



basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

**NATIONAL
SENIOR CERTIFICATE/
*NASIONALE
SENIOR SERTIFIKAAT***

GRADE/*GRAAD* 11

MATHEMATICS P1/*WISKUNDE V1*

NOVEMBER 2016

MEMORANDUM

MARKS/*PUNTE*: 150

**This memorandum consists of 15 pages.
*Hierdie memorandum bestaan uit 15 bladsye.***

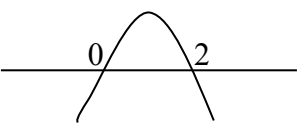
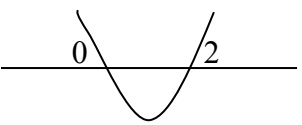
NOTE:

- If a candidate answered a question TWICE, mark only the FIRST attempt.
- If a candidate crossed out an answer and did not redo it, mark the crossed-out answer.
- Consistent accuracy applies to ALL aspects of the marking memorandum.
- Assuming values/answers in order to solve a problem is unacceptable.

LET WEL:

- As 'n kandidaat 'n vraag TWEE keer beantwoord het, sien slegs die EERSTE poging na.
- As 'n kandidaat 'n antwoord deurgehaal en nie oorgedoen het nie, sien die deurgehaalde antwoord na.
- Volgehoue akkuraatheid is op ALLE aspekte van die memorandum van toepassing.
- Dit is onaanvaarbaar om waardes/antwoorde te veronderstel om 'n probleem op te los.

QUESTION/VRAAG 1

1.1.1	$3x^2 - 5x - 1 = 0$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $= \frac{-(-5) \pm \sqrt{(-5)^2 - 4(3)(-1)}}{2(3)}$ $= \frac{5 \pm \sqrt{37}}{6}$ $x = 1,85 \text{ or } x = -0,18$	✓ substitution/vervanging ✓ answer/antwoord ✓ answer/antwoord (3)
1.1.2	$x^2 - 6x + 8 = 0$ $(x - 4)(x - 2) = 0$ $x = 4 \text{ or } x = 2$	✓ factors/faktore ✓ $x = 4$ ✓ $x = 2$ (3)
1.1.3	Option/Opsie 1 $4x - 2x^2 < 0$ $2x(2 - x) < 0$ $x < 0 \text{ or } x > 2$  OR/OF Option/Opsie 2 $4x - 2x^2 < 0$ $-2x^2 + 4x < 0$ $2x^2 - 4x > 0$ $x(2x - 4) > 0$ $x < 0 \text{ or } x > 2$ 	✓ factors/faktore ✓ method/metode ✓ $x < 0$ ✓ $x > 2$ (4)

1.1.4	$2^{3x+1} + 2^{3x} = 12$ $2^{3x} [2^1 + 1] = 12$ $2^{3x} \cdot 3 = 12$ $2^{3x} = 4$ $2^{3x} = 2^2$ $3x = 2$ $\therefore x = \frac{2}{3}$	✓ common/<i>gemene</i> factor ✓ simplification/<i>vereenv.</i> ✓ equating/<i>gelykst</i> exponents ✓ answer/<i>antw.</i> (4)
1.1.5	$\sqrt{x-1} + 3 = x - 4$ $\sqrt{x-1} = x - 4 - 3$ $x - 1 = (x - 7)^2$ $x - 1 = x^2 - 14x + 49$ $x^2 - 15x + 50 = 0$ $(x - 5)(x - 10) = 0$ $x \neq 5 \text{ or } x = 10$	✓ isolate/<i>isoleer</i> ✓ sign/<i>teken</i> ✓ squaring/<i>kwadr</i> both sides ✓ std form/<i>stand vorm</i> ✓ factors/<i>fakt</i> ✓ $x \neq 5$ ✓ $x = 10$ (6)
1.2	$3x - y + 2 = 0 \quad \text{and} \quad y = -x^2 + 2x + 8$ $\therefore y = 3x + 2$ $3x + 2 = -x^2 + 2x + 8$ $x^2 + x - 6 = 0$ $(x + 3)(x - 2) = 0$ $x = -3 \text{ or } x = 2$ $y = 3(-3) + 2 \quad \text{or} \quad y = 3(2) + 2$ $= -7 \quad \text{or} \quad y = 8$	✓ $y = 3x + 2$ ✓ substitution/<i>verv</i> ✓ std form/<i>stand vorm</i> ✓ factors/<i>fakt</i> ✓ x-values/<i>wrdes</i> ✓ y-values/<i>wrdes</i> (6)
1.3	$3x^2 + (k + 2)x = 1 - k$ $3x^2 + (k + 2)x - 1 + k = 0$ $\Delta = b^2 - 4ac$ $= (k + 2)^2 - 4(3)(-1 + k)$ $= k^2 + 4k + 4 + 12 - 12k$ $= k^2 - 8k + 16$ $= (k - 4)^2$ $\therefore b^2 - 4ac \text{ is a perfect square.}$ Roots are real and rational.	✓ std form/<i>stand vorm</i> ✓ substitution/<i>verv</i> ✓ $k^2 - 8k + 16$ ✓ $(k - 4)^2$ (4)

[30]

QUESTION/VRAAG 2

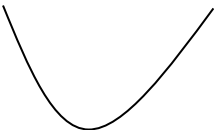
2.1.1	$\frac{5^a \cdot 5^{-2} \cdot 2^a \cdot 2^2}{10^a - 10^a \cdot 10^{-1} \cdot 2}$ $= \frac{(5 \cdot 2)^a \cdot 5^{-2} \cdot 2^2}{10^a \left[1 - \frac{2}{10} \right]}$ $= \frac{10^a \cdot \frac{4}{25}}{10^a \cdot \frac{8}{10}}$ $= \frac{4}{25} \times \frac{10}{8}$ $= \frac{1}{5}$	✓ writing as separate bases/ <i>skryf as priembasisse</i> ✓ multiplication of bases with same exponents/<i>vermenigv.</i> <i>van basisse met dies. eksp.</i> ✓ common/<i>gemene</i> factor ✓ simplification/<i>vereenv.</i> ✓ answer/<i>antw.</i>
		(5)
2.1.2	$\frac{\sqrt{27m^6} - \sqrt{48m^6}}{\sqrt{12m^6}}$ $= \frac{3\sqrt{3}m^3 - 4\sqrt{3}m^3}{2\sqrt{3m^6}}$ $= \frac{\sqrt{3m^6}(3-4)}{2\sqrt{3}m^3}$ $= \frac{-\sqrt{3}m^3}{2\sqrt{3}m^3}$ $= -\frac{1}{2}$ OR/OF $= \frac{3\sqrt{3m^6} - 4\sqrt{3m^6}}{2\sqrt{3m^6}}$ $= \frac{\sqrt{3m^6}(3-4)}{2\sqrt{3m^6}}$ $= \frac{3-4}{2}$ $= -\frac{1}{2}$	✓ simplification of surds/<i>vereenv. van wortels</i> ✓ simplification of numerator/<i>vereenv. van teller</i> ✓ answer/<i>antw.</i>
		(3)
		(3)

2.2	$\begin{aligned}\text{LHS} &= \frac{4\sqrt{2} - 8(1 + \sqrt{2})}{2\sqrt{2}(1 + \sqrt{2})} \\ &= \frac{-4\sqrt{2} - 8}{2\sqrt{2}(1 + \sqrt{2})} \\ &= \frac{-4(\sqrt{2} + 2)}{2(\sqrt{2} + 2)} \\ &= -2 \\ &= \text{RHS}\end{aligned}$ OR/OF $\begin{aligned}\text{LHS} &= \frac{2}{1 + \sqrt{2}} \times \frac{1 - \sqrt{2}}{1 - \sqrt{2}} - \frac{8 \times \sqrt{8}}{\sqrt{8} \times \sqrt{8}} \\ &= \frac{2 - 2\sqrt{2}}{1 - 2} - \sqrt{8} \\ &= -2 + 2\sqrt{2} - 2\sqrt{2} \\ &= -2 \\ &= \text{RHS}\end{aligned}$	✓ LCD/KGN ✓ numerator/teller ✓ simplification/ vereenv. ✓ common/gemene factor (4) ✓✓ rationalise the denominator of both fractions/ras. die noemer van beide breuke ✓ $-2 + 2\sqrt{2}$ ✓ $-2 \sqrt{2}$ (4) [12]
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QUESTION/VRAAG 3

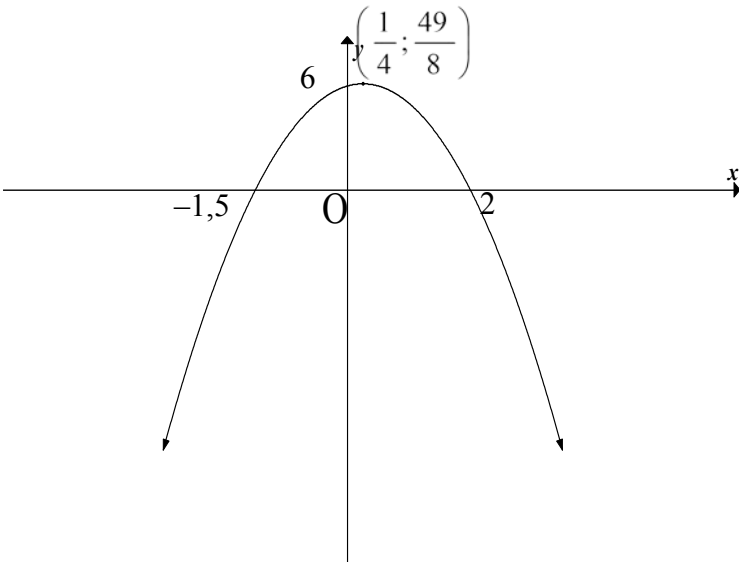
3.1	$x - 23 = 4$ $x = 27$	✓ answer/antw. (1)
3.2	$2a = 4$ $a = 2$ $3a + b = 3$ $6 + b = 3$ $b = -3$ $a + b + c = -9$ $2 - 3 + c = -9$ $c = -8$ $T_n = 2n^2 - 3n - 8$	✓ $a = 2$ ✓ $b = -3$ ✓ $c = -8$ ✓ $T_n = 2n^2 - 3n - 8$ (4)
3.3	$T_n = 2n^2 - 3n - 8 + 3$ $= 2n^2 - 3n - 5$	✓ answer/antw. (1)
3.4	$T_n = 400$ $2n^2 - 3n - 5 = 400$ $2n^2 - 3n - 405 = 0$ $(n - 15)(2n + 27) = 0$ $n = 15 \quad \text{or} \quad n \neq -\frac{27}{2}$ OR $2n^2 - 3n - 8 = 397$ $2n^2 - 3n - 405 = 0$ $(n - 5)(2n + 27) = 0$ $n = 15 \quad \text{or} \quad n \neq -\frac{27}{2}$	✓ equating/verg. ✓ std form/stand vorm ✓ factorisation/fakt. ✓ $n = 15$ (4) ✓ equating/verg. ✓ std form/stand vorm ✓ factorisation/fakt. ✓ $n = 15$ (4) [10]

QUESTION/VRAAG 4

4.1.1	$ \begin{array}{ccccc} 18 & & 14 & & 10 \\ & \searrow & \nearrow & \searrow & \nearrow \\ & -4 & & -4 & \end{array} $ $T_4 = 6$	✓ answer/antw. (1)
4.1.2	$ \begin{aligned} T_n &= a + (n-1)d \\ &= 18 + (n-1)(-4) \\ &= -4n + 22 \end{aligned} $	✓ substitution/verv. ✓ answer/antw. (2)
4.1.3	$ \begin{aligned} T_n &= 22 - 4n \\ -70 &= 22 - 4n \\ -92 &= -4n \\ n &= 23 \end{aligned} $	✓ substitution/verv. ✓ answer/antw. (2)
4.1.4	$ \begin{aligned} Q_{510} - Q_{509} &= T_{509} \text{ of the linear sequence} \\ &= 22 - 4 \times 509 \\ &= -2014 \end{aligned} $	✓ making association/ass. ✓ answer/antw. (2)
4.2.1	$ \begin{aligned} 2a &= 2 \\ \therefore a &= 1 \\ \therefore a &> 0 \\ \therefore \text{this pattern has a minimum value.} \\ \text{The shape of the graph will be} \end{aligned} $ 	✓ value/wrde of a ✓ $a > 0$ ✓ minimum value/wrde (3)
4.2.2	$ \begin{aligned} T_n &= 1(n+p)^2 + q \\ \text{A.O.S} &= \frac{5+17}{2} \\ p &= 11 \\ \therefore T_n &= 1(n-11)^2 + q \\ 29 &= 1(17-11)^2 + q \\ \therefore q &= -7 \\ \therefore T_n &= (n-11)^2 - 7 \\ T_n &= n^2 - 22n + 114 \end{aligned} $ OR/OF	✓ axis of symmetry/simm. as ✓ value/wrde of p ✓ substitution/verv. (17 ; 29) or/of (5 ; 29) ✓ value/wrde of q ✓ answer/antw. (5)

$T_5 = 29$ $\therefore 1(5)^2 + 5b + c = 29$ <i>ie</i> $5b + c = 4 \dots (1)$ and $T_{17} = 29$ $\therefore 1(17)^2 + 17b + c = 29$ <i>ie</i> $17b + c = -260 \dots (2)$ solve the equations simultaneously $-12b = 264$ $\therefore b = -22$ substitute in (1) <i>ie</i> $5(-22) + c = 4$ $-110 + c = 4$ $\therefore c = 114$ $\therefore T_n = n^2 - 22n + 114$	✓✓ equations/verg. (1) & (2) ✓ value/wrde of b ✓ value/wrde of c ✓ answer/antw. (5) [15]
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QUESTION 5

5.1	$x = -\frac{b}{2a}$ $= -\frac{1}{2(-2)}$ $= \frac{1}{4}$ $\therefore y = -2\left(\frac{1}{4}\right)^2 + \left(\frac{1}{4}\right) + 6$ $y = \frac{49}{8}$	✓ substitution/verv. ✓ x-value/wrde ✓ substitution/verv. ✓ y-value/wrde (4)
5.2	$y = -2(0)^2 + 0 + 6$ $\therefore y \text{ intercept } (0;6)$	✓ y-value/wrde (1)
5.3	$x \text{ intercepts}$ $0 = -2x^2 + x + 6$ $0 = 2x^2 - x - 6$ $0 = (2x + 3)(x - 2)$ $\therefore x = 2 \text{ or } x = -\frac{3}{2}$ $(2;0) \text{ and } \left(-\frac{3}{2};0\right)$	✓ $y = 0$ ✓ factorisation/fakt. ✓ ✓ x-values/wrde (4)
5.4		✓ shape/vorm ✓ intercepts/afsnitte ✓ turning point/drpnt (3)
5.5	$k = \frac{49}{8}$	✓ ✓ answer/antw. (2)
5.6	$\text{New/Nuwe turning point/drpnt } \left(\frac{9}{4}; \frac{57}{8}\right)$ $\text{Equation/verg. of } h$ $y = -2\left(x - \frac{9}{4}\right)^2 + \frac{57}{8}$	✓ ✓ turning points/drpnt ✓ equation/verg. (3) OR/OF ✓ ✓ ✓ answer only (3) [17]

QUESTION/VRAAG 6

6.1	$x = -3$ and $y = -1$	✓ $x = -3$ ✓ $y = -1$ (2)
6.2	$x \in R ; x \neq -3$	✓✓ answer/antw. (2)
6.3.1	At B, $x = 0$ $\therefore y = \frac{1}{0+3} - 1$ $y = -\frac{2}{3}$ $\therefore OB = \frac{2}{3} \text{ units}$	✓ substituton/verv. ✓ answer/antw. (2)
6.3.2	At A, $y = 0$ $0 = \frac{1}{x+3} - 1$ $1 = \frac{1}{x+3}$ $x+3 = 1$ $x = -2$ $\therefore OA = 2 \text{ units}$	✓ substitution/verv. ✓ simplification/vereenv. ✓ answer/antw. (3)
6.4	$\frac{1}{x+3} - 1 = \frac{1}{2}x$ $2 - 2(x+3) = x(x+3)$ $x^2 + 3x - 2 + 2x + 6 = 0$ $x^2 + 5x + 4 = 0$ $(x+4)(x+1) = 0$ $x = -4 \text{ or } x = -1$ when $x = -1 ; y = -\frac{1}{2}$ when $x = -4 ; y = -2$ $\therefore C \left(-1; -\frac{1}{2}\right) \text{ and } D (-4 ; -2)$	✓ equating the two equations/ verg. van 2 vergelykings ✓ std vorm/std vorm ✓ factors/fakt. ✓ x-values/wrds ✓ co-ordinates/koörd of C ✓ co-ordinates/ koörd of D (6)

6.5	$\frac{1}{x+3} \geq \frac{x+2}{2}$ $\frac{1}{x+3} \geq \frac{x}{2} + 1$ $\frac{1}{x+3} - 1 \geq \frac{x}{2}$ $\therefore f(x) \geq g(x)$ $\therefore x \leq 4 \text{ or } -3 < x \leq -1$	✓ simplification/<i>vereen</i> ✓ $f(x) \geq g(x)$ ✓ $x \leq -4$ ✓ $-3 < x \leq -1$ (4) [19]
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QUESTION/VRAAG 7

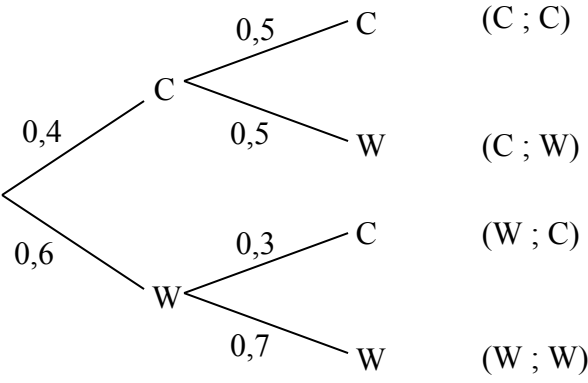
7.1	$q = 2$ $f(x) = 2 \cdot b^{x+1} + 2$ $20 = 2 \cdot b^{1+1} + 2$ $18 = 2 \cdot b^2$ $9 = b^2$ $b = 3$ $f(x) = 2 \cdot 3^{x+1} + 2$	✓ substitution of $q = 2$ ✓ substitution of 1 and 20 ✓ value/<i>wrde</i> of b (3)
7.2	$y = 2 \cdot 3^{-1+1} + 2$ $y = 2 \cdot 1 + 2$ $y = 4$	✓ answer/<i>antw.</i> (1)
7.3	$m = \frac{y_2 - y_1}{x_2 - x_1}$ $= \frac{20 - 4}{1 - (-1)}$ $= 8$	✓ substitution/<i>verv.</i> ✓ answer/<i>antw.</i> (2)
7.4	$h(x) = -2 \cdot 3^{x+1} + 2$ OR/OF Reflected about the x -axis $= -2 \cdot 3^{x+1} - 2$ $\therefore$ Reflected about the asymptote $h(x) = -2 \cdot 3^{x+1} - 2 + 4$ $= -2 \cdot 3^{x+1} + 2$	✓✓ answer/<i>antw.</i> ✓✓ answer/<i>antw.</i> (2)
7.5	$y < 2$	✓ answer/<i>antw.</i> (1) [9]

QUESTION/VRAAG 8

8.1	$A = P(1-i)^n$ $= R\ 25\ 000\ (1-0,09)^4$ $= R\ 17\ 143,74$	✓ $A = P(1-i)^n$ ✓ substitution/verv. ✓ answer/antw. (3)
8.2	$1+i_{eff} = \left(1 + \frac{i_{nom}}{m}\right)^m$ $1+i_{eff} = \left(1 + \frac{0,1235}{12}\right)^{12}$ $i_{eff} = \left(1 + \frac{0,1235}{12}\right)^{12} - 1$ $\therefore \text{Rate} = 0,13073 \times 100$ $= 13,07\%$ The effective interest rate/Die effektiewe rentekoers is 13.07%	✓ formula/for. ✓ substitution//verv. ✓ simplificationvereenv. ✓ answer/antw. (4)
8.3	$A = P(1+i)^n$ $R\ 221\ 292,32 = R\ 145\ 000 \left(1 + \frac{r}{100}\right)^6$ $\sqrt[6]{\frac{R\ 221\ 292,32}{145\ 000}} = 1 + \frac{r}{100}$ $\frac{r}{100} = 0,07300000324$ $r = 7,3\%$	✓ correct substitution into correct formula ✓ $n = 6$ ✓ $\sqrt[6]{\frac{R\ 221\ 292,32}{145\ 000}} = 1 + \frac{r}{100}$ ✓ answer/antw. (4)
8.4	$A = 15\ 000 \left(1 + \frac{0,096}{4}\right)^{12} - 5\ 000 \left(1 + \frac{0,096}{4}\right)^{10} + 3\ 500 \left(1 + \frac{0,096}{4}\right)^4$ $= R\ 17\ 448,46$	✓ $\frac{0,096}{4}$ ✓ $15\ 000 \left(1 + \frac{0,096}{4}\right)^{12}$ ✓ $5\ 000 \left(1 + \frac{0,096}{4}\right)^{10}$ ✓ $3\ 500 \left(1 + \frac{0,096}{4}\right)^4$ ✓ answer/antw. (5)

[16]

QUESTION/VRAAG 9

9.1	Given/Gegee: $P(A) = 0,2$ $P(B) = 0,5$ $P(A \text{ or } B) = 0,6$	
9.1.1	$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$ $0,6 = 0,2 + 0,5 - P(A \text{ and } B)$ $P(A \text{ and } B) = 0,1$	$\checkmark 0,6 = 0,2 + 0,5 - P(A \text{ and } B)$ $\checkmark P(A \text{ and } B) = 0,1$ (2)
9.1.2	$P(A \text{ and } B) = 0,1$ $P(A) \times P(B) = 0,2 \times 0,5$ $= 0,1$ $\therefore P(A \text{ and } B) = P(A) \times P(B)$ $\therefore A \text{ and } B \text{ are independent}$	$\checkmark P(A) \times P(B) = 0,1$ $\checkmark P(A \text{ and } B) = P(A) \times P(B)$ $\checkmark \text{ conclusion}$ (3)
9.2.1	$a = 15$ $b = 1$ $c = 38$ $d = 3$ $e = 37$	$\checkmark a = 15$ $\checkmark b = 1$ $\checkmark c = 38$ $\checkmark d = 3$ $\checkmark e = 37$ (5)
9.2.2	$P(\text{one learner plays netball or volleyball}) = \frac{25}{100} = \frac{1}{4}$	$\checkmark 25$ $\checkmark \text{answer/antwoord}$ (2)
9.3.1		$\checkmark \text{branch at first level}$ $\checkmark \text{branches at second level}$ $\checkmark \text{probabilities and outcomes}$ (3)

9.3.2	$P(\text{second answer correct}) = P(C \text{ and } C) + P(W \text{ and } C)$ $= (0,4 \times 0,5) + (0,6 \times 0,3)$ $= 0,38$	✓ addition of probabilities ✓ substitution ✓ answer/antw. (3) [18]
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QUESTION/VRAAG 10

10	 Let one of the equal sides = x the other side = $14 - 2x$ Area = $(14 - 2x)x$ $= -2x^2 + 14x$ $x = \frac{-14}{2(-2)}$ $= \frac{7}{2}m$ $y = 7m$ OR/OF $\therefore$ the other side = $14 - 2x$ $\therefore$ Area = $(14 - 2x)x$ $= -2(x^2 - 7x)$ $= -2\left(x^2 - 7x + \frac{49}{4} - \frac{49}{4}\right)$ $= -2\left[\left(x - \frac{7}{2}\right)^2 - \frac{49}{4}\right]$ $= -2\left(x - \frac{7}{2}\right)^2 + \frac{49}{2}$ $\therefore$ when $x = \frac{7}{2}$ metres it will have a maximum area $\therefore$ the other side = $14 - 2\left(\frac{7}{2}\right)$ = 7 metres OR/OF	✓ area formula/oppervl.for. $x = \frac{-14}{2(-2)}$ ✓ answer for x ✓ answer for y (4)
	OR/OF $\therefore$ the other side = $14 - 2x$ $\therefore$ Area = $(14 - 2x)x$ $= -2(x^2 - 7x)$ $= -2\left(x^2 - 7x + \frac{49}{4} - \frac{49}{4}\right)$ $= -2\left[\left(x - \frac{7}{2}\right)^2 - \frac{49}{4}\right]$ $= -2\left(x - \frac{7}{2}\right)^2 + \frac{49}{2}$ $\therefore$ when $x = \frac{7}{2}$ metres it will have a maximum area $\therefore$ the other side = $14 - 2\left(\frac{7}{2}\right)$ = 7 metres OR/OF	✓ area formula/oppervl.for. ✓ completing the square ✓ answer for x ✓ answer for y (4)

	Let the length be y Width be $\frac{14-y}{2}$ Area = $y\left(7 - \frac{1}{2}y\right)$ $= \frac{-1}{2}y^2 + 7y$ $y = \frac{-7}{2\left(\frac{-1}{2}\right)}$ $= 7m$ width = $3,5m$ OR Area = $y\left(7 - \frac{1}{2}y\right)$ $= \frac{-1}{2}y^2 + 7y$ $= \frac{-1}{2}(y^2 - 14y)$ $= \frac{-1}{2}(y-7)^2 + \frac{49}{2}$ length = $7m$ width = $3,5m$	✓ area formula/oppervl.for. ✓ $y = \frac{-7}{2\left(\frac{-1}{2}\right)}$ ✓ answer for y ✓ answer for width (4) ✓ area formula/oppervl.for. ✓ completing the square ✓ answer for y ✓ answer for width (4) [4]
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TOTAL/TOTAAL:**150**