



basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

**SENIOR CERTIFICATE EXAMINATIONS/
*SENIORSERTIFIKAAT-EKSAMEN***

MATHEMATICS P1/*WISKUNDE V1*

2016

MEMORANDUM

MARKS/*PUNTE*: 150

**This memorandum consists of 20 pages and an addendum of 7 pages
*Hierdie memorandum bestaan uit 20 bladsye en 'n addendum uit 7 bladsye.***

NOTE:

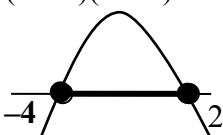
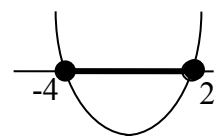
- If a candidate answers a question TWICE, only mark the FIRST attempt.
- Consistent accuracy applies in ALL aspects of the marking memorandum.

LET WEL:

- Indien 'n kandidaat 'n vraag TWEE keer beantwoord, sien slegs die EERSTE poging na.
- Volgehoue akkuraatheid is op ALLE aspekte van die memorandum van toepassing.

QUESTION/VRAAG 1

1.1.1	$4x^2 - 25 = 0$ $(2x - 5)(2x + 5) = 0$ $x = \frac{5}{2} \quad \text{or/of} \quad x = -\frac{5}{2}$ <p>OR/OF</p> $4x^2 = 25$ $x^2 = \frac{25}{4}$ $x = \pm \sqrt{\frac{25}{4}}$ $x = \frac{5}{2} \quad \text{or/of} \quad x = -\frac{5}{2}$	<p>✓✓ factors</p> <p>✓ answers (3)</p> <p>✓ $x^2 = \frac{25}{4}$</p> <p>✓ $x = \pm \sqrt{\frac{25}{4}}$</p> <p>✓ answer (3)</p>
1.1.2	$x^2 - 5x - 2 = 0$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $= \frac{-(-5) \pm \sqrt{(-5)^2 - 4(1)(-2)}}{2(1)}$ $= \frac{5 \pm \sqrt{33}}{2}$ $x = 5,37 \quad \text{or/of} \quad x = -0,37$ <p>OR/OF</p> $x^2 - 5x + \frac{25}{4} = 2 + \frac{25}{4}$ $\left(x - \frac{5}{2}\right)^2 = \frac{33}{4}$ $x - \frac{5}{2} = \pm \frac{\sqrt{33}}{2}$ $x = \frac{5 \pm \sqrt{33}}{2}$ $x = -0,37 \quad \text{or} \quad x = 5,37$	<p>✓ correct substitution into correct formula</p> <p>✓ answer</p> <p>✓ answer (3)</p> <p>✓ for adding $\frac{25}{4}$ on both sides</p> <p>✓ answer</p> <p>✓ answer (3)</p>

<p>1.1.3</p>	<p>$(2-x)(x+4) \geq 0$</p>  <p>OR / OF</p> <p>$-4 \leq x \leq 2$ OR / OF $x \in [-4; 2]$</p> <p>OR / OF</p> <p>$(2-x)(x+4) \geq 0$ $(x-2)(x+4) \leq 0$</p>  <p>OR / OF</p> <p>$-4 \leq x \leq 2$ OR / OF $x \in [-4; 2]$</p>	<p>✓ method</p> <p>✓ critical values in context of inequality</p> <p>✓ inequality or interval (3)</p> <p>✓ change of inequality</p> <p>✓ critical values in context of inequality</p> <p>✓ inequality or interval (3)</p>
<p>1.1.4</p>	<p>$x - 3x^{\frac{1}{2}} - 4 = 0$</p> <p>$\left(x^{\frac{1}{2}} - 4\right)\left(x^{\frac{1}{2}} + 1\right) = 0$</p> <p>$x^{\frac{1}{2}} = 4$ or $x^{\frac{1}{2}} = -1$</p> <p>$x = 16$ N/A</p> <p>OR/OF</p> <p>$x - 3x^{\frac{1}{2}} - 4 = 0$</p> <p>Let $x^{\frac{1}{2}} = k$</p> <p>$k^2 - 3k - 4 = 0$</p> <p>$(k - 4)(k + 1) = 0$</p> <p>$x^{\frac{1}{2}} = 4$ or $x^{\frac{1}{2}} = -1$</p> <p>$x = 16$ N/A</p> <p>OR/OF</p> <p>$x - 3x^{\frac{1}{2}} = 4$</p> <p>$x - 4 = 3\sqrt{x}$ Restrictions/Beperkings:</p> <p>$9x = x^2 - 8x + 16$ $x \geq 4$ and $x \geq 0$</p> <p>$x^2 - 17x + 16 = 0$</p> <p>$(x - 1)(x - 16) = 0$</p> <p>$x = 1$ or $x = 16$</p> <p>N/A</p>	<p>✓ standard form</p> <p>✓ factors</p> <p>✓ $x^{\frac{1}{2}} = 4$</p> <p>✓ $x^{\frac{1}{2}} = -1$</p> <p>✓ answer (5)</p> <p>✓ standard form</p> <p>✓ factors</p> <p>✓ $x^{\frac{1}{2}} = 4$</p> <p>✓ $x^{\frac{1}{2}} = -1$</p> <p>✓ answer (5)</p> <p>✓ isolating $3\sqrt{x}$ or $3x^{\frac{1}{2}}$</p> <p>✓ standard form</p> <p>✓ factors</p> <p>✓ answers</p> <p>✓ selection (5)</p>

<p>1.2</p>	$y = 2x + 1$ $x^2 - 3x - 4 - (2x + 1) = (2x + 1)^2$ $x^2 - 3x - 4 - 2x - 1 = 4x^2 + 4x + 1$ $3x^2 + 9x + 6 = 0$ $x^2 + 3x + 2 = 0$ $(x + 2)(x + 1) = 0$ $x = -2 \text{ or } x = -1$ <p>If $x = -2$, then $y = -3$ If $x = -1$, then $y = -1$</p> <p>OR/OF</p> $x = \frac{y - 1}{2}$ $\left(\frac{y - 1}{2}\right)^2 - 3\left(\frac{y - 1}{2}\right) - 4 - y = y^2$ $\frac{y^2 - 2y + 1}{4} - 3\left(\frac{y - 1}{2}\right) - 4 - y = y^2$ $y^2 - 2y + 1 - 6y + 6 - 16 - 4y = 4y^2$ $3y^2 + 12y + 9 = 0$ $y^2 + 4y + 3 = 0$ $(y + 3)(y + 1) = 0$ $y = -3 \text{ or } y = -1$ <p>If $y = -3$, then $x = -2$ If $y = -1$, then $x = -1$</p>	<p>✓ y subject of formula ✓ substitution ✓ standard form ✓ factors ✓ values of x ✓ values of y</p> <p>(6)</p> <p>✓ x subject of formula ✓ substitution ✓ standard form ✓ factors ✓ values of y ✓ values of x</p> <p>(6)</p>
<p>1.3.1</p>	$2x + 1 \geq 0$ $x \geq -\frac{1}{2}$ <p>OR/OF</p> $\left[-\frac{1}{2}; \infty\right)$	<p>✓ answer</p> <p>(1)</p> <p>✓ answer</p> <p>(1)</p>

1.3.2	$f(x) = 2x - 1$ $\sqrt{2x+1} = 2x - 1$ <p style="text-align: center;">Restrictions/<i>Beperkings</i> :</p> $2x + 1 = 4x^2 - 4x + 1 \quad x \geq -\frac{1}{2} \text{ and } x \geq \frac{1}{2}$ $4x^2 - 6x = 0$ $x(4x - 6) = 0$ $x = \frac{3}{2} \text{ or } x = 0$ $\therefore x = \frac{3}{2}$	<ul style="list-style-type: none"> ✓ $\sqrt{2x+1} = 2x - 1$ ✓ standard form ✓ factors ✓ answers ✓ correct selection <p style="text-align: right;">(5) [26]</p>
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QUESTION/VRAAG 2

2.1.1	$27 - b = b - 13$ $b = \frac{27+13}{2}$ $b = 20$ $27 - 20 = 13 - a$ $a = 6$ <p style="text-align: center;">OR/OF</p> $27 - 13 = 2d$ $d = 7$ $b = 13 + 7 = 20$ $a = 13 - 7 = 6$	<ul style="list-style-type: none"> ✓ $27 - b = b - 13$ ✓ $27 - 20 = 13 - a$ ✓ $d = 7$ or $27 - 13 = 2d$ ✓ $b = 13 + 7$ ✓ $a = 13 - 7$ <p style="text-align: right;">(2) (2)</p>
2.1.2	$a = 6 \quad d = 7$ $S_n = \frac{n}{2}[2a + (n-1)d]$ $S_{20} = \frac{20}{2}[2(6) + (20-1)(7)]$ $= 1450$ <p style="text-align: center;">OR/OF</p> $T_{20} = a + 19(d)$ $= 6 + 19(7)$ $= 139$ $S_n = \frac{n}{2}[a + T_n]$ $S_{20} = \frac{20}{2}[6 + 139]$ $= 1450$	<ul style="list-style-type: none"> ✓ $d = 7$ ✓ correct substitution into correct formula ✓ answer ✓ $d = 7$ ✓ $T_{20} = 139$ ✓ answer <p style="text-align: right;">(3) (3)</p>

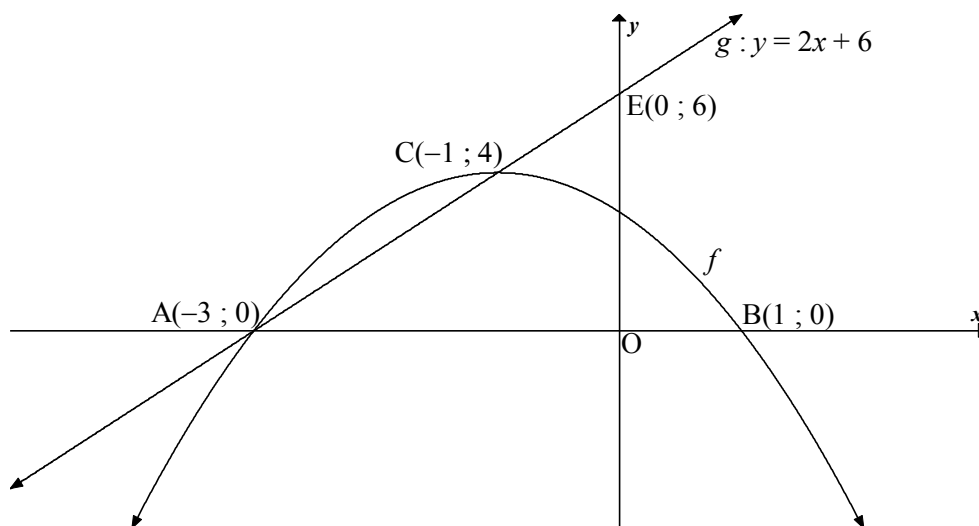
<p>2.1.3</p>	$T_n = 6 + (n-1)(7)$ $= 7n - 1$ $\sum_{n=1}^{20} (6 + 7(n-1))$ $= \sum_{n=1}^{20} (7n - 1)$	<p>✓ $T_n = 6 + (n-1)(7)$ or $7n-1$</p> <p>✓ $\sum_{n=1}^{20}$</p> <p>(2)</p>
<p>2.2.1</p>	$r = \frac{(x-2)(x+2)}{x-2} \quad \text{or} \quad r = \frac{(x^2-4)(x+2)}{x^2-4}$ $= x+2$ <p>For convergence/Om te konvergeer:</p> $-1 < r < 1$ $-1 < x+2 < 1$ $-3 < x < -1$	<p>✓ $\frac{(x^2-4)}{x-2}$ or $\frac{(x-2)(x+2)}{x-2}$ or $\frac{(x^2-4)(x+2)}{x^2-4}$</p> <p>✓ $r = x+2$</p> <p>✓ $-1 < r < 1$</p> <p>✓ answer</p> <p>(4)</p>
<p>2.2.2</p>	$\left(-\frac{7}{2}\right) + \left(-\frac{7}{4}\right) + \left(-\frac{7}{8}\right) + \dots$ $S_\infty = \frac{a}{1-r}$ $= \frac{-\frac{7}{2}}{1-\frac{1}{2}}$ $= -7$ <p>OR/OF</p> $S_\infty = \frac{a}{1-r}$ $= \frac{(x-2)}{1-(x+2)}$ $= \frac{x-2}{-x-1}$ $= \frac{-\frac{3}{2}-2}{\frac{3}{2}-1}$ $= \frac{-\frac{7}{2}}{\frac{1}{2}}$ $= -7$	<p>✓ $a = -\frac{7}{2}$</p> <p>✓ substitution into correct formula</p> <p>✓ answer</p> <p>(3)</p> <p>✓ substitution into correct formula</p> <p>✓ substitution of $x = -\frac{3}{2}$</p> <p>✓ answer</p> <p>(3)</p> <p>[14]</p>

QUESTION/VRAAG 3

<p>3.1</p>	
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3.4	$S_{69} = 9591$ and $T_1 = -1$ (of the original sequence/ <i>van die oorspronklike ry</i>) $9591 + (-1) = 9590$ $S_{69} + T_1 = 9590$ The 70 th term of the original sequence will have a value of 9590 OR/OF $2n^2 - 3n = 9590$ $2n^2 - 3n - 9590 = 0$ $(n - 70)(2n + 137) = 0$ $n = 70$ $T_{70} = 9590$	$\checkmark (9591) + (-1)$ $\checkmark 70$ (2) $\checkmark 2n^2 - 3n - 9590 = 0$ $\checkmark 70$ (2) [11]
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QUESTION/VRAAG 4



4.1	(0 ; 3)	$\checkmark (0 ; 3)$ (1)
4.2	$x = -\frac{b}{2a}$ or $-2x - 2 = 0$ $= -\frac{(-2)}{2(-1)}$ $\therefore x = -1$ $= -1$ $y = -(-1)^2 - 2(-1) + 3$ or $y = \frac{4ac - b^2}{4a}$ $= 4$ $= \frac{4(-1)(3) - (-2)^2}{4(-1)}$ $C(-1 ; 4)$	$\checkmark x = -\frac{(-2)}{2(-1)}$ or $-2x - 2 = 0$ \checkmark simplification \checkmark in the context of a turning point $-(-1)^2 - 2(-1) + 3$ $\frac{4(-1)(3) - (-2)^2}{4(-1)}$ (3)

<p>4.3</p>	<p>B(1 ; 0) By symmetry/<i>Deur simmetrie</i> A(-3 ; 0) OR/OF $x^2 + 2x - 3 = 0$ $(x + 3)(x - 1) = 0$ $x = -3$ or $x = 1$ A(-3 ; 0)</p>	<p>✓ A(-3 ; 0) (1) ✓ A(-3 ; 0) (1)</p>
<p>4.4</p>	<p>Equation of g: $m = \frac{4 - 0}{-1 + 3}$ $= 2$ $y = 2x + q$ OR/OF $y - 0 = 2(x + 3)$ $0 = 2(-3) + q$ or $4 = 2(-1) + q$ $y = 2x + 6$ $q = 6$ or $y - 4 = 2(x + 1)$ $y = 2x + 6$ E(0 ; 6) C(-1 ; 4) $CE = \sqrt{(0 + 1)^2 + (6 - 4)^2}$ $= \sqrt{5}$ units/2,24 units</p>	<p>✓ $m = 2$ ✓ subs of A(-3;0) or C(-1;4) ✓ $y = 2x + 6$ ✓ E(0 ; 6) ✓ substitution into distance formula ✓ answer (6)</p>
<p>4.5</p>	<p>$f'(x) = -2x - 2$. But $m_{\tan} = 2$ $-2x - 2 = 2$ $x = -2$ $f(-2) = 3$ $y = 2x + k$ $3 = 2(-2) + k$ $k = 7$ OR/OF $-x^2 - 2x + 3 = 2x + k$ $-x^2 - 4x + 3 - k = 0$ $x^2 + 4x - 3 + k = 0$ For equal roots: $\Delta = b^2 - 4ac = 0$ $(-4)^2 - 4(-1)(3 - k) = 0$ or $(4)^2 - 4(1)(k - 3) = 0$ $16 + 12 - 4k = 0$ or $16 - 4k + 12 = 0$ $k = 7$ $k = 7$</p>	<p>✓ $-2x - 2$ ✓ $-2x - 2 = 2$ ✓ $x = -2$ ✓ $y = 3$ ✓ answer (5) ✓ $-x^2 - 2x + 3 = 2x + k$ ✓ standard form ✓ $b^2 - 4ac = 0$ ✓ substitution ✓ answer (5)</p>

4.6	$g: y = 2x + 6$ $g^{-1}: x = 2y + 6$ $2y = x - 6$ $y = \frac{x-6}{2} \text{ or } y = \frac{x}{2} - 3$	$\checkmark x = 2y + 6$ $\checkmark y = \frac{x-6}{2} \text{ or } y = \frac{x}{2} - 3$ (2)
4.7	$g(x) \geq g^{-1}(x)$ $2x + 6 \geq \frac{x-6}{2}$ $4x + 12 \geq x - 6$ $3x \geq -18$ $x \geq -6$	$\checkmark 2x + 6 \geq \frac{x-6}{2}$ $\checkmark 4x + 12 \geq x - 6$ $\checkmark x \geq -6$ (3) [21]

QUESTION/VRAAG 5

5.1	$r = 2$	$\checkmark r = 2$ (1)
5.2	$g(x) = 2^x + 2$ $g(0) = 2^0 + 2 = 3$ $B(0 ; 3)$ $3 = \frac{3}{0-p} + 2$ $p = -3$	$\checkmark g(0) = 2^0 + 2$ $\checkmark y = 3$ \checkmark substitute $B(0 ; 3)$ and $q = 2$ $\checkmark p = -3$ (4)
5.3	at A: $x = -3$ $y = 2^{-3} + 2 = 2\frac{1}{8}$ $A\left(-3 ; 2\frac{1}{8}\right)$ or $A\left(-3 ; \frac{17}{8}\right)$ or $A(-3 ; 2,125)$	\checkmark at A : $x = -3$ (p -value) \checkmark substitute $x = -3$ into exponential equation \checkmark y -value (3)
5.4	$-3 < x \leq 0$ OR/ OF $(-3 ; 0]$	$\checkmark -3 < x$ $\checkmark x \leq 0$ (2)
5.5	$f(x) = \frac{3}{x+3} + 2$ $f(x-2) = \frac{3}{x-2+3} + 2$ $h(x) = \frac{3}{x+1} + 2$	\checkmark substitution of $x - 2$ $\checkmark h(x) = \frac{3}{x+1} + 2$ (2) [12]

QUESTION/VRAAG 6

6.1	$A = P(1 - i)^n$ $\frac{2}{3}P = P(1 - 0,047)^n$ $\frac{2}{3} = (1 - 0,047)^n$ $\log \frac{2}{3} = n \log(1 - 0,047)$ $n = \frac{\log \frac{2}{3}}{\log(1 - 0,047)}$ $n = 8,42 \text{ years}$	<p>✓ $A = \frac{2}{3}P$</p> <p>✓ substitution into correct formula</p> <p>✓ logs</p> <p>✓ answer (4)</p>
6.2.1	<p>The book value of the tractor after 5 years/<i>Die boekwaarde van die trekker na 5 jaar</i></p> <p>Book value = $x(1 - 0,2)^5$ or $x(0,8)^5$</p> <p>= 0,32768x</p>	<p>✓ $x(1 - 0,2)^5$ or $x(0,8)^5$</p> <p>✓ 0,32768x</p> <p>(2)</p>
6.2.2	<p>Price of new tractor after 5 years/<i>Prys van nuwe trekker na 5 jaar</i></p> <p>Book value = $x(1 + 0,18)^5$ or $x(1,18)^5$</p> <p>= 2,28776x</p>	<p>✓ $x(1 + 0,18)^5$ or $x(1,18)^5$</p> <p>✓ 2,28776x</p> <p>(2)</p>
6.2.3	$F = \frac{x[(1 + i)^n - 1]}{i}$ $= \frac{8000 \left[\left(1 + \frac{0,10}{12} \right)^{60} - 1 \right]}{\frac{0,10}{12}}$ $= R619\,496,58$	<p>✓ $i = \frac{0,10}{12}$</p> <p>✓ $n = 60$</p> <p>✓ subst. into future value formula</p> <p>✓ answer (4)</p>

<p>6.2.4</p>	<p>Sinking fund = New tractor price – Scrap value <i>Delgingsfonds = Nuwe trekker se prys – boekwaarde</i></p> $619\,496,58 = x(1 + 0,18)^5 - x(1 - 0,2)^5$ $619\,496,58 = x[(1,18)^5 - (0,8)^5]$ $x = \frac{619\,496,58}{[(1,18)^5 - (0,8)^5]}$ $x = R\,316\,057,15$ $x = R\,316\,000$ <p>OR/OF</p> $619\,496,58 = x(2,28776) - x(0,32768)$ $619\,496,58 = x[1,96008]$ $x = \frac{619\,496,58}{1,96008}$ $x = R\,316\,056,78$ $x = R\,316\,000$	<p>✓ 619 496,58 ✓ $x(1 + 0,18)^5 - x(1 - 0,2)^5$ ✓ common factor x</p> <p>✓ R 316 000 (4)</p> <p>✓ 619 496,58 ✓ $x(2,28776) - x(0,32768)$</p> <p>✓ simplification</p> <p>✓ R 316 000 (4) [16]</p>
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QUESTION/VRAAG 7

<p>7.1</p>	$f(x+h) = 3(x+h)^2 - 5 = 3(x^2 + 2xh + h^2) - 5$ $= 3x^2 + 6xh + 3h^2 - 5$ $f(x+h) - f(x) = 3x^2 + 6xh + 3h^2 - 5 - 3x^2 + 5$ $= 6xh + 3h^2$ $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $= \lim_{h \rightarrow 0} \frac{6xh + 3h^2}{h}$ $= \lim_{h \rightarrow 0} \frac{h(6x + 3h)}{h}$ $= \lim_{h \rightarrow 0} (6x + 3h)$ $= 6x$ <p>OR/OF</p> $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $= \lim_{h \rightarrow 0} \frac{3(x+h)^2 - 5 - (3x^2 - 5)}{h}$ $= \lim_{h \rightarrow 0} \frac{3x^2 + 6xh + 3h^2 - 5 - 3x^2 + 5}{h}$ $= \lim_{h \rightarrow 0} \frac{6xh + 3h^2}{h}$ $= \lim_{h \rightarrow 0} \frac{h(6x + 3h)}{h}$ $= \lim_{h \rightarrow 0} (6x + 3h)$ $= 6x$	<p>✓ $3x^2 + 6xh + 3h^2 - 5$</p> <p>✓ $6xh + 3h^2$</p> <p>✓ $\frac{f(x+h) - f(x)}{h}$</p> <p>✓ common factor/ $(6x + 3h)$</p> <p>✓ answer (5)</p> <p>✓ $\frac{f(x+h) - f(x)}{h}$</p> <p>✓ $3x^2 + 6xh + 3h^2 - 5$</p> <p>✓ $6xh + 3h^2$</p> <p>✓ common factor/ $(6x + 3h)$</p> <p>✓ answer (5)</p>
<p>7.2.1</p>	$y = 2x^5 + \frac{4}{x^3}$ $y = 2x^5 + 4x^{-3}$ $\frac{dy}{dx} = 10x^4 - 12x^{-4}$	<p>✓ $2x^5 + 4x^{-3}$</p> <p>✓ $10x^4$</p> <p>✓ $-12x^{-4}$</p> <p>(3)</p>

7.2.2	$y = (\sqrt{x} - x^2)^2$ $y = \left(x^{\frac{1}{2}} - x^2\right)^2$ $= x - 2x^{\frac{5}{2}} + x^4$ $\frac{dy}{dx} = 1 - 5x^{\frac{3}{2}} + 4x^3$	$\checkmark x - 2x^{\frac{5}{2}} + x^4$ $\checkmark 1$ $\checkmark -5x^{\frac{3}{2}}$ $\checkmark 4x^3$ <p style="text-align: right;">(4) [12]</p>
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QUESTION/VRAAG 8

8.1	$y = 12$	✓ answer (1)
8.2	$12 = (0 - 2)^2(0 - k)$ $k = -3$ $(x - 2)^2(x + 3) = 0$ $x = -3$ <p>OR/OF</p> $y = 0$ $(x - 2)^2(x - k) = 0$ $(x^2 - 4x + 4)(x - k) = 0$ $x^3 - kx^2 - 4x^2 + 4kx + 4x - 4k = 0$ <p style="text-align: center;">But $-4k$ is the y-intercept Maar $-4k$ is die y-afsnit</p> $-4k = 12$ $k = -3$ $x = -3$	✓ substituting (0;12) ✓ $k = -3$ ✓ $x = -3$ (3) ✓ $-4k$ ✓ $-4k = 12$ or $k = -3$ ✓ $x = -3$ (3)
8.3	$f(x) = x^3 + 3x^2 - 4x^2 - 12x + 4x + 12$ $f(x) = x^3 - x^2 - 8x + 12$ $f'(x) = 3x^2 - 2x - 8$ $3x^2 - 2x - 8 = 0$ $(3x + 4)(x - 2) = 0$ $x = -\frac{4}{3} \text{ or } x = 2$ $y = \frac{500}{27} \text{ or } 18,52 \text{ or } 18\frac{14}{27}$ $C\left(-\frac{4}{3}; 18,52\right)$	✓ $f(x) = x^3 - x^2 - 8x + 12$ ✓ derivative ✓ derivative equal to 0 ✓ factors or formula ✓ $x = -\frac{4}{3}$ ✓ $y = \frac{500}{27}$ or 18,52 or $18\frac{14}{27}$ (6)

QUESTION/VRAAG 9

9.1	$V = \pi r^2 h$ $\pi r^2 h = 340$ $h = \frac{340}{\pi r^2}$	✓ formula ✓ equating to 340 $\checkmark h = \frac{340}{\pi r^2}$ (3)
9.2	$A = 2\pi r^2 + 2\pi rh$ $= 2\pi r^2 + 2\pi r \left(\frac{340}{\pi r^2} \right)$ $= 2\pi r^2 + \frac{680}{r}$ $A'(r) = 4\pi r - \frac{680}{r^2}$ $A'(r) = 0 \text{ for minimum surface area/}$ $\text{vir minimum buite-oppervlakte}$ $4\pi r - \frac{680}{r^2} = 0$ $r^3 = \frac{680}{4\pi} = \frac{170}{\pi}$ $= 54,11268$ $r = 3,78 \text{ cm}$	$\checkmark 2\pi r^2 + 2\pi rh$ $\checkmark \text{substituting } h$ $\checkmark 4\pi r - \frac{680}{r^2}$ $\checkmark A'(r) = 0$ $\checkmark r^3 = \frac{680}{4\pi}$ $\checkmark \text{answer}$ (6) [9]

QUESTION/VRAAG 10

10.1.1 (a)	$P(\text{Female/Vroulik}) = \frac{70}{150} = \frac{7}{15} = 0,47$	✓ 70 ✓ answer (2)
10.1.1 (b)	$P(\text{Female playing tennis/Vroulik speel tennis}) = \frac{20}{150} = \frac{2}{15} = 0,13$	✓ answer (1)

10.1.2	$P(\text{Female/Vroulik}) = \frac{70}{150}$ $P(\text{Playing/Speel tennis}) = \frac{70}{150}$ $P(\text{Female playing tennis/Vrouliks speel tennis}) = \frac{20}{150} = 0,13$ $P(\text{Female/Vroulik}) \times P(\text{Playing/Speel tennis}) = \left(\frac{70}{150}\right)\left(\frac{70}{150}\right) = \frac{4900}{22500} = 0,22$ $P(\text{Female playing tennis/Vroulik speel tennis}) \neq P(\text{Female/Vroulik}) \times P(\text{Playing/Speel tennis})$ <p>Therefore the event of playing tennis is not independent of gender./ Dus is die gebeurtenis om tennis te speel nie onafhanklik van geslag nie</p> <p>OR/OF</p> $P(\text{Male/Manlik}) = \frac{80}{150}$ $P(\text{Playing/Speel tennis}) = \frac{70}{150}$ $P(\text{Male playing tennis/Manlik speel tennis}) = \frac{50}{150} = 0,33333$ $P(\text{Male/Manlik}) \times P(\text{Playing/Speel tennis}) = \left(\frac{80}{150}\right)\left(\frac{70}{150}\right) = \frac{5600}{22500} = 0,25$ $P(\text{Male playing tennis/Manlik speel tennis}) \neq P(\text{Male/Manlik}) \times P(\text{Playing/Speel tennis})$ <p>Therefore the event of playing tennis is not independent of gender./ Dus is die gebeurtenis om tennis te speel nie onafhanklik van geslag nie.</p> <p>OR/OF</p>	$\checkmark P(\text{Play ten}) = \frac{70}{150}$ $\checkmark \left(\frac{70}{150}\right)\left(\frac{70}{150}\right) = \frac{4900}{22500} = 0,22$ $\checkmark P(\text{F play t}) \neq P(\text{F}) \times P(\text{Play t})$ <p>Not independent (3)</p> $\checkmark P(\text{Play ten}) = \frac{70}{150}$ $\checkmark \left(\frac{80}{150}\right)\left(\frac{70}{150}\right) = \frac{5600}{22500} = 0,25$ $\checkmark P(\text{M play t}) \neq P(\text{M}) \times P(\text{Play t})$ <p>Not independent (3)</p>
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	<p> $P(\text{Male}) = \frac{80}{150}$ $P(\text{Not playing tennis}) = \frac{80}{150}$ $P(\text{Male not playing tennis}) = \frac{80}{150} = 0,53333$ $P(\text{Male}) \times P(\text{Not playing tennis}) = \left(\frac{80}{150}\right)\left(\frac{80}{150}\right) = \frac{6400}{22500} = 0,28$ $P(\text{Male not playing tennis}) \neq P(\text{Male}) \times P(\text{Not playing tennis})$ <p>Therefore the event of playing tennis in not independent of gender.</p> <p>OR/OF</p> $P(\text{Female}) = \frac{70}{150}$ $P(\text{Not playing tennis}) = \frac{80}{150}$ $P(\text{Female not playing tennis}) = \frac{50}{150} = 0,33333$ $P(\text{Female}) \times P(\text{Not playing tennis}) = \left(\frac{70}{150}\right)\left(\frac{80}{150}\right) = \frac{5600}{22500} = 0,25$ $P(\text{Female not playing tennis}) \neq P(\text{Female}) \times P(\text{Not playing tennis})$ <p>Therefore the events of playing tennis and gender are not independent.</p> </p>	<p> $\checkmark P(\text{not play ten}) = \frac{80}{150}$ </p> <p> \checkmark </p> <p> $\left(\frac{80}{150}\right)\left(\frac{80}{150}\right) = \frac{6400}{22500} = 0,28$ </p> <p> $\checkmark P(\text{M not play t}) \neq P(\text{M}) \times P(\text{Not play t})$ </p> <p>Not independent</p> <p>(3)</p> <p> $\checkmark P(\text{not play ten}) = \frac{80}{150}$ </p> <p> \checkmark </p> <p> $\left(\frac{70}{150}\right)\left(\frac{80}{150}\right) = \frac{5600}{22500} = 0,25$ </p> <p> $\checkmark P(\text{F not play t}) \neq P(\text{F}) \times P(\text{Not play t})$ </p> <p>Not independent</p> <p>(3)</p>
<p>10.2</p>	<p> $P(B) = 1 - P(B')$ $= 1 - 0,28$ $= 0,72$ $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$ $0,96 = 0,24 + 0,72 - P(A \text{ and } B)$ $0,96 = 0,96 - P(A \text{ and } B)$ $P(A \text{ and } B) = 0$ <p>Events A and B are mutually exclusive <i>Gebeurtenis A en B is onderling uitsluitend</i></p> </p>	<p> $\checkmark P(B) = 0,72$ </p> <p> $\checkmark P(A) = 0,24$ </p> <p> \checkmark substitution into correct formula </p> <p> $\checkmark P(A \text{ and } B) = 0$ </p> <p>(4)</p> <p>[10]</p>

QUESTION/VRAAG 11

11.1	$2 \times 2! \times 7! = 20\ 160$	✓ $2 \times 2!$ ✓ $7!$ ✓ $20\ 160$ (3)
11.2	<p>All seated in $9! = 362\ 880$ ways Girls seated together in $4!$ ways. With the girls as one unit they can all be seated in $4! 6!$ ways = 17280 <i>Almal sit op $9! = 362\ 880$ maniere</i> <i>Meisies sit saam op $4!$ maniere.</i> <i>Met die meisies as 'n eenheid kan almal op</i> <i>$4! 6!$ maniere = 17280 sit</i></p> $P(\text{all girls seated together/al die meisies sit saam}) = \frac{4! 6!}{9!}$ $= \frac{17280}{362880}$ $= \frac{1}{21}$ $= 0,047619\dots$ $= 4,76\%$	✓ $9!$ or 362 880 ✓ $4! 6!$ or 17280 ✓ $\frac{17280}{362880}$ or $\frac{1}{21}$ or 0,047619 or 4,76% (3) [6]
TOTAL/TOTAAL:		150