LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF
EDUCATION

VHEMBE WEST DISTRICT

GRADE 12

MATHEMATICS P1

PRE-MIDYEAR EXAMINATION 2024

MEMORANDUM

MARKS: 120

This question paper consists of 7 pages **including the cover page**

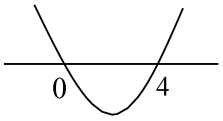
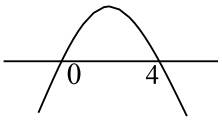
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NOTE:
- If a candidate answers a question TWICE, only mark the FIRST attempt.
- Consistent Accuracy applies in all aspects of the marking memorandum.

LET WEL:
- *Indien 'n kandidaat 'n vraag TWEE keer beantwoord, merk slegs die EERSTE poging.*
- *Volgehoue akkuraatheid is DEURGAANS op ALLE aspekte van die memorandum van toepassing.*

QUESTION/*VRAAG* 1

1.1.1	$x^2-5x-6=0$ $(x-6)(x+1)=0$ $x=6$ or $x=-1$ **OR/*OF*** $x^2-5x-6=0$ $x=\frac{5\pm\sqrt{(-5)^2-4(1)(-6)}}{2(1)}$ $x=\frac{5\pm\sqrt{49}}{2}$ $x=6$ or $x=-1$	✓ factors ✓ both answers (2) **OR/*OF*** ✓ correct subst into correct formula ✓ both answers (2)
1.1.2	$(3x-1)(x-4)=16$ $3x^2-13x-12=0$ $x=\frac{13\pm\sqrt{(-13)^2-4(3)(-12)}}{2(3)}$ $x=\frac{13\pm\sqrt{313}}{6}$ $x=5{,}12$ or $x=-0{,}78$ **OR/*OF*** $3x^2-13x-12=0$ $x^2-\frac{13}{3}x=4$ $x^2-\frac{13}{3}x+\left(-\frac{13}{6}\right)^2=4+\left(-\frac{13}{6}\right)^2$ $\left(x-\frac{13}{6}\right)^2=\frac{313}{36}$ $x=\frac{13\pm\sqrt{313}}{6}$ $x=5{,}12$ or $x=-0{,}78$	✓ standard form ✓ correct subst into correct formula ✓✓ answers (4) **OR/*OF*** ✓ standard form ✓ adding $\left(-\frac{13}{6}\right)^2$ both sides ✓✓ answers (4)

1.1.3	$x(4-x)\geq 0$ $-x(x-4)\geq 0$ or $-x(x-4)\geq 0$ $x(x-4)\leq 0$   $0\leq x\leq 4$ or $x\in[0\,;4]$	✓ factorisation ✓✓ $0\leq x\leq 4$ (3)
1.1.4	$\frac{5^{2x}-1}{5^x+1}=4$ $\frac{(5^x+1)(5^x-1)}{5^x+1}=4$ $5^x-1=4$ $5^x=5$ $x=1$ **OR/*OF*** $\frac{5^{2x}-1}{5^x+1}=4$ $5^{2x}-1=4.5^x+4$ $5^{2x}-4.5^x-5=0$ $(5^x-5)(5^x+1)=0$ $5^x=5$ or $5^x\neq -1$ $x=1$	✓ factors in numerator ✓ $5^x-1=4$ ✓ answer (3) **OR/*OF*** ✓ standard form ✓ factors ✓ answer (3)
1.2	$x=2-3y$..... (1) $x^2+4xy-5=0$ .....(2) Substitute (1) in (2): $(2-3y)^2+4y(2-3y)-5=0$ $4-12y+9y^2+8y-12y^2-5=0$ $-3y^2-4y-1=0$ $3y^2+4y+1=0$ $(3y+1)(y+1)=0$ $y=-\frac{1}{3}$ or $y=-1$ $x=3$ or $x=5$ **OR/*OF***	$x=2-3y$ ✓ correct subst into correct formula ✓ either standard form ✓ y – values ✓ x – values (5) **OR/*OF***

	$y=\frac{2}{3}-\frac{x}{3}$ ..... (1) $x^2+4xy-5=0$ .....(2) Substitute (1) in (2): $x^2+4x\left(\frac{2}{3}-\frac{x}{3}\right)-5=0$ $3x^2+8x-4x^2-15=0$ $-x^2+8x-15=0$ $x^2-8x+15=0$ $(x-5)(x-3)=0$ $x=3$ or $x=5$ $y=-\frac{1}{3}$ or $y=-1$	$y=\frac{2}{3}-\frac{x}{3}$ ✓ correct subst into correct formula ✓ either standard form ✓ $x-$ values ✓ $y-$ values (5)
1.3	$ab=2\sqrt{10}$ $bc=3\sqrt{2}$ $ac=6\sqrt{5}$ $ab.bc.ac=2\sqrt{10}.6\sqrt{5}.3\sqrt{2}$ $(abc)^2=36\sqrt{100}$ $abc=\sqrt{360}=6\sqrt{10}$ **OR/*OF*** $ac=6\sqrt{5} \quad \therefore a=\frac{6\sqrt{5}}{c}$ $bc=3\sqrt{2} \quad \therefore b=\frac{3\sqrt{2}}{c}$ $ab=2\sqrt{10}$ $\left(\frac{6\sqrt{5}}{c}\right)\left(\frac{3\sqrt{2}}{c}\right)=2\sqrt{10}$ $18\sqrt{10}=2\sqrt{10}.c^2$ $c^2=9$ $c=3$ Volume $=abc=2\sqrt{10}.3=\sqrt{360}=6\sqrt{10}$	✓ volume = abc ✓ $ab.bc.ac=2\sqrt{10}.6\sqrt{5}.3\sqrt{2}$ ✓ $(abc)^2=36\sqrt{100}$ ✓ answer (5) **OR/*OF*** ✓ $a=\frac{6\sqrt{5}}{c}$ ✓ $b=\frac{3\sqrt{2}}{c}$ ✓ value of c ✓ Volume = abc ✓ answer (5) **[22]**

QUESTION/*VRAAG* 2

2.1.1	59	answer (1)
2.1.2	15 29 41 51 14 12 10 –2 –2 $2a=-2$ $a = -1$ $3(-1)+b=14$ $b=17$ $(-1)+(17)+c=15$ $c=-1$ $T_n=-n^2+17n-1$	✓second difference of – 2 ✓ a ✓ b ✓ c (4)
2.1.3	$T_{27}=-(27)^2+17(27)-1$ $=-271$	substitution answer (2)
2.2.1	$r=\frac{-18}{36}=-\frac{1}{2}$	✓ answer (1)
2.2.2	$T_n=36\left(-\frac{1}{2}\right)^{n-1}$ $\frac{9}{4096}=36\left(-\frac{1}{2}\right)^{n-1}$ $\frac{1}{16384}=\left(-\frac{1}{2}\right)^{n-1}$ $\left(-\frac{1}{2}\right)^{14}=\left(-\frac{1}{2}\right)^{n-1}$ $14=n-1$ $n=15$ **OR/*OF*** $36\ ;-18\ ;9\ ;\frac{-9}{2};\frac{9}{4};\frac{-9}{8};\ldots;\frac{9}{4096}$ If you look only at the denominator: 2 ; 4 ; 8 ; … ; 4096 $2^k=4096$ $2^k=2^{12}$ $k=12$ $\therefore n=15$ terms	$T_n=36\left(-\frac{1}{2}\right)^{n-1}$ $\frac{1}{16384}=\left(-\frac{1}{2}\right)^{n-1}$ answer (3) **OR/*OF*** $2^k=4096$ $k=12$ answer (3)

2.2.3	$S_{\infty} = \frac{a}{1-r}$ $= \frac{36}{1-\left(-\frac{1}{2}\right)}$ $= 24$	✓ correct subst into correct formula with $-1 < r < 1$ ✓ answer if $-1 < r < 1$ (2)
2.2.4	$S_{250\,\text{even}} = \frac{-18\left[\left(\frac{1}{4}\right)^{250} - 1\right]}{\frac{1}{4} - 1}$ $= -24$ $S_{250\,\text{odd}} = \frac{36\left[\left(\frac{1}{4}\right)^{250} - 1\right]}{\frac{1}{4} - 1}$ $= 48$ $\frac{S_{odd}}{S_{even}} = \frac{48}{-24}$ $= -2$ **OR/*OF*** $\frac{T_1 + T_3 + T_5 + T_7 + \ldots + T_{499}}{T_2 + T_4 + T_6 + T_8 + \ldots + T_{500}}$ $= \frac{a + ar^2 + ar^4 + \ldots + ar^{498}}{ar + ar^3 + ar^5 + \ldots + ar^{499}}$ $= \frac{a + ar^2 + ar^4 + \ldots + ar^{498}}{r\left(a + ar^2 + ar^4 + \ldots + ar^{498}\right)}$ $= \frac{1}{r}$ $= -2$	✓ $r = \frac{1}{4}$ and $n = 250$ ✓ $S_{250\,\text{even}} = -24$ ✓ $S_{250\,\text{odd}} = 48$ ✓ answer (4) **OR/*OF*** ✓ $a + ar^2 + ar^4 + \ldots + ar^{498}$ ✓ $ar + ar^3 + ar^5 + \ldots + ar^{499}$ ✓ $r\left(a + ar^2 + ar^4 + \ldots + ar^{498}\right)$ ✓ answer (4) **[17]**

QUESTION/*VRAAG* 3

3.1.1	$p+6-(2p+3)=p-2-(p+6)$ $-p+3=-8$ $p=11$	✓ equating i.t.o p ✓ simplifying (2)
3.1.2	$T_n=25+(n-1)(-8)=33-8n$ $33-8n<-55$ $-8n<-88$ $n>11$ $\therefore$ Term 12 will be the first term smaller than -55 $\therefore$ *Term 12 sal die eerste term kleiner as – 55 wees.*	✓ subst into T_n formula ✓ $n>11$ ✓ $n=12$ (3)
3.2	$S_6=\frac{n}{2}[a+l]=\frac{6}{2}[(x-3)+(x-18)]$ $=6x-63$ $S_9=\frac{n}{2}[a+l]=\frac{9}{2}[(x-3)+(x-27)]$ $=9x-135$ $6x-63=9x-135$ $3x=72$ $x=24$ $\therefore S_{15}=\frac{n}{2}[a+l]=\frac{15}{2}[(x-3)+(x-45)]$ $=\frac{15}{2}[2x-48]$ $=\frac{15}{2}[2(24)-48]=0=\text{RHS}$ **OR/*OF*** $\sum_{k=7}^{9}(x-3k)=0$ $(x-21)+(x-24)+(x-27)=0$ $\therefore 3x-72=0$ $3x=72$ $x=24$ $\sum_{k=1}^{15}(24-3k)$ $=21+18+15+.....+-21.$ $S_n=\frac{n}{2}[a+l)]$ $=\frac{15}{2}[21-21]$ $=0=\text{RHS}$ **OR/*OF***	✓ $6x-63$ ✓ $9x-135$ ✓ 24 ✓ $\frac{15}{2}[(x-3)+(x-45)]$ ✓ substitution of x (5) **OR/*OF*** ✓ expansion ✓ $3x-72=0$ ✓ 24 ✓ substitution of x ✓ sum of 15 terms (5) **OR/*OF***

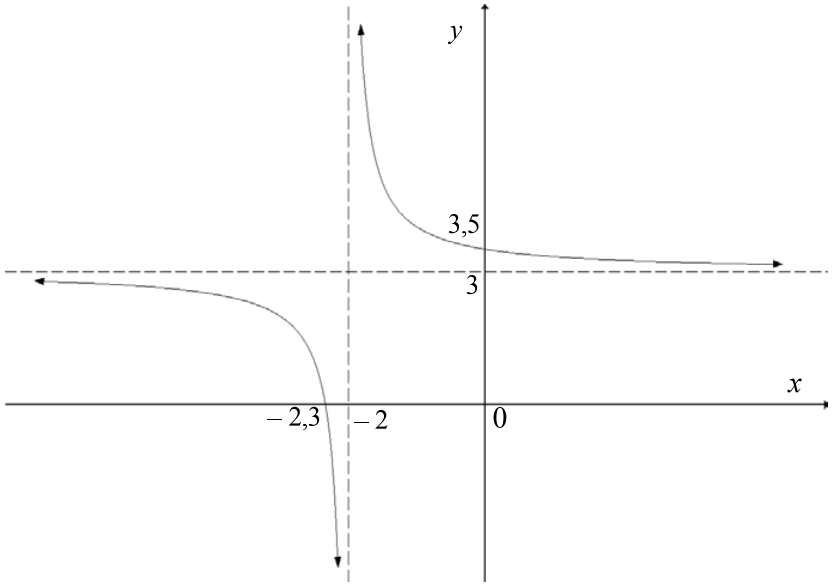
	$(x-3)+(x-6)+(x-9)+(x-12)+(x-15)+(x-18)$ $=(x-3)+(x-6)+(x-9)+(x-12)+(x-15)+(x-18)$ $+(x-21)+(x-24)+(x-27)$ $\therefore 3x-72=0$ $3x=72$ $x=24$ $\sum_{k=1}^{15}(24-3k)$ $=21+18+15+.....+-21.$ $S_n=\frac{n}{2}[a+l]$ $=\frac{15}{2}[21-21]$ $=0=\text{RHS}$	✓ expansion ✓ $3x-72=0$ ✓ 24 ✓ substitution of x ✓ sum of 15 terms (5) **[10]**

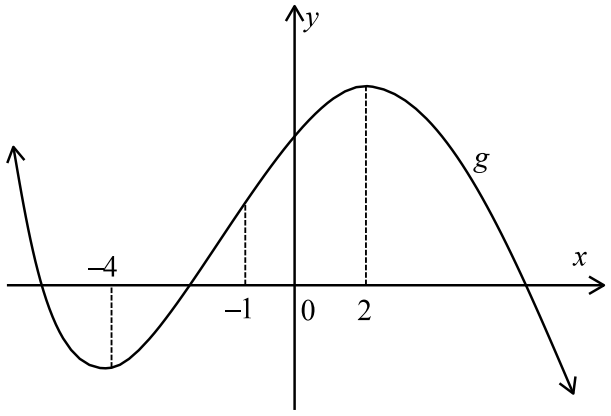
QUESTION/*VRAAG* 4

4.1	$y>0$ **OR/*OF*** $y\in(0\ ;\infty)$	✓answer (1) **OR/*OF*** ✓answer (1)
4.2	$g: y=\left(\frac{1}{2}\right)^x$ $g^{-1}: x=\left(\frac{1}{2}\right)^y$ $y=\log_{\frac{1}{2}} x$ or $y=-\log_2 x$ or $y=\log_2 \frac{1}{x}$	✓ $x=\left(\frac{1}{2}\right)^y$ ✓ equation (2)
4.3	Yes. The vertical line test cuts g^{-1} once *Ja. Die vertikale lyn toets sny g^{-1} slegs eenkeer.* **OR/*OF*** Yes. For every *x*-value there is a unique *y*-value *Ja. Vir elke x-waarde is daar 'n unieke y-waarde* **OR/*OF*** Yes. *g* is a one-to-one function / *Ja. g is 'n een-tot-een funksie* **OR/*OF*** Yes. The horizontal line cuts *g* only once *Ja. Die horisontale lyn sny g slegs een keer*	✓ yes ✓ valid reason (2) **OR/*OF*** ✓ yes ✓ valid reason (2) **OR/*OF*** ✓ yes ✓ valid reason (2) **OR/*OF*** ✓ yes ✓ valid reason (2)

4.4.1	$y = -\log_2 x$ $2 = -\log_2 a$ $a = 2^{-2} = \frac{1}{4}$ or $a = \left(\frac{1}{2}\right)^2 = \frac{1}{4}$	✓correct subst into correct formula (a ; 2) ✓answer (2)
4.4.2	$M'\left(2;\frac{1}{4}\right)$ or $M'(2;a)$	✓ answer (1)
4.5	$M''\left(-1;\frac{9}{4}\right)$	✓ -1 ✓✓ $\frac{9}{4}$ (3)
		[11]

QUESTION/*VRAAG* 5

5.1.1	$x = -2$ $y = 3$	✓ answer ✓ answer (2)
5.1.2	$\left(0\,;\frac{7}{2}\right)$	✓ answer (1)
5.1.3	$\frac{1}{x+2} + 3 = 0$ $1 + 3(x+2) = 0$ $3x = -7$ $x = -\frac{7}{3}$ x-intercept $\left(-\frac{7}{3}\,;0\right)$	✓ $y = 0$ ✓ answer (2)
5.1.4		✓asymptotes at $y = 3$ and $x = -2$ ✓intercepts at $y = 3{,}5$ and $x = -2{,}3$ ✓shape (reasonable representation in correct quadrants) (3)

5.2.1	$-2x+4=0$ $2x=4$ $x=2$ $\therefore$ S(2 ; 0)	✓ $y=0$ ✓ $x=2$ (2)
5.2.2	Equation of k: $y=a(x+1)^2+18$ $0=a(2+1)^2+18$ or $0=a(-4+1)^2+18$ $9a=-18$ $a=-2$ $y=-2(x+1)^2+18$	✓ $y=a(x+1)^2+18$ ✓ substitute (2 ; 0) or (– 4 ; 0) ✓ a (3)
5.2.3	$-2x^2-4x+16=-2x+4$ $-2x^2-2x+12=0$ $x^2+x-6=0$ $(x+3)(x-2)=0$ $x=-3$ or $x=2$ $y=-2(-3)+4=10$ T(–3 ; 10)	✓ equating ✓ standard form ✓ choosing $x=-3$ ✓ answer (4)
5.2.4	$x<-3$ or $x>2$ **OR/*OF*** $(-\infty ; -3)\cup(2 ; \infty)$	✓✓ answer (2) **OR/*OF*** ✓✓ answer (2)
5.2.5(a)	$x<-1$ **OR/*OF*** $(-\infty ; -1)$	✓ answer (2) **OR/*OF*** ✓ answer (2)
5.2.5(b)		✓ shape of cubic with local min tp moving to local max tp ✓ turning points at $x=2$ and $x=-4$ ✓ point of inflection at $x=-1$ (3) **[24]**

QUESTION/*VRAAG* 6

6.1	$f(x)=x^2+2$ $f(x+h)=(x+h)^2+2$ $=x^2+2xh+h^2+2$ $f(x+h)-f(x)=x^2+2xh+h^2+2-(x^2+2)$ $=2xh+h^2$ $f'(x)=\lim_{h\to 0}\frac{f(x+h)-f(x)}{h}$ $=\lim_{h\to 0}\frac{2xh+h^2}{h}$ $=\lim_{h\to 0}\frac{h(2x+h)}{h}$ $=\lim_{h\to 0}(2x+h)$ √ $=2x$ **OR/*OF*** $f'(x)=\lim_{h\to 0}\frac{f(x+h)-f(x)}{h}$ $=\lim_{h\to 0}\frac{x_2+2xh+h_2+2-(x_2+2)}{h}$ $=\lim_{h\to 0}\frac{2xh+h^2}{h}$ $=\lim_{h\to 0}\frac{h(2x+h)}{h}$ $=\lim_{h\to 0}(2x+h)$ $=2x$	✓ $x^2+2xh+h^2+2$ ✓ $\lim_{h\to 0}\frac{2xh+h^2}{h}$ ✓ $\lim_{h\to 0}\frac{h(2x+h)}{h}$ ✓ answer **OR/*OF*** ✓ $x^2+2xh+h^2+2$ ✓ $\lim_{h\to 0}\frac{2xh+h^2}{h}$ ✓ $\lim_{h\to 0}\frac{h(2x+h)}{h}$ ✓ answer	(5) (5)

6.2.1	$y = 4x^3 + 2x^{-1}$ $\frac{dy}{dx} = 12x^2 - 2x^{-2}$	✓ $+2x^{-1}$ ✓ $12x^2$ ✓ $-2x^{-2}$ (3)
6.2.2	$y = 4\sqrt[3]{x} + (3x^3)^2$ $= 4x^{\frac{1}{3}} + 9x^6$ $\frac{dy}{dx} = \frac{4}{3}x^{-\frac{2}{3}} + 54x^5$	✓ $4x^{\frac{1}{3}}$ ✓ $9x^6$ ✓ $\frac{4}{3}x^{-\frac{2}{3}}$ ✓ $54x^5$ (4)
6.3	Point of contact: (1 ; 5) $m = 2$ $y - y_1 = m(x - x_1)$ or $y = 2x + c$ $y - 5 = 2(x - 1)$ $5 = 2 + c$ $c = 3$ $y = 2x + 3$ $y = 2x + 3$	✓ $m = 2$ ✓ substitution of (1 ; 5) ✓ answer (3) **[14]**

QUESTION/*VRAAG* 7

7.1	$h(x) = -2(x + \frac{3}{2})(x - 1)(x + 3)$ $h(x) = -(2x + 3)(x^2 + 2x - 3)$ $h(x) = -2x^3 - 7x^2 + 9$ **OR/*OF*** $h(x) = -(2x + 3)(x - 1)(x + 3)$ $h(x) = -(2x + 3)(x^2 + 2x - 3)$ $h(x) = -2x^3 - 7x^2 + 9$	✓✓ $-2(x + \frac{3}{2})(x - 1)(x + 3)$ ✓ correct simplification (3) **OR/*OF*** ✓✓ $-(2x + 3)(x - 1)(x + 3)$ ✓ correct simplification (3)
7.2	$h'(x) = -6x^2 - 14x$ $-6x^2 - 14x = 0$ $-2x(3x + 7) = 0$ $x = 0$ or $x = -\frac{7}{3}$	✓ first derivative ✓ $= 0$ ✓ both answers (3)
7.3	$x < -\frac{7}{3}$ or $x > 0$ **OR/*OF*** $x \in \left(-\infty ; -\frac{7}{3}\right) \cup (0 ; \infty)$	✓✓ answer (2) **OR/*OF*** ✓✓ answer (2)

7.4	$y = 4x + 7$ $-6x^2 - 14x = 4$ $0 = 6x^2 + 14x + 4$ $0 = 3x^2 + 7x + 2$ $0 = (3x+1)(x+2)$ $x = -\frac{1}{3}$ or $x = -2$	✓ $y = 4x + 7$ ✓ $h'(x) = 4$ ✓ standard form ✓ both answers (5)
		[12]

QUESTION/*VRAAG* 9

8.1	Volume of Sphere $= \frac{4}{3}\pi(8)^3$ or $= \frac{2048\pi}{3}$ or $= 2144{,}66$	✓ answer (1)
8.2	$r^2 + x^2 = 8^2$ (Pythagoras) $r^2 = 64 - x^2$	✓ substitution or reason Pythagoras (1)
8.3	$V_{cone} = \frac{1}{3}\pi r^2 h$ $= \frac{1}{3}\pi(64 - x^2)(8 + x)$ $= \frac{\pi}{3}(512 + 64x - 8x^2 - x^3)$ $\frac{dV}{dx} = \frac{64\pi}{3} - \frac{16\pi}{3}x - \frac{3\pi}{3}x^2$ $0 = 64 - 16x - 3x^2$ $0 = (8 - 3x)(x + 8)$ $x = \frac{8}{3}$ $x \neq -8$ $\frac{V_{cone}}{V_{sphere}} = \frac{\frac{1}{3}\pi\left(\frac{512}{9}\right)\left(\frac{32}{3}\right)}{\frac{2048\pi}{3}}$ $= \frac{8}{27} = 0{,}3$	✓ $h = 8 + x$ ✓ $\frac{1}{3}\pi(64 - x^2)(8 + x)$ ✓ expansion ✓ $\frac{dV}{dx} = \frac{64\pi}{3} - \frac{16\pi}{3}x - \frac{3\pi}{3}x^2$ ✓ $x = \frac{8}{3}$ ✓ volume of the cone ✓ $\frac{8}{27}$ or 0,3 (7)
		[9]

TOTAL/*TOTAAL*: 120