



basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 11

MATHEMATICS P1

EXEMPLAR 2013

MEMORANDUM

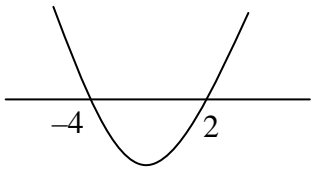
MARKS: 150

This memorandum consists of 13 pages.

QUESTION 1

| | | |
|-------|--|--|
| 1.1.1 | $(2x-1)(x+5) = 0$ $x = \frac{1}{2}$ OR $x = -5$ | ✓✓ answers (2) |
| 1.1.2 | $2x^2 - 4x + 1 = 0$ $x = \frac{-(-4) \pm \sqrt{(-4)^2 - 4(2)(1)}}{2(2)}$ $x = \frac{4 \pm \sqrt{8}}{4}$ $x = \frac{4 \pm \sqrt{4 \cdot 2}}{4}$ $x = \frac{4 \pm 2\sqrt{2}}{4}$ $x = \frac{2(2 \pm \sqrt{2})}{4}$ $x = \frac{2 \pm \sqrt{2}}{2}$ | ✓ substitution into correct formula ✓✓ answers (3) |
| 1.2.1 | $125^{\frac{2}{3}}$ $= (5^3)^{\frac{2}{3}}$ $= 5^2$ $= 25$ | ✓ 5^3 ✓ answer (accept 25 or 5^2) (2) |
| 1.2.2 | $(3\sqrt{2} - 12)(2\sqrt{2} + 1)$ $= 6 \cdot 2 + 3\sqrt{2} - 24\sqrt{2} - 12$ $= -21\sqrt{2}$ | ✓ $6 \cdot 2 + 3\sqrt{2}$ ✓ $-24\sqrt{2} - 12$ ✓ answer (3) |
| 1.3.1 | $3x - 9 = 0$ $3x = 9$ $x = 3$ | ✓ $3x - 9 = 0$ ✓ answer (2) |
| 1.3.2 | $\frac{x^2 - x - 6}{3x - 9} = \frac{(x-3)(x-2)}{3(x-3)}$ $= \frac{x-2}{3}$ | ✓ $(x-3)(x-2)$ ✓ $3(x-3)$ ✓ answer (3) [15] |

QUESTION 2

| | | |
|-------|---|---|
| 2.1.1 | $(x+2)(x-3) < -3x+2$ $x^2 - x - 6 + 3x - 2 < 0$ $x^2 + 2x - 8 < 0$ $(x+4)(x-2) < 0$ $\begin{array}{ccccccc} + & 0 & - & 0 & + & & \\ & -4 & & 2 & & & \end{array}$ or  $-4 < x < 2$ | ✓ standard form ✓ factors ✓ $-4 < x$ ✓ $x < 2$ (4) |
| 2.1.2 | $x^2 + 2x - 8 < 0$ $-4 < x < 2$ $\text{Sum of integers} = (-3) + (-2) + (-1) + (0) + (1)$ $= -5$ | ✓ $-4 < x < 2$ ✓ $-3, -2, -1, 0, 1$ ✓ answer (3) |
| 2.2.1 | $\frac{4^{x-1} + 4^{x+1}}{17 \cdot 12^x} = \frac{4^x \cdot 4^{-1} + 4^x \cdot 4^1}{17 \cdot 3^x \cdot 4^x}$ $= \frac{4^x(4^{-1} + 4)}{17 \cdot 3^x \cdot 4^x}$ $= \frac{4^x\left(\frac{1}{4} + 4\right)}{17 \cdot 3^x \cdot 4^x}$ $= \frac{\left(\frac{17}{4}\right)}{17 \cdot 3^x}$ $= \frac{1}{4} \cdot 3^{-x} \text{ or } \frac{1}{4 \cdot 3^x}$ | ✓ factorise numerator ✓ $3^x \cdot 4^x$ ✓ simplification of numerator to $\frac{17}{4}$ ✓ answer (4) |
| 2.2.2 | $\frac{4^{x-1} + 4^{x+1}}{17 \cdot 12^x} = \frac{1}{4} \cdot 3^{-x}$ $= \frac{1}{4} \cdot 4t$ $= t$ | ✓ answer (1) |

| | | |
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| 2.3 | $3^y = 81^x$ and $y = x^2 - 6x + 9$ $3^y = 3^{4x}$ $y = 4x$ $4x = x^2 - 6x + 9$ $0 = x^2 - 10x + 9$ $0 = (x-9)(x-1)$ $x = 9$ or 1 $y = 4(9)$ or $4(1)$ $= 36$ or 4 $(x; y) = (9 ; 36)$ or $(1 ; 4)$ | $\checkmark 3^y = 3^{4x}$ $\checkmark y = 4x$ $\checkmark 4x = x^2 - 6x + 9$ \checkmark standard form \checkmark factors \checkmark x-values \checkmark y-values <p style="text-align: right;">(7) [19]</p> |
|-----|--|---|

QUESTION 3

| | | |
|-------|--|--|
| 3.1.1 | $4 - 8p = 0$ $-8p = -4$ $p = \frac{1}{2}$ | $\checkmark 4 - 8p = 0$ \checkmark answer <p style="text-align: right;">(2)</p> |
| 3.1.2 | $4 - 8p < 0$ $p > \frac{1}{2}$ | $\checkmark 4 - 8p < 0$ \checkmark answer <p style="text-align: right;">(2)</p> |
| 3.2.1 | $\sqrt{5-x} = x+1$ $5-x \geq 0$ and $x+1 \geq 0$ $x \leq 5$ and $x \geq -1$ Hence $-1 \leq x \leq 5$ | $\checkmark 5-x \geq 0$ $\checkmark x+1 \geq 0$ \checkmark and <p style="text-align: right;">(3)</p> |
| 3.2.2 | $5-x = x^2 + 2x + 1$ $x^2 + 3x - 4 = 0$ $(x+4)(x-1) = 0$ $x = -4$ or $x = 1$ Since $-1 \leq x \leq 5$, $x = 1$ only | \checkmark square both sides \checkmark standard form \checkmark factors \checkmark answers \checkmark selection of 1 <p style="text-align: right;">(5)</p> |
| 3.2.3 | $x = -4$ | \checkmark answer <p style="text-align: right;">(1) [13]</p> |

QUESTION 4

| | | |
|-------|--|--|
| 4.1 | $A = P(1 - in)$ $= 145000[1 - (0,17)(5)]$ $= R 21 750$ | ✓ substitution ✓ answer (2) |
| 4.2.1 | $\frac{8\%}{4} = 2\% \text{ per quarter}$ | ✓ answer (1) |
| 4.2.2 | $A = P(1 + i)^n$ <p>After 1 year, $A = P(1 + i_{\text{eff}})^1$ and $A = P(1 + 0,02)^4$</p> <p>Hence</p> $1 + i_{\text{eff}} = (1 + 0,02)^4$ $i_{\text{eff}} = (1 + 0,02)^4 - 1$ $= 0,0824$ <p>The effective interest rate is 8,24% p.a.</p> | $\checkmark 1 + i_{\text{eff}} = (1 + 0,02)^4$ ✓ answer (2) |
| 4.3 | $A = 14000 \left(1 + \frac{0,09}{2}\right)^3 \left(1 + \frac{0,075}{12}\right)^{42}$ $= R 20 755,08$ | $\checkmark \frac{0,09}{2}$ $\checkmark 14000 \left(1 + \frac{0,09}{2}\right)^3$ $\checkmark \frac{0,07}{12}$ $\checkmark 42$ ✓ answer (5) [10] |

QUESTION 5

| | | |
|-----|---|---|
| 5.1 | R 15 000 | ✓ answer (1) |
| 5.2 | Simple interest | ✓ answer (1) |
| 5.3 | $A = P(1 + in)$ $31 = 15(1 + 6i)$ $\frac{31}{15} = 1 + 6i$ $i = \left(\frac{31}{15} - 1\right) \div 6$ $= \frac{8}{45}$ $= 0,1778$ $= 17,78\%$ | ✓ substitution of (6 ; 31) into correct formula ✓ answer (2) |
| 5.4 | $A = P(1 + in)$ $w = 15(1 + 0,1778 \times 12)$ $= 47$ $A = P(1 + i)^n$ $47 = 15(1 + i)^{12}$ $\sqrt[12]{\frac{47}{15}} = 1 + i$ $i = \sqrt[12]{\frac{47}{15}} - 1 = 0,09985 = 9,99\%$ | ✓ $w = 47$ ✓ substitutes (12 ; w) ✓ $\sqrt[12]{\frac{47}{15}}$ ✓ answer (4) [8] |

QUESTION 6

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|-------|--|--|
| 6.1.1 | Multiply $\frac{1}{8}$ by $\frac{1}{2}$ | ✓ multiply $\frac{1}{8}$ ✓ $\frac{1}{2}$ (2) |
| 6.1.2 | $T_n = \frac{1}{2} \left(\frac{1}{2} \right)^{n-1}$ <p>OR</p> $T_n = \left(\frac{1}{2} \right)^n$ <p>OR</p> $T_n = 2^{-n}$ | ✓ $a = \frac{1}{2}$ ✓ $\left(\frac{1}{2} \right)^{n-1}$ (2) ✓✓ answer (2) ✓✓ answer (2) |
| 6.1.3 | Continuing the pattern: $\frac{1}{2}; \frac{1}{4}; \frac{1}{8}; \frac{1}{16}; \frac{1}{32}; \frac{1}{64}; \frac{1}{128}; \frac{1}{256}; \frac{1}{512}; \frac{1}{1024}$ Hence $n = 10$ <p>OR</p> $\frac{1}{2^n} = \frac{1}{1024}$ $2^{-n} = 2^{-10}$ $n = 10$ | ✓ expand sequence ✓ $n = 10$ (2) ✓ $\frac{1}{2^n} = \frac{1}{1024}$ ✓ $n = 10$ (2) |
| 6.2.1 | 124 | ✓ answer (1) |
| 6.2.2 | $T_n = -8n + 164$ | ✓ $-8n$ ✓ $+164$ (2) |
| 6.2.3 | $-8n + 164 < 0$ $164 < 8n$ $20,5 < n$ Hence T_{21} is the first term to be negative. | ✓ $-8n + 164 < 0$ ✓ $20,5 < n$ ✓ answer (3) |

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| 6.2.4 | $2a = -8$ $a = -4$ $3a + b = 156$ $3(-4) + b = 156$ $b = 168$ $T_5 = -24$ $-4(5)^2 + 168(5) + c = -24$ $c = -764$ $T_n = -4n^2 + 168n - 764$ <p>OR</p> $T_5 = -24 \text{ (given)}$ $T_6 = -24 + 124$ $= 100$ $T_n = -4n^2 + bn + c$ $-24 = -4(5)^2 + b(5) + c$ $76 = 5b + c \quad \dots \text{ (1)}$ $100 = -4(6)^2 + b(6) + c$ $244 = 6b + c \quad \dots \text{ (2)}$ $168 = b \quad \dots \text{ (2) - (1)}$ $c = -764$ <p>OR</p> $T_5 = -24 \text{ (given)}$ $T_4 = -24 - 132$ $= -156$ $T_n = -4n^2 + bn + c$ $-24 = -4(5)^2 + b(5) + c$ $76 = 5b + c \quad \dots \text{ (1)}$ $-156 = -4(4)^2 + b(4) + c$ $-92 = 4b + c \quad \dots \text{ (2)}$ $168 = b \quad \dots \text{ (1) - (2)}$ $c = -764$ | $\checkmark a = -4$ \checkmark substitutions $\checkmark b = 168$ \checkmark substitution $\checkmark c = -764$ (5) $\checkmark T_6 = 100$ $\checkmark a = -4$ \checkmark substitutions $\checkmark b = 168$ $\checkmark c = -764$ (5) $\checkmark T_4 = -156$ $\checkmark a = -4$ \checkmark substitutions $\checkmark b = 168$ $\checkmark c = -764$ (5) [17] |
|-------|--|---|

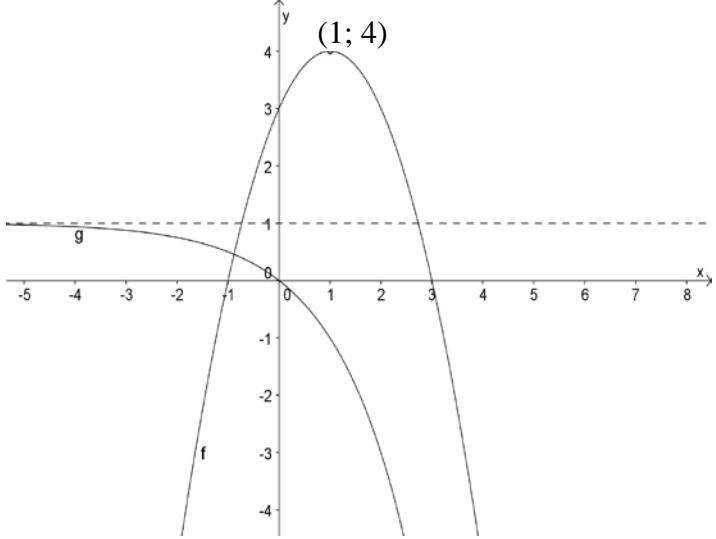
QUESTION 7

| | |
|--|---|
| <p style="text-align: center;"> T_1 0 T_3 0 </p> <p> $y = x + 12$ $T_3 = 0 + x = x$ AND $T_3 + y = 0$ $y = -x$ </p> <p>AND $y = x + 12$</p> <p>Hence $-x = x + 12$ $-2x = 12$ $x = -6$</p> <p>OR</p> <p>2a = 12 a = 6 $T_n = 6n^2 + bn + c$</p> <p style="padding-left: 40px;">$n = 2$ and $n = 4$:</p> <p>$24 + 2b + c = 0$ $96 + 4b + c = 0$ $72 + 2b = 0$ $2b = -72$ $b = -36$</p> <p>$24 - 72 + c = 0$ $c = 48$</p> <p>$T_n = 6n^2 - 36n + 48$ $T_3 = 6(3)^2 - 36(3) + 48$ $= 102 - 108$ $= -6$</p> | <p>✓ introduce variables</p> <p>✓ $T_3 = x$ ✓ $y = -x$</p> <p>✓ $y = x + 12$</p> <p>✓ $-x = x + 12$</p> <p>✓ answer</p> <p style="text-align: right;">[6]</p> <p>✓ $a = 6$</p> <p>✓ $24 + 2b + c = 0$ ✓ $96 + 4b + c = 0$</p> <p>✓ $b = -36$</p> <p>✓ $c = 48$</p> <p>✓ answer</p> <p style="text-align: right;">[6]</p> |
|--|---|


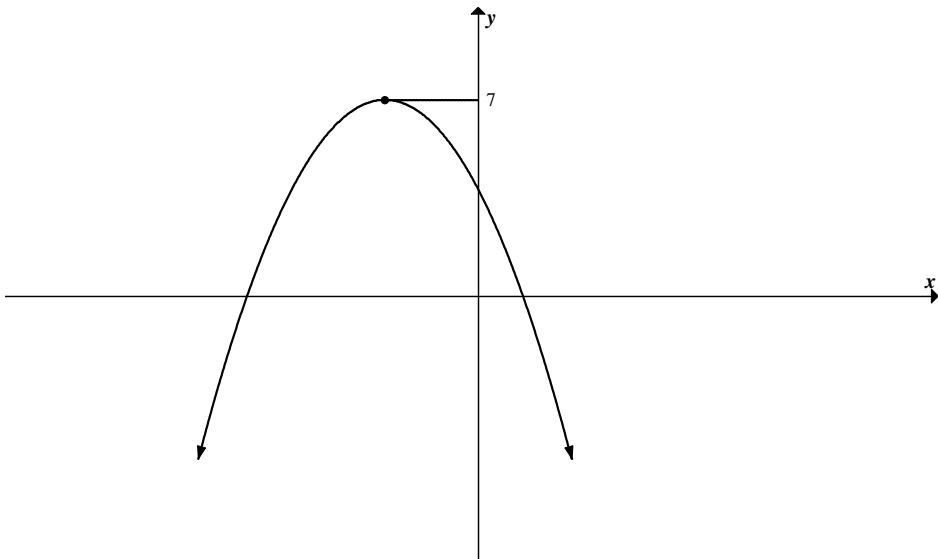
QUESTION 8

| | | |
|-----|--|---|
| 8.1 | $x = 3$ $y = -1$ | ✓ answer ✓ answer (2) |
| 8.2 | $R; x \neq 3$ OR $(-\infty; 3) \cup (3; \infty)$ | ✓ R ✓ $x \neq 3$ ✓ $(-\infty; 3)$ ✓ $(3; \infty)$ (2) |
| 8.3 | $d = \tan 76^\circ$ $d = 4$ $6 = 4(3) + e$ $e = -6$ $g(x) = 4x - 6$ | ✓ $d = \tan 76^\circ$ ✓ $d = 4$ ✓ $e = -6$ (3) |
| 8.4 | $\frac{2}{x-3} - 1 = 4x - 6$ $\frac{2}{x-3} = 4x - 5$ $2 = 4x(x-3) - 5(x-3)$ $2 = 4x^2 - 12x - 5x + 15$ $0 = 4x^2 - 17x + 13$ $0 = (4x - 13)(x - 1)$ $x = \frac{13}{4}$ or $x = 1$ $y = 4\left(\frac{13}{4}\right) - 6$ or $y = 4(1) - 6$ $y = 7$ or $y = -2$ Points of intersection are A $(1; -2)$ and C $\left(\frac{13}{4}; 7\right)$ | ✓ equating ✓ simplification ✓ standard form ✓ factors ✓ x-values ✓ y-values (6) |
| 8.5 | $1 \leq x < 3$ or $x \geq \frac{13}{4}$ OR $x \in [1; 3) \cup \left[\frac{13}{4}; \infty\right)$ | ✓ $1 \leq x$ ✓ $x < 3$ ✓ $x \geq \frac{13}{4}$ (3) |
| 8.6 | $y = (x-3) - 1$ $y = x - 4$ OR $y = x + c$ Substitute $(3; -1)$ $-1 = 3 + c$ $c = -4$ $y = x - 4$ | ✓ $x - 3$ ✓ -1 ✓ answer (3) ✓✓ substitute $(3; -1)$ ✓ answer (3) [19] |

QUESTION 9

| | | |
|------------|--|---|
| <p>9.1</p> |  <p> $x^2 - 2x - 3 = 0$ $(x - 3)(x + 1) = 0$ $x = 3 \text{ or } x = -1$ $x = \frac{-2}{2(-1)} = 1$ $y = -(1)^2 + 2(1) + 3 = 4$ </p> <p> $0 = 1 - 2^x$ $2^x = 2^0$ $x = 0$ </p> <p> $y = 1 - 2^0$ $y = 0$ </p> | <p>f:</p> <ul style="list-style-type: none"> ✓ shape ✓ x-int ✓ y-int ✓✓ turning point <p>g:</p> <ul style="list-style-type: none"> ✓ shape ✓ x-int ✓ y-int ✓ asymptote <p>(9)</p> |
| <p>9.2</p> | <p>Average gradient = $\frac{f(0) - f(-3)}{0 - (-3)}$</p> $= \frac{3 - (-12)}{3}$ $= 5$ | <ul style="list-style-type: none"> ✓ correct formula ✓ $f(-3) = -12$ ✓ answer <p>(3)</p> |
| <p>9.3</p> | <p>$-1 \leq x \leq 0 \text{ or } x \geq 3$</p> | <ul style="list-style-type: none"> ✓ $-1 < x$ ✓ $x < 0$ ✓ $x > 3$ <p>(3)</p> |
| <p>9.4</p> | <p>Given: $f(x) + c = 0$ has one solution/equal roots i.e. $f(x) = -c$ has one solution $\Rightarrow -c = f(1) = 4$ $\Rightarrow c = -4$</p> <p>OR</p> <p>h is f translated 4 units down y-intercept of h will then be at -1 $\therefore 3 + c = -1$ $c = -4$</p> | <ul style="list-style-type: none"> ✓ $-c = f(1)$ ✓ answer <p>(2)</p> <ul style="list-style-type: none"> ✓ $3 + c = -1$ ✓ answer <p>(2)</p> |
| <p>9.5</p> | <p>$(0; 1)$</p> | <ul style="list-style-type: none"> ✓✓ $(0; 1)$ <p>(2)</p> |
| <p>9.6</p> | <p>$k(x) = 1 - 2^{-x}$</p> | <ul style="list-style-type: none"> ✓ answer <p>(1)</p> <p>[20]</p> |

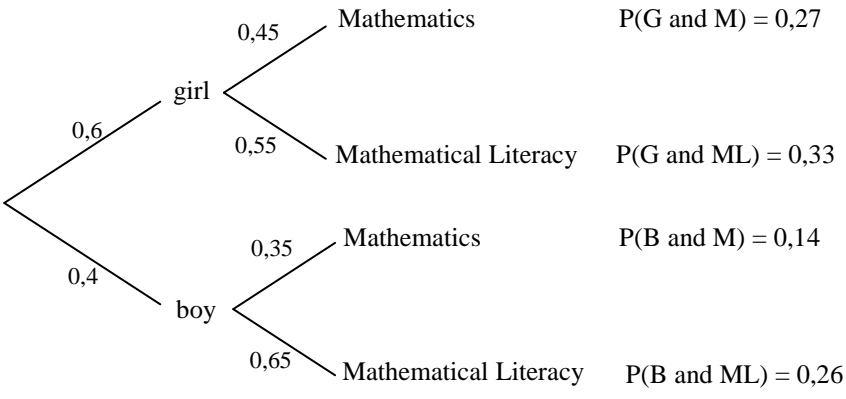
QUESTION 10

| | |
|---|---|
| <p>Range of $f(-\infty;7] \Rightarrow$ y-part of turning point [Max value of $f(x)$] is 7 $a < 0$ and shape </p> <p>$b < 0 \Rightarrow b$ negative \Rightarrow axis of symmetry on left of y-axis</p> <p>roots real, unequal & opposite signs \Rightarrow x-ints on opposite sides of y-axis</p>  | <p>✓ shape</p> <p>✓ turning point at $y = 7$</p> <p>✓ axis of symmetry on left of y-axis</p> <p>✓ roots are on opposite sides</p> <p style="text-align: right;">[4]</p> |
|---|---|

QUESTION 11

| | | |
|-------------|---|--|
| <p>11.1</p> | <p>No, W and T are not mutually exclusive Because $P(W \text{ and } T) \neq 0$</p> <p>OR</p> <p>No, W and T are not mutually exclusive Because $P(W \text{ or } T) = 0,61 \neq 0,75 = P(W) + P(T)$</p> | <p>✓ not mutually exclusive ✓ $P(W \text{ and } T) \neq 0$</p> <p style="text-align: right;">(2)</p> <p>✓ not mutually exclusive ✓ $P(W \text{ or } T) \neq P(W) + P(T)$</p> <p style="text-align: right;">(2)</p> |
| <p>11.2</p> | <p>$P(W \text{ and } T) = 0,14$ (given)</p> <p>and</p> <p>$P(W) \times P(T) = 0,4 \times 0,35 = 0,14$ $\Rightarrow P(W \text{ and } T) = P(W) \times P(T)$ Therefore yes, W and T are independent events</p> | <p>✓ $P(W) \times P(T) = 0,14$ ✓ $P(W \text{ and } T) = P(W) \times P(T)$ ✓ conclusion (yes)</p> <p style="text-align: right;">(3)</p> <p style="text-align: right;">[5]</p> |

QUESTION 12

| | | |
|--------|--|---|
| 12.1.1 | $a = 5$ $b = 4$ $c = 8$ $d = 1$ $e = 6$ | ✓ $a = 5$ ✓ $b = 4$ ✓ $c = 8$ ✓ $d = 1$ ✓ $e = 6$ (5) |
| 12.1.2 | 6 | ✓ answer (1) |
| 12.1.3 | $\frac{4}{33}$ | ✓ answer (1) |
| 12.1.4 | $\frac{4 + 3 + 2 + a + b + c}{33} = \frac{26}{33}$ | ✓ answer (1) |
| 12.2 |  <p> $P(\text{Mathematics}) = P(\text{G and M}) + P(\text{B and M})$ $= (0,6)(0,45) + (0,4)(0,35)$ $= 0,27 + 0,14$ $= 0,41$ </p> | P(G and M) = 0,27 P(G and ML) = 0,33 P(B and M) = 0,14 P(B and ML) = 0,26 ✓ 0,4 ✓ 0,45 ✓ 0,35 ✓ P(G and M) = 0,27 ✓ P(B and M) = 0,14 ✓ answer (6) [14] |

TOTAL: 150