



basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 12/GRAAD 12

MATHEMATICS P1/WISKUNDE VI

NOVEMBER 2015

MEMORANDUM

MARKS: 150

PUNTE: 150

**This memorandum consists of 17 pages.
*Hierdie memorandum bestaan uit 17 bladsye.***

NOTE:

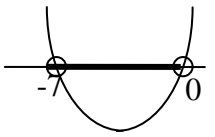
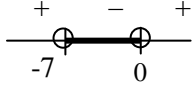
- If a candidate answers a question TWICE, only mark the FIRST attempt.
- Consistent accuracy applies in ALL aspects of the marking memorandum.

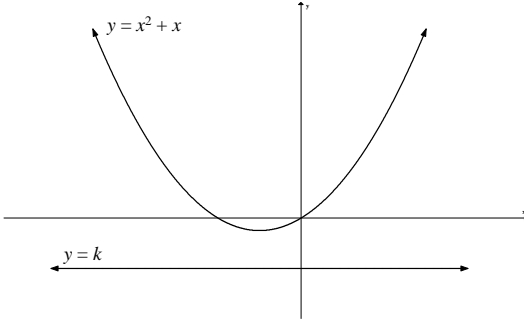
LET WEL:

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

QUESTION/VRAAG 1

1.1.1	$x^2 - 9x + 20 = 0$ $(x - 4)(x - 5) = 0$ $x = 4 \text{ or } x = 5$	✓ factors ✓ $x = 4$ ✓ $x = 5$ (3)
1.1.2	$3x^2 + 5x - 4 = 0$ $x = \frac{-5 \pm \sqrt{(5)^2 - 4(3)(-4)}}{2(3)}$ $x = \frac{-5 \pm \sqrt{73}}{6}$ $x = -2,26 \text{ or } x = 0,59$ <p>OR/OF</p> $x^2 + \frac{5}{3}x + \frac{25}{36} = \frac{4}{3} + \frac{25}{36}$ $\left(x + \frac{5}{6}\right)^2 = \frac{73}{36}$ $x + \frac{5}{6} = \pm \frac{\sqrt{73}}{6}$ $x = \frac{-5 \pm \sqrt{73}}{6}$ $x = -2,26 \text{ or } x = 0,59$	✓ standard form ✓ substitution into correct formula ✓ ✓ answers (4) ✓ for adding $\frac{25}{36}$ on both sides ✓ $x = \frac{-5 \pm \sqrt{73}}{6}$ ✓ ✓ answers (4)
1.1.3	$2x^{\frac{-5}{3}} = 64$ $x^{\frac{-5}{3}} = 32$ $x = (2^5)^{\frac{-3}{5}}$ $x = 2^{-3} \text{ or } \frac{1}{8}$	✓ dividing both sides by 2 ✓ 2^5 ✓ raising RHS to $\frac{-3}{5}$ ✓ answer (4)

<p>1.1.4</p>	$\sqrt{2-x} = x-2$ $2-x = (x-2)^2$ $2-x = x^2 - 4x + 4$ $x^2 - 3x + 2 = 0$ $(x-1)(x-2) = 0$ $x=1 \text{ or } x=2$ <p>if $x=1$, $\sqrt{2-x}=1$ and $x-2=-1$ $x=2$ only</p> <p>OR/OF</p> $\sqrt{2-x} = x-2$ $2-x = (2-x)^2$ $2-x = 1 \text{ or } 2-x = 0$ $x=1 \text{ or } x=2$ <p>if $x=1$, $\sqrt{2-x}=1$ and $x-2=-1$ $\therefore x=2$ only</p> <p>OR/OF</p> $\sqrt{2-x} = x-2$ $2-x \geq 0 \text{ and } x-2 \geq 0$ $x \leq 2 \text{ and } x \geq 2$ $\therefore x=2 \text{ only}$	<p>✓ squaring both sides</p> <p>✓ factors</p> <p>✓ rejecting $x=1$</p> <p>✓ $x=2$ (4)</p> <p>✓ squaring both sides</p> <p>✓ $2-x=1$ or $2-x=0$</p> <p>✓ rejecting $x=1$</p> <p>✓ $x=2$ (4)</p> <p>✓ $2-x \geq 0$</p> <p>✓ $x-2 \geq 0$</p> <p>✓ $x \leq 2$ and $x \geq 2$</p> <p>✓ $x=2$ (4)</p>
<p>1.1.5</p>	$x^2 + 7x < 0$ $x(x+7) < 0$ <div style="display: flex; align-items: center; justify-content: center;">  <div style="margin: 0 10px;">OR/OF</div>  </div> $-7 < x < 0 \text{ OR/OF } x \in (-7; 0)$	<p>✓ factors</p> <p>✓ critical values</p> <p>✓ inequality or interval (3)</p>

<p>1.2</p>	<p>The square of any number is always positive or zero So for the sum of two squares to be zero, both squares must be zero, i.e. <i>Die kwadraat van enige getal is altyd positief of nul. Vir die som van twee kwadrate om nul te wees, moet beide die kwadrate nul wees, d.i.</i> $(3x - y)^2 = 0$ and/en $(x - 5)^2 = 0$ $3x - y = 0$ and/en $x - 5 = 0$ $x = 5$ $3(5) - y = 0$ $y = 15$</p>	<p>✓ $(3x - y)^2 = 0$ ✓ $(x - 5)^2 = 0$ ✓ and ✓ both values (4)</p>
<p>1.3</p>	<p>$x^2 + x = k$ $x^2 + x - k = 0$ $\Delta < 0$ $b^2 - 4ac < 0$ $1^2 - 4(1)(-k) < 0$ $1 + 4k < 0$ $k < \frac{-1}{4}$ OR/OF Consider the functions $y = x^2 + x$ and $y = k$ <i>Beskou die funksies $y = x^2 + x$ en $y = k$</i></p>  <p>Turning point of/<i>Draaipunt van</i> $y = x^2 + x$ is $\left(\frac{-1}{2}; \frac{-1}{4}\right)$ $x^2 + x = k$ does not have real roots when the line $y = k$ does not intersect $y = x^2 + x$. $x^2 + x = k$ <i>het geen reële wortels as die lyn $y = k$ nie met $y = x^2 + x$ sny nie.</i> Therefore $k < \frac{-1}{4}$</p>	<p>✓ standard form ✓ $\Delta < 0$ ✓ $1^2 - 4(1)(-k)$ ✓ $k < \frac{-1}{4}$ (4) ✓ sketch ✓ $x = -\frac{1}{2}$ ✓ $y = -\frac{1}{4}$ ✓ $k < \frac{-1}{4}$ (4) [26]</p>

QUESTION/VRAAG 2

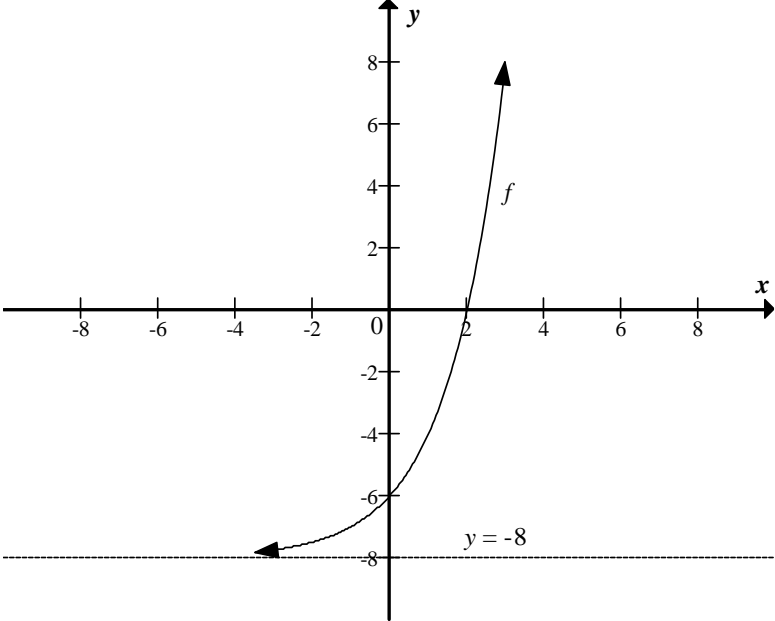
<p>2.1</p>	$r = \frac{T_2}{T_1}$ $= \frac{5}{10}$ $= \frac{1}{2}$ $T_5 = 1,25 \left(\frac{1}{2}\right)$ $= \frac{5}{8} \text{ or } 0,625$ <p style="text-align: center;">OR/OF</p> $T_5 = 10 \left(\frac{1}{2}\right)^4$ $= \frac{5}{8} \text{ or } 0,625$	$\checkmark r = \frac{1}{2}$ \checkmark answer (2)
<p>2.2</p>	$T_n = 10 \left(\frac{1}{2}\right)^{n-1}$	\checkmark geometric formula \checkmark substitutes a and r values into formula (2)
<p>2.3</p>	$r = \frac{1}{2}$ $-1 < r < 1$ <p>Therefore the sequence converges/<i>Die ry konvergeer</i></p>	$\checkmark r = \frac{1}{2}$ $\checkmark -1 < r < 1$ (2)
<p>2.4</p>	$S_\infty - S_n = \frac{a}{1-r} - \frac{a(1-r^n)}{1-r}$ $= \frac{10}{1-\frac{1}{2}} - \frac{10\left(1-\frac{1^n}{2}\right)}{1-\frac{1}{2}}$ $= 20 - 20\left(1-\frac{1^n}{2}\right)$ $= 20 - 20 + 20 \times \left(\frac{1}{2}\right)^n$ $= 20 \times \left(\frac{1}{2}\right)^n$ <p>OR/OF</p> $S_\infty - S_n = T_{n+1} + T_{n+2} + T_{n+3} + \dots$ $= 10 \left(\frac{1}{2}\right)^n \left[1 + \frac{1}{2} + \frac{1}{4} + \dots\right]$ $= 10 \left(\frac{1}{2}\right)^n \left[\frac{1}{1-\frac{1}{2}}\right]$ $= 20 \times \left(\frac{1}{2}\right)^n$	$\checkmark \frac{10}{1-\frac{1}{2}}$ $\checkmark \frac{10\left(1-\frac{1^n}{2}\right)}{1-\frac{1}{2}}$ $\checkmark 20 - 20 + 20 \times \left(\frac{1}{2}\right)^n$ \checkmark answer (4) \checkmark constructing the series \checkmark $10 \left(\frac{1}{2}\right)^n \left[1 + \frac{1}{2} + \frac{1}{4} + \dots\right]$ $\checkmark \frac{1}{1-\frac{1}{2}}$ \checkmark answer (4) [10]

QUESTION/VRAAG 3

3.1	$T_k = a + (k-1)d$ $= -3 + (k-1)(8)$ $= -3 + 8k - 8$ $= 8k - 11$	✓ d value ✓ answer (2)
3.2	$\sum_{k=1}^n (8k-11) \quad \mathbf{OR/OF} \quad \sum_{k=0}^{n-1} (8(k+1)-11) = \sum_{k=0}^{n-1} (8k-3)$	✓ for general term ✓ lower and upper values in sigma notation (2)
3.3	$S_n = \frac{n}{2}[2a + (n-1)d]$ $= \frac{n}{2}[2(-3) + (n-1)(8)]$ $= \frac{n}{2}[-6 + 8n - 8]$ $= \frac{n}{2}[8n - 14]$ $= n(4n - 7)$ $= 4n^2 - 7n$ <p>OR/OF</p> $S_n = \frac{n}{2}[2a + (n-1)d]$ $= \frac{n}{2}[2(-3) + (n-1)(8)]$ $= n[(-3) + (n-1)(4)]$ $= -3n + 4n^2 - 4n$ $= 4n^2 - 7n$ <p>OR/OF</p> $S_n = \frac{n}{2}[a + l]$ $= \frac{n}{2}[-3 + 8n - 11]$ $= n[4n - 7]$ $= 4n^2 - 7n$	✓ correct substitution into formula ✓ $\frac{n}{2}[-6 + 8n - 8]$ ✓ $(4n - 7)$ (3)
		✓ correct substitution into formula ✓ $n[(-3) + (n-1)(4)]$ ✓ $-3n + 4n^2 - 4n$ (3)
		✓ correct substitution into formula ✓ $\frac{n}{2}[-3 + 8n - 11]$ ✓ $(4n - 7)$ (3)

3.4.1	$Q_6 = -6 - 3 + 5 + 13 + 21 + 29$	✓ $-6 - 3 + 5 + 13 + 21$ ✓ $+ 29$ (2)
3.4.2	$Q_{129} = -6 + S_{128}$ $= -6 + 4(128)^2 - 7(128)$ $= 64634$	✓✓ $-6 - 7(128) + 4(128)^2$ ✓ answer (3) [12]

QUESTION/VRAAG 4

Given: $f(x) = 2^{x+1} - 8$		
4.1	$y = -8$	✓ answer (1)
4.2		✓ x-intercept ✓ y-intercept ✓ shape ✓ asymptote (4)
4.3	$g(x) = 2^{-x+1} - 8$ <p>OR/OF</p> $g(x) = \left(\frac{1}{2}\right)^{x-1} - 8$	✓ answer (1) ✓ answer (1) [6]

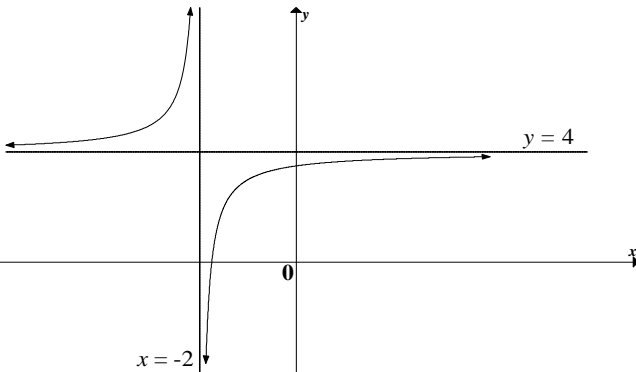
QUESTION/VRAAG 5

<p>Given $h(x) = 2x - 3$ for $-2 \leq x \leq 4$.</p>		
5.1	<p>For x-intercepts, $y = 0$ $2x - 3 = 0$ $x = 1,5$ $Q(1,5 ; 0)$</p>	<p>✓ $x = 1,5$ ✓ $y = 0$ (2)</p>
5.2	<p>h: $x = -2$: $y = 2(-2) - 3 = -7$ $x = 4$: $y = 2(4) - 3 = 5$ Domain of h^{-1}: $-7 \leq x \leq 5$</p>	<p>✓ -7 ✓ 5 ✓ $-7 \leq x \leq 5$ (3)</p>
5.3		<p>✓ intercepts ✓ shape ✓ endpoints (3)</p>
5.4	<p>$h(x) = 2x - 3$</p> <p>For the inverse of h, $x = 2y - 3$ $y = \frac{x + 3}{2}$ $h(x) = h^{-1}(x)$ $2x - 3 = \frac{x + 3}{2}$ $4x - 6 = x + 3$ $3x = 9$ $x = 3$</p> <p>OR/OF</p>	<p>✓ $y = \frac{x + 3}{2}$ ✓ $2x - 3 = \frac{x + 3}{2}$ ✓ $x = 3$ (3)</p>

	$h(x) = 2x - 3$ <p>h and h^{-1} intersect when $y = x$</p> $h(x) = x$ $2x - 3 = x$ $x = 3$	$\checkmark h(x) = x$ $\checkmark 2x - 3 = x$ $\checkmark x = 3$ <p style="text-align: right;">(3)</p>
<p>5.5</p>	$OP^2 = x^2 + y^2$ $= x^2 + (2x - 3)^2$ $= x^2 + 4x^2 - 12x + 9$ $= 5x^2 - 12x + 9$ <p>For OP to be at its minimum, OP^2 has to be a minimum <i>Vir OP om minimum te wees, moet OP^2 'n minimum wees</i></p> $\frac{d(OP^2)}{dx} = 0 \quad \text{or} \quad x = -\frac{b}{2a}$ $10x - 12 = 0 \quad \quad \quad = -\frac{-12}{2(5)}$ $\therefore x = \frac{6}{5}$ <p>Minimum length of $OP = \sqrt{5\left(\frac{6}{5}\right)^2 - 12\left(\frac{6}{5}\right) + 9} = \sqrt{\frac{9}{5}}$ or $\frac{3}{\sqrt{5}}$ or 1,34 units</p> <p>OR/OF</p> $m_h = 2 \text{ (given)}$ $m_{OP} = \frac{-1}{2}$ <p>$\therefore OP$ has equation $y = \frac{-1}{2}x$</p> $\frac{-1}{2}x = 2x - 3$ $-x = 4x - 6$ $5x = 6$ $x_p = 1,2$ $y_p = -\frac{1}{2}(1,2) = -0,6$ $OP = \sqrt{(1,2 - 0)^2 + (-0,6 - 0)^2}$ $= 1,34 \text{ or } \sqrt{1,8} \text{ units}$ <p>OR/OF</p>	$\checkmark OP^2 = x^2 + y^2$ $\checkmark \text{substitute } y = 2x - 3$ $\checkmark 5x^2 - 12x + 9$ $\checkmark x\text{-value}$ $\checkmark \text{answer}$ <p style="text-align: right;">(5)</p> <p style="text-align: center;">\</p> $\checkmark m_{OP} = \frac{-1}{2}$ $\checkmark \text{equation of } OP$ $\checkmark \frac{-1}{2}x = 2x - 3$ $\checkmark \text{substitution into distance formula}$ $\checkmark \text{answer}$ <p style="text-align: right;">(5)</p>

	<p>Minimum distance between the line $ax + by + c = 0$ and the point $(x_0; y_0)$ <i>Minimum afstand tussen die lyn $ax + by + c = 0$ en die punt $(x_0; y_0)$</i></p> $= \frac{ ax_0 + by_0 + c }{\sqrt{a^2 + b^2}}$ $= \frac{ 2(0) + (-1)(0) - 3 }{\sqrt{2^2 + (-1)^2}}$ $= \frac{3}{\sqrt{5}}$	<p>✓✓ formula ✓✓ substitution ✓ answer (5)</p>
<p>5.6.1</p>	<p>$h(x) = f'(x) < 0$ for $x \in (-2 ; 1,5) \Rightarrow f$ is decreasing on the left of Q / <i>f is dalend links van Q.</i></p> <p>$h(x) = f'(x) > 0$ for $x \in (1,5 ; 4) \Rightarrow f$ is increasing on the right of Q / <i>f is stygend regs van Q.</i></p> <p>OR/OF</p> $h\left(\frac{3}{2}\right) = f'\left(\frac{3}{2}\right) = 0$ <p>Since $h'(x) = 2$ $f''(x) = 2 > 0$ $f''\left(\frac{3}{2}\right) > 0$</p> <p>$f$ has a local minimum at $x = \frac{3}{2}$ by the second derivative test. <i>f het 'n lokale minimum by $x = \frac{3}{2}$ deur die tweede afgeleide toets.</i></p> <p>OR/OF</p> $f(x) = x^2 - 3x + c$ <p>f has a minimum value since $a > 0$ / <i>f het 'n minimum waarde omdat $a > 0$</i></p>	<p>✓ decreasing left of Q ✓ increasing right of Q (2)</p> <p>✓ $f'\left(\frac{3}{2}\right) = 0$ ✓ $f''(x) = 2 > 0$</p> <p>(2)</p> <p>✓ $f(x) = x^2 - 3x + c$ ✓ explanation (2)</p>
<p>5.6.2</p>	<p>$m = f'(4) = h(4) = 5$</p>	<p>✓ answer (1) [19]</p>

QUESTION/VRAAG 6

6.1.1	$T(0;18)$	✓ answer (1)
6.1.2	$-2x^2 + 18 = 0$ $(x - 3)(x + 3) = 0$ $Q(3; 0)$ OR/OF $-2x^2 + 18 = 0$ $x^2 = 9$ $Q(3; 0)$	✓ equating to 0 ✓ factors ✓ coordinates of Q (3) ✓ equating to 0 ✓ $x^2 = 9$ ✓ coordinates of Q (3)
6.1.3	x -coordinate of S is 4,5/ x -koördinaat van S is 4,5 By symmetry about the line $x = 4,5$ / <i>Deur simmetrie om die lyn $x = 4,5$:</i> $R(6; 0)$	✓✓ $R(6; 0)$ (2)
6.1.4	For all $x \in \mathbf{R}$	✓✓ answer (2)
6.2	If $C(x; y)$ is the centre of the hyperbola/ <i>As $C(x; y)$ die middelpunt is van die hiperbool</i> $y = x + 6$ and $x = -2$ $\therefore y = -2 + 6 = 4$ 	✓✓ asymptote $y = 4$ ✓ asymptote $x = -2$ ✓ shape (4) [12]

QUESTION/VRAAG 7

7.1	R450 000	✓ answer (1)
7.2	$A = P(1-i)^n$ $243\,736,90 = 450\,000(1-i)^4$ $i = 1 - \sqrt[4]{\frac{243\,736,90}{450\,000}}$ $i = 0,1421$ The rate of depreciation is 14,21 % p.a. <i>Die waardeverminderingskoers is 14,21% p.j.</i>	✓ substitution of 450 000 into correct formula ✓ substitution of (4; 243 736,90) ✓ making i the subject ✓ answer (4)
7.3	At T: $A = P(1+i)^n$ $y = 450\,000(1+0,081)^4$ $a = R614\,490,66$	✓ $i = 0,081$ and $n = 4$ ✓ correct substitution into formula ✓ answer (3)
7.4	Future Value = R614 490,66 – R243 736,90 = R370 753,76 $F_v = \frac{x[(1+i)^n - 1]}{i}$ $370\,753,76 = \frac{x \left[\left(1 + \frac{0,062}{12} \right)^{36} - 1 \right]}{\frac{0,062}{12}}$ $x = R9397,12$	✓ R370 753,76 ✓ substitution into correct formula ✓ $i = \frac{0,062}{12}$ ✓ $n = 36$ ✓ answer (5) [13]

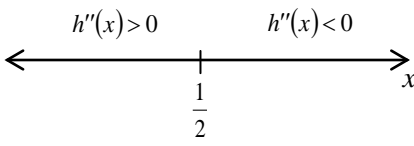
QUESTION/VRAAG 8

8.1	$f(x+h) = (x+h)^2 - 3(x+h)$ $= x^2 + 2xh + h^2 - 3x - 3h$ $f(x+h) - f(x) = x^2 + 2xh + h^2 - 3x - 3h - (x^2 - 3x)$ $= 2xh + h^2 - 3h$ $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $= \lim_{h \rightarrow 0} \frac{2xh + h^2 - 3h}{h}$ $= \lim_{h \rightarrow 0} \frac{h(2x + h - 3)}{h}$ $= \lim_{h \rightarrow 0} (2x + h - 3)$ $= 2x - 3$ <p>OR/OF</p> $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $= \lim_{h \rightarrow 0} \frac{(x+h)^2 - 3(x+h) - (x^2 - 3x)}{h}$ $= \lim_{h \rightarrow 0} \frac{x^2 + 2xh + h^2 - 3x - 3h - x^2 + 3x}{h}$ $= \lim_{h \rightarrow 0} \frac{2xh + h^2 - 3h}{h}$ $= \lim_{h \rightarrow 0} \frac{h(2x + h - 3)}{h}$ $= \lim_{h \rightarrow 0} (2x + h - 3)$ $= 2x - 3$	<p>✓ finding $f(x+h)$</p> <p>✓ $2xh + h^2 - 3h$</p> <p>✓ formula</p> <p>✓ factorisation</p> <p>✓ answer (5)</p> <p>✓ formula</p> <p>✓ finding $f(x+h)$</p> <p>✓ $2xh + h^2 - 3h$</p> <p>✓ factorisation</p> <p>✓ answer (5)</p>
8.2.1	$y = \left(x^2 - \frac{1}{x^2} \right)^2$ $y = x^4 - 2 + \frac{1}{x^4}$ $= x^4 - 2 + x^{-4}$ $\frac{dy}{dx} = 4x^3 - 4x^{-5}$	<p>✓ $x^4 - 2 + \frac{1}{x^4}$</p> <p>✓ x^{-4}</p> <p>✓ $4x^3 - 4x^{-5}$</p> <p>(3)</p>

8.2.2	$D_x \left[\frac{(x-1)(x^2+x+1)}{x-1} \right]$ $= D_x [x^2+x+1]$ $= 2x+1$	✓ factorisation ✓ simplification ✓ $2x+1$ (3) [11]
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QUESTION/VRAAG 9

9.1	Substitute Q(2; 10) into $h(x)$: $-2^3 + a(2^2) + b(2) = 10$ $-8 + 4a + 2b = 10$ $2a + b = 9 \text{line 1}$ $h'(x) = -3x^2 + 2ax + b$ At Q: $h'(2) = 0$ $-3(2)^2 + 2a(2) + b = 0$ $-12 + 4a + b = 0$ $4a + b = 12 \text{line 2}$ line 1 – line 2: $2a = 3$ $a = \frac{3}{2}$ Substitute in line 1: $b = 6$	✓ substitute Q into h ✓ finding derivative ✓ $h'(2)$ ✓ equating derivative to 0 ✓ solving simultaneously for a and b (5)
9.2	Average gradient/ <i>Gemiddelde gradiënt</i> = $\frac{f(x_Q) - f(x_P)}{x_Q - x_P}$ $f(-1) = -(-1)^3 + \frac{3}{2}(-1)^2 + 6(-1)$ $= -3,5$ Average gradient/ <i>Gemiddelde gradiënt</i> = $\frac{10 - (-3,5)}{2 - (-1)}$ $= 4,5$	✓ formula ✓ $f(-1) = -3,5$ ✓ substitution ✓ answer (4)

<p>9.3</p>	<p> $h'(x) = -3x^2 + 3x + 6$ $h''(x) = -6x + 3$ $= -3(2x - 1)$ </p>  <p>The concavity changes at $x = \frac{1}{2}$. <i>Die konkawiteit verander by $x = \frac{1}{2}$.</i></p>	<p> ✓ linking second derivative with concavity ✓ $-6x + 3$ </p> <p>✓ explanation</p> <p>(3)</p>
<p>9.4</p>	<p>The graph of h has a point of inflection at $x = \frac{1}{2}$ <i>Die grafiek van h het 'n buigpunt by $x = \frac{1}{2}$.</i></p> <p>OR/OF</p> <p>The graph of h changes from concave up to concave down at $x = \frac{1}{2}$ / <i>Die grafiek van h verander by $x = \frac{1}{2}$ van konkaaf op na konkaaf af</i></p>	<p>✓ answer (1)</p> <p>✓ answer (1)</p>
<p>9.5</p>	<p>Gradient of g is -12 / <i>Gradiënt van g is -12</i> Gradient of tangent is / <i>Gradiënt van die raaklyn is:</i> $h'(x) = -3x^2 + 3x + 6$ $h'(x) = -12$ $-3x^2 + 3x + 6 = -12$ $3x^2 - 3x + 18 = 0$ $x^2 - x + 6 = 0$ $(x - 3)(x + 2) = 0$ $x = -2$ only</p>	<p> ✓ $h'(x) = -3x^2 + 3x + 6$ ✓ $h'(x) = -12$ </p> <p> ✓ factors ✓ selection of x-value </p> <p>(4) [17]</p>

QUESTION/VRAAG 10

10.1	$\frac{h}{r} = \tan 60^\circ$ $r = \frac{h}{\tan 60^\circ}$ $\therefore r = \frac{h}{\sqrt{3}}$	$\checkmark \frac{h}{r} = \tan 60^\circ$ $\checkmark \text{answer}$ (2)
10.2	$V_{\text{cone}} = \frac{1}{3} \pi r^2 h$ $= \frac{1}{3} \pi \left(\frac{h}{\sqrt{3}} \right)^2 h$ $= \frac{1}{9} \pi h^3$ $\frac{dV}{dh} = \frac{1}{3} \pi h^2$ $\left. \frac{dV}{dh} \right _{h=9} = \frac{1}{3} \pi (9)^2$ $= 27\pi \text{ or } 84,82 \text{ cm}^3/\text{cm}$	$\checkmark \text{formula}$ $\checkmark \text{substitution of the value of } r \text{ in terms of } h$ $\checkmark \text{simplified volume answer}$ $\checkmark \text{derivative}$ $\checkmark \text{answer with units}$ (5) [7]

QUESTION/VRAAG 11

11.1	$P(A) \times P(B)$ $= 0,2 \times 0,63$ $= 0,126$ <p>i.e. $P(A) \times P(B) = P(A \text{ and } B)$ Therefore A and B are independent/<i>Dus is A en B onafhanklik</i></p>	$\checkmark 0,2 \times 0,63$ $\checkmark P(A) \times P(B) = P(A \text{ and } B)$ $\checkmark \text{conclusion}$ (3)
11.2.1	$7^7 = 823\,543$	$\checkmark \checkmark 7^7$ (2)
11.2.2	$7! = 5040$	$\checkmark \checkmark 7!$ (2)

11.2.3	<p>There are 3 vowels \Rightarrow 3 options for first position There are 4 consonants \Rightarrow 4 options for last position The remaining 5 letters can be arranged in $5 \times 4 \times 3 \times 2 \times 1$ ways $3 \times (5 \times 4 \times 3 \times 2 \times 1) \times 4 = 1440$</p> <p><i>Daar is 3 klinkers \Rightarrow 3 opsies vir die eerste posisie</i> <i>Daar is 4 konsonante \Rightarrow 4 opsies vir die laaste posisie</i> <i>Die oorblywende 5 letters kan as volg gerangskik word</i></p> <p>$5 \times 4 \times 3 \times 2 \times 1$ ways/maniere $3 \times (5 \times 4 \times 3 \times 2 \times 1) \times 4 = 1440$</p>	<p>$\checkmark \times 3$ $\checkmark \times 4$ $\checkmark 5 \times 4 \times 3 \times 2 \times 1$ \checkmark answer</p> <p style="text-align: right;">(4)</p>
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11.3	<p style="text-align: center;"> $P(\text{Orange})P(\text{Orange}) + P(\text{Yellow})P(\text{Yellow}) = \frac{52}{100}$ $\left(\frac{t}{t+2}\right)\left(\frac{t}{t+2}\right) + \left(\frac{2}{t+2}\right)\left(\frac{2}{t+2}\right) = \frac{52}{100}$ $\frac{t^2}{t^2 + 4t + 4} + \frac{4}{t^2 + 4t + 4} = \frac{13}{25}$ $25(t^2 + 4) = 13(t^2 + 4t + 4)$ $3t^2 - 13t + 12 = 0$ $(3t - 4)(t - 3) = 0$ $t = 3$ </p> <p>There are 3 orange balls in the bag/<i>Daar is 3 oranje balle in die sak</i></p>	<p>$\checkmark \frac{52}{100}$ $\checkmark \left(\frac{t}{t+2}\right)\left(\frac{t}{t+2}\right)$ $\checkmark \left(\frac{2}{t+2}\right)\left(\frac{2}{t+2}\right)$ $\checkmark 25(t^2 + 4) = 13(t^2 + 4t + 4)$ $\checkmark 3t^2 - 13t + 12 = 0$ $\checkmark t = 3$</p> <p style="text-align: right;">(6) [17]</p>
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TOTAL/TOTAAL: 150 marks