



# basic education

Department:  
Basic Education  
**REPUBLIC OF SOUTH AFRICA**

**GRADE 12/*GRAAD 12***

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

**MATHEMATICS P1/*WISKUNDE V1***

**NOVEMBER 2016**

**MEMORANDUM**

**MARKS: 150**

***PUNTE: 150***

**This memorandum consists of 20 pages.  
*Hierdie memorandum bestaan uit 20 bladsye.***

**NOTE:**

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

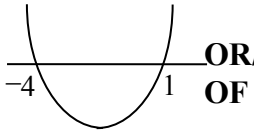
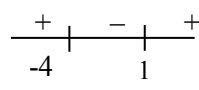
**LET WEL:**

- 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	$x(x-7) = 0$ $x = 0$ or $x = 7$	✓ $x = 0$ ✓ $x = 7$ (2)
1.1.2	$x^2 - 6x + 2 = 0$ $x = \frac{6 \pm \sqrt{(-6)^2 - 4(1)(2)}}{2(1)}$ $x = \frac{6 \pm \sqrt{28}}{2}$ $x = 0,35$ or $x = 5,65$ <b>OR/OF</b> $x^2 - 6x + 2 = 0$ $x^2 - 6x + 9 = -2 + 9$ $(x-3)^2 = 7$ $x-3 = \pm\sqrt{7}$ $x = 3 \pm \sqrt{7}$ $x = 0,35$ or $x = 5,65$	✓ correct substitution into correct formula ✓ $x = 0,35$ ✓ $x = 5,65$ (3) ✓ $(x-3)^2 = 7$ ✓ $x = 0,35$ ✓ $x = 5,65$ (3)
1.1.3	$\sqrt{x-1} + 1 = x$ $\sqrt{x-1} = x-1$ $x-1 = x^2 - 2x + 1$ $x^2 - 3x + 2 = 0$ $(x-2)(x-1) = 0$ $x = 2$ or $x = 1$ Both answers are valid <b>OR/OF</b>	✓ isolate $\sqrt{x-1}$ ✓ $x^2 - 2x + 1$ ✓ standard form ✓ factors ✓ both answers (5)

	$\sqrt{x-1} + 1 = x$ $\sqrt{x-1} = x-1$ <p>Let <math>x-1 = k</math></p> $\sqrt{k} = k \quad k \geq 0$ $k = k^2$ $k^2 - k = 0$ $k(k-1) = 0$ $(x-1)(x-2) = 0$ $x = 2 \text{ or } x = 1 \quad ; \quad x \geq 1$ <p>Both answers are valid</p> <p><b>OR/OF</b></p> $\sqrt{x-1} + 1 = x$ $\sqrt{x-1} = x-1$ <p>By inspection :</p> $x-1 = 0 \quad \text{or} \quad x-1 = 1$ $x = 2 \quad \text{or} \quad x = 1$	<p>✓ isolate <math>\sqrt{x-1}</math></p> <p>✓ <math>k^2</math></p> <p>✓ standard form</p> <p>✓ factors</p> <p>✓ both answers</p> <p>(5)</p> <p>✓ isolate <math>\sqrt{x-1}</math></p> <p>✓ <math>x-1 = 0</math></p> <p>✓ <math>x-1 = 1</math></p> <p>✓ <math>x = 2</math></p> <p>✓ <math>x = 1</math></p> <p>(5)</p>
1.1.4	$3^{x+3} - 3^{x+2} = 486$ $3^x 3^3 - 3^x 3^2 = 486$ $3^x (3^3 - 3^2) = 486$ $3^x = 27$ $3^x = 3^3$ $x = 3$ <p><b>OR/OF</b></p> $3^{x+3} - 3^{x+2} = 486$ $3^{x+2} (3^1 - 1) = 486$ $3^{x+2} = 243$ $3^{x+2} = 3^5$ $x+2 = 5$ $x = 3$	<p>✓ expansion</p> <p>✓ common factor</p> <p>✓ <math>3^x = 27</math></p> <p>✓ <math>x = 3</math></p> <p>(4)</p> <p>✓ common factor</p> <p>✓ <math>(3^1 - 1)</math></p> <p>✓ <math>3^{x+2} = 243</math></p> <p>✓ <math>x = 3</math></p> <p>(4)</p>
1.2.1	$f(x) = x^2 + 3x - 4$ $0 = (x+4)(x-1)$ $x = -4 \text{ or } x = 1$	<p>✓ factors</p> <p>✓ both answers</p> <p>(2)</p>

<p>1.2.2</p>	$x^2 + 3x - 4 < 0$ $(x + 4)(x - 1) < 0$  <p style="text-align: center;"><b>OR/</b> <b>OF</b></p>  $-4 < x < 1 \quad \text{OR/OF} \quad x \in (-4 ; 1)$	<p>✓ ✓ <math>-4 &lt; x &lt; 1</math></p> <p style="text-align: right;">(2)</p>
<p>1.2.3</p>	$2x + 3 \geq 0$ $x \geq -\frac{3}{2}$ <p><math>f'(x) \geq 0</math> when <math>f</math> is increasing</p> <p>The turning point occurs at <math>x = \frac{-4 + 1}{2}</math></p> $x \geq -\frac{3}{2}$	<p>✓ <math>2x + 3</math></p> <p>✓ <math>x \geq -\frac{3}{2}</math></p> <p>✓ <math>x = \frac{-4 + 1}{2}</math></p> <p>✓ <math>x \geq -\frac{3}{2}</math></p> <p style="text-align: right;">(2)</p>
<p>1.3</p>	$x = 2y \text{ and } x^2 - 5xy = -24$ $(2y)^2 - 5(2y)(y) = -24$ $4y^2 - 10y^2 = -24$ $-6y^2 = -24$ $y^2 = 4$ $y = -2 \text{ or } y = 2$ $x = -4 \text{ or } x = 4$ <p><b>OR/OF</b></p> $x = 2y \text{ and } x^2 - 5xy = -24$ $y = \frac{x}{2}$ $x^2 - 5(x)\left(\frac{x}{2}\right) = -24$ $x^2 - \frac{5}{2}x^2 = -24$ $-\frac{3}{2}x^2 = -24$ $x^2 = 16$ $x = -4 \text{ or } x = 4$ $y = -2 \text{ or } y = 2$ <p><b>OR/OF</b></p>	<p>✓ substitution of <math>2y</math></p> <p>✓ <math>-6y^2 = -24</math></p> <p>✓ both <math>y</math> – values</p> <p>✓ both <math>x</math> – values</p> <p style="text-align: right;">(4)</p> <p>✓ substitution of <math>\frac{x}{2}</math></p> <p>✓ <math>-\frac{3}{2}x^2 = -24</math></p> <p>✓ both <math>x</math> – values</p> <p>✓ both <math>y</math> – values</p> <p style="text-align: right;">(4)</p>



	$-3; -7; \dots; -87$ $S_n = \frac{n}{2}[2a + (n-1)d]$ $S_{22} = \frac{22}{2}[2(-3) + (22-1)(-4)]$ $= -990$ <p><b>OR/OF</b></p> <p>All negative terms can be written down and added to get the answer of <math>-990</math>. / <i>Alle negatiewe terme kan neergeskryf word en dan bymekaar getel word om <math>-990</math> te kry.</i></p> <p><b>OR/OF</b></p> $\text{Sum} = S_{24} - (5+1)$ $= \frac{24}{2}[5 - 87] - 6$ $= -990$	$\checkmark n = 22$ $\checkmark a = -3$ $\checkmark$ answer (3)
2.4	$5; -15; -35 \dots$ $d = -20$ $T_n = -20n + 25$ <p>Last term in the sequence divisible by 5 is: / <i>Laaste term in die ry deelbaar deur 5 is:</i></p> $-4187 + 4(3)$ $= -4175$ $T_n = -20n + 25$ $-4175 = -20n + 25$ $20n = 4200$ $n = 210$ <p>There will be 210 terms in the sequence that is divisible by 5. / <i>Daar is 210 terme in die ry deelbaar deur 5.</i></p> <p><b>OR/OF</b></p>	$\checkmark d = -20$ $\checkmark T_n = -20n + 25$  $\checkmark -4175 = -20n + 25$  $\checkmark n = 210$ (4)

	<p>5 ; 1 ; -3 ; ... ; -83 ; -87 ; ..... ; -4187</p> $T_n = -4n + 9$ $-4187 = -4n + 9$ $4n = 4196$ $n = 1049$ <p>There are 1049 terms in the sequence./Daar is 1049 terme in die ry.</p> <p><math>T_1 ; T_6 ; T_{11} ; T_{16} \dots</math> are divisible by 5./is deelbaar deur 5.</p> <p>The largest integer value of <math>k</math> such that</p> $5k - 4 \leq 1049$ $5k \leq 1053$ $k \leq 210,6$ $k = 210$ <p><b>OR/OF</b></p> <p>5 ; 1 -3 ; -7 ; ... ; <b>-4175</b>; -4179 ; -4183 ; -4187</p> $T_n = a + (n-1)d$ $-4175 = 5 + (n-1)(-4)$ $-4180 = -4(n-1)$ $n = 1046$ <p>Number of terms divisible by 5</p> $= \frac{1046-1}{5} + 1$ $= 210$	<p>✓ <math>-4n + 9 = -4187</math></p> <p>✓ <math>n = 1049</math></p> <p>✓ <math>5k - 4 \leq 1049</math></p> <p>✓ <math>k = 210</math></p> <p>(4)</p> <p>✓ <math>d = -4</math></p> <p>✓ <math>-4175 = -4n + 9</math></p> <p>✓ 1046</p> <p>✓ <math>n = 210</math></p> <p>(4)</p> <p><b>[11]</b></p>
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**QUESTION/VRAAG 3**

<p>3.1.1</p>	<p><math>-1 ; x ; 3 ; x + 8 ; \dots</math></p> <p><math>-2x + 2 = 2x + 2</math> <math>4x = 0</math> <math>x = 0</math></p>	<p>✓ <math>x + 1 ; 3 - x</math> and <math>x + 5</math></p> <p>✓ calculating second differences</p> <p>✓ <math>-2x + 2 = 2x + 2</math></p> <p>✓ <math>x = 0</math> (4)</p>
<p>3.1.2</p>	<p>First differences/<i>Eerste verskille</i>: <math>1 ; 3 ; 5 ; \dots</math></p> $S_n = \frac{n}{2} [2(1) + (n-1)(2)]$ $= n^2$ <p><math>250 &lt; n^2</math> <math>n &gt; \sqrt{250}</math> <math>\therefore n &gt; 15,8</math></p> <p>The sum of the 16 first differences will be greater than 250. Therefore the 17<sup>th</sup> term of the quadratic number pattern is the first satisfying this condition. / <i>Die som van 16 eerste verskille sal groter as 250 wees. Gevolglik sal die 17<sup>de</sup> term van die kwadratiese getalpatroon die eerste wees wat aan die voorwaarde voldoen.</i></p>	<p>✓ <math>S_n = n^2</math></p> <p>✓ <math>S_n &gt; 250</math></p> <p>✓ <math>n &gt; 15,8</math></p> <p>✓ <math>n = 17</math> (4)</p>
<p>3.2.1</p>	<p><math>21 + 21(0,85) + 21(0,85)^2 + \dots</math></p> $T_n = ar^{n-1}$ $T_{10} = (21)(0,85)^9$ <p><math>= 4,86 \text{ cm}</math></p>	<p>✓ <math>n = 10 ; r = 0,85</math> or <math>\frac{17}{20}</math></p> <p>✓ substitution into correct formula</p> <p>✓ answer (3)</p>
<p>3.2.2</p>	$S_n = \frac{a(1-r^n)}{1-r}$ $S_{15} = \frac{21(1-(0,85)^{15})}{1-0,85}$ <p><math>= 127,77</math></p> <p>Area of the page = <math>30 \times 21 = 630</math> Percentage of paper covered in grey ink: <math>= \frac{127,77}{630} \times 100\%</math> <math>= 20,28\%</math></p>	<p>✓ <math>n = 15</math></p> <p>✓ 127,77</p> <p>✓ 630</p> <p>✓ 20,28 (4)</p> <p>[15]</p>



**QUESTION/VRAAG 4**

4.1	$y = 0$	✓ $y = 0$ (1)
4.2	$R(0 ; 1)$	✓ answer (1)
4.3	$y = a^x$ $9 = a^2$ $\therefore a = 3$	✓ substitution ✓ $a = 3$ (2)
4.4	$DP = 2 - b$ $y = 3^x$ $\frac{1}{81} = 3^b$ $3^{-4} = 3^b$ $b = -4$ $DP = 2 - (-4)$ $= 6$ units	✓ $\frac{1}{81} = 3^b$ ✓ $3^{-4}$ or use of logs ✓ $b = -4$  ✓ DP = 6 units (4)
4.5	$h(x + 2) + k = 0$ $h(x + 2) = -k$ $0 < -k < \frac{1}{81}$ $-\frac{1}{81} < k < 0$	✓✓ $-k < \frac{1}{81}$ or $k > -\frac{1}{81}$ ✓ $-\frac{1}{81} < k < 0$ (3)
		<b>[11]</b>

**QUESTION/VRAAG 5**

5.1	$f(x) = -x^2 + 4x - 3$ $f'(x) = 0 \quad \text{or} \quad x = -\frac{4}{2(-1)}$ $-2x + 4 = 0$ $x = 2$ $y = -(2)^2 + 4(2) - 3$ $= 1$ $B(2; 1)$ <p><b>OR/OF</b></p> $-x^2 + 4x - 3 = 0$ $x^2 - 4x + 3 = 0$ $(x - 3)(x - 1) = 0$ $x = 3 \text{ or } x = 1$ $x = \frac{3+1}{2}$ $x = 2$ $y = -(2)^2 + 4(2) - 3$ $= 1$ $B(2; 1)$	$\checkmark -2x + 4 = 0 \text{ or}$ $x = -\frac{4}{2(-1)}$ $\checkmark y = -(2)^2 + 4(2) - 3$ <p style="text-align: right;">(2)</p> $\checkmark x = \frac{3+1}{2}$ $\checkmark y = -(2)^2 + 4(2) - 3$ <p style="text-align: right;">(2)</p>
5.2	Range/Waardeversameling : $y \leq 1$ <p><b>OR/OF</b></p> Range/Waardeversameling : $y \in (-\infty; 1]$	$\checkmark y \leq 1$ <p style="text-align: right;">(1)</p> $\checkmark (-\infty; 1]$ <p style="text-align: right;">(1)</p>
5.3	$x \leq -1 \text{ or } x > 2$ <p><b>OR/OF</b></p> $(-\infty; -1] \cup (2; \infty)$	$\checkmark \text{critical values}$ $\checkmark x \leq -1 \text{ or } x > 2$ <p style="text-align: right;">(2)</p> $\checkmark \text{critical values}$ $\checkmark x \leq -1 \text{ or } x > 2$ <p style="text-align: right;">(2)</p>
5.4	$(x - p)(y + t) = 3$ Vertical asymptote of $h(x)$ / <i>vertikale asimptoot</i> at $x = 2$ Translation 4 units to the left / <i>Translasie 4 eenhede links</i> $x = 2 - 4 = -2$ is the equation of the vertical asymptote of $h(x + 4)$ $x = 2 - 4 = -2$ is die vergelyking van die vertikale asimptoot <p><b>OR/OF</b></p>	$\checkmark x = -2$ <p style="text-align: right;">(1)</p>

	<p><b>OR/OF</b></p> $h(x) = \frac{3}{x-2+4} + 1$ $= \frac{3}{x+2} + 1$ $x = -2$ <p>is the equation of the vertical asymptote / <i>is die vergelyking van die vertikale asimptoot</i></p>	<p>✓ <math>x = -2</math></p> <p>(1)</p>
5.5	$(x-p)(y+t) = 3$ $(y+t) = \frac{3}{(x-p)}$ $y = \frac{3}{x-p} - t$ <p>B(2;1) Point of intersection of the asymptotes <i>Snypunt van die asimptote</i> <math>p = 2</math> <math>-t = 1</math> <math>t = -1</math></p>	<p>✓ <math>\frac{3}{x-p}</math> ✓ <math>-t</math></p> <p>✓ <math>p = 2</math></p> <p>✓ <math>t = -1</math></p> <p>(4)</p>
5.6	<p><math>x</math>-intercepts of <math>f</math> / <math>x</math>-afsnitte van <math>f</math>: <math>x^2 - 4x + 3 = 0</math> <math>(x-3)(x-1) = 0</math> <math>x = 1</math> or <math>x = 3</math> <math>g'(x) &lt; 0</math> for <math>x \in R; x \neq 2</math> Hence <math>f(x) &lt; 0</math> <math>x \leq 1</math> or <math>x \geq 3</math> <b>OR/OF</b> <math>(-\infty; 1] \cup [3; \infty)</math></p>	<p>✓ both critical values</p> <p>✓ <math>x \leq 1</math> ✓ or ✓ <math>x \geq 3</math></p> <p>(4) <b>[14]</b></p>

**QUESTION/VRAAG 6**

<p>6.1</p>		<p>g:                  ✓ shape: increasing curve                  ✓ (1 ; 0):                  only on log graph</p> <p>f:                  ✓ (3 ; 0)                  ✓ (0 ; 3)</p> <p style="text-align: right;">(4)</p>
<p>6.2</p>	<p><math>y = \log_2 x</math>  <math>g^{-1} : x = \log_2 y</math>  <math>y = 2^x</math></p>	<p>✓ interchange <math>x</math> and <math>y</math>                  ✓ <math>y = 2^x</math></p> <p style="text-align: right;">(2)</p>
<p>6.3</p>	<p><math>\log_2(3 - x) = x</math>  <math>2^x = 3 - x</math>  <math>2^x = -x + 3</math></p> <p>Reflect the graph of <math>g</math> about the line <math>y = x</math> to obtain <math>g^{-1}</math> and determine the point of intersection of <math>f</math> and <math>g^{-1}</math>. / Reflekteer die grafiek van <math>g</math> om die lyn <math>y = x</math> en bepaal die snypunt van <math>f</math> and <math>g^{-1}</math></p>	<p>✓ ✓ <math>2^x = -x + 3</math></p> <p>✓ point of intersection of <math>f</math> and <math>g^{-1}</math></p> <p style="text-align: right;">(3)</p>
<p>6.4</p>	<p><math>x = 1</math></p>	<p>✓ answer (1)</p> <p style="text-align: right;"><b>[10]</b></p>

**QUESTION/VRAAG 7**

7.1	$A = P(1+i)^n$ $= 250000 \left(1 + \frac{0,15}{12}\right)^2$ $= R256\,289,06$	<p>✓ substituting <math>i</math> and <math>n</math> values in correct formula</p> <p>✓ answer</p> <p>(2)</p>
7.2	$P = \frac{x[1 - (1+i)^{-n}]}{i}$ $256\,289,06 = \frac{x \left[1 - \left(1 + \frac{0,15}{12}\right)^{-46}\right]}{\frac{0,15}{12}}$ $3203,6133 = x \left[1 - \left(1 + \frac{0,15}{12}\right)^{-46}\right]$ <p><math>x = R\,7\,359,79</math> per month</p> <p><b>OR/OF</b></p> $250000 = \frac{x \left(1 + \frac{0,15}{12}\right)^{-2} \left[1 - \left(1 + \frac{0,15}{12}\right)^{-46}\right]}{\frac{0,15}{12}}$ <p><math>x = R\,7\,359,79</math></p>	<p>✓ <math>i = \frac{0,15}{12}</math></p> <p>✓ <math>n = 46</math></p> <p>✓ substitution into correct formula</p> <p>✓ answer</p> <p>(4)</p> <p>✓ <math>i = \frac{0,15}{12}</math></p> <p>✓ <math>n = 46</math></p> <p>✓ substitution into correct formula</p> <p>✓ answer</p> <p>(4)</p>
7.3	$256\,289,06 = \frac{9\,000 \left[1 - \left(1 + \frac{0,15}{12}\right)^{-n}\right]}{\frac{0,15}{12}}$ $\left(1 + \frac{0,15}{12}\right)^{-n} = 0,6440429722$ $-n \log \left(1 + \frac{0,15}{12}\right) = \log 0,6440429722$ <p><math>n = 35,41872568</math> months/ <i>maande</i></p> <p><math>\therefore</math> 36 payments are required</p> <p><math>\therefore</math> 36 <i>paaiemente moet betaal word</i></p> <p><math>\therefore</math> Thabiso will pay his loan off 10 months sooner./Thabiso <i>los sy lening 10 maande vroeër af.</i></p> <p><b>OR/OF</b></p>	<p>✓ <math>x = 9\,000</math></p> <p>✓ substitute into correct formula</p> <p>✓ use of logs</p> <p>✓ <math>n = 35,42</math></p> <p>✓ 10 months</p> <p>(5)</p>

	$256289,06 \left(1 + \frac{0,15}{12}\right)^n = \frac{9000 \left[ \left(1 + \frac{0,15}{12}\right)^n - 1 \right]}{\frac{0,15}{12}}$ $3203,61325 \left(1 + \frac{0,15}{12}\right)^n = 9000 \left(1 + \frac{0,15}{12}\right)^n - 9000$ $9000 = 5796,38675 \left(1 + \frac{0,15}{12}\right)^n$ $n = \log_{\left(1 + \frac{0,15}{12}\right)} 1,5523691425$ $n = 35,41872568$ <p>∴ 36 payments are required ∴ 36 <i>paaiemente moet betaal word</i> ∴ Thabiso will pay his loan off 10 months sooner./Thabiso <i>los sy lening 10 maande vroeër af.</i></p>	<p>✓ 9 000</p> <p>✓ substitute into correct formula</p> <p>✓ use of logs</p> <p>✓ <math>n = 35,42</math></p> <p>✓ 10 months</p> <p>(5)</p>
<p>7.4</p>	<p>The balance of his loan after the 35<sup>th</sup> payment was made: <i>Die balans van sy lening nadat die 35<sup>ste</sup> paaiement betaal is:</i></p> $\text{Balance} = 256289,06 \left(1 + \frac{0,15}{12}\right)^{35} - \frac{9000 \left[ \left(1 + \frac{0,15}{12}\right)^{35} - 1 \right]}{\frac{0,15}{12}}$ $= \text{R } 3\,735,45$ <p>Final instalment = <math>3\,735,45 \left(1 + \frac{0,15}{12}\right)</math> = R 3 782,14</p> <p><b>OR/OF</b></p> $P = \frac{x[1 - (1 + i)^{-n}]}{i}$ <p>Final instalment</p> $= \frac{9\,000 \left[ 1 - \left(1 + \frac{0,15}{12}\right)^{-0,41872568} \right]}{\frac{0,15}{12}} \left(1 + \frac{0,15}{12}\right)$ $= \text{R } 3\,782,14$ <p><b>OR/OF</b></p>	<p>✓ <math>256289,06 \left(1 + \frac{0,15}{12}\right)^{35}</math></p> <p>✓ <math>\frac{9000 \left[ \left(1 + \frac{0,15}{12}\right)^{35} - 1 \right]}{\frac{0,15}{12}}</math></p> <p>✓ <math>3\,735,45 \left(1 + \frac{0,15}{12}\right)</math></p> <p>✓ answer</p> <p>(4)</p> <p>✓ 0,41872568</p> <p>✓ <math>\frac{9\,000 \left[ 1 - \left(1 + \frac{0,15}{12}\right)^{-0,41872568} \right]}{\frac{0,15}{12}}</math></p> <p>✓ <math>\times \left(1 + \frac{0,15}{12}\right)</math></p> <p>✓ answer</p> <p>(4)</p>

	$\text{Balance} = 256289,06 \left(1 + \frac{0,15}{12}\right)^{36} - \frac{9000 \left( \left(1 + \frac{0,15}{12}\right)^{36} - 1 \right)}{\frac{0,15}{12}}$ $= \text{R } -5\,217,86$ $\text{Final payment} = 9\,000 - 5217,86$ $= \text{R } 3\,782,14$	$\checkmark 256289,06 \left(1 + \frac{0,15}{12}\right)^{36}$ $\checkmark \frac{9000 \left( \left(1 + \frac{0,15}{12}\right)^{36} - 1 \right)}{\frac{0,15}{12}}$ $\checkmark 9\,000 - 5217,86$ $\checkmark \text{answer}$
		(4)
		<b>[15]</b>

**QUESTION/VRAAG 8**

8.1	$f(x+h) = 3(x+h)^2$ $= 3(x^2 + 2xh + h^2)$ $= 3x^2 + 6xh + 3h^2$ $f(x+h) - f(x) = 3x^2 + 6xh + 3h^2 - 3x^2$ $= 6xh + 3h^2$ $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $= \lim_{h \rightarrow 0} \frac{6xh + 3h^2}{h}$ $= \lim_{h \rightarrow 0} \frac{h(6x + 3h)}{h}$ $= \lim_{h \rightarrow 0} (6x + 3h)$ $= 6x$ <b>OR/OF</b> $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $= \lim_{h \rightarrow 0} \frac{3(x+h)^2 - 3x^2}{h}$ $= \lim_{h \rightarrow 0} \frac{3x^2 + 6xh + 3h^2 - 3x^2}{h}$ $= \lim_{h \rightarrow 0} \frac{6xh + 3h^2}{h}$ $= \lim_{h \rightarrow 0} \frac{h(6x + 3h)}{h}$ $= \lim_{h \rightarrow 0} (6x + 3h)$ $= 6x$	$\checkmark 3(x+h)^2$  $\checkmark 6xh + 3h^2$  $\checkmark f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$  $\checkmark \lim_{h \rightarrow 0} (6x + 3h)$  $\checkmark 6x$
		(5)
		(5)

<p>8.2</p>	$\lim_{h \rightarrow 0} \frac{\sqrt{4+h} - 2}{h}$ $g(x) = \sqrt{x}$ $a = 4$	<p>✓ answer ✓ answer</p> <p>(2)</p>
<p>8.3</p>	$y = \sqrt{x^3} - \frac{5}{x^3}$ $y = x^{\frac{3}{2}} - 5x^{-3}$ $\frac{dy}{dx} = \frac{3}{2}x^{\frac{1}{2}} + 15x^{-4}$	<p>✓ <math>x^{\frac{3}{2}}</math> ✓ <math>-5x^{-3}</math> ✓ <math>\frac{3}{2}x^{\frac{1}{2}}</math> ✓ <math>15x^{-4}</math></p> <p>(4)</p>
<p>8.4</p>	$f(x) = x^3 + ax^2 + bx + 18$ $f'(x) = 3x^2 + 2ax + b$ <p>At <math>x = 1</math>, <math>m_{\text{tan}} = -8</math></p> $f'(1) = -8$ $3(1)^2 + 2a(1) + b = -8$ $3 + 2a + b = -8$ $2a + b = -11 \dots\dots(1)$ $y = f(1)$ $= g(1)$ $= -8(1) + 20$ $= 12$ $1 + a + b + 18 = 12$ $a + b = -7 \dots\dots(2)$ $a = -4$ $b = -3$	<p>✓ <math>3x^2 + 2ax + b</math></p> <p>✓ <math>f'(1) = -8</math> or <math>3(1)^2 + 2a(1) + b = -8</math></p> <p>✓ <math>1 + a + b + 18 = 12</math></p> <p>✓ <math>a = -4</math> ✓ <math>b = -3</math></p> <p>(5) <b>[16]</b></p>



**QUESTION/VRAAG 9**

9.1	$f'(x) = 3x^2 + 8x - 3 = 0$ $(3x - 1)(x + 3) = 0$ $x = \frac{1}{3} \quad \text{or} \quad x = -3$	✓ equating derivative to zero ✓ factors ✓ x – values (3)
9.2	$f''(x) = 6x + 8$ $6x + 8 < 0$ $x < -\frac{4}{3}$ <p><b>OR</b></p> $x = \frac{\frac{1}{3} - 3}{2}$ $= \frac{4}{3}$ $\therefore x < -\frac{4}{3}$	✓ $6x + 8$ ✓✓ $x < -\frac{4}{3}$ ✓ $\frac{\frac{1}{3} - 3}{2}$ ✓✓ $x < -\frac{4}{3}$ (3)
9.3	$x \leq -3 \quad \text{or} \quad x \geq \frac{1}{3}$ <p><b>OR/OF</b></p> $[-\infty; -3] \cup \left[\frac{1}{3}; \infty\right]$	✓ $x \leq -3$ ✓ $x \geq \frac{1}{3}$ ✓ $[-\infty; -3]$ ✓ $\left[\frac{1}{3}; \infty\right]$ (2) (2)
9.4	$f(0) = -18$ $d = -18$ $f(x) = ax^3 + bx^2 + cx - 18$ $f'(x) = 3ax^2 + 2bx + c$ $f'(x) = 3x^2 + 8x - 3$ $3a = 3 \quad 2b = 8$ $a = 1 \quad b = 4 \quad c = -3$ $f(x) = x^3 + 4x^2 - 3x - 18$ <p><b>OR/OF</b></p> $f'(x) = 3x^2 + 8x - 3$ <p>By integration/<i>Deur integrasie</i></p> $f(x) = x^3 + 4x^2 - 3x + d$ $f(0) = d = -18$ $a = 1$ $b = 4$ $c = -3$	✓ $d = -18$ ✓ $f'(x) = 3ax^2 + 2bx + c$ ✓ $a = 1$ ✓ $b = 4$ ✓ $c = -3$ (5) ✓ $f(x) = x^3 + 4x^2 - 3x + d$ ✓ $d = -18$ ✓ $a = 1$ ✓ $b = 4$ ✓ $c = -3$ (5)
		[13]

**QUESTION/VRAAG 10**

10.1	$M(t) = -t^3 + 3t^2 + 72t$ $M(3) = -(3)^3 + 3(3)^2 + 72(3)$ $= 216$ <p>216 molecules/molekules</p>	$\checkmark M(3) = -(3)^3 + 3(3)^2 + 72(3)$ $\checkmark 216$ <p style="text-align: right;">(2)</p>
10.2	$M(t) = -t^3 + 3t^2 + 72t$ $M'(t) = -3t^2 + 6t + 72$ $M'(2) = -3(2)^2 + 6(2) + 72$ $= 72$ <p>72 molecules per hour/molekules per uur</p>	$\checkmark M'(t) = -3t^2 + 6t + 72$ $\checkmark M'(2)$ $\checkmark 72$ <p style="text-align: right;">(3)</p>
10.3	$M(t) = -t^3 + 3t^2 + 72t$ $M'(t) = -3t^2 + 6t + 72$ $M''(t) = 0$ $-6t + 6 = 0$ $t = 1$ <p>Maximum rate of change of the number of molecules of the drug in the bloodstream is after 1 hour./Maksimum tempo van verandering van die getal molekules in die bloedstroom is na 1 uur</p>	$\checkmark M''(t)$ $\checkmark M''(t) = 0$ $\checkmark \text{answer}$ <p style="text-align: right;">(3) <b>[8]</b></p>

**QUESTION/VRAAG 11**

11.1	<table border="1" data-bbox="252 331 1114 577"> <thead> <tr> <th></th> <th>Watches TV during exams</th> <th>Do not watch TV during exams</th> <th>Total</th> </tr> </thead> <tbody> <tr> <td>Male</td> <td>80</td> <td><math>a</math></td> <td><math>80+a</math></td> </tr> <tr> <td>Female</td> <td>48</td> <td>12</td> <td>60</td> </tr> <tr> <td>Total</td> <td><math>b</math></td> <td>32</td> <td>160</td> </tr> </tbody> </table> <p data-bbox="252 584 400 613"><math>a + 12 = 32</math></p> <p data-bbox="316 629 400 658"><math>a = 20</math></p> <p data-bbox="316 674 459 752"><math>b = 80 + 48</math> <math>= 128</math></p>		Watches TV during exams	Do not watch TV during exams	Total	Male	80	$a$	$80+a$	Female	48	12	60	Total	$b$	32	160	<p data-bbox="1142 629 1254 658">✓ <math>a = 20</math></p> <p data-bbox="1142 696 1270 725">✓ <math>b = 128</math></p> <p data-bbox="1382 741 1425 770">(2)</p>
	Watches TV during exams	Do not watch TV during exams	Total															
Male	80	$a$	$80+a$															
Female	48	12	60															
Total	$b$	32	160															
11.2	<p data-bbox="252 779 296 808">No</p> <p data-bbox="252 815 759 893"><math>P(\text{M and not watching TV}) = \frac{20}{160} \neq 0</math></p>	<p data-bbox="1142 779 1209 808">✓ No</p> <p data-bbox="1142 846 1254 875">✓ reason</p> <p data-bbox="1382 891 1425 920">(2)</p>																
11.3.1	<p data-bbox="252 927 759 1005"><math>P(\text{watching TV}) = \frac{128}{160} = \frac{4}{5} = 0,8 = 80\%</math></p>	<p data-bbox="1142 927 1222 956">✓ 128</p> <p data-bbox="1142 965 1222 994">✓ 160</p> <p data-bbox="1382 1005 1425 1034">(2)</p>																
11.3.2	<p data-bbox="252 1050 1011 1128"><math>P(\text{female and not watching TV}) = \frac{12}{160} = \frac{3}{40} = 0,075 = 7,5\%</math></p>	<p data-bbox="1142 1084 1209 1113">✓ 12</p> <p data-bbox="1142 1122 1222 1151">✓ 160</p> <p data-bbox="1382 1167 1425 1196">(2)</p> <p data-bbox="1382 1205 1425 1234"><b>[8]</b></p>																

**QUESTION/VRAAG 12**

<p>12. We want to create codes that are even numbers greater than 5000. The digit 6 can be used in one of two places in these codes and therefore this presents two scenarios. <i>Ons wil kodes kry wat ewe getalle groter as 5000 is. Die syfer 6 kan in twee posisies in die kode gebruik word en twee opsies is moontlik:</i></p> <p>CASE 1: The first digit is a 6./<i>Die eerste syfer is 'n 6.</i></p> $\begin{array}{ccccccc} & & & & & & 2 \\ & & & & & & 4 \\ 6 & & & & & & \\ \hline 1 & \times & 5 & \times & 4 & \times & 2 \\ \hline \end{array}$ <p>Number of codes starting with 6./<i>Getal kodes wat met 6 begin.</i> <math>= 1 \times 5 \times 4 \times 2 = 40</math></p> <p>CASE 2: The first digit is a 5 or 7./<i>Die eerste syfer is 'n 5 of 7.</i></p> $\begin{array}{ccccccc} & & & & & & 2 \\ & & & & & & 4 \\ 5 & & & & & & 6 \\ 7 & & & & & & \\ \hline 2 & \times & 5 & \times & 4 & \times & 3 \\ \hline \end{array}$ <p>Number of codes not starting with 6./<i>Getal kodes wat nie met 6 begin</i> <math>= 2 \times 5 \times 4 \times 3 = 120</math></p> <p>Therefore total number of possible codes./<i>Die totale getal moontlike kodes</i> <math>= 40 + 120 = 160.</math></p> <p><b>OR/OF</b></p> $\begin{aligned} & (3 \times 5 \times 4 \times 1) + (3 \times 5 \times 4 \times 1) + (2 \times 5 \times 4 \times 1) \\ & = 60 + 60 + 40 \\ & = 160 \end{aligned}$ <p><b>OR/OF</b></p> $\begin{aligned} & (3 \times 5 \times 4 \times 3) - (1 \times 5 \times 4 \times 1) \\ & = 180 - 20 \\ & = 160 \end{aligned}$	<p>✓ <math>1 \times 5 \times 4 \times 2</math> ✓ 40</p> <p>✓ <math>2 \times 5 \times 4 \times 3</math> ✓ 120 ✓ 160</p> <p>[5]</p> <p>✓ <math>(3 \times 5 \times 4 \times 1)</math> ✓ <math>(3 \times 5 \times 4 \times 1)</math> ✓ <math>(2 \times 5 \times 4 \times 1)</math> ✓✓ 160</p> <p>[5]</p> <p>✓✓ <math>(3 \times 5 \times 4 \times 3)</math> ✓✓ <math>(1 \times 5 \times 4 \times 1)</math> ✓ 160</p> <p>[5]</p>
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**TOTAL/TOTAAL: 150**