basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

NATIONAL
SENIOR CERTIFICATE
NASIONALE
SENIOR SERTIFIKAAT

GRADE 11/*GRAAD 11*

MATHEMATICS P1/*WISKUNDE V1*

NOVEMBER 2013

MEMORANDUM

MARKS/*PUNTE*: 150

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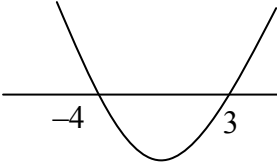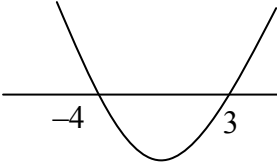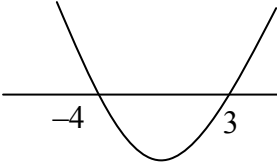*Hierdie memorandum bestaan uit 14 bladsye.*

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

1.1.1	$3x^2 = 5x + 2$ $3x^2 - 5x - 2 = 0$ $(3x+1)(x-2) = 0$ $x = -\dfrac{1}{3}$ or $x = 2$	✓ standard form ✓ factors ✓✓ answers (4)
1.1.2	$x^2 + 2x - 4 = 0$ $x = \dfrac{-(2) \pm \sqrt{(2)^2 - 4(1)(-4)}}{2(1)}$ $x = \dfrac{-2 \pm \sqrt{20}}{2}$ $x = 1{,}24$ or $x = -3{,}24$	✓ substitution into correct formula ✓ simplification ✓✓ answers (4)
1.1.3	$x^2 + x - 12 < 0$ $(x+4)(x-3) < 0$ (number line: $+$ 0 $-$ 0 $+$ at -4 and 3) **OR** (parabola through -4 and 3) $-4 < x < 3$ **OR** $x \in (-4\,;3)$	✓ standard form ✓ factors ✓ method ✓ answer (4)
1.2.1	$\left(\dfrac{125x^7}{x}\right)^{\frac{2}{3}}$ $= \left(5^3 x^6\right)^{\frac{2}{3}}$ $= 5^2 x^4$ $= 25x^4$	 ✓ $5^3 x^6$ ✓ x^4 ✓ answer (accept 25 or 5^2) (3)

1.2.2	$(\sqrt{3}+3)^2 - 2\sqrt{27}$ $= 3 + 6\sqrt{3} + 9 - 2\sqrt{9.3}$ $= 12 + 6\sqrt{3} - 6\sqrt{3}$ $= 12$	$\checkmark 3 + 6\sqrt{3} + 9$ $\checkmark 6\sqrt{3}$ $\checkmark$ simplification $\checkmark$ answer (4)
1.3.1	$y = x + 2$ $xy + y^2 - 10(x+1) = 0$ $x(x+2) + (x+2)^2 - 10(x+1) = 0$ $x^2 + 2x + x^2 + 4x + 4 - 10x - 10 = 0$ $2x^2 - 4x - 6 = 0$ $x^2 - 2x - 3 = 0$ $(x-3)(x+1) = 0$ $x = 3$ or $x = -1$ $y = 5$ or $y = 1$ **OR** $y = x + 2$ $x = y - 2$ $xy + y^2 - 10(x+1) = 0$ $xy + y^2 - 10(x+1) = 0$ $(y-2)y + y^2 - 10(y-2+1) = 0$ $y^2 - 2y + y^2 - 10y + 10 = 0$ $2y^2 - 12y + 10 = 0$ $y^2 - 6y + 5 = 0$ $(y-5)(y-1) = 0$ $y = 5$ or $y = 1$ $x = 3$ or $x = -1$	$\checkmark$ substitution $\checkmark$ simplification $\checkmark$ standard form $\checkmark$ factors $\checkmark$ *x*-values $\checkmark$ *y*-values (6) $\checkmark$ substitution $\checkmark$ simplification $\checkmark$ standard form $\checkmark$ factors $\checkmark$ *x*-values $\checkmark$ *y*-values (6) **[25]**

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/*Skuif is een eenheid na REGS* $\therefore x = -2+1$ $= -1$	✓Shift is one unit RIGHT ✓$x = -2+1$ (2)
2.2.1	$f(3) = \dfrac{3}{\sqrt{3^3-9}}$ $= \dfrac{3}{\sqrt{18}}$ $= \dfrac{3}{3\sqrt{2}}$ $= \dfrac{1}{\sqrt{2}}$	✓$\dfrac{3}{\sqrt{18}}$ ✓$\dfrac{3}{3\sqrt{2}}$ ✓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

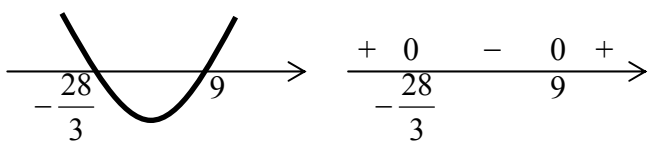| 3.1	Perimeter is 60 cm. Hypotenuse is 25 cm. *Omtrek is 60 cm. Skuinssy is 25 cm.* Let the third side of the triangle be y: *Laat die derde sy van die driehoek y wees:* $x + 25 + y = 60$ $y = 35 - x$	✓ $x + 25 + y = 60$ (1)
3.2	By Pythagoras: $x^2 + y^2 = r^2$ $x^2 + (35 - x)^2 = 25^2$ $x^2 + 1225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

QUESTION/*VRAAG* 4

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

QUESTION/*VRAAG* 5

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

QUESTION/*VRAAG* 6

Pattern number	1	2	3		
Number of sticks	2	7	15		

6.1	26	✓ (1)
6.2	$\begin{array}{c} 2 \quad\quad 7 \quad\quad 15 \quad\quad 26 \\ \quad 5 \quad\quad 8 \quad\quad 11 \\ \quad\quad 3 \quad\quad 3 \end{array}$ If the new sequence terms are given by $T_n = an^2 + bn + c$ $2a = 3$ $3a + b = 5$ $a + b + c = 2$ Hence: $$a = \frac{3}{2}$$ $$3\left(\frac{3}{2}\right) + b = 5$$ $$b = \frac{1}{2}$$ $$\left(\frac{3}{2}\right) + \left(\frac{1}{2}\right) + c = 2$$ $$c = 0$$ $$T_n = \frac{3}{2}n^2 + \frac{1}{2}n$$ **OR** If the new sequence terms are given by $T_n = an^2 + bn + c$ $2a = 3$ $$a = \frac{3}{2}$$ By inspection, $c = 0$ $$T_n = \frac{3}{2}n^2 + bn$$ Substitute $T_1 = 2$ $$2 = \frac{3}{2}(1)^2 + b(1)$$ $$b = \frac{1}{2}$$ $$T_n = \frac{3}{2}n^2 + \frac{1}{2}n$$	✓substitutions ✓$a = \dfrac{3}{2}$ ✓$b = \dfrac{1}{2}$ ✓$c = 0$ (4) ✓$a = \dfrac{3}{2}$ ✓$c = 0$ ✓substitution ✓$b = \dfrac{1}{2}$ (4)

6.3	$T_{16} = \dfrac{3}{2}(16)^2 + \dfrac{1}{2}(16)$ $\qquad = 392$	✓ substitution ✓ answer (2)
6.4	$\dfrac{3}{2}n^2 + \dfrac{1}{2}n < 126$ $3n^2 + n < 252$ $3n^2 + n - 252 < 0$ $(3n + 28)(n - 9) < 0$ $-\dfrac{28}{3} < n < 9$ $n = 8$	✓ setting up inequality ✓ standard form ✓ factors ✓ method ✓ answer (5) **[12]**

QUESTION/*VRAAG* 7

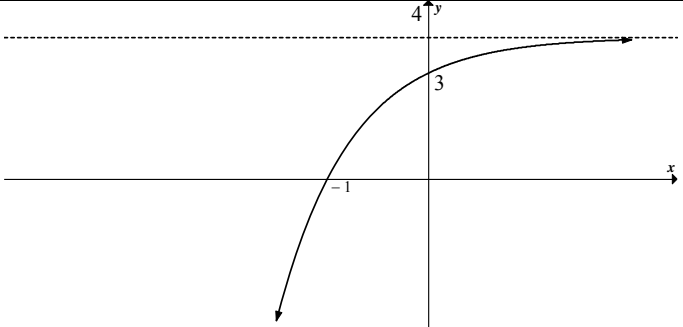| Given the sequence: $\dfrac{1}{2}$; $\dfrac{2}{3}$; $\dfrac{3}{4}$; $\dfrac{4}{5}$; y	
7.1 $y = \dfrac{5}{6}$	✓ answer (1)
7.2 $T_n = \dfrac{n}{n+1}$	✓numerator ✓✓ denominator (3) **[4]**

QUESTION/*VRAAG* 8

Given: 1 ; 2 ; 5 ; 6 ; 9 ; 18 ; 13 ; 54 ; …	
8.1 17 ; 162 NOTE: If the answers are in the incorrect order: 1/2 marks *LET WEL: As die antwoorde in die verkeerde volgorde is: 1/2 punte*	✓ 17 ✓ 162 (2)
8.2 31st term of the sequence is LINEAR. It will be the 16th linear term. *31ste term van die ry is LINEÊR. Dit sal die 16de lineêre term wees.* $T_{31} = 4(16) - 3$ $\quad = 61$ **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 31st 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 $= \dfrac{-3 - 0}{0 - (-1)}$ $\qquad\qquad\qquad = \dfrac{-3}{1}$ $\qquad\qquad\qquad = -3$	✓$C(0;-3)$ ✓ correct formula ✓answer (3)
9.4	TP : $x = -\dfrac{(-2)}{2(1)}$ $\quad = 1$ $y = x^2 - 2x - 3$ $\quad = 1 - 2 - 3$ $\quad = -4$ H$(1 ; -4)$	✓ $x = -\dfrac{b}{2a}$ ✓$x = 1$ ✓$y = -4$ (3)
9.5	$m_{LINE} = 2$ $m_g = -\dfrac{1}{2}$ Point : $(-1 ; 0)$ $y - (0) = -\dfrac{1}{2}(x+1)$ $y = -\dfrac{1}{2}x - \dfrac{1}{2}$	✓ $m_g = -\dfrac{1}{2}$ ✓subs $(-1 ; 0)$ ✓formula ✓ $y = -\dfrac{1}{2}x - \dfrac{1}{2}$ (4)
9.6	$0 \le x \le 3$ **OR** $x \in [0 ; 3]$	✓ $0 \le x$ ✓ $x < 3$ (2) (2)

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

QUESTION/*VRAAG* 10

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

10.5	$y = \left(\dfrac{1}{4}\right)^x + 4$	$\checkmark \left(\dfrac{1}{4}\right)^x$ $\checkmark\, + 4$ (2) **[12]**

QUESTION/*VRAAG* 11

11.1	$p = -5$ $q = 1$	$\checkmark p = -5$ $\checkmark q = 1$ (2)
11.2	$h(x) = \dfrac{-3}{x-6} + 5$	$\checkmark\, x - 6$ $\checkmark 5$ (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 $x = 2$ $\therefore \dfrac{m-5+m+3}{2} = 2$ $2m - 2 = 4$ $m = 3$	$\checkmark \dfrac{m-5+m+3}{2}$ $\checkmark = 2$ $\checkmark$ 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'. *Laat M die gebeurtenis 'student is manlik' wees.* Let *H* be the event 'student is HIV positive'. *Laat H die gebeurtenis 'student is MIV-positief' wees.* $P(M) \times P(H) = \dfrac{528}{960} \times \dfrac{192}{960}$ $\qquad\qquad\qquad = 0{,}11$ $P(M \text{ and } H) = \dfrac{106}{960}$ $\qquad\qquad\qquad = 0{,}11$ 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. *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.*	✓ $P(M) = \dfrac{528}{960}$ or $P(H) = \dfrac{192}{960}$ ✓ $P(M) \times P(H) = 0{,}11$ ✓ $P(M \text{ and } H) = 0{,}11$ ✓ conclusion (4) **[10]**

QUESTION/*VRAAG* 14

14.1	Let H be the event 'customers said they were happy'. Let A be the event 'customers said they would shop at the store again'. *Laat H die gebeurtenis 'klante sê hulle is gelukkig' wees.* *Laat A die gebeurtenis 'klante sê hulle sal weer by die winkel koop' wees.*	✓level one of tree ✓ second level first tier ✓ second level, second tier ✓ outcomes given ✓ probabilities given on tree (5)

0,95 — A   P(H and A) = 0,665

H

0,7   0,05 — not A   P(H and not A) = 0,035

0,26 — A   P(not H and A) = 0,078

0,3   not H

0,74 — not A   P(not H and not A) = 0,222

14.2	P(A) = P(H and A) + P(not H and A)
	       = 0,665 + 0,078
	       = 0,743
		✓P(H and A) + P(not H and A)
		✓answer
		(2)
		[7]

QUESTION/*VRAAG* 15

	P(A and B) = P(A) × P(B) $= \dfrac{4}{9} \times \dfrac{3}{7}$ $= \dfrac{4}{21}$ P(A or B) = P(A) + P(B) – P(A and B) $= \dfrac{4}{9} + \dfrac{3}{7} - \dfrac{4}{21}$ $= \dfrac{28 + 27 - 12}{63}$ $= \dfrac{43}{63}$ = 68,25%	✓P(A) × P(B) = $\dfrac{4}{21}$ ✓ P(A or B) = P(A) + P(B) – P(A and B) ✓ substitution ✓ answer **[4]**

TOTAL/*TOTAAL*: 150