basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE/ *NASIONALE SENIOR SERTIFIKAAT*

GRADE/*GRAAD* 11

MATHEMATICS P1/*WISKUNDE V1*

NOVEMBER 2016

MEMORANDUM

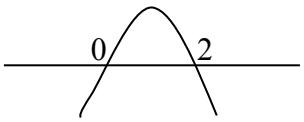
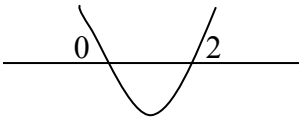
MARKS/*PUNTE*: 150

This memorandum consists of 15 pages.
Hierdie memorandum bestaan uit* 15 *bladsye.

NOTE:
- If a candidate answered a question TWICE, mark only the FIRST attempt.
- If a candidate crossed out an answer and did not redo it, mark the crossed-out answer.
- Consistent accuracy applies to ALL aspects of the marking memorandum.
- Assuming values/answers in order to solve a problem is unacceptable.

LET WEL:
- *As 'n kandidaat 'n vraag TWEE keer beantwoord het, sien slegs die EERSTE poging na.*
- *As 'n kandidaat 'n antwoord deurgehaal en nie oorgedoen het nie, sien die deurgehaalde antwoord na.*
- *Volgehoue akkuraatheid is op ALLE aspekte van die memorandum van toepassing.*
- *Dit is onaanvaarbaar om waardes/antwoorde te veronderstel om 'n probleem op te los.*

QUESTION/*VRAAG* 1

1.1.1	$3x^2 - 5x - 1 = 0$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $= \frac{-(-5) \pm \sqrt{(-5)^2 - 4(3)(-1)}}{2(3)}$ $= \frac{5 \pm \sqrt{37}}{6}$ $x = 1{,}85$ or $x = -0{,}18$	✓substitution/*vervanging* ✓answer/*antwoord* ✓answer/*antwoord* (3)
1.1.2	$x^2 - 6x + 8 = 0$ $(x-4)(x-2) = 0$ $x = 4$ or $x = 2$	✓ factors/*faktore* ✓ $x = 4$ ✓ $x = 2$ (3)
1.1.3	Option/*Opsie* 1 $4x - 2x^2 < 0$ $2x(2-x) < 0$ $x < 0$ *or* $x > 2$  **OR/*OF*** Option/*Opsie* 2 $4x - 2x^2 < 0$ $-2x^2 + 4x < 0$ $2x^2 - 4x > 0$ $x(2x-4) > 0$ $x < 0$ or $x > 2$ 	✓factors/*faktore* ✓ method/*metode* ✓$x < 0$ ✓$x > 2$ (4)

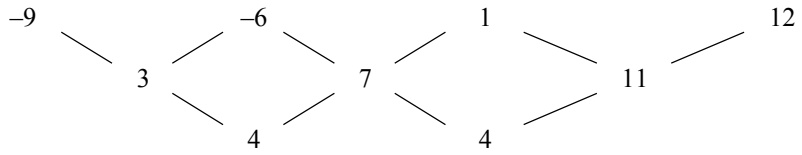
1.1.4	$2^{3x+1}+2^{3x}=12$ $2^{3x}\left[2^1+1\right]=12$ $2^{3x}.3 = 12$ $2^{3x} = 4$ $2^{3x} = 2^2$ $3x = 2$ $\therefore\ x=\frac{2}{3}$	✓common/*gemene* factor ✓ simplificaton/*vereenv.* ✓ equating/*gelykst* exponents ✓answer/*antw.* (4)
1.1.5	$\sqrt{x-1}+3=x-4$ $\sqrt{x-1}=x-4-3$ $x-1=(x-7)^2$ $x-1=x^2-14x+49$ $x^2-15x+50=0$ $(x-5)(x-10)=0$ $x\neq 5$ or $x=10$	✓isolate/*isoleer* √ sign/*teken* ✓squaring/*kwadr* both sides ✓ std vorm/*stand vorm* ✓factors/*fakt* ✓$x\neq 5$ ✓$x=10$ (6)
1.2	$3x-y+2=0$ and $y=-x^2+2x+8$ $\therefore\ y=3x+2$ $3x+2=-x^2+2x+8$ $x^2+x-6=0$ $(x+3)(x-2)=0$ $x=-3$ or $x=2$ $y=3(-3)+2$ or $y=3(2)+2$ $=-7$ or $y=8$	✓ $y=3x+2$ ✓substitution/*verv* ✓std form/*stand vorm* ✓factors/*fakt* ✓*x*-values/*wrdes* ✓ *y*-values/*wrdes* (6)
1.3	$3x^2+(k+2)x=1-k$ $3x^2+(k+2)x-1+k=0$ $\Delta=b^2-4ac$ $=(k+2)^2-4(3)(-1+k)$ $=k^2+4k+4+12-12k$ $=k^2-8k+16$ $=(k-4)^2$ $\therefore\ b^2-4ac$ is a perfect square. Roots are real and rational.	✓std form/*stand vorm* ✓substitution/*verv* ✓$k^2-8k+16$ ✓ $(k-4)^2$ (4) **[30]**

QUESTION/*VRAAG* 2

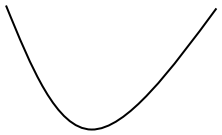
2.1.1	$\frac{5^a.5^{-2}.2^a\,2^2}{10^a - 10^a.10^{-1}.2}$ $= \frac{(5.2)^a.5^{-2}.2^2}{10^a\left[1-\frac{2}{10}\right]}$ $= \frac{10^a.\frac{4}{25}}{10^a.\frac{8}{10}}$ $= \frac{4}{25}\times\frac{10}{8}$ $= \frac{1}{5}$	✓writing as separate bases/ *skryf as priembasisse* ✓multiplication of bases with same exponents/*vermenigv. van basisse met dies. eksp.* ✓common/*gemene* factor ✓simplification/*vereenv.* ✓answer/*antw.* (5)
2.1.2	$\frac{\sqrt{27m^6} - \sqrt{48m^6}}{\sqrt{12m^6}}$ $= \frac{3.\sqrt{3}\,m^3 - 4.\sqrt{3}\,m^3}{2\sqrt{3m^6}}$ $= \frac{\sqrt{3m^6}(3-4)}{2\sqrt{3}\,m^3}$ $= \frac{-\sqrt{3}\,m^3}{2\sqrt{3}\,m^3}$ $= -\frac{1}{2}$ **OR/*OF*** $= \frac{3.\sqrt{3m^6} - 4.\sqrt{3m^6}}{2\sqrt{3m^6}}$ $= \frac{\sqrt{3m^6}(3-4)}{2.\sqrt{3m^6}}$ $= \frac{3-4}{2}$ $= -\frac{1}{2}$	✓simplification of surds/*vereenv. van wortels* ✓simplification of numerator/*vereenv. van teller* ✓answer/*antw.* (3) ✓ simplification of surds/ *vereenv. van wortels* ✓ simplification of numerator/ *vereenv. van teller* ✓answer/*antw.* (3)

2.2	$\text{LHS} = \dfrac{4\sqrt{2}-8\left(1+\sqrt{2}\right)}{2\sqrt{2}\left(1+\sqrt{2}\right)}$ $= \dfrac{-4\sqrt{2}-8}{2\sqrt{2}\left(1+\sqrt{2}\right)}$ $= \dfrac{-4\left(\sqrt{2}+2\right)}{2\left(\sqrt{2}+2\right)}$ $= -2$ $= \text{RHS}$ **OR/*OF*** $\text{LHS} = \dfrac{2}{1+\sqrt{2}} \times \dfrac{1-\sqrt{2}}{1-\sqrt{2}} - \dfrac{8\times\sqrt{8}}{\sqrt{8}\times\sqrt{8}}$ $= \dfrac{2-2\sqrt{2}}{1-2} - \sqrt{8}$ $= -2+2\sqrt{2}-2\sqrt{2}$ $= -2$ $= \text{RHS}$	✓ LCD/*KGN* ✓ numerator/*teller* ✓ simplification/ *vereenv.* ✓common/*gemene* factor (4) ✓✓ rationalise the denominator of both fractions/*ras. die noemer van beide breuke* ✓$-2+ 2\sqrt{2}$ ✓$-2\ \sqrt{2}$ (4) **[12]**

QUESTION/*VRAAG* 3

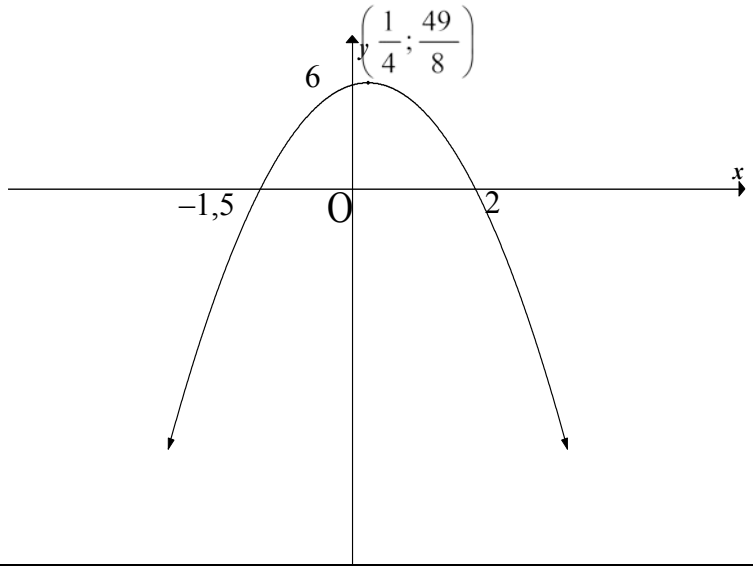
3.1	 $x-23=4$ $x=27$	✓answer/*antw.* (1)
3.2	$2a=4$ $a=2$ $3a+b=3$ $6+b=3$ $b=-3$ $a+b+c=-9$ $2-3+c=-9$ $c=-8$ $T_n=2n^2-3n-8$	✓ $a=2$ ✓ $b=-3$ ✓ $c=-8$ ✓ $T_n=2n^2-3n-8$ (4)
3.3	$T_n=2n^2-3n-8+3$ $=2n^2-3n-5$	✓answer/*antw.* (1)
3.4	$T_n=400$ $2n^2-3n-5=400$ $2n^2-3n-405=0$ $(n-15)(2n+27)=0$ $n=15$ or $n\neq\frac{-27}{2}$ **OR** $2n^2-3n-8=397$ $2n^2-3n-405=0$ $(n-5)(2n+27)=0$ $n=15$ or $n\neq-\frac{27}{2}$	✓ equating/*verg.* ✓std form/*stand vorm* ✓factorisation/*fakt.* ✓$n=15$ (4) ✓ equating/*verg.* ✓std form/*stand vorm* ✓factorisation/*fakt.* ✓$n=15$ (4) **[10]**

QUESTION/*VRAAG* 4

4.1.1	18 14 10 –4 –4 $T_4 = 6$	✓answer/*antw.* (1)
4.1.2	$T_n = a + (n-1)d$ $= 18 + (n-1)(-4)$ $= -4n + 22$	✓ substitution/*verv.* ✓ answer/*antw.* (2)
4.1.3	$T_n = 22 - 4n$ $-70 = 22 - 4n$ $-92 = -4n$ $n = 23$	✓substitution/*verv.* ✓answer/*antw.* (2)
4.1.4	$Q_{510} - Q_{509} = T_{509}$ of the linear sequence $= 22 - 4 \times 509$ $= -2014$	✓making association/*ass.* ✓answer/*antw.* (2)
4.2.1	$2a = 2$ $\therefore a = 1$ $\therefore a > 0$ $\therefore$ this pattern has a minimum value. The shape of the graph will be 	✓value/*wrde* of a ✓$a > 0$ ✓ minimum value/*wrde* (3)
4.2.2	$T_n = 1(n+p)^2 + q$ A.O.S $= \frac{5+17}{2}$ $p = 11$ $\therefore T_n = 1(n-11)^2 + q$ $29 = 1(17-11)^2 + q$ $\therefore q = -7$ $\therefore T_n = (n-11)^2 - 7$ $T_n = n^2 - 22n + 114$ **OR/*OF*** 	✓ axis of symmetry/*simm. as* ✓ value/*wrde* of p ✓ substitution/*verv.* (17 ; 29) or/*of* (5 ; 29) ✓ value/*wrde* of q ✓ answer/*antw.* (5)

	$T_5 = 29$ $\therefore 1(5)^2 + 5b + c = 29$ *ie* $5b + c = 4$ ... (1) and $T_{17} = 29$ $\therefore\ 1(17)^2 + 17b + c = 29$ *ie* $17b + c = -260$ ...(2) solve the equations simultaneously $-12b = 264$ $\therefore\ b = -22$ substitute in (1) ie $5(-22) + c = 4$ $-110 + c = 4$ $\therefore c = 114$ $\therefore T_n = n^2 - 22n + 114$	✓✓equations/*verg.* (1) & (2) ✓ value/*wrde* of *b* ✓ value/*wrde* of c ✓ answer/*antw.* (5) **[15]**

QUESTION 5

5.1	$x=-\frac{b}{2a}$ $=-\frac{1}{2(-2)}$ $=\frac{1}{4}$ $\therefore y=-2\left(\frac{1}{4}\right)^2+\left(\frac{1}{4}\right)+6$ $y=\frac{49}{8}$	✓substitution/*verv.* ✓*x*-value/*wrde* ✓substitution/*verv.* ✓ *y*-value/*wrde* (4)
5.2	$y=-2(0)^2+0+6$ $\therefore y$ intercept $(0;6)$	✓ *y*-value/*wrde* (1)
5.3	x intercepts $0=-2x^2+x+6$ $0=2x^2-x-6$ $0=(2x+3)(x-2)$ $\therefore x=2$ or $x=-\frac{3}{2}$ (2;0) and $\left(-\frac{3}{2};0\right)$	✓ $y=0$ ✓ factorisation/*fakt.* ✓ ✓ *x*-values/*wrde* (4)
5.4		✓ shape/*vorm* ✓ intercepts/*afsnitte* ✓ turning point/*drpnt* (3)
5.5	$k=\frac{49}{8}$	✓✓ answer/*antw.* (2)
5.6	New/*Nuwe* turning point/*drpn.t* $\left(\frac{9}{4};\frac{57}{8}\right)$ Equation/*verg.* of *h* $y=-2\left(x-\frac{9}{4}\right)^2+\frac{57}{8}$	✓ ✓ turning points/*drpnt* ✓ equation/*verg.* (3) **OR**/*OF* ✓✓✓ answer only (3) **[17]**

QUESTION/*VRAAG* 6

6.1	$x=-3$ and $y=-1$	✓ $x = -3$ ✓ $y = -1$ (2)
6.2	$x \in R\ ;\ x \neq -3$	✓✓answer/*antw.* (2)
6.3.1	At B, $x = 0$ $\therefore y = \frac{1}{0+3} - 1$ $y = -\frac{2}{3}$ $\therefore$ OB $= \frac{2}{3}$ units	✓substituton/*verv.* ✓ answer/*antw.* (2)
6.3.2	At A, $y = 0$ $0 = \frac{1}{x+3} - 1$ $1 = \frac{1}{x+3}$ $x + 3 = 1$ $x = -2$ $\therefore$ OA $= 2$ units	✓ substitution/*verv.* ✓ simplification/*vereenv.* ✓answer/*antw.* (3)
6.4	$\frac{1}{x+3} - 1 = \frac{1}{2}x$ $2 - 2(x+3) = x(x+3)$ $x^2 + 3x - 2 + 2x + 6 = 0$ $x^2 + 5x + 4 = 0$ $(x+4)(x+1) = 0$ $x = -4$ or $x = -1$ when $x = -1$; $y = -\frac{1}{2}$ when $x = -4$; $y = -2$ $\therefore$ C $(-1; -\frac{1}{2})$ and D $(-4\ ; -2)$	✓ equating the two equations/ *verg. van 2 vergelykings* ✓ std vorm/*std vorm* ✓factors/*fakt.* ✓ *x*-values/*wrds* ✓co-ordinates/*koörd* of C ✓co-ordinates/ *koörd* of D (6)

6.5	$\frac{1}{x+3} \geq \frac{x+2}{2}$ $\frac{1}{x+3} \geq \frac{x}{2}+1$ $\frac{1}{x+3}-1 \geq \frac{x}{2}$ $\therefore f(x) \geq g(x)$ $\therefore x \leq 4$ or $-3 < x \leq -1$	✓ simplification/*vereen* ✓$f(x) \geq g(x)$ ✓ $x \leq -4$ ✓$-3 < x \leq -1$ (4) **[19]**

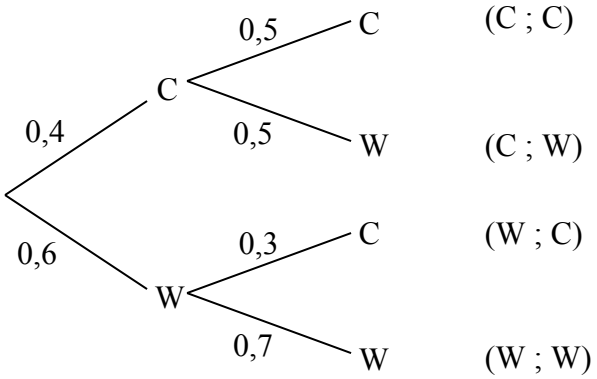
QUESTION/*VRAAG* 7

7.1	$q = 2$ $f(x) = 2.b^{x+1} + 2$ $20 = 2.b^{1+1} + 2$ $18 = 2.b^2$ $9 = b^2$ $b = 3$ $f(x) = 2.3^{x+1} + 2$	✓ substitution of $q = 2$ ✓ substitution of 1 and 20 ✓ value/*wrde* of b (3)
7.2	$y = 2.3^{-1+1} + 2$ $y = 2.1 + 2$ $y = 4$	✓answer/*antw.* (1)
7.3	$m = \frac{y_2 - y_1}{x_2 - x_1}$ $= \frac{20-4}{1-(-1)}$ $= 8$	✓ substitution/*verv.* ✓ answer/*antw.* (2)
7.4	$h(x) = -2.3^{x+1} + 2$ **OR/OF** Reflected about the x-axis $= -2.3^{x+1} - 2$ $\therefore$ Reflected about the asymptote $h(x) = -2.3^{x+1} - 2 + 4$ $= -2.3^{x+1} + 2$	✓✓answer/*antw.* ✓✓answer/*antw.* (2)
7.5	$y < 2$	✓ answer/*antw.* (1) **[9]**

QUESTION/*VRAAG* 8

8.1	$A = P(1-i)^n$ $= R\,25\,000\ (1-0,09)^4$ $= R\,17\,143,74$	✓ $A = P(1-i)^n$ ✓substitution/*verv.* ✓answer/*antw.* (3)
8.2	$1+i_{eff} = \left(1+\frac{i_{nom}}{m}\right)^m$ $1+i_{eff} = \left(1+\frac{0\,,1235}{12}\right)^{12}$ $i_{eff} = \left(1+\frac{0,1235}{12}\right)^{12} - 1$ $\therefore$ Rate $= 0,13073 \times 100$ $= 13,07\%$ The effective interest rate/*Die effektiewe rentekoers* is 13.07%	✓ formula/*for.* ✓ substitution//*verv.* ✓simplification*vereenv.* ✓answer/*antw.* (4)
8.3	$A = P(1+i)^n$ $R\,221\,292,32 = R145\,000\left(1+\frac{r}{100}\right)^6$ $\sqrt[6]{\frac{\text{R}\,221\,292,32}{145\,000}} = 1+\frac{r}{100}$ $\frac{r}{100} = 0,07300000324$ $r = 7,3\%$	✓correct substitution into correct formula ✓n =6 ✓ $\sqrt[6]{\frac{\text{R}\ 221\,292,32}{145\,000}} = 1+\frac{r}{100}$ ✓ answer/*antw.* (4)
8.4	$\text{A} = 15\,000\left(1+\frac{0,096}{4}\right)^{12} - 5\,000\left(1+\frac{0,096}{4}\right)^{10} + 3\,500\left(1+\frac{0.096}{4}\right)^4$ $= \text{R}17\ 448,46$	✓ $\frac{0,096}{4}$ ✓$15\,000\left(1+\frac{0,096}{4}\right)^{12}$ ✓$5\,000\left(1+\frac{0,096}{4}\right)^{10}$ ✓$3\,500\left(1+\frac{0.096}{4}\right)^4$ ✓answer/*antw.* (5) **[16]**

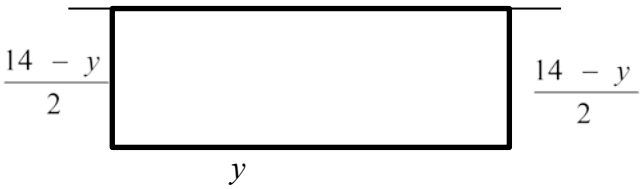
QUESTION/*VRAAG* 9

9.1	Given/*Gegee*: P(A) = 0,2 P(B) = 0,5 P(A or B) = 0,6	
9.1.1	P(A or B) = P(A) +P(B) – P(A and B) 0,6 = 0,2 + 0,5 – P(A and B) P(A and B) = 0,1	✓0,6 = 0,2 + 0,5 – P(A and B) ✓ P(A and B) = 0,1 (2)
9.1.2	P(A and B) = 0,1 P(A) × P(B) = 0,2 × 0,5 = 0,1 ∴ P(A and B) = P(A)×P(B) ∴ A and B are independent	✓ P(A) × P(B) = 0,1 ✓ P(A and B) = P(A)×P(B) ✓ conclusion (3)
9.2.2	$P(\text{one learner plays netball or volleyball}) = \frac{25}{100} = \frac{1}{4}$	✓25 ✓answer/*antwoord* (2)
9.3.1		✓ branch at first level ✓ branches at second level ✓ probabilities and outcomes (3)

9.3.2	P (second answer correct) = P(C and C)+P(W and C) = (0,4 × 0,5) + (0,6 × 0,3) = 0,38	✓ addition of probabilities ✓ substitution ✓ answer/*antw.* (3) **[18]**

QUESTION/*VRAAG* 10

10	 Let one of the equal sides = x the other side $= 14-2x$ Area $= (14-2x)x$ $= -2x^2 + 14x$ $x = \frac{-14}{2(-2)}$ $= \frac{7}{2}m$ $y = 7m$ **OR/*OF*** $\therefore$ the other side $= 14-2x$ $\therefore$ Area $= (14-2x)x$ $= -2(x^2 - 7x)$ $= -2\left(x^2 - 7x + \frac{49}{4} - \frac{49}{4}\right)$ $= -2\left[\left(x-\frac{7}{2}\right)^2 - \frac{49}{4}\right]$ $= -2\left(x-\frac{7}{2}\right)^2 + \frac{49}{2}$ $\therefore$ when $x = \frac{7}{2}$ metres it will have a maximum area $\therefore$ the other side $= 14-2\left(\frac{7}{2}\right)$ $= 7$ metres **OR/*OF***	✓area formula/*oppervl.for.* ✓ $x = \frac{-14}{2(-2)}$ ✓ answer for x ✓ answer for y (4) ✓area formula/*oppervl.for.* ✓ completing the square ✓ answer for x ✓ answer for y (4)



Let the length be y

Width be $\frac{14-y}{2}$

$\text{Area} = y\left(7-\frac{1}{2}y\right)$ ✓area formula/*oppervl.for.*

$=\frac{-1}{2}y^2+7y$

$y=\frac{-7}{2\left(\frac{-1}{2}\right)}$ ✓ $y=\frac{-7}{2\left(\frac{-1}{2}\right)}$

$=7m$

$\text{width} = 3{,}5m$ ✓ answer for y
✓ answer for width

(4)

OR

$\text{Area} = y\left(7-\frac{1}{2}y\right)$

$=\frac{-1}{2}y^2+7y$ ✓area formula/*oppervl.for.*

$=\frac{-1}{2}(y^2-14y)$ ✓ completing the square

$=\frac{-1}{2}(y-7)^2+\frac{49}{2}$

$\text{lenght} = 7m$

$\text{width} = 3{,}5m$ ✓ answer for y
✓ answer for width

(4)
[4]

TOTAL/*TOTAAL*: 150