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

GRADE/*GRAAD* 11

NOVEMBER 2016

**MATHEMATICS P1/*WISKUNDE V1*
MEMORANDUM**

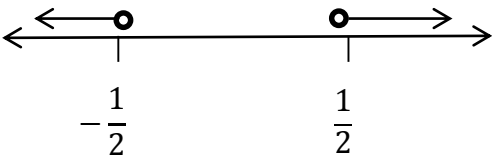**MARKS/*PUNTE*:** 150

NOTE/*LET OP*:
- If a candidate answered a QUESTION TWICE, mark the FIRST attempt ONLY.
  Indien 'n kandidaat 'n vraag TWEE keer beantwoord het, merk SLEGS die EERSTE poging.
- Consistent accuracy applies in ALL aspects of the memorandum.
  Volgehoue akkuraatheid geld deurgaans in ALLE aspekte van die memorandum.
- If a candidate crossed out an attempt of a QUESTION and did not redo the question, mark the crossed-out attempt.
  Indien 'n kandidaat 'n poging vir 'n vraag deurgetrek het en nie die vraag weer beantwoord het nie, merk die poging wat deurgetrek is.
- The mark for substitution is awarded for substitution into the correct formula.
  Die punt vir substitusie word toegeken vir substitusie in die korrekte formule.

QUESTION/*VRAAG* 1

1.1.1	$(x + 2)^2 = 1$ $x + 2 = \pm 1$ $x = -1$ or/*of* $x = -3$ **OR/*OF*** $(x + 2)^2 = 1$ $x^2 + 4x + 4 - 1 = 0$ $x^2 + 4x + 3 = 0$ $(x + 3)(x + 1) = 0$ $x = -3$ or/*of* $x = -1$	✓ ± 1 ✓ $x = -1$ ✓ $x = -3$ ✓ standard form/*standaardvorm* ✓ factors/*faktore* ✓ both x-values/*beide x waardes* (3)
1.1.2	$2x^2 - 11x - 4 = 0$ $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $x = \dfrac{11 \pm \sqrt{(-11)^2 - 4(2)(-4)}}{2(2)}$ $x = \dfrac{11 \pm \sqrt{153}}{4}$ $x = 5{,}84$ or/*of* $x = -0{,}34$	✓ sub into correct formula/*vervanging in korrekte formule* ✓ simplification/*vereenvoudiging* ✓ $x = 5{,}84$ ✓ $x = -0{,}34$ (4)
1.1.3	$x^2 > \dfrac{1}{4}$; $x < 0$ $x^2 - \dfrac{1}{4} > 0$ $\left(x - \dfrac{1}{2}\right)\left(x + \dfrac{1}{2}\right) > 0$ $-\dfrac{1}{2}$ $\dfrac{1}{2}$ $x > \dfrac{1}{2}$ or/*of* $x < -\dfrac{1}{2}$ $x < -\dfrac{1}{2}$	✓ factors/*faktore* ✓ solutions/*oplossings* ✓ critical values and method/*kritiese waarde en metode* ✓ $x < -\dfrac{1}{2}$ only/*alleenlik* (4)
1.1.4	$x + 5 = \sqrt{3 - 3x}$ $x^2 + 10x + 25 = 3 - 3x$ $x^2 + 13x + 22 = 0$ $(x + 11)(x + 2) = 0$ $x = -2$ *or/of* $x = -11$ $x = -2$	✓ squaring both sides/*kwadrering beide kante* ✓ standard form/*standaard vorm* ✓ both x values/*beide x waardes* ✓ $x = -2$ (4)

1.2.1	$y^2 - 9x^2$ $(y - 3x)(y + 3x)$	✓ factors/*faktore* (1)
1.2.2	$y + 3x = 2$ ... ... (1) $y^2 - 9x^2 = 16$ ... ... (2) From/*Vanaf* (2) $(y - 3x)(y + 3x) = 16$ Sub (1) into/*in* (2) $2(y - 3x) = 16$ From/*Vanaf* (1) $y = 2 - 3x$ $2(2 - 3x - 3x) = 16$ $4 - 12x = 16$ $12x = -12$ $x = -1$ $y = 2 - 3(-1)$ $y = 5$ **OR/*OF*** From/*vanaf* (1) $y = 2 - 3x$ Sub into (2)/*vervang in* (2) $(2 - 3x)^2 - 9x^2 = 16$ $4 - 12x + 9x^2 - 9x^2 = 16$ $4 - 12x = 16$ $12x = -12$ $x = -1$ $\therefore y = 5$	✓ sub 2 for $(y + 3x)$*vervanging van 2 vir* $(y + 3x)$ ✓ making *y* the subject/*maak y die onderwerp.* ✓ sub *y/vervanging van y.* ✓ *x* value/*x-waarde* ✓ *y* value/*y-waarde* ✓ $y = 2 - 3x$ ✓ Substitution/*vervanging* ✓ Simplification/*vereenvoudiging* ✓ *x* value/*x-waarde* ✓ *y* value/*y-waarde* (5)

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QUESTION/*VRAAG* 2

2.1	$\left(\dfrac{a^3}{2}\right)^2$ $= \dfrac{a^6}{4}$	✓ answer/*antwoord* (1)
2.2	$\dfrac{2^{x-3} - 3.2^{x-1}}{2^{x-2}}$ $= \dfrac{2^x\left(\frac{1}{8} - \frac{3}{2}\right)}{2^x\left(\frac{1}{4}\right)}$ $= -\dfrac{11}{2}$ or/of $-5\frac{1}{2}$ or/of $-5,5$	✓ 2^x common factor/*gemene faktor.* ✓ $\frac{1}{8} - \frac{3}{2}$ ✓ $2^x.\frac{1}{4}$ ✓ answer/*antwoord* (4)
2.3	10^{x+3} $= 10^x . 10^3$ $= 1,5 \times 1000$ $= 1500$	✓ sub/*vervang* $10^x = 1,5$ ✓ answer/antwoord (2)

2.4.1	$2^x = 0,125$ $2^x = 2^{-3}$ $x = -3$	✓ $0,125$ as 2^{-3} ✓ answer/*antwoord* (2)
2.4.2	$(0,5)^x \cdot \sqrt{1 + \frac{9}{16}} = 10$ $\left(\frac{1}{2}\right)^x \cdot \sqrt{\frac{25}{16}} = 10$ $\left(\frac{1}{2}\right)^x = 10 \times \frac{4}{5}$ $\left(\frac{1}{2}\right)^x = 8$ $2^{-x} = 2^3$ $\therefore x = -3$	✓ $\sqrt{\frac{25}{16}}$ ✓ $10 \times \frac{4}{5}$ ✓ 2^{-x} ✓ 2^3 ✓ $x = -3$ (5)

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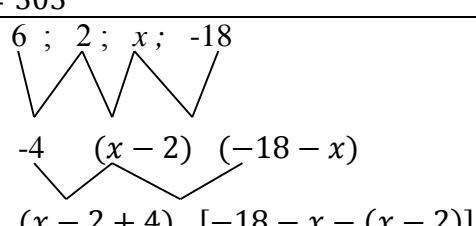## QUESTION/*VRAAG* 3

3.1	$2x(x + 1) + m = x$ $2x^2 + 2x + m - x = 0$ $2x^2 + x + m = 0$ $\Delta = b^2 - 4ac$ $= 1 - 4(2)(m)$ $= 1 - 8m$ For non-real roots/*vir nie-reële wortels* $\Delta < 0$ $1 - 8m < 0$ $8m > 1$ $m > \frac{1}{8}$	✓ standard form/*standaardvorm* ✓ sub into Δ/*vervang in* Δ ✓ $\Delta = 1 - 8m$ ✓ $\Delta < 0$ ✓ $m > \frac{1}{8}$ (5)
3.2	$f(x) = \frac{\sqrt{x+2}}{5-x^2}$ Undefined/*ongedefinieerd* $5 - x^2 = 0$ or/*of* $x + 2 < 0$ $x = \pm\sqrt{5}$ or/*of* $x < -2$	✓ $5 - x^2 = 0$ ✓ $x + 2 < 0$ ✓ $x < -2$ ✓ $x = \sqrt{5}$ ✓ or/*of* (5)

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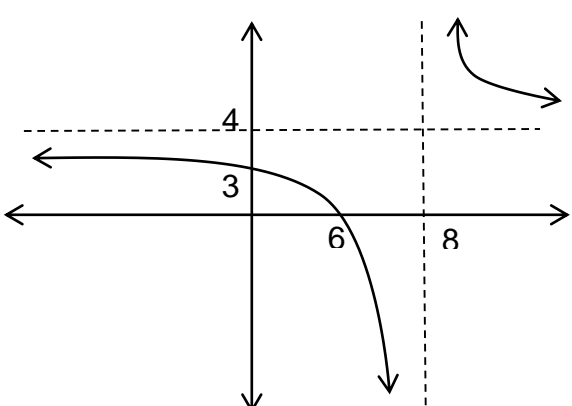
QUESTION/*VRAAG* 4

4.1.1	$22 ; 27$	✓ 22 ✓ 27 (2)
4.1.2	$T_n = 5n + 2$	✓ $5n$ ✓ 2 (2)
4.1.3	$5n + 2 = 12^5$ $5n = 12^5 - 2$ $n = 49766$ $T_{49766} = 12^5$	✓ $5n + 2 = 12^5$ ✓ $12^5 - 2$ ✓ $n = 49766$ (3)
4.1.4	General Term is multiples of 5 plus 2 therefor the numbers in the sequence will always end in a 2 or a 7 as multiples of 5 end with 0 or a 5. *Die algemene term is veelvoude van 5 plus 2 en daarom sal die patroon altyd eindig in 'n 2 of 'n 5 omdat die veelvoude van 5 altyd eindig op 0 of 5*	✓ multiples of 5 plus 2/*veelvoude van 5 plus 2* ✓ ending in 2 or 7/*eindig in 2 of 7*

4.2.1	39	✓ 39	(1)
4.2.2	$2a = 2$ $a = 1$ $3a + b = 6$ $b = 3$ $a + b + c = 3$ $c = -1$ $T_n = n^2 + 3n - 1$	✓ $a = 1$ ✓ $3a + b = 6$ ✓ $b = 3$ ✓ $a + b + c = 3$ ✓ $c = -1$	(5)
4.2.3	$n^2 + 3n - 1 = 269$ $n^2 + 3n - 270 = 0$ $(n - 15)(n + 18) = 0$ $n = 15$ $T_{16} = 16^2 + 3(16) - 1$ $T_{16} = 303$	✓ $n^2 + 3n - 1 = 269$ ✓ factors/*faktore* ✓ $n = 15$ ✓ $T_{16} = 303$	(4)
4.3	..... ; 6 ; 2 ; x ; -18 -4 $(x - 2)$ $(-18 - x)$ $(x - 2 + 4)$ $[-18 - x - (x - 2)]$	✓ Method/*metode*	
4.3.1	$x + 2 = -2x - 16$ $3x = -18$ $x = -6$ $T_4 = -6$ $d_2 = -4$	✓ setting up of equation/*opstel van vergelyking* ✓ $x = -6$ ✓ second diff/*tweede verskil*	(4)
4.3.2	$d_1 = 0$ $T_1 = 6$	✓ $d_1 = 0$ ✓ $T_1 = 6$	(3)

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QUESTION/*VRAAG* 5

5.1	$x = 8$ $y = 4$	✓ $x = 8$ ✓ $y = 4$	(2)
5.2	Domain $x \in R$; $x \neq 8$ Range $y \in R$; $y \neq 4$	✓ domain/*gebied* ✓ range/*terrein*	(2)
5.3		✓ shape/*vorm* ✓ asymptotes/*asimptote* ✓ x-intercept/*x-afsnit* ✓ y-intercept/*y-afsnit*	(4)
5.4.1	$\frac{8}{x-8} \geq -4$ $\frac{8}{x-8} + 4 \geq 0$ $\therefore f(x) \geq 0$ $x \leq 6$ or/*of* $x > 8$	✓ $x \leq 6$ ✓ $x > 8$ ✓ or/*of*	(3)

5.4.2	$f(x) \leq 3$ $0 \leq x < 8$	✓ $x \geq 0$ ✓ $x < 8$ ✓ notation/*notasie* (3)
5.5	$y = x - 8 + 4$ $y = x - 4$	✓ $y = x - 8 + 4$ ✓ $x - 4$ (2)
5.6	$g(x) = f(x - 2) - 2$ $g(x) = \dfrac{8}{x-10} + 2$	✓ $x - 10$ ✓ $+2$ (2)

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QUESTION/*VRAAG* 6

6.1	$y = a(x - x_1)(x - x_2)$ $y = a(x + 5)(x + 1)$ $2 = a(0 + 5)(0 + 1)$ $a = \dfrac{2}{5}$ $y = \dfrac{2}{5}(x^2 + 6x + 5)$ $y = \dfrac{2}{5}x^2 + \dfrac{12}{5}x + 2$	✓ $(x + 5)(x + 1)$ ✓ sub of/*vervang van* $(\mathbf{0; 2})$ ✓ a-value/*a-waarde* ✓ equation/*vergelyking* (4)
6.2	$y = k.m^x$ $2 = k.m^0$ $k = 2$ $y = 2.m^x$ $6 = 2.m$ $m = 3$ $\therefore \; g(x) = 2.3^x$	✓ $k = 2$ ✓ Sub of/*vervang van* (1;6) ✓ $m = 3$ (3)
6.3	$y = 0$	✓ answer/*antwoord* (1)
6.4.1	**x**-value of turning point/*x-waarde van draaipunt.* $x = -3$ decreasing/*dalend* $x < -3$ **OR/*OF*** $(-\infty \,; \, -3)$	✓ $x = -3$ ✓ $x < -3$ (2)
6.4.2	$0 \leq x \leq 1$	✓ $x \geq 0$ ✓ $x \leq -1$ (2)
6.4.3	$x \leq 0$	✓ answer/*antwoord* (2)
6.4.4	$-5 < x < -1$	✓ $x > -5$ ✓ $x < -1$ (2)
6.5	$(-5 \,; 0)$ and $y - intercept. \, (0 \,; 2)$ $m = \dfrac{y_2 - y_1}{x_2 - x_1}$ $m = \dfrac{0 - 2}{-5 - 0}$ $m = \dfrac{2}{5}$	✓ formula/*formule* ✓ *substitution/vervanging* ✓ answer/*antwoord* (3)

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QUESTION/*VRAAG* 7

7.1	$y = b^x$ $y = b^{x-2} + 4$ $8 = b^{4-2} + 4$ $4 = b^2$ $b = 2$	✓ $y = b^{x-2}$ ✓ $+4$ ✓ sub of/*vervang van* (4;8) ✓ $b = 2$ (4) ✓
7.2	$y = 2^{x-2} + 4$	equation/*vergelyking* (1)

[5]

QUESTION/*VRAAG* 8

8.1	$A = P(1-i)^n$ $A = 7\,200\left(1 - \dfrac{25}{100}\right)^3$ $A = R\,3\,037,50$	✓ formula/*formule* ✓ subst/*vervanging* ✓ answer/*antwoord* (3)
8.2	$A = P(1+i)^n$ $1\,126,10 = 500\left(1 + \dfrac{i}{2}\right)^{12}$ $\dfrac{1\,126,10}{500} = \left(1 + \dfrac{i}{2}\right)^{12}$ $i = 0,14$ Interest rate/*rentekoers* $= 14\%$	✓ formula/*formule* ✓ subst/*vervanging* ✓ simplification/*vereenvoudiging* ✓ answer/*antwoord* (4)
8.3.1	$1 + i_e = \left(1 + \dfrac{i_n}{m}\right)^m$ $i_e = \left(1 + \dfrac{7,2}{1200}\right)^{12} - 1$ $i_e = 0,07442\ldots$ $r = 7,442\,\%$	✓ formula/*formule* ✓ subst/*vervanging* ✓ answer/*antwoord* (3)
8.3.2	$A = P(1+i)^n$ $A = 120\,000(1 + 7,442\%)^3$ $A = 148\,834,46$	✓ formula/f*ormule* ✓ subst/*vervanging* ✓ answer/*antwoord* (3)
8.3.3	$A = 120\,000\left(1 + \dfrac{7,2}{1200}\right)^{48}$ $A = R159\,913,20$ $A = 20\,000\left(1 + \dfrac{7,2}{1200}\right)^{30}$ $A = 23\,931,47$ *Final amount* $R159913,20 - 23\,931,47$ *Finale bedrag* $\quad = R\,135\,981,73$ **OR/*OF*** $A = \left[120\,000\left(1 + \dfrac{7,2}{1200}\right)^{18} - 20\,000\right]\left(1 + \dfrac{7,2}{1200}\right)^{30}$ $A = R\,135\,981,73$	✓ R 159913,20 ✓ R 23931,47 ✓ subtracting/*aftrek* ✓ answer/*antwoord* (4)

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QUESTION/*VRAAG* 9

9.1		✓ 1st branch of tree diagram/*1ste tak van boom diagram* ✓ values on first branch/*waardes op 1ste tak* ✓ 2nd branch/*2de tak* ✓ values on 2nd branch/*waardes op 2de tak* ✓ first four outcomes/*eerste vier uitkoms* ✓ last 4 outcomes/*laaste 4 uitkomste* (6)
9.2.1	$P(BB) = \dfrac{5}{10} \times \dfrac{4}{9}$ $P(BB) = \dfrac{20}{90} = 1{,}333 \ldots.$	✓ $\dfrac{5}{10} \times \dfrac{4}{9}$ ✓ answer/*antwoord* (2)
9.2.2	$P = \left(\dfrac{2}{10} \times \dfrac{3}{9}\right) + \left(\dfrac{3}{10} \times \dfrac{2}{9}\right)$ $P = \dfrac{6}{90} + \dfrac{6}{90}$ $P = \dfrac{12}{90}$ $P = 0{,}133$	✓ $\left(\dfrac{2}{10} \times \dfrac{3}{9}\right)$ ✓ $\left(\dfrac{3}{10} \times \dfrac{2}{9}\right)$ ✓ simplify/*vereenvoud*, ✓ adding/*optel* ✓ answer/*antwoord* (5)

9.3.1		Sport	No sport *Geen sport*	Total *Totaal*	✓ labels/*opskrifte* ✓ boys row/*seuns ry* ✓ girls row/*meisies ry* ✓ column totals/*totale van kolomme* ✓ 120 (5)
	Boys/*Seuns*	50	10	60	
	Girls/*Meisies*	40	20	60	
	Total/*Totaal*	90	30	120	

9.3.2	(a) $\dfrac{40}{120} = \dfrac{1}{3}$	✓ answer/*antwoord* (1)
	(b) $\dfrac{10}{120} = \dfrac{1}{12}$	✓ answer/antwoord (1)

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TOTAL/*TOTAAL:* 150