



# 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 25 pages.  
*Hierdie memorandum bestaan uit 25 bladsye.***

**NOTE:**

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

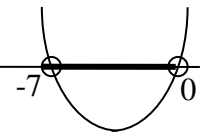
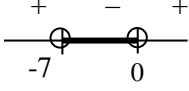
**LET WEL:**

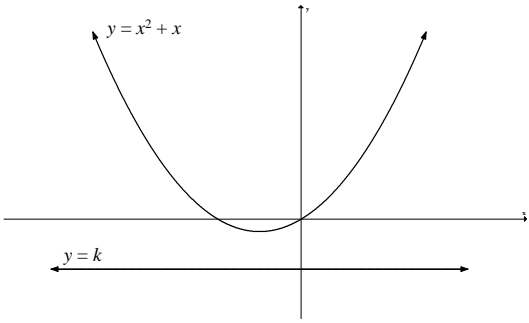
- Indien 'n kandidaat 'n vraag TWEE keer beantwoord, merk slegs die EERSTE poging.
- Volgehoue akkuraatheid is op ALLE aspekte van die memorandum van toepassing.

**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><b>OR/OF</b></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	$2x^{\frac{-5}{3}} = 64$ $x^{\frac{-5}{3}} = 32$ $x = (2^5)^{\frac{-3}{5}}$ $x = 2^{-3} \text{ or } \frac{1}{8} \text{ or } 0,125$ <p><b>OR/OF</b></p>	✓ dividing both sides by 2 ✓ $32 = 2^5$ or $64 = 2^6$ ✓ raising RHS to $\frac{-3}{5}$ ✓ answer (4)

	$2x^{\frac{-5}{3}} = 64$ $x^{\frac{-5}{3}} = 32$ $x = (32)^{\frac{-3}{5}}$ $x = \sqrt[5]{32^{-3}}$ $x = 2^{-3} \text{ or } \frac{1}{8} \text{ or } 0,125$ <p><b>OR/OF</b></p> $\left(2x^{\frac{-5}{3}}\right)^{\frac{-3}{5}} = 64^{\frac{-3}{5}}$ $0,659x = 0,0825$ $x = 0,125$ <p><b>OR/OF</b></p> $x^{\frac{-5}{3}} = 32$ $\frac{-5}{3} \log x = \log 32$ $\log x = \frac{3}{-5} \log 32$ $\log x = -0,903$ $x = 10^{-0,903}$ $= 0,125 \text{ or } \frac{1}{8}$	<p>✓ dividing both sides by 2</p> <p>✓ raising RHS to <math>\frac{-3}{5}</math></p> <p>✓ <math>\sqrt[5]{32^{-3}}</math></p> <p>✓ answer (4)</p> <p>✓ raising both sides to <math>\frac{-3}{5}</math></p> <p>✓ 0,659 and 0,0825</p> <p>✓ dividing both sides by 0,659</p> <p>✓ answer (4)</p> <p>✓ dividing both sides by 2</p> <p>✓ logs on both sides</p> <p>✓ <math>\log x = -0,903</math></p> <p>✓ answer (4)</p>
<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 <math>x = 1</math>, <math>\sqrt{2-x} = 1</math> and <math>x-2 = -1</math></p> <p><math>x = 2</math> only</p> <p><b>OR/OF</b></p>	<p>✓ squaring both sides</p> <p>✓ factors</p> <p>✓ <math>x = 1</math> or <math>x = 2</math></p> <p>✓ <math>x = 2</math> only (4)</p>

	$\sqrt{2-x} = x-2$ $2-x = (x-2)^2$ $2-x = (2-x)^2$ $2-x = 1 \text{ or } 2-x = 0$ $x = 1 \text{ or } x = 2$ <p>if <math>x = 1</math>, <math>\sqrt{2-x} = 1</math> and <math>x-2 = -1</math>  <math>\therefore x = 2</math> only</p> <p><b>OR/OF</b></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                  ✓ <math>2-x=1</math> or <math>2-x=0</math></p> <p>✓ <math>x = 1</math> or <math>x = 2</math></p> <p>✓ <math>x = 2</math> only (4)</p> <p>✓ <math>2-x \geq 0</math>                  ✓ <math>x-2 \geq 0</math></p> <p>✓ <math>x \leq 2</math> and <math>x \geq 2</math>                  ✓ <math>x = 2</math> (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;">  <p style="margin: 0 10px;"><b>OR/OF</b></p>  </div> $-7 < x < 0 \text{ OR/OF } x \in (-7; 0)$	<p>✓ factors</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></p> $(3x-y)^2 = 0 \text{ and/en } (x-5)^2 = 0$ $3x-y = 0 \text{ and/en } x-5 = 0$ $x = 5$ $3(5) - y = 0$ $y = 15$	<p>✓ <math>3x-y = 0</math>                  ✓ <math>x-5 = 0</math></p> <p>✓ <math>x = 5</math>                  ✓ <math>y = 15</math> (4)</p>

<p>1.3</p>	$x^2 + x = k$ $x^2 + x - k = 0$ $\Delta < 0$ $b^2 - 4ac < 0$ $1^2 - 4(1)(-k) < 0$ $1 + 4k < 0$ $k < \frac{-1}{4}$ <p><b>OR/OF</b></p> $x^2 + x = k$ $x^2 + x + \frac{1}{4} = k + \frac{1}{4}$ $\left(x + \frac{1}{2}\right)^2 = k + \frac{1}{4}$ <p>for nonreal roots <math>k + \frac{1}{4} &lt; 0</math></p> $k < \frac{-1}{4}$ <p><b>OR/OF</b></p> <p>Consider the functions <math>y = x^2 + x</math> and <math>y = k</math>  <i>Beskou die funksies <math>y = x^2 + x</math> en <math>y = k</math></i></p>  <p>Turning point of/<i>Draaipunt van</i> <math>y = x^2 + x</math> is <math>\left(\frac{-1}{2}; \frac{-1}{4}\right)</math></p> <p><math>x^2 + x = k</math> does not have real roots when the line <math>y = k</math> does not intersect <math>y = x^2 + x</math>.</p> <p><math>x^2 + x = k</math> <i>het geen reële wortels as die lyn <math>y = k</math> nie met <math>y = x^2 + x</math> sny nie.</i></p> <p>Therefore <math>k &lt; \frac{-1}{4}</math></p>	<p>✓ standard form</p> <p>✓ <math>\Delta &lt; 0</math></p> <p>✓ <math>1^2 - 4(1)(-k)</math></p> <p>✓ <math>k &lt; \frac{-1}{4}</math> (4)</p> <p>✓ adds <math>\frac{1}{4}</math> to both sides</p> <p>✓ <math>\left(x + \frac{1}{2}\right)^2 = k + \frac{1}{4}</math></p> <p>✓ <math>k + \frac{1}{4} &lt; 0</math></p> <p>✓ <math>k &lt; \frac{-1}{4}</math> (4)</p> <p>✓ sketch or explanation</p> <p>✓ <math>x = -\frac{1}{2}</math></p> <p>✓ <math>y = -\frac{1}{4}</math></p> <p>✓ <math>k &lt; \frac{-1}{4}</math> (4)</p> <p><b>[26]</b></p>
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**QUESTION/VRAAG 2**

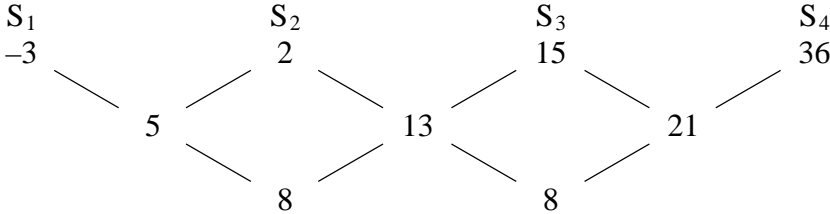
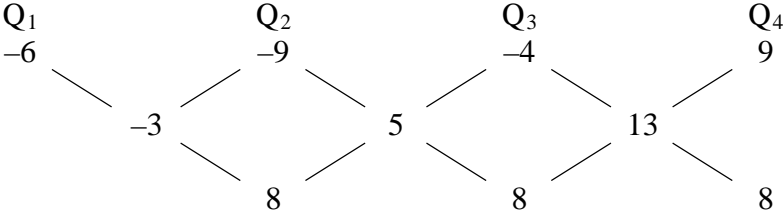
<p>2.1</p>	$r = \frac{T_2}{T_1}$ $= \frac{5}{10}$ $= \frac{1}{2}$ $T_5 = 1,25 \left(\frac{1}{2}\right)$ $= \frac{5}{8} \text{ or } 0,625$ <p style="text-align: center;"><b>OR/OF</b></p> $T_5 = 10 \left(\frac{1}{2}\right)^4$ $= \frac{5}{8} \text{ or } 0,625$	<p>✓ <math>r = \frac{1}{2}</math></p> <p>✓ answer</p> <p style="text-align: right;">(2)</p>
<p>2.2</p>	$T_n = 10 \left(\frac{1}{2}\right)^{n-1}$	<p>✓ substitutes <math>a = 10</math> into GP formula</p> <p>✓ substitutes <math>r = \frac{1}{2}</math> into GP formula</p> <p style="text-align: right;">(2)</p>
<p>2.3</p>	<p>For convergence/<i>Om te konvergeer</i> <math>-1 &lt; r &lt; 1</math></p> <p>Since/<i>Aangesien</i> <math>r = \frac{1}{2}</math> and/<i>en</i> <math>-1 &lt; \frac{1}{2} &lt; 1</math></p> <p>the sequence converges/<i>die ry konvergeer</i></p>	<p>✓ <math>-1 &lt; r &lt; 1</math></p> <p>✓ show that <math>r = \frac{1}{2}</math> is <math>-1 &lt; r &lt; 1</math></p> <p style="text-align: right;">(2)</p>
<p>2.4</p>	$S_\infty - S_n = \frac{a}{1-r} - \frac{a(1-r^n)}{1-r}$ $= \frac{10}{1-\frac{1}{2}} - \frac{10\left(1-\frac{1^n}{2}\right)}{1-\frac{1}{2}}$ $= 20 - 20\left(1-\frac{1^n}{2}\right)$ $= 20 - 20 + 20\left(\frac{1}{2}\right)^n$ $= 20\left(\frac{1}{2}\right)^n$ <p style="text-align: center;"><b>OR/OF</b></p>	<p>✓ <math>\frac{10}{1-\frac{1}{2}}</math></p> <p>✓ <math>\frac{10\left(1-\frac{1^n}{2}\right)}{1-\frac{1}{2}}</math></p> <p>✓ <math>20\left(1-\frac{1^n}{2}\right)</math></p> <p>✓ answer</p> <p style="text-align: right;">(4)</p> <p>✓ constructing the series</p>

$S_{\infty} - S_n = T_{n+1} + T_{n+2} + T_{n+3} + \dots$ $= 10\left(\frac{1}{2}\right)^n \left[ 1 + \frac{1}{2} + \frac{1}{4} + \dots \right]$ $= 10\left(\frac{1}{2}\right)^n \left[ \frac{1}{1 - \frac{1}{2}} \right]$ $= 20\left(\frac{1}{2}\right)^n$ <p><b>OR/OF</b></p> $S_{\infty} - S_n = \frac{a}{1-r} - \frac{a(1-r^n)}{1-r}$ $= \frac{a - a + ar^n}{1-r}$ $= \frac{ar^n}{1-r}$ $= \frac{10\left(\frac{1}{2}\right)^n}{\frac{1}{2}}$ $= 20\left(\frac{1}{2}\right)^n$	<p>✓</p> $10\left(\frac{1}{2}\right)^n \left[ 1 + \frac{1}{2} + \frac{1}{4} + \dots \right]$ <p>✓ <math>\frac{1}{1 - \frac{1}{2}}</math></p> <p>✓ answer (4)</p> <p>✓ <math>\frac{a - a + ar^n}{1-r}</math></p> <p>✓ <math>\frac{ar^n}{1-r}</math></p> <p>✓ <math>\frac{10\left(\frac{1}{2}\right)^n}{\frac{1}{2}}</math></p> <p>✓ answer (4)</p> <p style="text-align: right;"><b>[10]</b></p>
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**QUESTION/VRAAG 3**

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



	<p><b>OR/OF</b></p>  <p> <math>S_n = an^2 + bn + c</math>  <math>a = \frac{8}{2}</math>  <math>a = 4</math>  <math>S_1 = 4 + b + c = -3</math>      <math>b + c = -7</math> .....(1)  <math>S_2 = 16 + 2b + c = 2</math>      <math>2b + c = -14</math>.....(2)  <math>b = -7</math>.....(2) - (1)  <math>c = 0</math>                  Hence <math>S_n = 4n^2 - 7n</math> </p>	<p> <math>S_2 = -3 + 5 = 2</math>  <math>S_3 = 2 + 13 = 15</math>  <math>S_4 = 15 + 21</math>                      ✓ calculates <math>S_1, S_2, S_3</math> and <math>S_4</math>,                       ✓ <math>a = 4</math>                       ✓ solves simultaneously for <math>b</math> and <math>c</math>.                      (3)                 </p>
<p>3.4.1</p>	<p><math>Q_6 = -6 - 3 + 5 + 13 + 21 + 29</math></p>	<p>✓✓ answer (2)</p>
<p>3.4.2</p>	<p> <math>Q_{129} = -6 + S_{128}</math>  <math>= -6 + 4(128)^2 - 7(128)</math>   <math>= 64634</math> </p> <p><b>OR/OF</b></p>  <p> <math>Q_n = an^2 + bn + c</math>  <math>a = 4</math>  <math>Q_1 = 4 + b + c = -6</math>      <math>b + c = -10</math> .....(1)  <math>Q_2 = 16 + 2b + c = -9</math>      <math>2b + c = -25</math>.....(2)  <math>b = -15</math>.....(2) - (1)  <math>c = 5</math>                  Hence <math>Q_n = 4n^2 - 15n + 5</math>  <math>Q_{129} = 4(129)^2 - 15(129) + 5</math>  <math>= 64\ 634</math> </p>	<p>                     ✓✓  <math>-6 + 4(128)^2 - 7(128)</math>                      ✓ answer                      (3)                       ✓ <math>a = 4</math>                       ✓ <math>Q_n = 4n^2 - 15n + 5</math>                      ✓ answer                      (3)                 </p>

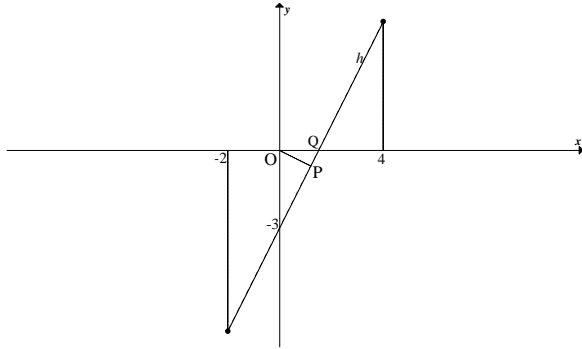
[12]

**QUESTION/VRAAG 4**

Given: $f(x) = 2^{x+1} - 8$		
4.1	$y = -8$	✓ $y = -8$ (1)
4.2		✓ x-intercept ✓ y-intercept ✓ shape ✓ asymptote (only if the graph does not cut the asymptote)  (4)
4.3	$g(x) = 2^{-x+1} - 8$  <b>OR/OF</b>  $g(x) = \left(\frac{1}{2}\right)^{x-1} - 8$	✓ answer (1)  ✓ answer (1) <b>[6]</b>

**QUESTION/VRAAG 5**

Given  $h(x) = 2x - 3$  for  $-2 \leq x \leq 4$ .

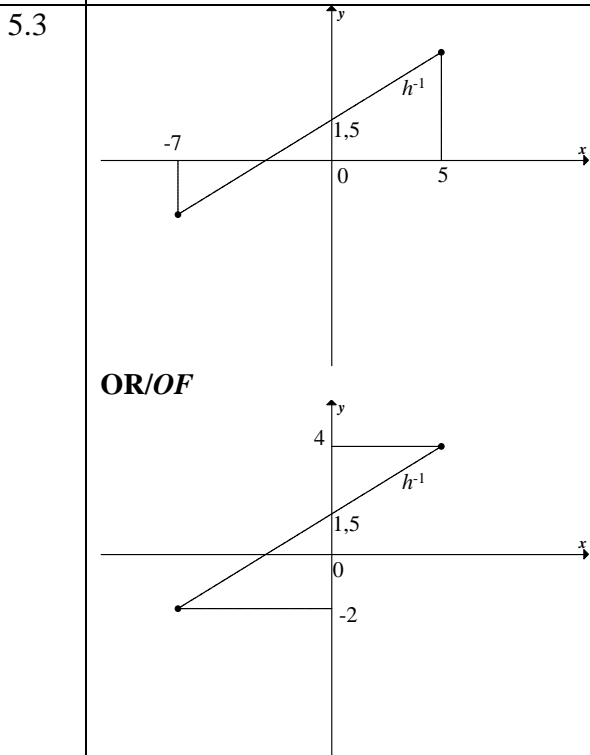


5.1 For  $x$ -intercepts,  $y = 0$   
 $2x - 3 = 0$   
 $x = 1,5$   
 $Q(1,5; 0)$

✓  $x = 1,5$   
 ✓  $y = 0$   
 (2)

5.2  $h$ :  
 $x = -2$ :  $y = 2(-2) - 3 = -7$   
 $x = 4$ :  $y = 2(4) - 3 = 5$   
 Domain of  $h^{-1}$ :  $-7 \leq x \leq 5$  **OR/OF**  $[-7; 5]$

✓  $h(-2) = -7$   
 ✓  $h(4) = 5$   
 ✓  $-7 \leq x \leq 5$   
 (3)



✓  $y$ -intercept on a straight line  
 ✓ line segment  
 ✓ accurate endpoints ( $x$  or  $y$  or both)  
 (3)

<p>5.4</p> <p><math>h(x) = 2x - 3</math></p> <p>For the inverse of <math>h</math>,</p> $x = 2y - 3$ $y = \frac{x+3}{2}$ $h^{-1}(x) = \frac{x+3}{2}$ $h(x) = h^{-1}(x)$ $2x - 3 = \frac{x+3}{2}$ $4x - 6 = x + 3$ $x = 3$ <p><b>OR/OF</b></p> $h(x) = 2x - 3$ <p><math>h</math> and <math>h^{-1}</math> intersect when <math>y = x</math></p> $h(x) = x$ $2x - 3 = x$ $x = 3$ <p><b>OR/OF</b></p> $h(x) = 2x - 3$ <p>For the inverse of <math>h</math>,</p> $x = 2y - 3$ $y = \frac{x+3}{2}$ $h^{-1}(x) = x$ $\frac{x+3}{2} = x$ $x + 3 = 2x$ $x = 3$	$\checkmark y = \frac{x+3}{2}$  $\checkmark 2x - 3 = \frac{x+3}{2}$  $\checkmark x = 3$ <p style="text-align: right;">(3)</p>  $\checkmark h(x) = x$ $\checkmark 2x - 3 = x$ $\checkmark x = 3$ <p style="text-align: right;">(3)</p>  $\checkmark y = \frac{x+3}{2}$  $\checkmark \frac{x+3}{2} = x$ $\checkmark x = 3$ <p style="text-align: right;">(3)</p>
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<p><b>OR/OF</b>                  For minimum distance <math>OP \perp</math> the line  <math>O(0;0) \quad P(x; 2x-3) \quad Q\left(\frac{3}{2}; 0\right)</math>  <math>OP^2 + PQ^2 = OQ^2</math> (pythag)  <math>(x-0)^2 + (2x-3-0)^2 + \left(x-\frac{3}{2}\right)^2 + (2x-3-0)^2 = \left(\frac{3}{2}\right)^2</math>  <math>x^2 + 4x^2 - 12x + 9 + x^2 - 3x + \frac{9}{4} + 4x^2 - 12x + 9 = \frac{9}{4}</math>  <math>10x^2 - 27x + 18 = 0</math>  <math>(5x-6)(2x-3) = 0</math>  <math>x = \frac{6}{5}</math> or <math>\frac{3}{2}</math></p> <p>Hence, <math>x = \frac{6}{5}</math> at P  <math>OP^2 = x^2 + (2x-3)^2</math>  <math>= \left(\frac{6}{5}\right)^2 + \left(2\left(\frac{6}{5}\right) - 3\right)^2</math>  <math>= \frac{36}{25} + \frac{9}{25}</math>  <math>= \frac{9}{5}</math>  <math>OP = 1,34</math></p> <p><b>OR/OF</b>                  For minimum distance <math>OP \perp</math> the line  <math>\tan \hat{Q} = 2</math>  <math>\hat{Q} = 63,43^\circ</math>  <math>\sin 63,43^\circ = \frac{OP}{1,5}</math>  <math>OP = 1,34</math></p>	<p>✓ <math>OP^2 = x^2 + y^2</math>                  ✓ substitute  <math>y = 2x - 3</math></p> <p>✓  <math>10x^2 - 27x + 18</math></p> <p>✓ x-value</p> <p>✓ answer (5)</p> <p>✓ <math>\tan \hat{Q} = 2</math>                  ✓ <math>\hat{Q} = 63,43^\circ</math>                  ✓ <math>\sin 63,43^\circ</math>                  ✓ <math>\frac{OP}{1,5}</math>                  ✓ answer (5)</p>
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**OR/OF**

$$\begin{aligned} OP &= \sqrt{(x-0)^2 + (y-0)^2} \\ &= \sqrt{(x-0)^2 + (2x-3-0)^2} \\ &= \sqrt{x^2 + 4x^2 - 12x + 9} \\ &= \sqrt{5x^2 - 12x + 9} \end{aligned}$$

By using the chain rule (which is not in the CAPS):

$$\frac{dOP}{dx} = \frac{1}{2}(5x^2 - 12x + 9)^{-\frac{1}{2}} \cdot (10x - 12)$$

$$0 = \frac{1}{2}(5x^2 - 12x + 9)^{-\frac{1}{2}} \cdot (10x - 12)$$

$$0 = \frac{1}{2}(10x - 12)$$

$$0 = 5x - 6$$

$$x = \frac{6}{5}$$

$$\begin{aligned} OP &= \sqrt{5\left(\frac{6}{5}\right)^2 - 12\left(\frac{6}{5}\right) + 9} \\ &= 1,34 \end{aligned}$$

**OR/OF**

For minimum distance  $OP \perp$  the line  
Let the y-intercept be R

$$OR = 3 \text{ units}$$

$$OQ = \frac{3}{2} \text{ units}$$

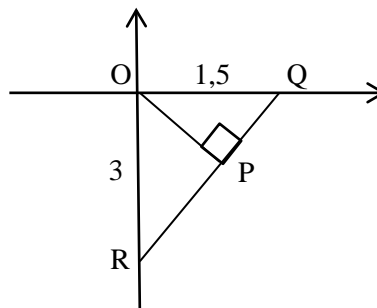
$$RQ = \frac{3}{2}\sqrt{5} \text{ (Pythagoras)}$$

$$\text{Area OQR} = \frac{1}{2} \times \text{base} \times \perp\text{height}$$

$$\frac{1}{2} \cdot OR \cdot OQ = \frac{1}{2} \cdot \left(\frac{3}{2}\sqrt{5}\right) \cdot OP$$

$$\frac{1}{2} \cdot 3 \cdot \left(\frac{3}{2}\right) = \frac{1}{2} \cdot \left(\frac{3}{2}\sqrt{5}\right) \cdot OP$$

$$OP = \frac{3}{\sqrt{5}} = 1,34$$



✓

$$OP = \sqrt{(x-0)^2 + (y-0)^2}$$

✓ substitute

$$y = 2x - 3$$

$$\checkmark 5x^2 - 12x + 9$$

✓ x-value

✓ answer

(5)

$$\checkmark RQ = \frac{3}{2}\sqrt{5}$$

$$\checkmark \frac{1}{2} \cdot \left(\frac{3}{2}\sqrt{5}\right) \cdot OP$$

$$\checkmark \frac{1}{2} \cdot 3 \cdot \left(\frac{3}{2}\right)$$

✓ equating

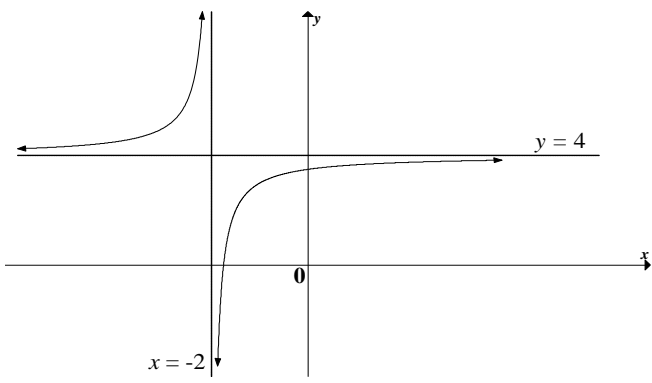
✓ answer

(5)

<p>5.6.1</p>	<p><math>f'(x) = 2x - 3</math></p> <p>Turning point at <math>x = \frac{3}{2}</math></p> <p><math>f''(x) = 2 &gt; 0</math> or <math>f''\left(\frac{3}{2}\right) &gt; 0</math></p> <p><math>f</math> has a local minimum at <math>x = \frac{3}{2}</math></p> <p><math>f</math> het 'n lokale minimum by <math>x = \frac{3}{2}</math></p> <p><b>OR/OF</b></p> <p><math>h(x) = f'(x) &lt; 0</math> for <math>x \in (-2 ; 1,5) \Rightarrow f</math> is decreasing on the left of Q / <i>f is dalend links van Q.</i></p> <p><math>h(x) = f'(x) &gt; 0</math> for <math>x \in (1,5 ; 4) \Rightarrow f</math> is increasing on the right of Q / <i>f is stygend regs van Q.</i></p> <p><math>\therefore f(x)</math> has a local minimum when <math>x = \frac{3}{2}</math> /</p> <p><math>\therefore f(x)</math> het 'n lokaal minimum by <math>x = \frac{3}{2}</math></p> <p><b>OR/OF</b></p> <p><math>f(x) = x^2 - 3x + c</math></p> <p><math>f</math> has a minimum value since <math>a &gt; 0</math></p> <p><math>f</math> het 'n minimum waarde omdat <math>a &gt; 0</math></p>	<p>✓ Turning point at <math>x = \frac{3}{2}</math></p> <p>✓ <math>f''(x) = 2 &gt; 0</math></p> <p>(2)</p> <p>✓ decreasing left of Q</p> <p>✓ increasing right of Q</p> <p>(2)</p> <p>✓</p> <p><math>f(x) = x^2 - 3x + c</math></p> <p>✓ explanation</p> <p>(2)</p>
<p>5.6.2</p>	<p><math>m = f'(4) = h(4) = 5</math></p>	<p>✓ answer</p> <p>(1)</p> <p>[19]</p>



**QUESTION/VRAAG 6**

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

**QUESTION/VRAAG 7**

7.1	R450 000	✓ answer (1)
7.2	$A = P(1-i)^n$ $f(x) = 450000(1-i)^x$ $243\,736,90 = 450000(1-i)^4$ $i = 1 - \sqrt[4]{\frac{243\,736,90}{450000}}$ $i = 0,1421$ <p>The rate of depreciation is 14,21 % p.a. Die waardeverminderingskoers is 14,21% p.j.</p>	✓ substitution of 450 000 into correct formula ✓ substitution of (4; 243 736,90) into correct formula ✓ making $i$ the subject ✓ answer (4)
7.3	At T: $A = P(1+i)^n$ $g(x) = 450000(1+i)^x$ $a = 450000(1+0,081)^4$ $= R614490,66$	✓ $i = 0,081$ & $n = 4$ ✓ correct substitution into formula ✓ answer (3)
7.4	Future Value = R614 490, 66 – R243 736,90 $= R370\,753,76$ Let $x$ be the value of monthly payment $F_v = \frac{x[(1+i)^n - 1]}{i}$ $370753,76 = \frac{x \left[ \left( 1 + \frac{0.062}{12} \right)^{36} - 1 \right]}{\frac{0.062}{12}}$ $x = R9397,11$	✓ R370 753,76 ✓ $i = \frac{0,062}{12}$ ✓ $n = 36$ ✓ substitution into correct formula ✓ answer (5) <b>[13]</b>

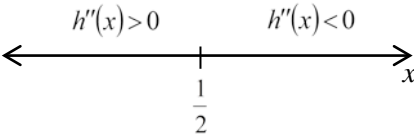
**QUESTION/VRAAG 8**

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

	<p>By using the chain rule (which is not part of CAPS):</p> $y = (x^2 - x^{-2})^2$ $\frac{dy}{dx} = 2(x^2 - x^{-2})(2x + 2x^{-3})$ $= 2(2x^3 + 2x^{-1} - 2x^{-1} - 2x^{-5})$ $= 2(2x^3 - 2x^{-5})$ $= 4x^3 - 4x^{-5}$	<p>✓✓✓</p> $2(x^2 - x^{-2})(2x + 2x^{-3})$ <p>(3)</p>
<p>8.2.2</p>	<p><math>D_x \left[ \frac{(x-1)(x^2+x+1)}{x-1} \right]</math></p> <p><math>= D_x [x^2 + x + 1]</math></p> <p><math>= 2x + 1</math></p> <p><b>OR/OF</b></p> <p>By using the quotient rule (with is not part of CAPS):</p> $D_x \left[ \frac{x^3 - 1}{x - 1} \right]$ $= \frac{3x^2(x-1) - (x^3 - 1)}{(x-1)^2}$	<p>✓ factorisation</p> <p>✓ <math>x^2 + x + 1</math></p> <p>✓ <math>2x + 1</math></p> <p>(3)</p> <p>✓✓✓</p> $\frac{3x^2(x-1) - (x^3 - 1)}{(x-1)^2}$ <p>(3)</p> <p><b>[11]</b></p>

**QUESTION/VRAAG 9**

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

<p>9.3</p>	$h'(x) = -3x^2 + 3x + 6$ $h''(x) = -6x + 3$ $= -3(2x - 1)$  <p>For <math>x &lt; \frac{1}{2}</math>, <math>h</math> is concave up and for <math>x &gt; \frac{1}{2}</math>, <math>h</math> is concave down  <i>Vir <math>x &lt; \frac{1}{2}</math>, is <math>h</math> konkaaf na bo en vir <math>x &gt; \frac{1}{2}</math>, is <math>h</math> konkaaf na onder</i></p> <p><math>\therefore</math> concavity changes at <math>x = \frac{1}{2}</math> /  <math>\therefore</math> <i>konkwiteit verander by <math>x = \frac{1}{2}</math></i></p>	<p>✓ <math>h'(x) = -3x^2 + 3x + 6</math>                  ✓ <math>h''(x) = -6x + 3</math></p> <p>✓ explanation using <math>h''(x)</math></p> <p>(3)</p>
<p>9.4</p>	<p>The graph of <math>h</math> has a point of inflection at <math>x = \frac{1}{2}</math> /  <i>Die grafiek van <math>h</math> het 'n buigpunt by <math>x = \frac{1}{2}</math>.</i></p> <p><b>OR/OF</b></p> <p>The graph of <math>h</math> changes from concave up to concave down at <math>x = \frac{1}{2}</math> / <i>Die grafiek van <math>h</math> verander by <math>x = \frac{1}{2}</math> van konkaaf op na konkaaf af</i></p>	<p>✓ answer (1)</p> <p>✓ answer (1)</p>
<p>9.5</p>	<p>Gradient of <math>g</math> is <math>-12</math> / <i>Gradiënt van <math>g</math> is <math>-12</math></i>                  Gradient of tangent is / <i>Gradiënt van die raaklyn is:</i></p> $h'(x) = -3x^2 + 3x + 6$ $h'(x) = -12$ $-3x^2 + 3x + 6 = -12$ $3x^2 - 3x + 18 = 0$ $x^2 - x + 6 = 0$ $(x - 3)(x + 2) = 0$ $x = -2 \text{ only}$	<p>✓ <math>h'(x) = -3x^2 + 3x + 6</math>                  ✓ <math>h'(x) = -12</math></p> <p>✓ factors                  ✓ selection of <math>x</math>-value</p> <p>(4)  <b>[17]</b></p>

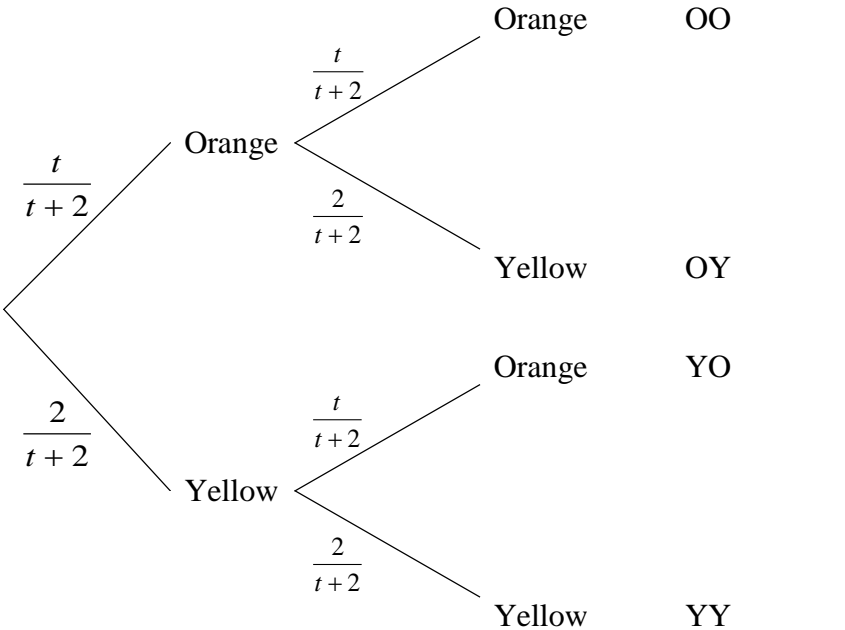
**QUESTION/VRAAG 10**

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

**QUESTION/VRAAG 11**

11.1	$P(A) \times P(B)$ $= 0,2 \times 0,63$ $= 0,126$ 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>	$\checkmark 0,2 \times 0,63$  $\checkmark P(A) \times P(B) = P(A \text{ and } B)$ $\checkmark$ 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	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 $3 \times (5 \times 4 \times 3 \times 2 \times 1) \times 4 = 1440$  <i>Daar is 3 klinkers <math>\Rightarrow</math> 3 opsies vir die eerste posisie</i> <i>Daar is 4 konsonante <math>\Rightarrow</math> 4 opsies vir die laaste posisie</i> <i>Die oorblywende 5 letters kan as volg gerangskik word</i>  $5 \times 4 \times 3 \times 2 \times 1$ ways/ <i>maniere</i> $3 \times (5 \times 4 \times 3 \times 2 \times 1) \times 4 = 1440$	$\checkmark \times 3$ $\checkmark \times 4$ $\checkmark 5 \times 4 \times 3 \times 2 \times 1$ $\checkmark$ answer (4)



<p>11.3</p>	 <p> <math>P(\text{Orange, Orange}) + P(\text{Yellow, Yellow}) = \frac{52}{100}</math>  <math>\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}</math>  <math>\frac{t^2}{t^2 + 4t + 4} + \frac{4}{t^2 + 4t + 4} = \frac{13}{25}</math>  <math>25(t^2 + 4) = 13(t^2 + 4t + 4)</math>  <math>3t^2 - 13t + 12 = 0</math>  <math>(3t - 4)(t - 3) = 0</math>  <math>t = 3</math> </p> <p>There are 3 orange balls in the bag/<i>Daar is 3 oranje balle in die sak</i></p>	<p>OO</p> <p>OY</p> <p>YO</p> <p>YY</p> <p> <math>\checkmark P(O) = \left(\frac{t}{t+2}\right)</math>  <math>\checkmark P(Y) = \left(\frac{2}{t+2}\right)</math>  <math>\checkmark P(O,O) = \left(\frac{t}{t+2}\right)^2</math>  <math>\checkmark P(Y,Y) = \left(\frac{2}{t+2}\right)^2</math>  <math>\checkmark \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}</math>  <math>\checkmark t = 3</math> (no ca)         </p> <p>(6) [17]</p>
<b>TOTAL/TOTAAL:</b>		<b>150 marks</b>