



# basic education

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

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

**GRADE 12/*GRAAD 12***

**MATHEMATICS P1/*WISKUNDE V1***

**NOVEMBER 2017**

**MARKING GUIDELINES/*NASIENRIGLYNE***

**MARKS/*PUNTE*: 150**

**This memorandum consists of 22 pages.  
*Hierdie memorandum bestaan uit 22 bladsye.***

**NOTE:**

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

**LET WEL:**

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

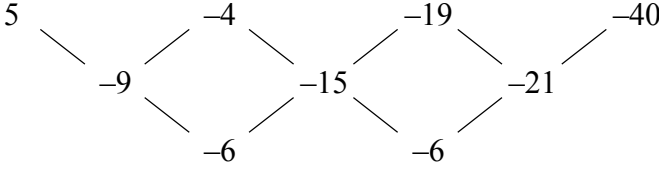
**QUESTION/VRAAG 1**

1.1.1	$x^2 + 9x + 14 = 0$ $(x + 7)(x + 2) = 0$ $x = -7 \text{ or } x = -2$	✓ factors ✓ $x = -7$ ✓ $x = -2$ (3)
1.1.2	$4x^2 + 9x - 3 = 0$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $= \frac{-9 \pm \sqrt{9^2 - 4(4)(-3)}}{2(4)}$ $= \frac{-9 \pm \sqrt{129}}{8}$ $x = 0,29 \text{ or } x = -2,54$ <p><b>OR/OF</b></p> $x^2 + \frac{9}{4}x + \frac{81}{64} = \frac{3}{4} + \frac{81}{64}$ $\left(x + \frac{9}{8}\right)^2 = \frac{129}{64}$ $x + \frac{9}{8} = \pm \frac{\sqrt{129}}{8}$ $x = \frac{-9 \pm \sqrt{129}}{8}$ $x = 0,29 \text{ or } x = -2,54$	✓ substitution  ✓ simplification ✓ $x = 0,29$ ✓ $x = -2,54$  <b>OR/OF</b>  ✓ for adding $\frac{81}{64}$ on both sides  ✓ simplification  ✓ $x = 0,29$ ✓ $x = -2,54$ (4)
1.1.3	$\sqrt{x^2 - 5} = 2\sqrt{x}$ $x^2 - 5 = 4x$ $x^2 - 4x - 5 = 0$ $(x - 5)(x + 1) = 0$ $x = 5 \text{ or } x = -1$ $x = 5$	✓ $x^2 - 5 = 4x$  ✓ standard form ✓ both answers  ✓ select $x = 5$ (4)

<p>1.2</p>	$3x - y = 4$ $y = 3x - 4$ $x^2 + 2xy - y^2 = -2$ $x^2 + 2x(3x - 4) - (3x - 4)^2 = -2$ $x^2 + 6x^2 - 8x - (9x^2 - 24x + 16) = -2$ $7x^2 - 8x - 9x^2 + 24x - 16 = -2$ $-2x^2 + 16x - 14 = 0$ $x^2 - 8x + 7 = 0$ $(x - 7)(x - 1) = 0$ $x = 1 \quad \text{or} \quad x = 7$ $y = 3(1) - 4 \quad y = 3(7) - 4$ $y = -1 \quad \text{or} \quad y = 17$ <p><b>OR/OF</b></p> $3x - y = 4$ $x = \frac{y + 4}{3}$ $x^2 + 2xy - y^2 = -2$ $x^2 + 2xy - y^2 = -2$ $\left(\frac{y + 4}{3}\right)^2 + 2\left(\frac{y + 4}{3}\right)y - y^2 = -2$ $y^2 + 8y + 16 + 6y^2 + 24y - 9y^2 = -18$ $-2y^2 + 32y + 34 = 0$ $y^2 - 16y - 17 = 0$ $(y - 17)(y + 1) = 0$ $y = -1 \quad \text{or} \quad y = 17$ $x = \frac{-1 + 4}{3} \quad x = \frac{17 + 4}{3}$ $x = 1 \quad \text{or} \quad x = 7$	<p>✓ y subject of formula</p> <p>✓ substitution</p> <p>✓ correct standard form</p> <p>✓ factors</p> <p>✓ x-values</p> <p>✓ y-values</p> <p><b>OR/OF</b></p> <p>✓ x subject of formula</p> <p>✓ substitution</p> <p>✓ correct standard form</p> <p>✓ factors</p> <p>✓ y-values</p> <p>✓ x-values</p> <p>(6)</p>
<p>1.3.1</p>	$x^2 + 8x + 16 > 0$ $(x + 4)(x + 4) > 0$ $x \in R, x \neq -4 \quad \text{or}$ $x \in (-\infty; -4) \quad \text{or} \quad x \in (-4; \infty) \quad \text{or}$ $x < -4 \quad \text{or} \quad x > -4$ <p><b>OR/OF</b></p> $x^2 + 8x + 16 > 0$ $(x + 4)(x + 4) > 0$ <div style="text-align: center;"> <p style="text-align: center;">← +   + → -4</p> </div> <p>The function values remain positive</p> $x \in R, x \neq -4$	<p>✓ <math>(x + 4)(x + 4)</math></p> <p>✓✓ any one of the solutions</p> <p><b>OR/OF</b></p> <p>✓ <math>(x + 4)(x + 4)</math></p> <p>✓✓ any one of the solutions</p> <p>(3)</p>

<p>1.3.2</p>	<p>For two negative unequal roots:  <math>0 &lt; p &lt; 16</math></p> <p><b>OR/OF</b></p> $x^2 + 8x + 16 = p$ $x^2 + 8x + 16 - p = 0$ $0 < 16 - p < 16$ $-16 < -p < 0$ $0 < p < 16$ <p><b>OR/OF</b></p> $x^2 + 8x + 16 - p = 0$ $x = \frac{-8 \pm \sqrt{64 - 4(16 - p)}}{2}$ $0 < 64 - 4(16 - p) < 64$ $0 < 4p < 64$ $0 < p < 16$ <p><b>OR/OF</b></p> $x^2 + 8x + 16 = p$ $x^2 + 8x + 16 - p = 0$ <p>Roots are real and unequal:</p> $8^2 - 4(16 - p) > 0$ $4p > 0$ $p > 0$ <p>Roots are: <math>\frac{-8 \pm \sqrt{4p}}{2}</math></p> <p>For both roots to be negative:</p> $\sqrt{4p} < 8$ $4p < 64$ $p < 16$ $0 < p < 16$	<p>✓ 0                  ✓ 16</p> <p>✓ ✓ <math>0 &lt; p &lt; 16</math> (4)</p> <p><b>OR/OF</b></p> <p>✓ 0                  ✓ 16</p> <p>✓ ✓ <math>0 &lt; p &lt; 16</math> (4)</p> <p>✓ 0                  ✓ 16</p> <p>✓ ✓ <math>0 &lt; p &lt; 16</math> (4)</p> <p>✓ 0                  ✓ 16</p> <p>✓ ✓ <math>0 &lt; p &lt; 16</math> (4)</p> <p>✓ 0                  ✓ 16</p> <p>✓ ✓ <math>0 &lt; p &lt; 16</math> (4)</p> <p><b>[24]</b></p>
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**QUESTION/VRAAG 2**

<p>2.1.1</p>	 <p>first differences: <math>-9; -15; -21</math> second difference = <math>-6</math></p>	<p>✓ first differences ✓ <math>-6</math></p> <p style="text-align: right;">(2)</p>
<p>2.1.2</p>	$T_n = an^2 + bn + c$ $a = \frac{\text{second difference}}{2} = -3$ $3a + b = -9$ $3(-3) + b = -9$ $b = 0$ $a + b + c = 5$ $-3 + 0 + c = 5$ $c = 8$ $T_n = -3n^2 + 8$ <p><b>OR/OF</b></p> $T_n = T_1 + (n-1)d_1 + \frac{(n-1)(n-2)d_2}{2}$ $= 5 + (n-1)(-9) + \frac{(n-1)(n-2)(-6)}{2}$ $= 5 - 9n + 9 - 3n^2 + 9n - 6$ $T_n = -3n^2 + 8$	<p>✓ <math>a = -3</math></p> <p>✓ <math>b = 0</math></p> <p>✓ <math>c = 8</math></p> <p>✓ <math>T_n = -3n^2 + 8</math></p> <p><b>OR/OF</b></p> <p>✓ <math>a = -3</math> ✓ <math>b = 0</math> ✓ <math>c = 8</math> ✓ <math>T_n = -3n^2 + 8</math></p> <p style="text-align: right;">(4)</p>
<p>2.1.3</p>	$-3n^2 + 8 = -25\ 939$ $-3n^2 = -25947$ $n^2 = 8649$ $n = -93 \text{ or } n = 93$ <p>The 93<sup>rd</sup> term has a value of <math>-25\ 939</math></p>	<p>✓ <math>T_n = -25\ 939</math></p> <p>✓ <math>n^2 = 8649</math> ✓ answer</p> <p style="text-align: right;">(3)</p>

<p>2.2.1</p>	<p><math>2k - 7 ; k + 8</math> and <math>2k - 1</math>  <math>k + 8 - (2k - 7) = 2k - 1 - (k + 8)</math>  <math>-k + 15 = k - 9</math>  <math>2k = 24</math>  <math>k = 12</math>  <math>2k - 7 ; k + 8</math> and <math>2k - 1</math>  <math>17 ; 20 ; 23 \dots\dots</math>  <math>d = 3</math>  <math>T_{15} = 17 + 14(3)</math>  <math>= 59</math></p>	<p>✓  <math>k + 8 - (2k - 7) = 2k - 1 - (k + 8)</math>                   ✓ <math>k = 12</math>                   ✓ 17                  ✓ <math>d = 3</math>                   ✓ <math>T_{15} = 59</math>                   (5)</p>
<p>2.2.2</p>	<p>Sequence is <math>17 ; 20 ; 23 ; 26 ; 29 ; 32 \dots\dots</math>                  Every alternate term of the sequence will be even /  <i>Elke tweede term van die ry sal ewe wees</i>  <math>20 + 26 + 32 + \dots\dots</math>  <math>S_{30} = \frac{30}{2} [2(20) + (29)(6)]</math>  <math>= 15[40 + 174]</math>  <math>= 3210</math>   <b>OR/OF</b>  <math>T_{30} = 20 + 29(6)</math>  <math>= 94</math>   <math>S_{30} = \frac{30}{2} (20 + 194)</math>  <math>= 3210</math></p>	<p>✓ <math>20 + 26 + 32 + \dots\dots</math>                   ✓ <math>a = 20 \quad d = 6</math>                  ✓ subst into correct formula                   ✓ answer                   (4)                   ✓ <math>a = 20 \quad d = 6</math>                   ✓ <math>T_{30} = 94</math>                  ✓ <math>S_{30} = \frac{30}{2} (20 + 194)</math>                  ✓ answer                   (4)   <b>[18]</b></p>

**QUESTION/VRAAG 3**

3.1	$a + ar = 2$ $a(1+r) = 2$ $a = \frac{2}{1+r}$ <p><b>OR/OF</b></p> $\frac{a}{1-r} - 2 = \frac{1}{4}$ $4a - 8(1-r) = 1-r$ $4a - 8 + 8r = 1-r$ $4a = 9 - 9r$ $a = \frac{9-9r}{4}$ <p><b>OR/OF</b></p> $S_n = \frac{a(r^n - 1)}{r - 1}$ $2 = \frac{a(r^2 - 1)}{r - 1}$ $2 = \frac{a(r-1)(r+1)}{r-1}$ $2 = a(r+1)$ $a = \frac{2}{r+1}$ <p><b>OR/OF</b></p> $\frac{ar^2}{1-r} = \frac{1}{4}$ $a = \frac{1-r}{4r^2}$	$\checkmark a + ar = 2$ $\checkmark a = \frac{2}{1+r} \quad (2)$ $\checkmark \frac{a}{1-r} - 2 = \frac{1}{4}$ $\checkmark a = \frac{9-9r}{4} \quad (2)$ <p><b>OR/OF</b></p> $\checkmark 2 = \frac{a(r^2 - 1)}{r - 1}$ $\checkmark a = \frac{2}{r+1} \quad (2)$ <p><b>OR/OF</b></p> $\checkmark \frac{ar^2}{1-r} = \frac{1}{4}$ $\checkmark a = \frac{1-r}{4r^2} \quad (2)$
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<p>3.2</p>	$S_{\infty} = T_1 + T_2 + \sum_{n=3}^{\infty} T_n$ $S_{\infty} = 2 + \frac{1}{4}$ $\frac{a}{1-r} = 2 + \frac{1}{4}$ $\frac{a}{1-r} = \frac{9}{4}$ $\left(\frac{2}{1+r}\right) \times \left(\frac{1}{1-r}\right) = \frac{9}{4}$ $\frac{2}{1-r^2} = \frac{9}{4}$ $8 = 9 - 9r^2$ $9r^2 = 1$ $r = \frac{1}{3}$ $a = \frac{3}{2}$ <p><b>OR/OF</b></p> $S_{\infty} = T_1 + T_2 + \sum_{n=3}^{\infty} T_n$ $S_{\infty} = 2 + \frac{1}{4}$ $\frac{a}{1-r} = 2 + \frac{1}{4}$ $\frac{a}{1-r} = \frac{9}{4}$ $4a = 9 - 9r$ $r = \frac{9-4a}{9}$ $a + a\left(\frac{9-4a}{9}\right) = 2$ $9a + 9a - 4a^2 = 18$ $2a^2 - 9a + 9 = 0$ $(a-3)(2a-3) = 0$ $a = \frac{3}{2} \text{ or } a = 3$ $r = \frac{1}{3} \text{ or } r = -\frac{1}{3}$ <p style="text-align: center;">N/A</p>	$\checkmark S_{\infty} = 2 + \frac{1}{4}$ $\checkmark \frac{a}{1-r} = \frac{9}{4}$ <p><math>\checkmark</math> substitution of <math>a</math> into the correct formula</p> $\checkmark 9r^2 = 1$ $\checkmark r = \frac{1}{3}$ $\checkmark a = \frac{3}{2}$ <p style="text-align: right;">(6)</p> <p><b>OR/OF</b></p> $\checkmark S_{\infty} = 2 + \frac{1}{4}$ $\checkmark \frac{a}{1-r} = \frac{9}{4}$ $\checkmark r = \frac{9-4a}{9}$ <p><math>\checkmark</math> substitution of <math>a</math> into the correct formula</p> $\checkmark a = \frac{3}{2}$
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<p><b>OR/OF</b></p> $r = \frac{2-a}{a}$ $\frac{ar^2}{1-r} = \frac{1}{4}$ $4ar^2 = 1-r$ $4a\left(\frac{2-a}{a}\right)^2 = 1 - \frac{2-a}{a}$ $16-16a+4a^2 = 2a+2$ $2a^2 - 9a + 9 = 0$ $(2a-3)(a-3) = 0$ $a = \frac{3}{2} \quad a \neq 3$ $r = \frac{1}{3} \quad r \neq -\frac{1}{3}$	<p>✓ <math>r = \frac{1}{3}</math></p> <p>(6)</p> <p><b>OR/OF</b></p> <p>✓ <math>r = \frac{2-a}{a}</math></p> <p>✓ <math>\frac{ar^2}{1-r} = \frac{1}{4}</math></p> <p>✓ substitution of <math>a</math></p> <p>✓ <math>(2a-3)(a-3) = 0</math></p> <p>✓ <math>a = \frac{3}{2}</math></p> <p>✓ <math>r = \frac{1}{3}</math></p>
<p><b>OR/OF</b></p> $S_{\infty} = T_1 + T_2 + \sum_{n=3}^{\infty} T_n$ $S_{\infty} = 2 + \frac{1}{4}$ $\frac{a}{1-r} = 2 + \frac{1}{4}$ $\frac{a}{1-r} = \frac{9}{4}$ $\left(\frac{1-r}{4r^2}\right) \times \left(\frac{1}{1-r}\right) = \frac{9}{4}$ $\frac{1}{4r^2} = \frac{9}{4}$ $4 = 36r^2$ $9r^2 = 1$ $r = \frac{1}{3}$ $a = \frac{3}{2}$	<p><b>OR/OF</b></p> <p>(6)</p> <p>✓ <math>S_{\infty} = 2 + \frac{1}{4}</math></p> <p>✓ <math>\frac{a}{1-r} = \frac{9}{4}</math></p> <p>✓ substitution of <math>a</math></p> <p>✓ <math>9r^2 = 1</math></p> <p>✓ <math>r = \frac{1}{3}</math></p> <p>✓ <math>a = \frac{3}{2}</math></p> <p>(6)</p>

[8]

**QUESTION/VRAAG 4**

<p>4.1</p>	$f(x) = -ax^2 + bx + 6$ $f'(x) = -2ax + b$ $-2ax + b = 3$ <p>at <math>x = -1</math></p> $2a + b = 3 \quad [1]$ $f(-1) = \frac{7}{2}$ $-a - b + 6 = \frac{7}{2}$ $-2a - 2b + 12 = 7$ $2a + 2b = 5 \quad [2]$ $[2] - [1]$ $b = 2$ $2a + 2 = 3$ $a = \frac{1}{2}$ <p><b>OR/OF</b></p> $f'(x) = -2ax + b$ $3 = 2a + b$ $b = 3 - 2a$ $\frac{7}{2} = -a(-1)^2 + (3 - 2a)(-1) + 6$ $a + 3 = \frac{7}{2}$ $a = \frac{1}{2}$ $b = 2$	$\checkmark -2ax + b$ $\checkmark \checkmark 2a + b = 3$ $\checkmark -a - b + 6 = \frac{7}{2}$ $\checkmark \text{solve simultaneously}$ <p style="text-align: right;">(5)</p> $\checkmark -2ax + b$ $\checkmark \checkmark 2a + b = 3$ $\checkmark$ $\frac{7}{2} = -a(-1)^2 + (3 - 2a)(-1) + 6$ $\checkmark \text{solve simultaneously}$ <p style="text-align: right;">(5)</p>
<p>4.2</p>	$f(x) = -\frac{1}{2}x^2 + 2x + 6$ <p><math>x</math> – intercepts :</p> $-\frac{1}{2}x^2 + 2x + 6 = 0$ $-x^2 + 4x + 12 = 0$ $x^2 - 4x - 12 = 0$ $(x - 6)(x + 2) = 0$ $(-2 ; 0) \quad (6 ; 0)$	$\checkmark -\frac{1}{2}x^2 + 2x + 6 = 0$ $\checkmark (-2 ; 0)$ $\checkmark (6 ; 0)$ <p style="text-align: right;">(3)</p>

<p>4.3</p>	$f(x) = -\frac{1}{2}x^2 + 2x + 6$ $f'(x) = 0 \quad \text{or} \quad x = -\frac{b}{2a} \quad \text{or} \quad x = \frac{-2+6}{2}$ $-x + 2 = 0 \quad \quad \quad x = -\frac{2}{2 \cdot \left(-\frac{1}{2}\right)} \quad \quad \quad x = 2$ $x = 2 \quad \quad \quad x = 2$ $y = -\frac{1}{2}(2)^2 + 2(2) + 6$ $= -2 + 4 + 6$ $= 8$ <p>TP (2;8)</p> <p><b>OR/OF</b></p> $y = -\frac{1}{2}(x^2 - 4x - 12)$ $= -\frac{1}{2}[(x-2)^2 - 4 - 12]$ $= -\frac{1}{2}(x-2)^2 + 8$ <p>TP (2;8)</p>	$\checkmark -x + 2 \quad / \quad -\frac{2}{2 \cdot \left(-\frac{1}{2}\right)} \quad /$ $\frac{-2+6}{2}$ $\checkmark x = 2$ $\checkmark y = 8$ <p><b>OR/OF</b></p> $\checkmark -\frac{1}{2}(x-2)^2 + 8$ $\checkmark x = 2$ $\checkmark y = 8$ <p>(3)</p>
<p>4.4 4.6</p>		<p>4.4: f:  <math>\checkmark</math> shape  <math>\checkmark</math> x- intercepts  <math>\checkmark</math> y- intercept  <math>\checkmark</math> (2; 8)</p> <p>(4)</p> <p>4.6: g:  <math>\checkmark</math> x- intercept  <math>\checkmark</math> y- intercept</p> <p>(2)</p>
<p>4.5</p>	<p><math>0 &lt; x &lt; 4</math> or (0; 4)</p>	<p><math>\checkmark 4</math>  <math>\checkmark \checkmark 0 &lt; x &lt; 4</math></p> <p>(3)</p>
<p>4.7</p>	<p><math>x \leq -2</math> or <math>-1 \leq x \leq 6</math></p> <p><b>OR/OF</b></p> <p><math>(-\infty ; -2]</math> or <math>[-1; 6]</math></p>	<p><math>\checkmark x \leq -2</math>  <math>\checkmark \checkmark -1 \leq x \leq 6</math></p> <p>(3) [23]</p>

**QUESTION/VRAAG 5**

5.1	$y \in \mathbb{R}; y \neq -1$ <b>OR/OF</b> $y < -1$ or $y > -1$ <b>OR/OF</b> $y \in (-\infty; -1)$ or $y \in (-1; \infty)$ <b>OR/OF</b> $\mathbb{R} - \{-1\}$	✓✓ answer     (2)
5.2	$D(2; -1)$ $g(x) = \frac{2}{x-2} - 1$	✓ $D(2; -1)$ ✓ $\frac{2}{x-2} - 1$ (2)
5.3	$f(x) = \log_3 x.$ $\log_3 t = 1$ <b>OR/OF</b> $g(x) = \frac{2}{x-2} - 1$ $t = 3$  $1 = \frac{2}{t-2} - 1$ $2 = \frac{2}{t-2}$ $2t - 4 = 2$ $t = 3$	✓ correct substitution of A ✓✓ $t = 3$     (3)
5.4	$x = \log_3 y$ $y = 3^x$	✓ interchange $x$ and $y$ ✓ $y = 3^x$ (2)
5.5	$3^x < 3^1$ $x < 1$  <b>OR/OF</b> $3^x < 3^1$ $x \in (-\infty; 1)$	✓ $3^x < 3^1$ ✓ $x < 1$   ✓ $3^x < 3^1$ ✓ $x \in (-\infty; 1)$ (2)
5.6	Equation of the axis of symmetry: $y = -x + 1$ $x$ -intercept of the axis of symmetry is at $x = 1$ $f$ has an $x$ -intercept at $B(1; 0)$ which is the same as the $x$ -intercept of the axis of symmetry Point of intersection: $B(1; 0)$  <b>OR/OF</b> Since $BE = ED = 1$ and $D$ lies on the axis of symmetry and the gradient of the axis of symmetry is $-1$ , $B$ will also lie on the axis of symmetry. But $B$ also lies on $f$ . Therefore $B(1; 0)$ is the point of intersection between $f$ and the axis of symmetry with a negative gradient./ <i>Omdat <math>BE = ED = 1</math> en <math>D</math> op die simmetrie-as lê en die simmetrie-as se gradiënt <math>-1</math> is, sal <math>B</math> ook op die simmetrie-as lê. Maar <math>B</math> lê ook op <math>f</math>. Dus is <math>B(1; 0)</math> die snypunt van <math>f</math> en die simmetrie-as met negatiewe gradiënt.</i>	✓✓ equation of axis of symmetry   ✓ B or $(1; 0)$  <b>OR/OF</b> ✓✓ $BE = ED = 1$  ✓ B or $(1; 0)$   (3) <b>[14]</b>

**QUESTION/VRAAG 6**

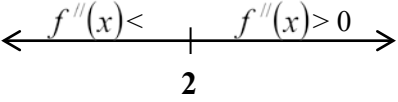
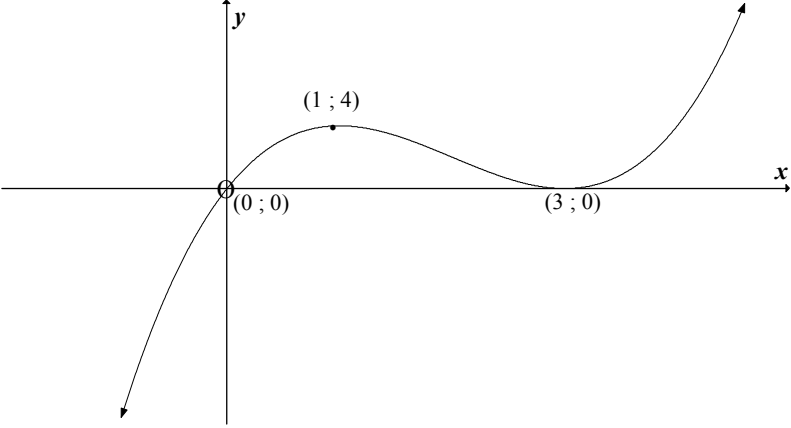
<p>6.1</p>	$A = P(1+i)^n$ $12\ 146,72 = 10\ 000 \left(1 + \frac{r}{12}\right)^{36}$ $\left(1 + \frac{r}{12}\right)^{36} = 1,214672$ $1 + \frac{r}{12} = \sqrt[36]{1,214672}$ $= 1,005416$ $\frac{r}{12} = 0,005416$ $r = 0,06500$ $r = 6,5\%$	<p>✓ <math>\frac{r}{12}</math></p> <p>✓ <math>n = 36</math></p> <p>✓ correct substitution into formula</p> <p>✓ <math>1 + \frac{r}{12} = \sqrt[36]{1,214672}</math></p> <p>✓ 6,5%</p> <p style="text-align: right;">(5)</p>
<p>6.2.1</p>	$P = \frac{x[1-(1+i)^{-n}]}{i}$ $235\ 000 = \frac{x \left[1 - \left(1 + \frac{0,11}{12}\right)^{-54}\right]}{\frac{0,11}{12}}$ $x = \frac{235\ 000 \times \frac{0,11}{12}}{\left[1 - \left(1 + \frac{0,11}{12}\right)^{-54}\right]}$ $= R5\ 536,95$ <p>His monthly instalment is R 5 536,95</p>	<p>✓ <math>i = \frac{0,11}{12}</math></p> <p>✓ <math>n = 54</math></p> <p>✓ correct substitution in P</p> <p>✓ answer</p> <p style="text-align: right;">(4)</p>
<p>6.2.2</p>	<p>Amount paid for the year : <math>(5\ 536,95 \times 12) = R66\ 443,40</math></p> $\text{Balance} = 235\ 000 \left(1 + \frac{0,11}{12}\right)^{12} - \frac{5\ 536,95 \left[\left(1 + \frac{0,11}{12}\right)^{12} - 1\right]}{\frac{0,11}{12}}$ $= 192\ 296,17$ $\text{Interest} = (5\ 536,95 \times 12) - (235\ 000 - 192\ 296,17)$ $= 66\ 443,40 - 42\ 703,83$ $= 23\ 739,57$ <p><b>OR/OF</b></p>	<p>✓ R66 443,40</p> <p>✓ <math>235\ 000 \left(1 + \frac{0,11}{12}\right)^{12}</math></p> <p>✓ <math>\frac{5\ 536,95 \left[\left(1 + \frac{0,11}{12}\right)^{12} - 1\right]}{\frac{0,11}{12}}</math></p> <p>✓ R192 296,17</p> <p>✓ R42 703,83</p> <p>✓ R23 739,57</p> <p><b>OR/OF</b></p>

	<p>Total amount paid in first year = R 5 536.95 × 12 = R66 443,40</p> <p>Balance on loan after 1 year = P of remaining installments</p> $P = \frac{x[1 - (1+i)^{-n}]}{i}$ $= \frac{5\,536,95 \left[ 1 - \left( 1 + \frac{0,11}{12} \right)^{-42} \right]}{\frac{0,11}{12}}$ <p>= R192 296,20</p> <p>Amount paid off in the first year: R235 000 – R192 296,20 = R42 703,80</p> <p>Amount of interest = R66 443,40 – R42 703,80 = R23 739,60</p> <p><b>OR/OF</b></p> $P = \frac{5536,95 \left[ 1 - \left( 1 + \frac{0,11}{12} \right)^{-12} \right]}{\frac{0,11}{12}}$ <p>= R 62 648,18</p> <p>235 000 – 62 648,18 = R172 351,82</p> <p>After 12 months, money owed on house is</p> $172\,351,82 \left( 1 + \frac{0,11}{12} \right)^{12}$ <p>= 192 296,17</p> <p>Amount paid after 12 months is</p> <p>5 536,95 × 12 = R 66 443, 40</p> <p>Amount of interest paid:</p> <p>R 66 443, 40 – (235 000 – 192 296,17) = R 23 739, 57</p>	<p>✓ R66 443,40</p> <p>✓ <math>n = - 42</math></p> <p>✓ substitution into correct formula</p> <p>✓ R192 296,20</p> <p>✓ R42 703,80</p> <p>✓ R23 739,60</p> <p><b>OR/OF</b></p> <p>✓ R62 648,18</p> <p>✓ R172 351,82</p> <p>✓ R192 296,17</p> <p>✓ R66 443,40</p> <p>✓ 235 000 – 192 296,17</p> <p>✓ R23 739,57</p> <p>(6)</p> <p>(6)</p> <p><b>[15]</b></p>
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**QUESTION/VRAAG 7**

7.1	$f(x+h) = 2(x+h)^2 - (x+h)$ $= 2(x^2 + 2xh + h^2) - x - h$ $= 2x^2 + 4xh + 2h^2 - x - h$ $f(x+h) - f(x) = 2x^2 + 4xh + 2h^2 - x - h - 2x^2 + x$ $= 4xh + 2h^2 - h$ $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $= \lim_{h \rightarrow 0} \frac{4xh + 2h^2 - h}{h}$ $= \lim_{h \rightarrow 0} \frac{h(4x + 2h - 1)}{h}$ $= \lim_{h \rightarrow 0} (4x + 2h - 1)$ $= 4x - 1$ <p><b>OR/OF</b></p> $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $= \lim_{h \rightarrow 0} \frac{2(x+h)^2 - (x+h) - (2x^2 - x)}{h}$ $= \lim_{h \rightarrow 0} \frac{2x^2 + 4xh + 2h^2 - x - h - 2x^2 + x}{h}$ $= \lim_{h \rightarrow 0} \frac{4xh + 2h^2 - h}{h}$ $= \lim_{h \rightarrow 0} \frac{h(4x + 2h - 1)}{h}$ $= \lim_{h \rightarrow 0} (4x + 2h - 1)$ $= 4x - 1$	$\checkmark 2x^2 + 4xh + 2h^2 - x - h$ $\checkmark 4xh + 2h^2 - h$ $\checkmark f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $\checkmark \text{subst. into formula}$ $\checkmark \lim_{h \rightarrow 0} (4x + 2h - 1)$ $\checkmark 4x - 1$ <p><b>OR/OF</b></p> $\checkmark f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $\checkmark \text{subst. into formula}$ $\checkmark 2x^2 + 4xh + 2h^2 - x - h$ $\checkmark 4xh + 2h^2 - h$ $\checkmark \lim_{h \rightarrow 0} (4x + 2h - 1)$ $\checkmark 4x - 1$ <p style="text-align: right;">(6)</p>
7.2.1	$D_x[(x+1)(3x-7)]$ $= D_x(3x^2 - 4x - 7)$ $= 6x - 4$	$\checkmark 3x^2 - 4x - 7$ $\checkmark 6x - 4$ <p style="text-align: right;">(2)</p>
7.2.2	$y = \sqrt{x^3} - \frac{5}{x} + \frac{1}{2}\pi$ $y = x^{\frac{3}{2}} - 5x^{-1} + \frac{1}{2}\pi$ $\frac{dy}{dx} = \frac{3}{2}x^{\frac{1}{2}} + 5x^{-2}$	$\checkmark x^{\frac{3}{2}} - 5x^{-1}$ $\checkmark \frac{3}{2}x^{\frac{1}{2}}$ $\checkmark + 5x^{-2}$ $\checkmark \text{derivative of } \frac{1}{2}\pi \text{ is } 0$ <p style="text-align: right;">(4) <b>[12]</b></p>

**QUESTION/VRAAG 8**

<p>8.1</p>	$f(x) = x^3 - 6x^2 + 9x$ $f'(x) = 3x^2 - 12x + 9$ $f''(x) = 6x - 12 = 0$ $x = 2$ $f''(0) = 6(0) - 12$ $= -12$ $f''(3) = 6(3) - 12$ $= 6$ <div style="text-align: center;">  </div> <p>Point of inflection at <math>x = 2</math></p>	<ul style="list-style-type: none"> <li>✓ <math>x^3 - 6x^2 + 9x</math></li> <li>✓ <math>3x^2 - 12x + 9</math></li> <li>✓ <math>6x - 12</math></li> <li>✓ <math>6x - 12 = 0</math></li>   <li>✓ explanation</li> </ul> <p style="text-align: right;">(5)</p>
<p>8.2</p>		<ul style="list-style-type: none"> <li>✓ shape</li> <li>✓ (0 ; 0)</li> <li>✓ (3 ; 0) as TP</li> <li>✓ (1 ; 4)</li> </ul> <p style="text-align: right;">(4)</p>
<p>8.3</p>	<p><math>f</math> concave up for <math>x &gt; 2</math>  <math>y = -f(x)</math> will be concave down for <math>x &gt; 2</math></p>	<ul style="list-style-type: none"> <li>✓✓ <math>x &gt; 2</math></li> </ul> <p style="text-align: right;">(2)</p>
<p>8.4.1</p>	<p>(3;7)</p>	<ul style="list-style-type: none"> <li>✓ 3</li> <li>✓ 7</li> </ul> <p style="text-align: right;">(2)</p>
<p>8.4.2</p>	<p>Do not agree with Claire as her statement is incorrect.          Between <math>x = 1</math> and <math>x = 3</math> the graph of <math>f</math> is decreasing.          Therefore at <math>x = 2</math> the gradient will have a negative value.</p> <p><i>Stem nie saam met Claire nie, want haar stelling in verkeerd.          Die grafiek van <math>f</math> is dalend/afnemend tussen <math>x = 1</math> en <math>x = 3</math>.          By <math>x = 2</math> moet die gradiënt dus 'n negatiewe waarde hê.</i></p> <p style="text-align: center;"><b>OR/OF</b></p> $f'(2) = 3(2)^2 - 12(2) + 9$ $= -3$ $\neq 1$	<ul style="list-style-type: none"> <li>✓ no</li>   <li>✓ justification</li> </ul> <p style="text-align: right;">(2)</p>

**[15]**



**QUESTION/VRAAG 9**

$y = x^2 + 2$ $P(x; x^2 + 2)$ $B(0; 3)$ $PB^2 = (x - 0)^2 + (x^2 + 2 - 3)^2$ $= x^2 + x^4 - 2x^2 + 1$ $= x^4 - x^2 + 1$ <p>PB will be a minimum if <math>PB^2</math> is a minimum</p> $\frac{d(PB^2)}{dx} = 4x^3 - 2x$ $4x^3 - 2x = 0$ $x(2x^2 - 1) = 0$ $x = 0 \text{ or } x^2 = \frac{1}{2}$ $x = \frac{1}{\sqrt{2}}$ $PB^2 = \left(\frac{1}{\sqrt{2}}\right)^4 - \left(\frac{1}{\sqrt{2}}\right)^2 + 1$ $= \frac{1}{4} - \frac{1}{2} + 1$ $= \frac{3}{4}$ $PB = \frac{\sqrt{3}}{2} = 0,87$ <p><b>OR/OF</b></p>	$\checkmark (x - 0)^2 + (x^2 + 2 - 3)^2$ $\checkmark x^4 - x^2 + 1$ $\checkmark 4x^3 - 2x$ $\checkmark \frac{d(PB^2)}{dx} = 0$ $\checkmark x = \frac{1}{\sqrt{2}}$ $\checkmark PB^2 = \left(\frac{1}{\sqrt{2}}\right)^4 - \left(\frac{1}{\sqrt{2}}\right)^2 + 1$ $\checkmark \text{answer}$ <p><b>OR/OF</b></p>
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<p>Gradient of tangent to curve = <math>2x</math></p> <p>Gradient of line joining B and the curve = <math>\frac{x^2 + 2 - 3}{x - 0}</math></p> $= \frac{x^2 - 1}{x}$ <p>Shortest distance will be where tangent to curve is perpendicular to the line joining P and the curve.</p> $\frac{x^2 - 1}{x} = -\frac{1}{2x}$ $2x(x^2 - 1) = -x$ $2x^3 - 2x = 0$ $x(2x^2 - 1) = 0$ $x = 0 \quad \text{or} \quad x^2 = \frac{1}{2}$ $x = \frac{1}{\sqrt{2}}$ $PB^2 = \left(\frac{1}{\sqrt{2}}\right)^4 - \left(\frac{1}{\sqrt{2}}\right)^2 + 1$ $= \frac{1}{4} - \frac{1}{2} + 1$ $= \frac{3}{4}$ $PB = \frac{\sqrt{3}}{2} = 0,87$ <p><b>OR/OF</b></p> <p><math>P(k; k^2 + 2)</math> and <math>B(0; 3)</math></p> <p><math>BP \perp</math> tangent passing through <math>y = x^2 + 2</math> at P.</p> $m_{\text{tangent at P}} = 2k$ $m_{BP} = -\frac{1}{2k}$ <p>Equation of BP: <math>y = \left(-\frac{1}{2k}\right)x + 3</math></p> $y_P = \left(-\frac{1}{2k}\right)(k) + 3 = 2,5$ $\Rightarrow k^2 + 2 = 2,5 \text{ and so } k = \sqrt{0,5} \text{ and } P(\sqrt{0,5}; 2,5)$ $BP = \sqrt{(\sqrt{0,5} - 0)^2 + (2,5 - 3)^2} = \sqrt{\frac{3}{4}} = \frac{\sqrt{3}}{2} = 0,87$	<p><math>\checkmark = 2x</math></p> <p><math>\checkmark = \frac{x^2 - 1}{x}</math></p> <p><math>\checkmark \frac{x^2 - 1}{x} = -\frac{1}{2x}</math></p> <p><math>\checkmark 2x^3 - 2x = 0</math></p> <p><math>\checkmark x = \frac{1}{\sqrt{2}}</math></p> <p><math>\checkmark PB^2 = \left(\frac{1}{\sqrt{2}}\right)^4 - \left(\frac{1}{\sqrt{2}}\right)^2 + 1</math></p> <p><math>\checkmark</math> answer</p> <p><b>OR/OF</b></p> <p><math>\checkmark P(k; k^2 + 2)</math></p> <p><math>\checkmark m_{\text{tangent at P}} = 2k</math></p> <p><math>\checkmark m_{BP} = -\frac{1}{2k}</math></p> <p><math>\checkmark y = \left(-\frac{1}{2k}\right)x + 3</math></p> <p><math>\checkmark</math> value of y at P</p> <p><math>\checkmark</math> value of k</p> <p><math>\checkmark</math> answer</p> <p style="text-align: right;"><b>[7]</b></p>
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**QUESTION/VRAAG 10**

<p>10.1</p>	<p style="text-align: right;"><math>n(S) = 100</math></p>	<p>8 values need to be placed in correct position:</p> <p>2 or 3 correct: 1 mark                  4 or 5 correct: 2 marks                  6 or 7 correct: 3 marks                  8 correct: 4 marks</p> <p style="text-align: right;">(4)</p>
<p>10.2</p>	$(49 - x) + x + 8 + 4 + 5 + 2 + (60 - x) + 14 = 100$ $- x + 142 = 100$ $x = 42$	<p>✓ setting up equation</p> <p>✓ answer</p> <p style="text-align: right;">(2)</p>
<p>10.3</p>	<p>P (use only one application) = <math>\frac{7 + 2 + 18}{100}</math></p> $= \frac{27}{100} \text{ or } 27\%$	<p>✓ <math>\frac{7 + 2 + 18}{100}</math></p> <p>✓ answer</p> <p style="text-align: right;">(2)</p> <p style="text-align: right;"><b>[8]</b></p>

**QUESTION/VRAAG 11**

<p>11.1</p>	$5 \times 5 \times 10 \times 9 = 2250$	<p>✓ <math>5 \times 5</math>                  ✓ <math>10 \times 9</math>                  ✓ 2250</p> <p style="text-align: right;">(3)</p>																								
<p>11.2</p>	<table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th>No of digits used</th> <th>Letters</th> <th>Digits</th> <th>Total</th> </tr> </thead> <tbody> <tr> <td>1</td> <td><math>5 \times 5</math></td> <td>10</td> <td>250</td> </tr> <tr> <td>2</td> <td><math>5 \times 5</math></td> <td><math>10 \times 9</math></td> <td>2 250</td> </tr> <tr> <td>3</td> <td><math>5 \times 5</math></td> <td><math>10 \times 9 \times 8</math></td> <td>18 000</td> </tr> <tr> <td>4</td> <td><math>5 \times 5</math></td> <td><math>10 \times 9 \times 8 \times 7</math></td> <td>126 000</td> </tr> <tr> <td>5</td> <td><math>5 \times 5</math></td> <td><math>10 \times 9 \times 8 \times 7 \times 6</math></td> <td>756 000</td> </tr> </tbody> </table> <p>Codes of two letters and five digits will ensure unique numbers for 700 000 clients.</p>	No of digits used	Letters	Digits	Total	1	$5 \times 5$	10	250	2	$5 \times 5$	$10 \times 9$	2 250	3	$5 \times 5$	$10 \times 9 \times 8$	18 000	4	$5 \times 5$	$10 \times 9 \times 8 \times 7$	126 000	5	$5 \times 5$	$10 \times 9 \times 8 \times 7 \times 6$	756 000	<p>✓ <math>5 \times 5 \times 10 \times 9 \times 8 \times 7 \times 6</math>                  ✓✓ five digits</p> <p style="text-align: right;">(3)</p> <p style="text-align: right;"><b>[6]</b></p>
No of digits used	Letters	Digits	Total																							
1	$5 \times 5$	10	250																							
2	$5 \times 5$	$10 \times 9$	2 250																							
3	$5 \times 5$	$10 \times 9 \times 8$	18 000																							
4	$5 \times 5$	$10 \times 9 \times 8 \times 7$	126 000																							
5	$5 \times 5$	$10 \times 9 \times 8 \times 7 \times 6$	756 000																							

**TOTAL/TOTAAL: 150**