>
<p>7.2.1</p>	<p> $A = P(1 + i)^n$ $= 800000(1.08)^5$ $= R1175462,46$ $\therefore R1175462,46 - R200\ 000$ $= R975462,46$ Some calculators give R 975 462,50 </p>	<p> ✓ substitution ✓ R 1 175 462,46 ✓ R 975 462,46 (3) Incorrect Formula: 0/3 </p>
<p>7.2.2</p>	<p> $F = \frac{x[(1 + i)^n - 1]}{i}$ $975462,46 = x \frac{[1,01]^{60} - 1}{0,01}$ $\frac{975462,46 \times 0.01}{[1,01]^{60} - 1} = x$ $x = R 11944,00$ </p>	<p> ✓ F = R975462,46 or answer in 7.2.1 ✓ $n = 60$ ✓ $i = 1,01$ ✓ formula ✓ simplification ✓ answer (6) </p>

OR	
$975462,46 = x \frac{[1,01]^{60} - 1}{0,01}$ $975462,46 = 81,66966986x$ $x = R 11944,00$	<ul style="list-style-type: none"> ✓ F = R975462,46 ✓ n = 60 ✓ i = 1,01 ✓ formula ✓ simplification ✓ answer <p style="text-align: right;">(6)</p> <p>Note: Continued Accuracy applies.</p>

7.2.3	<p>$Service = [5000(1,01)^{48} + 5000(1,01)^{36} + 5000(1,01)^{24} + 5000(1,01)^{12} + 5000]$ $= 32197,77$</p> <p>$975462,46 = x \frac{[1,01]^{60} - 1}{0,01} - Service$</p> <p>$975462,46 = 81,66966986x - 32197,77$</p> <p>$x = R 12338,24$</p> <p style="text-align: center;">OR</p> <p>$Service = \frac{5000[1,01^{60} - 1]}{1,01^{12} - 1}$ $= 32197,77$</p> <p>$975462,46 = x \frac{[1,01]^{60} - 1}{0,01} - Service$</p> <p>$975462,46 = 81,66966986x - 32197,77$</p> <p>$x = R 12338,24$</p> <p style="text-align: center;">OR</p> <p>Present Value payment of R 5000 $= 5000\{(1,01)^{-12} + (1,01)^{-24} + (1,01)^{-36} + (1,01)^{-48} + (1,01)^{-60}\}$</p> <p>$= 5000(1,01)^{-12} \left\{ \frac{1 - (1,01)^{-60}}{1 - (1,01)^{-12}} \right\}$</p> <p>$= R 17 723,25$</p> <p>Present Value of the sinking fund $= 975462,46(1,01)^{-60}$ $= R 536 942,94$</p> <p>Total Value of sinking fund $= R 17 723,25 + R 536 942,94$ $= R 554 666,19$</p> <p>$\therefore 554666,19 = x \left\{ \frac{1 - (1,01)^{-60}}{0,01} \right\}$</p> <p>$x = R 12 338,24$</p> <p style="text-align: center;">OR</p>	<ul style="list-style-type: none"> ✓✓ 32 197,77 ✓ setting up of correct equation ✓ answer <p style="text-align: right;">(4)</p> <ul style="list-style-type: none"> ✓✓ 32 197,77 ✓ setting up of correct equation ✓ answer <p style="text-align: right;">(4)</p> <ul style="list-style-type: none"> ✓ 17723,25 ✓ 554666,19 ✓ setting up of correct equation ✓ answer <p style="text-align: right;">(4)</p>
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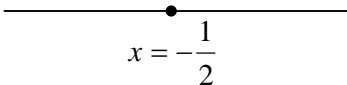
	$(1 + i_{eff}) = (1 + 0,01)^{12}$ $i_{eff} = 0,12682503.....$ $P(1 + i)^n$ $= 5000 \frac{(1,12682503)^5 - 1}{0,12682503}$ $= 32197,77$ $975462,46 = x \frac{[1,01]^{60} - 1}{0,01} - 32197,77$ $975462,46 = 81,66966986x - 32197,77$ $x = R 12338,24$ <p style="text-align: center;">OR</p> $5000 = \frac{x[(1,01)^{12} - 1]}{0,01}$ $x = \frac{5000 \times 0,01}{1,01^{12} - 1}$ $x = 394,24$ <p>So monthly deposit must be increased by R 394,24</p> <p>New monthly deposit = R 11 944 + R 394,24 = R 12 338,24</p>	<p>✓ substitution into formula ✓ 32 197,77</p> <p>✓ setting up of correct equation ✓ answer R 12 338,24 (4)</p> <p>✓ substitution into formula ✓ 394,24</p> <p>✓ setting up of correct equation ✓ answer R 12 338,24 (4)</p> <p style="text-align: right;">[17]</p>
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QUESTION 8

<p>8.1</p>	$f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $= \lim_{h \rightarrow 0} \frac{-3(x+h)^2 - (-3x^2)}{h}$ $= \lim_{h \rightarrow 0} \frac{-3x^2 - 6xh - 3h^2 + 3x^2}{h}$ $= \lim_{h \rightarrow 0} \frac{-6xh - 3h^2}{h}$ $= \lim_{h \rightarrow 0} \frac{h(-6x - 3h)}{h}$ $= \lim_{h \rightarrow 0} (-6x - 3h)$ $= -6x$	<p>✓✓ definition</p> $\lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ <p>✓ $-3(x+h)^2$</p> <p>✓ substitution of $-3x^2$</p> <p>✓ correct answer (5)</p> <p>Note: Penalty 1 for incorrect notation If a candidate has used the rules only: 0/5</p>
<p>8.2</p>	$y = \frac{\sqrt{x}}{2} - \frac{1}{6x^3}$ $y = \frac{1}{2} \cdot x^{\frac{1}{2}} - \frac{1}{6} \cdot x^{-3}$ $\frac{dy}{dx} = \frac{1}{4} x^{-\frac{1}{2}} + \frac{3}{6} x^{-4}$ $\frac{dy}{dx} = \frac{1}{4} x^{-\frac{1}{2}} + \frac{1}{2} x^{-4}$ $\frac{dy}{dx} = \frac{1}{4\sqrt{x}} + \frac{1}{2x^4}$ <div style="border: 1px solid black; padding: 5px; margin: 10px 0;"> <p>Note: If removed coefficients, or moved the numbers from the denominator to the numerator: Continued accuracy applies for each correct derivative Max 2/3 If leave out $\frac{dy}{dx}$ penalise 1 mark.</p> </div>	<p>✓ Simplification</p> $\checkmark \frac{1}{4} x^{-\frac{1}{2}}$ $\checkmark \frac{1}{2} x^{-4} \text{ or } \frac{3}{6} x^{-4}$ <p>(3)</p> <p>[8]</p>

QUESTION 9

9.1	$-(2x-5)(x+2) = 0$ $x = \frac{5}{2} \text{ or } -2$ $AB = 4,5 \text{ units}$ <p style="text-align: center;">OR</p> $-(2x-5)(x+2) = 0$ $x = \frac{5}{2} \text{ or } -2$ $AB = \sqrt{(2,5 - (-2))^2 + (0-0)^2}$ $AB = 4,5 \text{ units}$	$\checkmark x = \frac{5}{2}; x = -2$ $\checkmark \text{ answer} \quad (2)$ $\checkmark x = \frac{5}{2}; x = -2$ $\checkmark \text{ answer} \quad (2)$
9.2	$g'(x) = 0$ $-6x^2 - 6x + 12 = 0$ $x^2 + x - 2 = 0$ $(x+2)(x-1) = 0$ $x = -2 \text{ or } x = 1$ $\text{at T: } x = 1$	$\checkmark g'(x) = 0$ $\checkmark g'(x) = -6x^2 - 6x + 12$ $\checkmark \text{ factorisation}$ $\checkmark \text{ answer} \quad (4)$
9.3	$g'(x) = -6x^2 - 6x + 12$ $g'(-3) = -6(-3)^2 - 6(-3) + 12$ $g'(-3) = -54 + 18 + 12$ $g'(-3) = -24$ $y = ax + q$ $11 = -24(-3) + q$ $q = -61$ $y = -24x - 61$ <p style="text-align: center;">OR</p> $g'(x) = -6x^2 - 6x + 12$ $g'(-3) = -6(-3)^2 - 6(-3) + 12$ $g'(-3) = -54 + 18 + 12$ $g'(-3) = -24$ $y - 11 = -24(x + 3)$ $y - 11 = -24x - 72$ $y = -24x - 61$	$\checkmark g'(-3)$ $\checkmark -24$ $\checkmark \text{ method of setting up straight line equation}$ $\checkmark \text{ substitution of point } (-3; 11)$ $\checkmark \text{ answer in equation form} \quad (5)$ $\checkmark g'(-3)$ $\checkmark -24$ $\checkmark \text{ formula}$ $\checkmark \text{ substitution of point } (-3; 11)$ $\checkmark \text{ answer in equation form} \quad (5)$

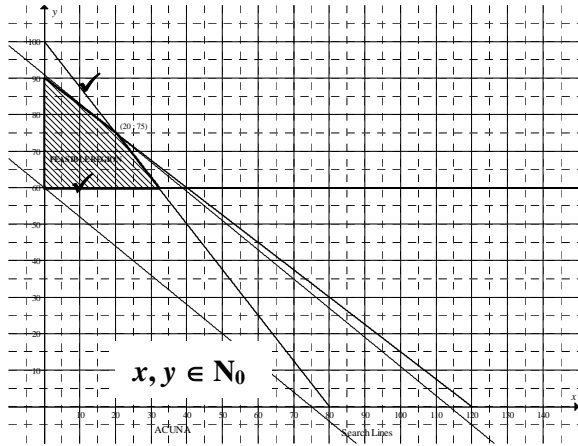
<p>9.4</p>	<p>y-coordinate of T is $g(1) = -2(1)^3 - 3(1)^2 + 12(1) + 20$ $= 27$ T(1 ; 27) $\therefore 0 < k < 27$</p> <p style="text-align: center;">OR</p> <p>$-2x^3 - 3x^2 + 12x + 20 = k$ $-2x^3 - 3x^2 + 12x + 20 - k = 0$ $-7 < 20 - k < 20$ $-27 < -k < 0$ $0 < k < 27$</p>	<p>✓ y-coordinate of T (27)</p> <p>✓✓ answer (3)</p> <p>✓ $-7 < 20 - k < 20$ ✓✓ answer (3)</p> <p>Answer Only: 3/3 $0 \leq k \leq 27$: 2 / 3 $k > 0$: 1 / 3 $k < 27$: 1 / 3</p>
<p>9.5</p>	<p>$g'(x) = -6x^2 - 6x + 12$ $g''(x) = -12x - 6$ $12x + 6 = 0$ $x = -\frac{1}{2}$</p> <p style="text-align: center;"> $g''(x) < 0$ $g''(x) > 0$  $x = -\frac{1}{2}$</p> <p>$g''(x)$ changes sign at $x = -\frac{1}{2}$ \therefore point of inflection at $x = -\frac{1}{2}$</p> <p style="text-align: center;">OR</p> <p>Turning points A(-2;0); T(1;27) Now x co-ordinate of point of inflection is $x = -\frac{-2+1}{2} = -\frac{1}{2}$</p>	<p>✓ $-12x$ ✓ -6 ✓ $= 0$ ✓ $x = -\frac{1}{2}$ (4)</p> <p>✓✓ points ✓✓ $x = -\frac{1}{2}$</p> <p style="text-align: right;">(4) [18]</p>

QUESTION 10

10.1	$V = \pi r^2 h$ $200 = \pi r^2 h$ $h = \frac{200}{\pi r^2}$	✓ formula ✓ substitution (2)
10.2	$\text{Surface Area} = 2\pi rh + \pi r^2$ $S(r) = \pi r^2 + \frac{200}{\pi r^2} \cdot 2\pi r$ $S(r) = \pi r^2 + \frac{400}{r}$	✓ formula ✓ substitution (2)
10.3	$S(r) = \pi r^2 + 400r^{-1}$ $\frac{dS}{dr} = 2\pi r - 400r^{-2}$ <p>At minimum: $\frac{dS}{dr} = 0$</p> $2\pi r - \frac{400}{r^2} = 0$ $\pi r^3 - 200 = 0$ $r^3 = \frac{200}{\pi}$ $r = 3,99 \text{ cm}$	✓ exponents correct ✓ $\frac{dS}{dr} = 2\pi r - 400r^{-2}$ ✓ $\frac{dS}{dr} = 0$ ✓ $r^3 = \frac{200}{\pi}$ ✓ $r = 3,99$ or $r = \sqrt[3]{\frac{200}{\pi}}$ (5) Note: If did not put = 0, penalise 1 mark If notation is $\frac{dy}{dx}$, ignore notation. [9]

QUESTION 11

11.1	$10x + 8y \leq 800$ $3x + 4y \leq 360$ $y \geq 60$ $x, y \in N_0$	✓ answer ✓ answer ✓ answer (3)
11.2 & 11.3	See attached graph ... (5) See attached graph ... (1)	11.2 ✓✓ $y = -\frac{3}{4}x + 90$ ✓✓ $y = -\frac{5}{4}x + 100$ ✓ $y = 60$ (5) 11.3 ✓ feasible region (1) Note: If shading only, and did not state feasible region 1/1
11.4	$P = 200x + 250y$	✓ answer (1)
11.5	$250y = -200x + P$ $y = -\frac{4}{5}x + \frac{P}{250}$ Maximum at (20 ; 75)	✓ gradient ✓ search line ✓ answer (3) Note: Read correctly from the candidate's graph for the point for maximum profit. If used vertices method: 1/3 for accurate answer.
11.6	$m = -\frac{3}{4}$ Since the gradient of the new profit function is equal to the gradient of the constraint $3x + 4y \leq 360$, there are points other than (20 ; 75) that give an optimal solution.	✓ $m = -\frac{3}{4}$ ✓✓ more points in optimal solution (more than one solution) (3) Note: If just answer Yes 0 / 3 If just answer No 0 / 3 [16]



✓

✓

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✓

✓