LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF
EDUCATION

NATIONAL SENIOR CERTIFICATE

GRADE/GRAAD 12

MATHEMATICS PAPER 1/ WISKUNDE V1
SEPTEMBER 2020

MEMORANDUM

MARKS: 150

This memorandum consists of 16 pages/Hierdie memorandum bestaan uit 16 bladsye

QUESTION 1		
1.1.1	$x=2$ or $x=-1$	✓ $x=2$ ✓ $x=-1$ (2)
1.1.2	$x^2-x+5=0$ $x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$ $=\frac{=-(-1)\pm\sqrt{(-1)^2-4(1)(5)}}{2(1)}$ $=\frac{1\pm\sqrt{-19}}{2}$ No real solution	✓ standard form ✓correct substitution in correct formula $\sqrt{-19}$ ✓ simplification /vereenvoudiging ✓ answer /antwoord (4)
1.1.3	$\left(3\sqrt{x-2}\right)^2=(x-6)^2$ $9(x-2)=x^2-12x+36$ $0=x^2-21x+54$ $0=(x-18)(x-3)$ $x=18$ or $x=3$ $\therefore x=18,\ x\neq 3$	✓$9(x-2)=x^2-12x+36$ ✓standard form = 0 ✓factorisation ✓$x=18$ or $x=3$ ✓selection $x=18$ (5)
1.1.4	$-3x^2+5x\geq -2$ $-3x^2+5x+2\geq 0 \quad \Rightarrow 3x^2-5x-2\leq 0$ $(3x+1)(x-2)\leq 0$ $-\frac{1}{3}\leq x\leq 2$	✓ standard form/standaard vorm ✓factors/faktore ✓✓$-\frac{1}{3}\leq x\leq 2$ (4)

1.2	$x^2 + p = (p+1)x \quad \Rightarrow x^2 - (p+1)x + p = 0$ $\Delta = b^2 - 4ac$ $= [-(p+1)]^2 - 4p$ $= p^2 + 2p + 1 - 4p$ $= p^2 - 2p + 1$ $= (p-1)^2$ $\therefore \Delta$ a perfect square/volkome vierkant roots are rational/wortels is rasionaal	✓substitution $[-(p+1)]^2 - 4p$ ✓ $p^2 - 2p + 1$ ✓ $(p-1)^2$ ✓explanation/verduideliking (4)

1.3	$\frac{1}{x} + \frac{1}{y} = 3$ $\therefore y + x = 3xy$----------equation 1 (eq 1) $x = y + \frac{1}{2}$--------equation 2 (eq 2) eq 2 in eq 1 : $y + y + \frac{1}{2} = 3y\left(y + \frac{1}{2}\right)$ $2y + \frac{1}{2} = 3y^2 + \frac{3}{2}y$ $4y + 1 = 6y^2 + 3y$ $(\times 2)\ 6y^2 - y - 1 = 0$ $(3y+1)(2y-1) = 0$ $y = \frac{-1}{3}$ or $y = \frac{1}{2}$ Substitute in eq 2:	✓ $\therefore y + x = 3xy$- ✓substitute eq 2 in eq 1 ✓simplification/vereenvoudiging $2y + \frac{1}{2} = 3y^2 + \frac{3}{2}y$ ✓standard form =0 ✓ $y = \frac{-1}{3}$ or $y = \frac{1}{2}$

	$x=\left(\frac{-1}{3}\right)+\frac{1}{2}$ or $x=\left(\frac{1}{2}\right)+\frac{1}{2}$ $\therefore x=\frac{1}{6}$ $x=1$	✓$x=\frac{1}{6}$ or $x=1$ Both $x-$values (6)
	ALTERNATIVE:	
	$\therefore y+x=3xy$----------equation 1 (eq 1)	✓$\therefore y+x=3xy$----------
	$y=x-\frac{1}{2}$ ----------eq 2	
	$x-\frac{1}{2}+x=3x\left(x-\frac{1}{2}\right)$----------eq 2	✓substitute eq 2 in eq 1 $x-\frac{1}{2}+x=3x\left(x-\frac{1}{2}\right)$-
	$2x-\frac{1}{2}=3x^2-\frac{3}{2}x$	
	$(\times 2)\quad 4x-1=6x^2-3x$	✓simplification
	$6x^2-7x+1=0$	✓standard form
	$(6x-1)(x-1)=0$	$x-$values
	$x=\frac{1}{6}$ or/of $x=1$	✓$x=\frac{1}{6}$ or/of $x=1$
	Substitute in eq 1:	
	$y=3y\left(\frac{1}{6}\right)-\frac{1}{6}$ or/of $y=3y(1)-1$	✓both $y-$values
	$y=\frac{-1}{3}$ or $y=\frac{1}{2}$	$y=1$ or $y=\frac{1}{2}$ (6)
		[25]

QUESTION 2/VRAAG 2		
2.1	$-6 \quad 2-x \quad 4 \quad 2x+5$ $8-x \quad 2+x \quad 2x+1$ first difference $2x-6 \quad 2x-1$ second difference $2x-6 = 2x-1$ $x=5$	$8-x \quad 2+x \quad 2x+1$ ✓ first differences ✓equating second differences ✓ x – value (3)
2.2	Row/ry: $-6; -3; 4; 15$ $T_n = an^2+bn+c$ $2a=4$ $a=2$ $T_n = n^2+bn+c$ $3a+b=T_2-T_1$ $3(2)+b=6$ $b=-3$ $T_1 = a+b+c$ $-6=2-3+c$ $-5=c$ $\therefore T_n = 2n^2-3n-5$	✓ $a=2$ ✓ $b=-3$ ✓ $c=-5$ ✓ $\therefore T_n = 2n^2-3n-5$ (4)
		[7]

QUESTION 3/VRAAG 3		
3.1.1	$T_3 = \frac{a^2}{-2}$	✓✓ $\frac{a^2}{-2}$ (2)
3.1.2	$T_3 = 2a+2$	✓✓ $2a+2$ (2)
3.2	$S_3 = \frac{a^2}{-2}$ $\frac{3}{2}(2(-2)+(3-1)(a+2)) = \frac{a^2}{-2}$ $3(2a) = -a^2$ $a^2+6a=0$ $a(a+6)=0$ $a=0$ of $a=-6$	✓✓ equating ✓ $a^2+6a=0$ ✓factors ✓ $a=0$ or/of $a=-6$ (5)
3.3	$r = \frac{a}{-2}$ $r = \frac{-6}{-2} = 3$ ∴ Nee / No $r > 1$	✓ $\frac{a}{-2}$ ✓substitution $r=3$ ✓ no ; $r>0$ (3)
		[12]

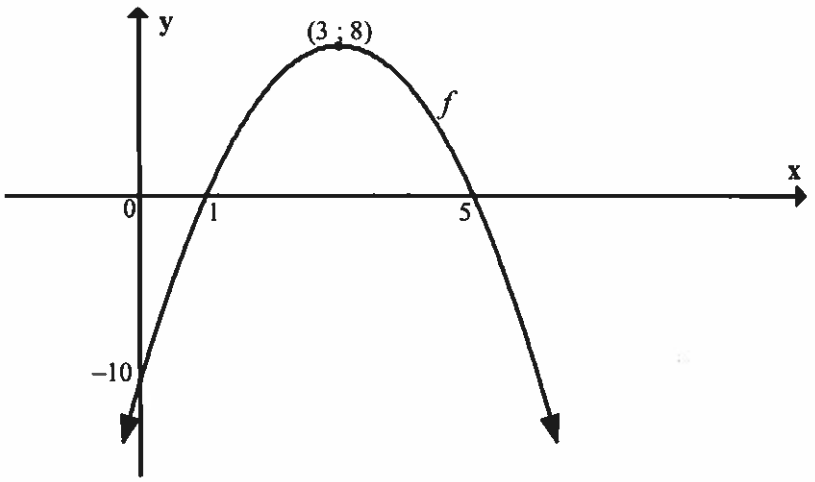
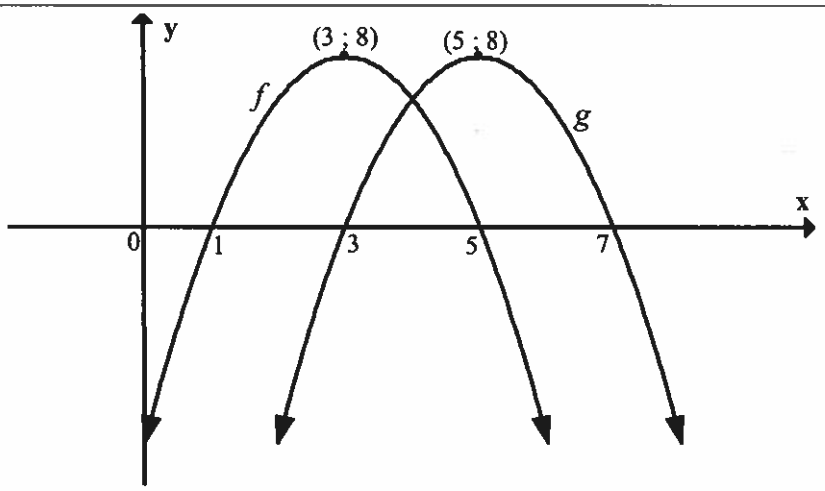
QUESTION 4		
4.1	$\sum_{p=1}^{\infty}(-5+2)^p$ $= \sum_{p=1}^{\infty}(-3)^p$ $= (-3)+(9)+(-27)+.....$ GS/MR $a=-3$ $r=-3$ DOES NOT EXIST/BESTAAN NIE For convergence/vir konvergensie $-1 < r < 1$	✓ $(-3)+(9)+(-27)+.....$ ✓ DOES NOT EXIST/BESTAAN NIE (2)

4.2	AS/RR: $a=1 \quad l=2000 \quad n=2000$ $S_n=\frac{n}{2}(a+l)$ $S_{2000}=\frac{2000}{2}(1+2000)=\ 2\ 001\ 000$ Powers of 2 /magte van 2: $2^0;\ 2^1;\ 2^2;\ \ldots\ldots;2^{10}$ $[2^{11}=2048>2000]$ GS/MR : $a=1\ ;\ r=2;\ n=11$ $S_n=\frac{a(r^n-1)}{r-1}$ $\therefore S_{11}=\frac{1(2^{11}-1)}{2-1}=2^{11}-1=2047$ sum of remaining integers/som van oorblywende heelgetalle 2 001 000 – 2047 = 1 998 953	✓$S_{2000}=\frac{2000}{2}(1+2000)$ ✓answer 2 001 000 ✓$2^0;\ 2^1;\ 2^2;\ \ldots\ldots;2^{10}$ ✓$S_{11}=\frac{1(2^{11}-1)}{2-1}$ Substitution in correct formula ✓1 998 953 (5)
		[7]

QUESTION 5			
5.1	$y\in R; y\neq -1$	✓✓answer	(2)
5.2	$y=\frac{2}{x+p}-1$ OB = OE $\therefore \mathrm{E}(2;0)$ $\therefore y=\frac{2}{x-2}-1$	✓substitution ✓substitute $E(2;0)$	(2)

5.3	x-intercept $\frac{2}{x-2}-1=0$ $2=x-2$ $x=4$ y-intercept $y=\frac{2}{-2}-1$ $=-2$	✓ x-intercept ✓ y-intercept (2)
5.4	$f: y=\log_3 x$ $A(t;1)$ in $y=\log_3 x$ $1=\log_3 t$ $\therefore 3^1=t$ $A(3;1)$ Substitute in $1=\frac{2}{3+p}-1$ $2(3+p)=2$ $p=-2$ $\therefore y=\frac{2}{x-2}-1$	✓✓substitution of $A(t;1)$ in correct formula ✓ (3)
5.5	$f^{-1}\ x=\log_3 x$ $y=3^x$	✓✓ (2)
5.6	$0<x<1$	✓✓answer (2)
5.7	$-x+1=\log 3_x$ $0=\log 3_x+(x-1)$ $\therefore x=1$	✓✓ $-x+1=\log 3_x$ ✓ $x=1$ (3)
		[16]

QUESTION 6/VRAAG 6		
6.1	(3;8)	✓ $x=3$ ✓ $y=8$ (2)
6.2	$y=-2(x-3)^2+8=-2x^2+12x-10$ $x-$ int *ercepts*: $\therefore\ x^2-6x+5=0$ $(x-5)(x-1)=0$	

	$x=5$ of/or $x=1$  	✓ (shape)form /vorm ✓ y- intercept ✓ x - *afsnitte/* int*ercpts* ✓ turning point/draaipunt (4)
6.3	$x<0$ or/of $1<x<5$	✓ $x<0$ ✓ $1<x<5$ (2)
6.4	$f(-1)=-2(-1)^2+12(-1)-10=-23$ $f(0)=-2(0)^2+12(0)-10=-10$ $m=\frac{f(-1)-f(0)}{-1-0}$ $m=\frac{-23-(-10)}{-1-0}=13$	✓ $f(-1)=-23$ ✓ $f(0)=-10$ ✓ $m=13$ (3)
6.5	 	✓graph/grafiek ✓turning point/draaipunt (5;8) ✓✓ x-intercepts (4)
		[15]

QUESTION 7

7.1.	$A = P(1-ni)$ $1000 = 11\,500(1-3i)$ $3i = 1 - \frac{1000}{11500}$ $\therefore i = 30,4\%$	✓ correct substitution into correct formula ✓ simplification ✓ 30,4 % (3)
7.2.1	$P = \frac{x\left[1-(1+i)^{-n}\right]}{i}$ $950\,000 = \frac{x\left[1-\left(1+\frac{0,10}{12}\right)^{-108}\right]}{\frac{0,10}{12}}$ $7196,666... = 0,591911...x$ $\therefore x = \text{R}13374,76$ is the monthly instalment	✓ – 108 ✓ $\frac{0,10}{12}$ ✓ simplification ✓ instalment (4)
7.2.2	$P = \frac{x\left[1-(1+i)^{-n}\right]}{i}$ $P = \frac{13\,374,76\left[1-\left(1+\frac{0,10}{12}\right)^{-12}\right]}{\frac{0,10}{12}}$ $= \text{R}152\,131,32$ is the outstanding balance	✓ – 12 ✓ R 13 374,76 ✓ balance (3)
7.2.3	$\text{R}152\,131,32\left(1+\frac{0,1}{12}\right)$ $= \text{R}15\,3399,08$ $\therefore$ interest $= 15\,3399,08 - 152\,131,32$ $= \text{R}1\,267,76$ Percentage $= \frac{1\,267,76}{13\,374,76} \times 100$ $= 9,48\%$	✓ R 152 131,32 ✓ R 15 3399,08 ✓ Interest ✓ 13 374,76 ✓ 9,48 % (5)
		[15]

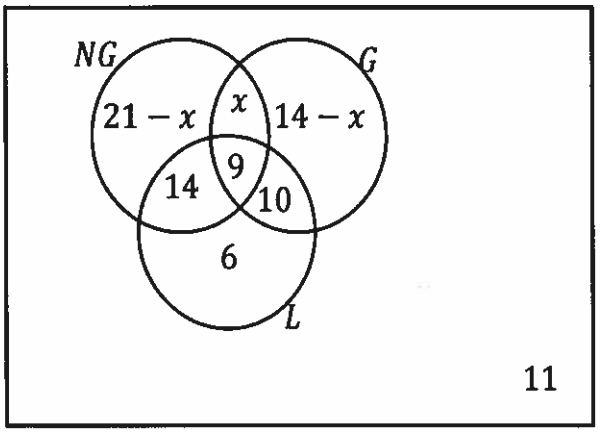
QUESTION 8/VRAAG 8		
8.1	$f(x) = -x^2 - 3x$ $f'(x) = \frac{f(x+h) - f(x)}{h}$ $= \lim_{h \to 0} \frac{-(x+h)^2 - 3(x+h) - \left(-x^2 - 3x\right)}{h}$ $= \lim_{h \to 0} \frac{-x^2 - 2hx - h^2 - 3x - 3h + x^2 + 3x}{h}$ $= \lim_{h \to 0} \frac{-2hx - h^2 - 3h}{h}$ $= \lim_{h \to 0} \frac{h(-2x - h - 3)}{h}$ $= \lim_{h \to 0} (-2x - h - 3)$ $= -2x - 3$ ANSWER ONLY: 0 marks SLEGS antwoord: 0 punte	✓simplifying of $f(x+h)$ ✓simplifying $\frac{-2hx - h^2 - 3h}{h}$ ✓common factor ✓answer (4)
8.2	$D_x\left[x + \frac{1}{x}\right]^2$ $= D_x\left[x^2 + 2 + \frac{1}{x^2}\right]$ $= D_x\left[x^2 + 2 + x^{-2}\right]$ $= 2x - 2x^{-3}$ $= 2x - \frac{2}{x^3}$	✓ $x^2 + 2 + \frac{1}{x^2}$ ✓ x^{-2} ✓ $2x$ ✓ $-2x^{-3}$ (4)
8.3	$y = -3x^2 - \frac{3}{\sqrt[3]{x}} + 3^{-1}$ $y = -3x^2 - 3x^{-1/3} + 3^{-1}$ $\frac{dy}{dx} = -6x + x^{-4/3}$	✓ $-3x^{-1/3}$ ✓ $-6x$ ✓✓ $x^{-4/3}$ (4)

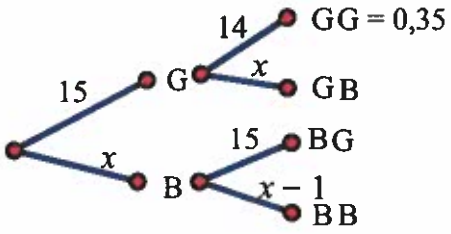
8.4	$D_x = -4x-1$ Perpendicular: $m_{\text{tangent}} \times m_{\text{straight line}} = -1$ $\therefore m_{\text{tangent}} = \frac{1}{2}$ $-4x-1 = \frac{1}{2}$ $x = \frac{3}{8}$	✓ $D_x = -4x-1$ ✓ $m_{\text{tangent}} = \frac{1}{2}$ ✓ $-4x-1 = \frac{1}{2}$ ✓ $x = \frac{3}{8}$ (4)
8.5	$p(x) = \frac{f(x)}{g(x)} = \frac{2(x-3)(x^2+2x+4)}{(x^2+2x+4)}$ $= 2(x-3)$ $= 2x-6$ $p'(x) = 2$ $\therefore p'(3) = 2$	✓factorisation ✓simplifying $2x-6$ ✓ $p'(x) = 2$ ✓ $p'(3) = 2$ (4)
		[20]

QUESTION 9/VRAAG 9		
9.1	$\frac{dy}{dx} = 6x^2 + px + q$ At F/by F : $\frac{dy}{dx} = 0$ $\therefore 6(2)^2 + 2p(2) + q = 0$ $24 + 4p + q = 0$ → *equation 1/ vergelyking 1* $-9 = 2(2)^3 + p(2)^2 + q(2) + 3$ $-9 = 19 + 4p + 2q$ $4p + 2q + 28 = 0$ → *equation/ vergelyking 2* Eq 1 - Eq 2 = $-q-4 = 0$ $q = 4$	✓ $\frac{dy}{dx} = 6x^2 + px + q = 0$ ✓ simplification ✓Substitute /vervang $(2;-9)$ ✓ $q = 4$

	In Eq (2) $4p+2(-4)+28=0$ $4p-8+28=0$ $\therefore p=-5$	✓$\therefore p=-5$ (5)
9.2	$y=2x^3-5x^2-4x+3$ $y=2x^3-5x^2-4x+3=0$ $(x+1)(2x^2-7x+3x)=0$ $(x+1)(2x-1)(x-3)=0$ B$\left(\frac{1}{2};0\right)$ en/and C$(3;0)$	✓$(x+1)(2x-1)(x-3)=0$ ✓B$\left(\frac{1}{2};0\right)$ ✓C$(3;0)$ (3)
9.3	By D/at D : $D_x=6x^2-10x-4=0$ $(3x+1)(x-2)=0$ $x=\frac{-1}{3}$ of/or $x=2$ Substitute/vervang $x=\frac{-1}{3}$ $2\left(\frac{-1}{3}\right)^3-5\left(\frac{-1}{3}\right)^2-4\left(\frac{-1}{3}\right)+3 = \frac{100}{27}=3\frac{19}{27}$ $\therefore D\left(\frac{-1}{3};3\frac{19}{27}\right)$	✓$6x^2-10x-4=0$ ✓Substitute/vervang $x=\frac{-1}{3}$ ✓$\therefore D\left(\frac{-1}{3};3\frac{19}{27}\right)$ (3)
		[11]

QUESTION 10		
10.1	$B\left(x;;4-\frac{x^2}{4}\right)$	✓ (1)
10.2	Area ΔOBD: $A=\frac{1}{2}.OD.DB$ $=\frac{1}{2}(x)\left(4-\frac{x^2}{4}\right)$ $=2x-\frac{x^3}{8}$	✓$\frac{1}{2}(x)\left(4-\frac{x^2}{4}\right)$ ✓$2x-\frac{x^3}{8}$ (2)
10.3	For max/vir maks: $\frac{dA}{dx}=0$ $2-\frac{3}{8}x^2=0$ $x^2=\frac{16}{3}$ $x=\pm\sqrt{\frac{16}{3}}$ $x=\pm 2,3091$ $x=2,31$	✓✓$2-\frac{3}{8}x^2=0$ ✓$x^2=\frac{16}{3}$ ✓$x=2,31$ (4)
		[7]

QUESTION 11/VRAAG 11		
11.1.1	$80-69=11$	✓ 11 (1)
11.1.2		✓ $(21-x)$ & $(14-x)$ ✓ 14 & 10 ✓ 6 & 11 (3)
11.1.3	$21-x+x+9+14+10+6+14-x+11=80$ $-x+85=80$ $\therefore x=5$	✓ equating/vergelyking=80 ✓ $\therefore x=5$ (2)
11.1.4	$P(at\ least\ 2)=\frac{5+9+10+14}{80}=\frac{38}{80}=0,475$ $P(ten\ \text{minste}\ 2)=\frac{5+9+10+14}{80}=\frac{38}{80}=0,475$	✓ $\frac{5+9+10+14}{80}$ ✓ 0,475 (2)
11.2.1	$P(A\ \text{or/of B})=P(A)+P(B)-P(Aen/and\ B)$ $=0,95+0,98-0,94$ $=0,99$	✓ $0,95+0,98-0,94$ ✓ 0,99 (2)
11.2.2	$P(not\ \text{detected/nie bespeur})=1-0,99$ $=0,01$	✓ 0,01 (1)

11.3	Let the number of boys be x,  $\frac{15}{15+x}\times\frac{14}{14+x}=\frac{35}{100}$ $35(15+x)(14+x)=15\times14\times100$ $x^2+39x+210=600$ $x^2+39x+390=0$ $(x+39)(x-10)=0$ $\therefore x=10$ i.e. there are 10 boys in the class.	✓ probability equation ✓ quadratic equation ✓ factors ✓ answer (4)
		[15]

TOTAL:150