



basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

**NATIONAL
SENIOR CERTIFICATE
NASIONALE
SENIOR SERTIFIKAAT**

GRADE 11/GRAAD 11

MATHEMATICS P1/WISKUNDE VI

NOVEMBER 2013

MEMORANDUM

MARKS/PUNTE: 150

**This memorandum consists of 14 pages.
*Hierdie memorandum bestaan uit 14 bladsye.***

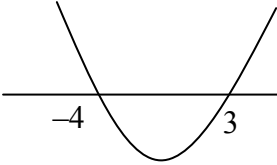
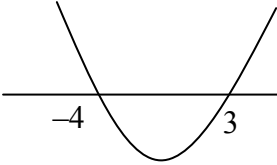
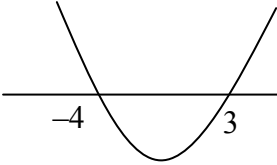
NOTE:

- If a candidate answered a question TWICE, mark the FIRST attempt ONLY.
- If a candidate crossed out an attempt of a question and did not redo the question, mark the crossed-out question.
- Consistent accuracy applies in ALL aspects of the memorandum.

LET WEL:

- As 'n kandidaat 'n vraag TWEE keer beantwoord het, merk SLEGS die EERSTE poging.
- As 'n kandidaat 'n antwoord deurgehaal het en nie oorgedoen het nie, merk die deurgehaalde antwoord.
- Volgehoue akkuraatheid (werk met die fout) moet op ALLE aspekte van die memorandum toegepas word.

QUESTION/VRAAG 1

<p>1.1.1</p>	$3x^2 = 5x + 2$ $3x^2 - 5x - 2 = 0$ $(3x + 1)(x - 2) = 0$ $x = -\frac{1}{3} \text{ or } x = 2$	<p>✓ standard form</p> <p>✓ factors</p> <p>✓✓ answers</p> <p>(4)</p>												
<p>1.1.2</p>	$x^2 + 2x - 4 = 0$ $x = \frac{-(2) \pm \sqrt{(2)^2 - 4(1)(-4)}}{2(1)}$ $x = \frac{-2 \pm \sqrt{20}}{2}$ $x = 1,24 \text{ or } x = -3,24$	<p>✓ substitution into correct formula</p> <p>✓ simplification</p> <p>✓✓ answers</p> <p>(4)</p>												
<p>1.1.3</p>	$x^2 + x - 12 < 0$ $(x + 4)(x - 3) < 0$ <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: center;">+</td> <td style="text-align: center;">0</td> <td style="text-align: center;">-</td> <td style="text-align: center;">0</td> <td style="text-align: center;">+</td> <td rowspan="2" style="vertical-align: middle; padding: 0 10px;">OR</td> <td rowspan="2" style="text-align: center; vertical-align: middle;">  </td> </tr> <tr> <td style="text-align: center;">-</td> <td style="text-align: center;">-4</td> <td style="text-align: center;">-</td> <td style="text-align: center;">3</td> <td style="text-align: center;">-</td> </tr> </table> $-4 < x < 3 \text{ OR } x \in (-4; 3)$	+	0	-	0	+	OR		-	-4	-	3	-	<p>✓ standard form</p> <p>✓ factors</p> <p>✓ method</p> <p>✓ answer</p> <p>(4)</p>
+	0	-	0	+	OR									
-	-4	-	3	-										
<p>1.2.1</p>	$\left(\frac{125x^7}{x}\right)^{\frac{2}{3}}$ $= (5^3 x^6)^{\frac{2}{3}}$ $= 5^2 x^4$ $= 25x^4$	<p>✓ $5^3 x^6$</p> <p>✓ x^4</p> <p>✓ answer (accept 25 or 5^2)</p> <p>(3)</p>												

<p>1.2.2</p>	$(\sqrt{3} + 3)^2 - 2\sqrt{27}$ $= 3 + 6\sqrt{3} + 9 - 2\sqrt{9 \cdot 3}$ $= 12 + 6\sqrt{3} - 6\sqrt{3}$ $= 12$	<ul style="list-style-type: none"> ✓ $3 + 6\sqrt{3} + 9$ ✓ $6\sqrt{3}$ ✓ simplification ✓ answer <p style="text-align: right;">(4)</p>
<p>1.3.1</p>	$y = x + 2$ $xy + y^2 - 10(x + 1) = 0$ $x(x + 2) + (x + 2)^2 - 10(x + 1) = 0$ $x^2 + 2x + x^2 + 4x + 4 - 10x - 10 = 0$ $2x^2 - 4x - 6 = 0$ $x^2 - 2x - 3 = 0$ $(x - 3)(x + 1) = 0$ $x = 3 \quad \text{or} \quad x = -1$ $y = 5 \quad \text{or} \quad y = 1$ <p>OR</p> $y = x + 2$ $x = y - 2$ $xy + y^2 - 10(x + 1) = 0$ $xy + y^2 - 10(x + 1) = 0$ $(y - 2)y + y^2 - 10(y - 2 + 1) = 0$ $y^2 - 2y + y^2 - 10y + 10 = 0$ $2y^2 - 12y + 10 = 0$ $y^2 - 6y + 5 = 0$ $(y - 5)(y - 1) = 0$ $y = 5 \quad \text{or} \quad y = 1$ $x = 3 \quad \text{or} \quad x = -1$	<ul style="list-style-type: none"> ✓ substitution ✓ simplification ✓ standard form ✓ factors ✓ x-values ✓ y-values <p style="text-align: right;">(6)</p> <ul style="list-style-type: none"> ✓ substitution ✓ simplification ✓ standard form ✓ factors ✓ x-values ✓ y-values <p style="text-align: right;">(6) [25]</p>

QUESTION/VRAAG 2

2.1.1	$\sqrt{x+6} = x+4$ $x+6 = x^2 + 8x+16$ $0 = x^2 + 7x+10$ $0 = (x+5)(x+2)$ $x \neq -5$ or $x = -2$ Answer : $x = -2$ only	✓ square both sides ✓ standard form ✓ factors ✓ $x \neq -5$ ✓ $x = -2$ (5)
2.1.2	Shift is one unit RIGHT/ <i>Skuif is een eenheid na REGS</i> $\therefore x = -2 + 1$ $= -1$	✓ Shift is one unit RIGHT ✓ $x = -2 + 1$ (2)
2.2.1	$f(3) = \frac{3}{\sqrt{3^3 - 9}}$ $= \frac{3}{\sqrt{18}}$ $= \frac{3}{3\sqrt{2}}$ $= \frac{1}{\sqrt{2}}$	✓ $\frac{3}{\sqrt{18}}$ ✓ $\frac{3}{3\sqrt{2}}$ ✓ answer (3)
2.2.2	Undefined if: $3^x - 9 = 0$ $3^x = 9$ $3^x = 3^2$ $x = 2$	✓ $3^x - 9 = 0$ ✓ $3^x = 3^2$ ✓ answer (3)
2.2.3	$x < 2$	✓ answer (1) [14]

QUESTION/VRAAG 3

<p>3.1</p>	<p>Perimeter is 60 cm. Hypotenuse is 25 cm. <i>Omtrek is 60 cm. Skuinssy is 25 cm.</i> Let the third side of the triangle be y: <i>Laat die derde sy van die driehoek y wees:</i> $x + 25 + y = 60$ $y = 35 - x$</p>	<p>✓ $x + 25 + y = 60$ (1)</p>
<p>3.2</p>	<p>By Pythagoras: $x^2 + y^2 = r^2$ $x^2 + (35 - x)^2 = 25^2$ $x^2 + 1225 - 70x + x^2 = 625$ $2x^2 - 70x - 600 = 0$ $x^2 - 35x - 300 = 0$ $(x - 15)(x - 20) = 0$ $x = 15$ or $x = 20$ Other sides have lengths of 15 and 20. <i>Ander sye het lengtes van 15 en 20.</i></p>	<p>✓ Pythagoras ✓ Subs $35 - x$ ✓ Standard form ✓ factors ✓ answer ✓ answer (5) [6]</p>

QUESTION/VRAAG 4

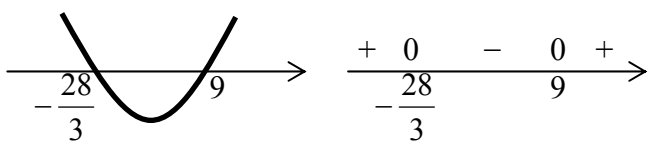
<p>4.1</p>	<p>$A = P(1 + i)^n$ $= 1500 \left(1 + \frac{0,15}{2} \right)^{5 \times 2}$ $= R 3091,55$</p>	<p>✓ subs into correct formula ✓ $i = \frac{0,15}{2}$ ✓ $n = 10$ ✓ answer (4)</p>
<p>4.2</p>	<p>$1 + i_{eff} = \left(1 + \frac{0,15}{2} \right)^2$ $i_{eff} = 0,1556 = 15,56\%$ OR $A = P(1 + i)^n$ $3091,55 = 1500(1 + i)^5$ $\frac{3091,55}{1500} = (1 + i)^5$ $\sqrt[5]{2,061033} = 1 + i$ $i = 0,1556 = 15,56\%$</p>	<p>✓ formula ✓ substitution into correct formula ✓ answer (3) ✓ formula ✓ $3091,55 = 1500(1 + i)^5$ ✓ answer (3) [7]</p>

QUESTION/VRAAG 5

5.1	$A = P(1 - i)^n$ $= 23000(1 - 0,135)^5$ $= R11\,138,03$	✓ subs into correct formula ✓ answer (2)
5.2	$A = P(1 + i)^n$ $= 23\,000(1 + 0,066)^5$ $= R31\,660,21$	✓ subs into correct formula ✓ answer (2)
5.3	Value of fund needed = R 31 660,21 – R 11 138,03 <i>Waarde van die fonds benodig</i> $= R20\,522,18 \quad 20522,18 = P \left(1 + \frac{0,047}{12} \right)^{60}$ $P = R\,16231,69$	✓ method (subtraction) ✓ answer ✓ $n = 60$ ✓ $i = \frac{0,047}{12}$ ✓ substitution into correct formula ✓ answer (6) [10]

QUESTION/VRAAG 6

Pattern number	1	2	3		
Number of sticks	2	7	15		
6.1	26				✓
6.2	<p>If the new sequence terms are given by $T_n = an^2 + bn + c$</p> $2a = 3$ $3a + b = 5$ $a + b + c = 2$ <p>Hence:</p> $a = \frac{3}{2}$ $3\left(\frac{3}{2}\right) + b = 5$ $b = \frac{1}{2}$ $\left(\frac{3}{2}\right) + \left(\frac{1}{2}\right) + c = 2$ $c = 0$ $T_n = \frac{3}{2}n^2 + \frac{1}{2}n$ <p>OR</p> <p>If the new sequence terms are given by $T_n = an^2 + bn + c$</p> $2a = 3$ $a = \frac{3}{2}$ <p>By inspection, $c = 0$</p> $T_n = \frac{3}{2}n^2 + bn$ <p>Substitute $T_1 = 2$</p> $2 = \frac{3}{2}(1)^2 + b(1)$ $b = \frac{1}{2}$ $T_n = \frac{3}{2}n^2 + \frac{1}{2}n$				<p>(1)</p> <p>✓substitutions</p> <p>✓ $a = \frac{3}{2}$</p> <p>✓ $b = \frac{1}{2}$</p> <p>✓ $c = 0$</p> <p>(4)</p> <p>✓ $a = \frac{3}{2}$</p> <p>✓ $c = 0$</p> <p>✓substitution</p> <p>✓ $b = \frac{1}{2}$</p> <p>(4)</p>

<p>6.3</p>	$T_{16} = \frac{3}{2}(16)^2 + \frac{1}{2}(16)$ $= 392$	<p>✓ substitution</p> <p>✓ answer</p> <p style="text-align: right;">(2)</p>
<p>6.4</p>	$\frac{3}{2}n^2 + \frac{1}{2}n < 126$ $3n^2 + n < 252$ $3n^2 + n - 252 < 0$ $(3n + 28)(n - 9) < 0$  $-\frac{28}{3} < n < 9$ $n = 8$	<p>✓ setting up inequality</p> <p>✓ standard form</p> <p>✓ factors</p> <p>✓ method</p> <p>✓ answer</p> <p style="text-align: right;">(5) [12]</p>

QUESTION/VRAAG 7

Given the sequence: $\frac{1}{2}$; $\frac{2}{3}$; $\frac{3}{4}$; $\frac{4}{5}$; y		
7.1	$y = \frac{5}{6}$	✓ answer (1)
7.2	$T_n = \frac{n}{n+1}$	✓ numerator ✓✓ denominator (3) [4]

QUESTION/VRAAG 8

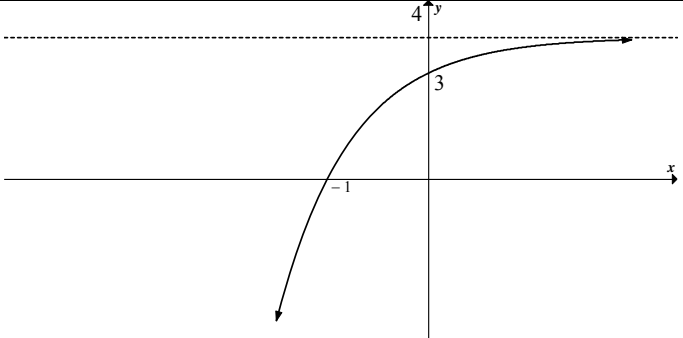
Given: 1 ; 2 ; 5 ; 6 ; 9 ; 18 ; 13 ; 54 ; ...		
8.1	17 ; 162 <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 5px auto;">NOTE: If the answers are in the incorrect order: 1/2 marks <i>LET WEL: As die antwoorde in die verkeerde volgorde is: 1/2 punte</i></div>	✓ 17 ✓ 162 (2)
8.2	31 st term of the sequence is LINEAR. It will be the 16 th linear term. <i>31^{ste} term van die ry is LINEÊR. Dit sal die 16^{de} lineêre term wees.</i> $T_{31} = 4(16) - 3$ $= 61$ OR 1 ; 2 ; 5 ; 6 ; 9 ; 18 ; 13 ; 54 ; 17 ; 162 ; 21 ; 486 ; 25 ; 1 458 ; 29 ; 4 374 ; 33 ; 13 122 ; 37 ; 39 366 ; 41 ; 118 098 ; 45 ; 354 294 ; 49 ; 1 062 882 ; 53 ; 3 188 646 ; 57 ; 9 565 938 ; 61 The 31 st term of the sequence is 61.	✓ $n = 16$ ✓ $4n - 3$ ✓ answer (3) ✓✓ correct expansion ✓ answer (3) [5]

QUESTION/VRAAG 9

9.1	R	✓ answer (1)
9.2	$f(x) = x^2 - 2x - 3$ $x^2 - 2x - 3 = 0$ $(x-3)(x+1) = 0$ $x = 3$ or $x = -1$ $AB = 4$	✓ $(x-3)(x+1) = 0$ ✓ $x = 3$ or $x = -1$ ✓ $AB = 4$ (3)
9.3	$C(0; -3)$ Average gradient = $\frac{-3-0}{0-(-1)}$ $= \frac{-3}{1}$ $= -3$	✓ $C(0; -3)$ ✓ correct formula ✓ answer (3)
9.4	TP : $x = -\frac{(-2)}{2(1)}$ $= 1$ $y = x^2 - 2x - 3$ $= 1 - 2 - 3$ $= -4$ $H(1; -4)$	✓ $x = -\frac{b}{2a}$ ✓ $x = 1$ ✓ $y = -4$ (3)
9.5	$m_{LINE} = 2$ $m_g = -\frac{1}{2}$ Point : $(-1; 0)$ $y - (0) = -\frac{1}{2}(x+1)$ $y = -\frac{1}{2}x - \frac{1}{2}$	✓ $m_g = -\frac{1}{2}$ ✓ subs $(-1; 0)$ ✓ formula ✓ $y = -\frac{1}{2}x - \frac{1}{2}$ (4)
9.6	$0 \leq x \leq 3$ OR $x \in [0; 3]$	✓ $0 \leq x$ ✓ $x < 3$ (2) (2)

<p>9.7</p>	$DE = x^2 - 2x - 3 - \left(-\frac{1}{2}x - \frac{1}{2}\right)$ $7,5 = x^2 - \frac{3}{2}x - \frac{5}{2}$ $2x^2 - 3x - 20 = 0$ $(2x + 5)(x - 4) = 0$ $x = -\frac{5}{2} \text{ or } x = 4$ <p>Answer: $x = 4$ only</p>	$\checkmark DE = x^2 - 2x - 3 - \left(-\frac{1}{2}x - \frac{1}{2}\right)$ $\checkmark x^2 - \frac{3}{2}x - \frac{5}{2} = 7,5$ <p> \checkmark standard form \checkmark factors \checkmark answer </p> <p>(5)</p>
<p>9.8</p>	<p>$k < -4$</p>	<p>$\checkmark k < -4$</p> <p>(1)</p> <p>[22]</p>

QUESTION/VRAAG 10

<p>Given: $f(x) = -\left(\frac{1}{4}\right)^x + 4$</p>		
<p>10.1</p>	<p>$y = 4$</p>	<p>\checkmark answer</p> <p>(1)</p>
<p>10.2</p>	$y = -\left(\frac{1}{4}\right)^0 + 4$ $= 3$ <p>$(0 ; 3)$</p>	<p>$\checkmark x = 0$</p> <p>$\checkmark 3$</p> <p>(2)</p>
<p>10.3</p>	$0 = -\left(\frac{1}{4}\right)^x + 4$ $\left(\frac{1}{4}\right)^x = 4$ $4^{-x} = 4$ $-x = 1$ $x = -1$ <p>$(-1 ; 0)$</p>	<p>$\checkmark y = 0$</p> <p>$\checkmark \left(\frac{1}{4}\right)^x = 4$</p> <p>$\checkmark x = 1$</p> <p>(3)</p>
<p>10.4</p>		<p>\checkmark shape</p> <p>\checkmark x-intercept</p> <p>\checkmark y-intercept</p> <p>\checkmark asymptote</p> <p>(4)</p>

10.5	$y = \left(\frac{1}{4}\right)^x + 4$	$\checkmark \left(\frac{1}{4}\right)^x$ $\checkmark + 4$	(2) [12]
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QUESTION/VRAAG 11

11.1	$p = -5$ $q = 1$	$\checkmark p = -5$ $\checkmark q = 1$	(2)
11.2	$h(x) = \frac{-3}{x-6} + 5$	$\checkmark x - 6$ $\checkmark 5$	(2) [4]

QUESTION/VRAAG 12

12.1	$f(x) = ax^2 + bx + c$ $m - 5$ and $m + 3$ are roots of $f(x) = 0$ Max value at $x = 2$ $\therefore \frac{m-5+m+3}{2} = 2$ $2m - 2 = 4$ $m = 3$	$\checkmark \frac{m-5+m+3}{2}$ $\checkmark = 2$ \checkmark answer	(3)
12.2	For $m = 3$ the roots are : $3 - 5 = -2$ and $3 + 3 = 6$ $f(1) = 15$ $y = a(x+2)(x-6)$ $15 = a(1+2)(1-6)$ $15 = -15a$ $a = -1$ $y = -1(x+2)(x-6)$ $y = -(x^2 - 4x - 12)$ $y = -x^2 + 4x + 12$	\checkmark roots: -2 and 6 $\checkmark y = a(x+2)(x-6)$ \checkmark subs $f(1) = 15$ $\checkmark a = -1$ $\checkmark y = -x^2 + 4x + 12$	(5) [8]

QUESTION/VRAAG 13

Given:			
	HIV POSITIVE	HIV NEGATIVE	TOTAL
Male	106	422	b
Female	a	d	c
TOTAL	192	e	960

13.1	960	✓ answer (1)
13.2	$a = 86$ $b = 528$ $c = 432$ $d = 346$ $e = 768$	✓ $a = 86$ ✓ $b = 528$ ✓ $c = 432$ ✓ $d = 346$ ✓ $e = 768$ (5)
13.3	Let M be the event 'student is male'. <i>Laat M die gebeurtenis 'student is manlik' wees.</i> Let H be the event 'student is HIV positive'. <i>Laat H die gebeurtenis 'student is MIV-positief' wees.</i> $P(M) \times P(H) = \frac{528}{960} \times \frac{192}{960}$ $= 0,11$ $P(M \text{ and } H) = \frac{106}{960}$ $= 0,11$ Since $P(M) \times P(H) = P(M \text{ and } H)$, the events M and H are independent, i.e. HIV status is independent of gender. <i>Aangesien $P(M) \times P(H) = P(M \text{ en } H)$, is die gebeurtenisse M en H onafhanklik, d.i. MIV-status is onafhanklik van geslag.</i>	✓ $P(M) = \frac{528}{960}$ or $P(H) = \frac{192}{960}$ ✓ $P(M) \times P(H) = 0,11$ ✓ $P(M \text{ and } H) = 0,11$ ✓ conclusion (4) [10]

QUESTION/VRAAG 14

<p>14.1</p>	<p>Let H be the event 'customers said they were happy'. Let A be the event 'customers said they would shop at the store again'. <i>Laat H die gebeurtenis 'klante sê hulle is gelukkig' wees. Laat A die gebeurtenis 'klante sê hulle sal weer by die winkel koop' wees.</i></p>	<ul style="list-style-type: none"> ✓ level one of tree ✓ second level first tier ✓ second level, second tier ✓ outcomes given ✓ probabilities given on tree <p style="text-align: right;">(5)</p>
<p>14.2</p>	$P(A) = P(H \text{ and } A) + P(\text{not } H \text{ and } A)$ $= 0,665 + 0,078$ $= 0,743$	<ul style="list-style-type: none"> ✓ $P(H \text{ and } A) + P(\text{not } H \text{ and } A)$ ✓ answer <p style="text-align: right;">(2) [7]</p>

QUESTION/VRAAG 15

$P(A \text{ and } B) = P(A) \times P(B)$ $= \frac{4}{9} \times \frac{3}{7}$ $= \frac{4}{21}$ $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$ $= \frac{4}{9} + \frac{3}{7} - \frac{4}{21}$ $= \frac{28 + 27 - 12}{63}$ $= \frac{43}{63}$ $= 68,25\%$	<ul style="list-style-type: none"> ✓ $P(A) \times P(B) = \frac{4}{21}$ ✓ $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$ ✓ substitution ✓ answer <p style="text-align: right;">[4]</p>
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TOTAL/TOTAAL: 150