



basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 11

MATHEMATICS P1

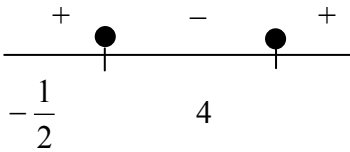
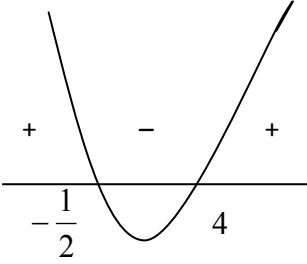
NOVEMBER 2014

MEMORANDUM

MARKS: 150

This memorandum consists of 14 pages.

QUESTION 1

<p>1.1.1</p>	$x = -2 \text{ or } x = \frac{7}{3}$	<p>✓ $x = -2$ ✓ $x = \frac{7}{3}$ (2)</p>
<p>1.1.2</p>	$x^2 - 5x - 2 = 0$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $x = \frac{5 \pm \sqrt{25 - 4(1)(-2)}}{2}$ $x = \frac{5 \pm \sqrt{33}}{2}$ $x = 5,37 \text{ or } x = -0,37$ <p>OR</p> $x^2 - 5x + \left(\frac{25}{4}\right) = 2 + \left(\frac{25}{4}\right)$ $\left(x - \frac{5}{2}\right)^2 = \frac{33}{4}$ $x - \frac{5}{2} = \pm \frac{\sqrt{33}}{2}$ $x = \frac{5 + \sqrt{33}}{2} \text{ or } x = \frac{5 - \sqrt{33}}{2}$ $x = 5,37 \quad x = -0,37$	<p>✓ standard form</p> <p>✓ correct substitution into correct formula</p> <p>✓ $x = 5,37$ ✓ $x = -0,37$ (4)</p> <p>✓ completing the square</p> <p>✓ $\sqrt{33}$</p> <p>✓ $x = 5,37$ ✓ $x = -0,37$ (4)</p>
<p>1.1.3</p>	$\sqrt{x-3} = 5 + 4$ $(\sqrt{x-3})^2 = (9)^2$ $x - 3 = 81$ $x = 84$	<p>✓ isolating $\sqrt{\quad}$ ✓ squaring both sides</p> <p>✓ simplify ✓ answer (4)</p>
<p>1.1.4</p>	$2x^2 - 7x - 4 \geq 0$ $(2x + 1)(x - 4) \geq 0$ <p>CV's: $-\frac{1}{2}; 4$</p>   $x \leq -\frac{1}{2} \text{ or } x \geq 4$ <p>OR</p> $x \in (-\infty; -\frac{1}{2}] \cup [4; \infty)$	<p>✓ factors</p> <p>✓ method</p> <p>✓ notation ✓ critical values (4)</p> <p>✓ notation ✓ critical values</p>

<p>1.2</p>	$x = 2y + 1 \quad \dots\dots(1)$ $x^2 - 2y + 3xy = 6 \quad \dots\dots(2)$ $(2y + 1)^2 - 2y + 3y(2y + 1) = 6$ $4y^2 + 4y + 1 - 2y + 6y^2 + 3y - 6 = 0$ $10y^2 + 5y - 5 = 0$ $2y^2 + y - 1 = 0$ $(2y - 1)(y + 1) = 0$ $y = \frac{1}{2} \quad \text{or} \quad y = -1$ $x = 2 \quad x = -1$ <p>OR</p> $y = \frac{x - 1}{2}$ $x^2 - 2\left(\frac{x - 1}{2}\right) + 3x\left(\frac{x - 1}{2}\right) = 6$ $2x^2 - 2x + 2 + 3x^2 - 3x - 12 = 0$ $5x^2 - 5x - 10 = 0$ $x^2 - x - 2 = 0$ $(x + 1)(x - 2) = 0$ $x = -1 \quad \text{or} \quad x = 2$ $y = -1 \quad y = \frac{1}{2}$	<ul style="list-style-type: none"> ✓ substitution of $x = 2y + 1$ ✓ simplification ✓ standard form ✓ factors ✓ both y values ✓ both x values (6) <ul style="list-style-type: none"> ✓ substitution of $y = \frac{x - 1}{2}$ ✓ simplification ✓ standard form ✓ factors ✓ both x values ✓ both y values (6) <p style="text-align: right;">[20]</p>
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QUESTION 2

2.1	$\frac{3^x(3-3^{-1})}{2 \cdot 3^x}$ $= \frac{3 - \frac{1}{3}}{2}$ $= \frac{8}{3} \times \frac{1}{2}$ $= \frac{4}{3}$ <p>OR</p> $\frac{3^{x-1}(3^2 - 1)}{2 \cdot 3^x}$ $= \frac{3^x \cdot 3^{-1} (8)}{2 \cdot 3^x}$ $= \frac{1}{3} \times 4$ $= \frac{4}{3}$	<p>✓ common factor 3^x</p> <p>✓ $3 - 3^{-1}$</p> <p>✓ answer (3)</p> <p>✓ common factor 3^{x-1}</p> <p>✓ simplification</p> <p>✓ answer (3)</p>
2.2	$(x-2)^{\frac{3}{2}} = 64$ $x-2 = \left[(4^3) \right]^{\frac{-2}{3}}$ $x-2 = 4^{-2}$ $x = 2 + \frac{1}{16}$ $\therefore x = 2\frac{1}{16}$ <p>OR</p> $\sqrt{(x-3)^{-3}} = 64$ $(x-3)^{-3} = 4096$ $(x-2)^3 = \frac{1}{4096}$ $x-2 = \frac{1}{16}$ $x = 2\frac{1}{16}$	<p>✓ applying exp. law</p> <p>✓ 4^3</p> <p>✓ simplifying</p> <p>✓ answer (4)</p> <p>✓ squaring</p> <p>✓ applying exp. law</p> <p>✓ simplification</p> <p>✓ answer (4)</p>

<p>2.3</p>	$\frac{x \cdot x^{\frac{1}{2}} \cdot x^{\frac{1}{4}} \cdot x^{\frac{1}{8}}}{\sqrt[8]{x^7}}$ $= \frac{x^{\frac{7}{8}}}{x^{\frac{7}{8}}}$ $= x$	<p>✓ applying surd law ✓ applying surd law ✓ simplifying ✓ answer (4) [11]</p>
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QUESTION 3

<p>3</p>	<p>AC.(x-2) = x² + 2x - 8 AC.(x-2) = (x+4)(x-2) AC = (x+4) cm ∴ FD = (x+4) cm ∴ ED = x+4 - (x-2) ED = 6 cm</p>	<p>✓ statement ✓ factors ✓ AC = (x+4) cm ✓ method ✓ answer (6) [6]</p>
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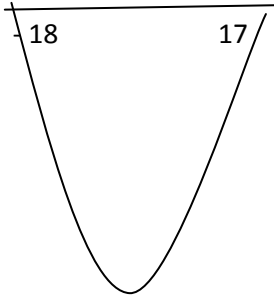
QUESTION 4

<p>4.1</p>	$\begin{matrix} -7 & 0 & 9 & 20 \\ 7 & 9 & 11 & \\ & 2 & 2 & \end{matrix}$ <p>2a = 2 a = 1 3(1) + b = 7 b = 4 (1) + (4) + c = -7 c = -12 ∴ T_n = n² + 4n - 12</p> <p>OR 2a = 2 a = 1 T₂ = 2² + b(2) + c = 0 2b + c = -4 (1) 3(1) + b = 7 T₃ = 3² + b(3) + c = 9 (2) <i>OR</i> b = 4 3b + c = 0 1 + a + c = -7 c = -12</p> <p>(2) - (1) b = 4 ∴ c = -4 - 2(4) = -12 T_n = n² + 4n - 12</p>	<p>✓ 2a = 2 ✓ a value ✓ b value ✓ c value (4) ✓ 2a = 2 ✓ a value ✓ b value ✓ c value (4)</p>
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	<p>OR</p> $T_n = T_1 + (n-1)d_1 + \frac{(n-1)(n-2)}{2} \cdot d_2$ $= -7 + (n-1) \cdot 7 + \frac{(n-1)(n-2)}{2} \cdot 2$ $= -7 + 7n - 7 + n^2 - 3n + 2$ $= n^2 + 4n - 12$	<p>✓ formula ✓✓ substitution ✓ simplification (4)</p>
4.2	$n^2 + 4n - 12 = 128$ $n^2 + 4n - 140 = 0$ $(n+14)(n-10) = 0$ $n \neq -14$ or $n = 10$ invalid $\therefore n = 10$	<p>✓ equation ✓ factors ✓ answers for n ✓ $n = 10$ (choice) (4)</p>
4.3	$-7 ; 0 ; 9 ; 20 ; \dots$ first difference 7 9 11 second difference 2 2 $F_n = 2n + c$ $F_1 = 2(1) + c = 7$ $\therefore c = 5$ $F_n = 2n + 5$	<p>✓ first differences</p> <div style="border: 1px solid black; padding: 5px; width: fit-content;"> Answer only: Full Marks </div> <p>✓ $c = 5$ (3)</p>
4.4	$F_n = 2n + 5 = 599$ $2n = 594$ $\therefore n = 297$ this difference will be between term 297 and term 298	<p>✓ equating ✓ 297 ✓ 298(3)</p> <p style="text-align: right;">[14]</p>

QUESTION 5

5.1	<table border="1" style="display: inline-table;"> <tr> <td>Pattern</td> <td>1</td> <td>2</td> <td>3</td> </tr> <tr> <td>White squares</td> <td>4</td> <td>12</td> <td>24</td> </tr> </table>	Pattern	1	2	3	White squares	4	12	24	<p>40</p> <p>✓✓ answer(2)</p>
	Pattern	1	2	3						
White squares	4	12	24							
5.2	$W_n = 2n^2 + 2n$ $W_{157} = 2(157)^2 + 2(157)$ $= 49612$	<p>✓ W_n ✓ substitution answer (3) ✓</p>								

<p>5.3</p>	$2n^2 + 2n + 1 < 613$ $2n^2 + 2n - 612 < 0$ $n^2 + n - 306 < 0$ $(n - 17)(n + 18) < 0$  <p>$\therefore n = 16$</p>	<p>✓ setting up inequality</p> <p>✓ factors</p> <p>✓ method</p> <p>✓ answer (4)</p>
<p>5.4</p>	$P_n = 4n^2 + 4n + 1$ $= (2n)^2 + 2(2n) + 1$ <p>$2n$ is even for all $n \in Z$</p> <p>\therefore Total squares used in the n^{th} pattern is always odd.</p> <p>OR</p> $P_n = 4n^2 + 4n + 1$ $= 2(2n^2 + 2n) + 1$ <p>$2(2n^2 + 2n)$ is odd for all $n \in Z$</p> <p>$2(2n^2 + 2n) + 1$ is odd for all $n \in Z$</p> <p>\therefore Total squares used in the n^{th} pattern is always odd.</p>	<p>✓ $P_n = 4n^2 + 4n + 1$</p> <p>✓ rewriting P_n</p> <p>✓ conclusion (3)</p> <p>✓ $P_n = 4n^2 + 4n + 1$</p> <p>✓ rewriting P_n</p> <p>✓ conclusion (3)</p> <p style="text-align: right;">[12]</p>

QUESTION 6

<p>6.1</p>	$x = 2$ $y = 3$	<p>✓ $x = 2$</p> <p>✓ $y = 3$ (2)</p>
<p>6.2</p>	$x.\text{int} : \frac{8}{x-2} + 3 = 0$ $8 + 3(x-2) = 0$ $3x + 2 = 0$ $\therefore x = -\frac{2}{3}$ $\therefore x - \text{int} \left(-\frac{2}{3}; 0 \right)$ $y = \frac{8}{0-2} + 3$ $y = -1$ $y.\text{int} : (0; -1)$	<p>✓ $\frac{8}{x-2} + 3 = 0$</p> <p>✓ $\left(-\frac{2}{3}; 0 \right)$</p> <p>✓ $(0; -1)$ (3)</p>

<p>6.3</p>	<p>The graph shows a hyperbola in a Cartesian coordinate system. The horizontal asymptote is at $y = 3$ and the vertical asymptote is at $x = 2$. The curve has two branches: one in the upper-left region relative to the asymptotes, passing through the point $(-2/3, -1)$, and another in the lower-right region. Arrows indicate the direction of the branches as they approach the asymptotes.</p>	<ul style="list-style-type: none"> ✓ asymptotes ✓ intercepts with axes ✓ shape <p>(3)</p>
<p>6.4</p>	$3 = 2 + k$ $k = 1$ <p>OR</p> $y = (x - 2) + 3$ $y = x + 1$ $\therefore k = 1$	<ul style="list-style-type: none"> ✓ substitute ✓ answer (2) <ul style="list-style-type: none"> ✓ $y = x + 1$ ✓ answer (2) <p>[10]</p>

QUESTION 7

<p>7.1</p>	$q = -6$	<ul style="list-style-type: none"> ✓ answer (1)
<p>7.2</p>	$-5\frac{1}{4} = a \cdot 2^{-1-1} - 6$ $\frac{3}{4} = \frac{1}{4}a$ $a = 3$	<ul style="list-style-type: none"> ✓ substitute x ✓ substitute y ✓ simplifying ✓ answer <p>(4)</p>
<p>7.3</p>	<p>x int : $2^{x-1} = 2 \therefore x = 2 \therefore (2; 0)$</p> <p>y int : $y = 3 \cdot 2^{-1} - 6 = -4\frac{1}{2} \therefore (0; -4\frac{1}{2})$</p> <p>Average Gradient</p> $\frac{0 + 4\frac{1}{2}}{2 - 0}$ $= \frac{9}{4} \text{ or } 2\frac{1}{4}$	<ul style="list-style-type: none"> ✓ $2^{x-1} = 2$ ✓ $x = 2$ ✓ $y = -4\frac{1}{2}$ ✓ subst. into gradient formula ✓ answer <p>(5)</p>
<p>7.4</p>	$y = 3 \cdot 2^{x-3} - 6$	<ul style="list-style-type: none"> ✓ ✓ answer (2) [12]

QUESTION 8

8.1	$C(-1; 0)$	✓ $C(-1; 0)$ (1)
8.2	$y = (x-3)(x+1)$ $y = x^2 - 2x - 3$	✓ $(x-3)$ ✓ $(x+1)$ ✓ $y = x^2 - 2x - 3$ (3)
8.3	TP: $y = (1)^2 - 2(1) - 3$ $y = -4$ R: $y \in [-4; \infty)$ OR $y \geq -4$	✓ $y = -4$ ✓ $[-4; \infty)$ (2) ✓ $y \geq -4$
8.4	$m = \frac{0+4}{3-1} = 2$ $y - 0 = 2(x-3)$ $y = 2x - 6$	✓ substituting into gradient formula ✓ $m = 2$ ✓ equation (3)
8.5.1	$x \leq -1$ or $x \geq 3$ OR $x \in (-\infty; -1] \cup [3; \infty)$	✓ $x \leq -1$ ✓ $x \geq 3$ (2) ✓ $(-\infty; -1]$ ✓ $[3; \infty)$ (2)
8.5.2	$-1 < x < 3$ or $x > 3$ OR $x > -1$; $x \neq 3$ OR $(-1; 3) \cup (3; \infty)$	✓ critical values ✓ notation (2) ✓ $x > -1$ ✓ $x \neq 3$ (2) ✓ $(-1; 3)$ ✓ $(3; \infty)$ (2)
8.5.3	$-1 < x < 0$ or $x > 3$ OR $(-1; 0) \cup (3; \infty)$	✓ critical values ✓ notation (2) ✓ $(-1; 0)$ ✓ $(3; \infty)$ (2)

<p>8.6</p>	$x^2 - 2x - p = 0$ $\Delta = (-2)^2 - 4(1)(-p)$ $= 4 + 4p$ <p>for non - real roots $\Delta < 0$</p> $4 + 4p < 0$ $4p < -4$ $\therefore p < -1$ <p>OR</p> $A(1; -4)$ $x^2 - 2x - 3 = 0$ $x^2 - 2x - p = 0$ $-p > 1$ $\therefore p < -1$	<p>✓ $4 + 4p < 0$</p> <p>✓ $p < -1(2)$</p> <p>✓ $-p > 1$</p> <p>✓ $p < -1(2)$</p>
<p>8.7</p>	$PM = (2x - 6) - (x^2 - 2x - 3)$ $= -x^2 + 4x - 3$ $x = -\frac{b}{2a}$ $= -\frac{4}{2(-1)} = 2$ <p><i>Max. PM</i> = $-(2)^2 + 4(2) - 3 = 1$ unit</p> <p>OR</p> $PM = (2x - 6) - (x^2 - 2x - 3)$ $= -x^2 + 4x - 3$ $= -(x^2 - 4x + 4 - 4 + 3)$ $= -[(x - 2)^2 - 1]$ $= -(x - 2)^2 + 1$ <p><i>Max. PM</i> = 1 unit</p>	<p>✓ subtraction</p> <p>✓ quadratic expression</p> <p>✓ method</p> <p>✓ maximum value (4)</p> <p>✓ subtraction</p> <p>✓ quadratic expression</p> <p>✓ method</p> <p>✓ maximum value (4)</p> <p>[21]</p>

QUESTION 9

<p>9.1</p>	$A = P(1 - i)^n$ $11090,41 = 120000(1 - i)^{12}$ $\therefore i = 1 - \sqrt[12]{\frac{11090,41}{120000}}$ <p>Thus $i = 0,179999\dots$</p> <p>Rate of Depreciation = 18%</p>	<p>✓ substitution</p> <p>✓ making i subject</p> <p>✓ i value as decimal</p> <p>✓ answer (4)</p>
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<p>9.2</p>	$i_{eff} = \left(1 + \frac{i}{m}\right)^m - 1$ $= \left(1 + \frac{0,098}{12}\right)^{12} - 1$ $= 0,10252.....$ <p>rate = 10,25%</p>	<p>✓ formula</p> <p>✓ substitution into formula</p> <p>✓ 10,25% (3)</p>
<p>9.3</p>	$A = P(1+i_1)^{n_1}(1+i_2)^{n_2}$ $= 80000\left(1 + \frac{0,075}{4}\right)^{16} \left(1 + \frac{0,092}{12}\right)^{36}$ $= R141768,60$ <p>OR</p> $A_1 = 80000\left(1 + \frac{0,075}{4}\right)^{16}$ $= 107689,1465..$ $A_2 = 107689,1465\left(1 + \frac{0,092}{12}\right)^{36}$ $= R141768,60$	<p>✓ $\left(1 + \frac{0,075}{4}\right)^{16}$</p> <p>✓ $\left(1 + \frac{0,092}{12}\right)^{36}$</p> <p>✓ multiplication</p> <p>✓ answer (4)</p> <p>✓ $\left(1 + \frac{0,075}{4}\right)^{16}$</p> <p>✓ A_1</p> <p>✓ $\left(1 + \frac{0,092}{12}\right)^{36}$</p> <p>✓ answer (4)</p>
<p>9.4.1</p>	<p>Investment : end of third year :</p> $A = P(1+i)^n$ $= 30000\left(1 + \frac{0,065}{12}\right)^{96}$ $= R50390,07$	<p>✓ $\frac{0,065}{12}$</p> <p>✓ subst. into correct formula</p> <p>✓ answer (3)</p>
<p>9.4.2</p>	$\frac{T_0 \quad T_3 \quad T_5 \quad T_8}{30000 \quad -10000 \quad +10000}$ $A = 30000\left(1 + \frac{0,65}{12}\right)^{96} - 10000\left(1 + \frac{0,65}{12}\right)^{60} + 10000\left(1 + \frac{0,65}{12}\right)^{36}$ $A = R48708,61$ <p>∴ difference = 48708,61 – 50390,07</p> $= -R1681,46$	<p>✓ $30000\left(1 + \frac{0,65}{12}\right)^{96}$</p> <p>✓ $-10000\left(1 + \frac{0,65}{12}\right)^{60}$</p> <p>✓ $10000\left(1 + \frac{0,65}{12}\right)^{36}$</p> <p>✓ R48708,61</p> <p>✓ subtracting</p> <p>✓ answer (7)</p>

	<p>Investment : end of third year :</p> $A = P(1+i)^n$ $= 30\,000\left(1 + \frac{0,065}{12}\right)^{36}$ $= R36\,440,14881$ <p>Principal(new) : $R36\,440,14881 - R10\,000,00 = R26\,440,14881$</p> <p>Investment : end of fifth year :</p> $A = P(1+i)^n$ $= 26\,440,14881\left(1 + \frac{0,065}{12}\right)^{24}$ $= R30\,100,2304$ <p>Principal(new) : $R30\,100,2304 + R10\,000,00 = R40\,100,2304$</p> <p>Investment : end of eighth year :</p> $A = P(1+i)^n$ $= 40\,100,2304\left(1 + \frac{0,065}{12}\right)^{24}$ $= R48\,708,61$ <p>Tashil had a deficit of R1681,46</p>	<p>✓ subst. into formula ✓ answer</p> <p>✓ subst. into formula ✓ answer</p> <p>✓ subst. into formula ✓ answer ✓ conclusion(7)</p> <p style="text-align: right;">[21]</p>
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QUESTION 10

10.1	5 customers	✓ answer (1)
10.2	<p>$P(C \text{ and } B) \neq 0$ Thus events B and C are not mutually exclusive</p>	<p>✓ $P(C \text{ and } B) \neq 0$ ✓ conclusion (2)</p>
10.3.1	$P(\text{V only}) = \frac{58}{240} = \frac{29}{120}$	✓ answer (1)
10.3.2	$P(C \text{ and } B) = \frac{29}{240}$	✓ answer (1)
10.3.3	<p>$P(\text{not C}) = 1 - P(C)$ $= 1 - \frac{122}{240} = \frac{59}{120}$</p> <p>OR</p> $P(\text{not C}) = \frac{52 + 3 + 58 + 5}{240}$ $= \frac{118}{240} = \frac{59}{120}$	<p>✓ formula ✓ substitution ✓ answer (3)</p> <p>✓ ✓ numerator and denominator ✓ answer (3)</p>

10.3.4	$P(B \text{ or } V) = P(B) + P(V) - P(B \text{ and } V)$ $= \frac{84}{240} + \frac{82}{240} - \frac{15}{240}$ $= \frac{151}{240}$ <p>OR</p> $P(B \text{ or } V) = \frac{17 + 52 + 12 + 3 + 9 + 58}{240}$ $= \frac{151}{240}$	$\checkmark \frac{84}{240}$ $\checkmark \frac{82}{240}$ $\checkmark \frac{15}{240}$ $\checkmark \frac{151}{240} (4)$ $\checkmark \checkmark$ numerator and denominator $\checkmark \checkmark$ answer (4) [12]
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QUESTION 11

	$P(A \text{ or } B) = P(A) + P(B) - P(A \cap B)$ $0,428 = 0,12 + 0,35 - P(A \cap B)$ $P(A \cap B) = 0,042$ $P(A) \times P(B) = 0,12 \times 0,35 = 0,042$ $\therefore P(A \cap B) = P(A) \times P(B)$ <p>Thus A and B are independent events</p>	\checkmark substitution \checkmark value of $P(A \cap B)$ \checkmark value of $P(A) \times P(B)$ \checkmark conclusion (4) [4]
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QUESTION 12

12.1	There are $100\% - 60\% - 10\% = 30\%$ red marbles $\therefore \frac{30}{100} \times 80 = 24$ red marbles	$\checkmark 30\%$ $\checkmark 24$ (2)
12.2		Outcome R,R R,Y R,G Y,R Y,Y Y,G G,R G,Y \checkmark first branch \checkmark second branch \checkmark values on diagram (3)
12.3	$P(\text{G and Y}) = P(\text{G, Y}) + P(\text{Y, G})$ $= \frac{48}{80} \times \frac{8}{79} + \frac{8}{80} \times \frac{48}{79}$ $= \frac{48}{395}$	\checkmark multiplication rule \checkmark addition \checkmark answer (3) [8]
		TOTAL: 150