α-WISKUNDE/MATHEMATICS

Alpha Wiskunde Graad 11 / ***Alpha Mathematics Grade 11***

Junie eksamen 2026 / ***June examination 2026***

MEMORANDUM

Totaal / ***Total*****: 150 punte /** ***marks***

Eksaminator / ***Examiner*****: Pieter van Onselen**

Moderator: Anna Muller

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

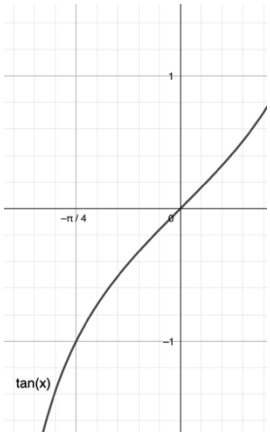
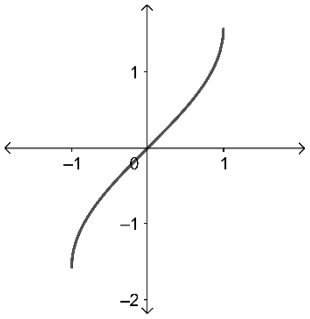
Vraag / *Question* 1 **[20 punte / *marks*]**

1.1	**A**	B	C	D
1.2	**A**	B	C	D
1.3	A	B	**C**	D
1.4	A	B	**C**	D
1.5	A	B	C	**D**
1.6	A	B	C	**D**
1.7	A	B	C	**D**
1.8	A	**B**	C	D
1.9	A	B	**C**	D
1.10	A	**B**	C	D

Vraag / *Question* 1 **[20 punte / *marks*]**

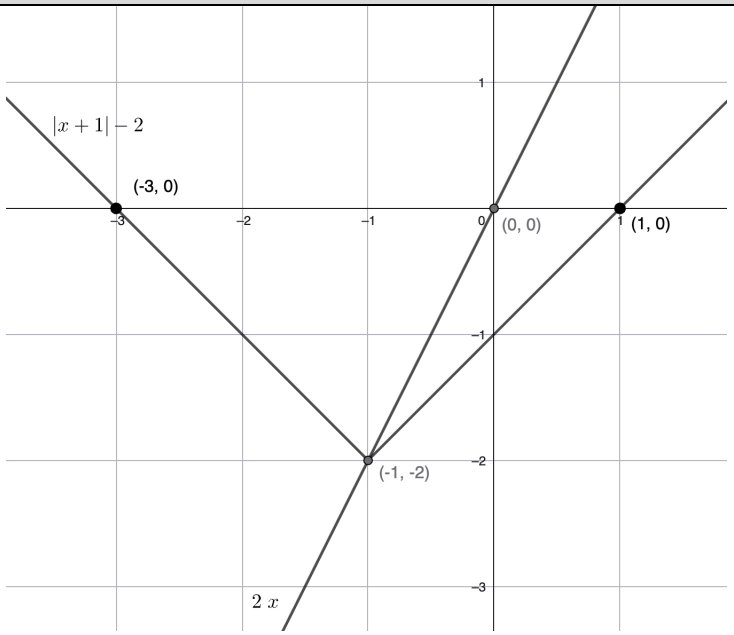
NR. NO.	ANTWOORD / *ANSWER*	PUNTE / *MARKS*
1.1	$8A \quad A_1 = \frac{1}{2}\theta r^2$ Verdubbel/*double:* $A_2 = \frac{1}{2}(2\theta)(2r)^2$ $= \frac{1}{2}2\theta 4r^2$ $= 8\left(\frac{1}{2}\theta r^2\right)$ $= 8A_1$	**(2)**
1.2	$A \quad \frac{7-x}{(x+1)(x-3)} \equiv \frac{A}{x-3} + \frac{B}{x+1}$ $7 - x = A(x+1) + B(x-3)$ $x = 3: \quad 4 = A(4)$ $A = 1$	**(2)**

NR. NO.	ANTWOORD / *ANSWER*	PUNTE / *MARKS*
1.3	C $f^{-1}(x): x = \sin(2y) - \frac{\pi}{2}$ $x + \frac{\pi}{2} = \sin(2y)$ $\text{bgsin}/arcsin\left(x + \frac{\pi}{2}\right) = 2y$ $y = \frac{1}{2}\boldsymbol{bgsin}/arcsin(x + \frac{\pi}{2})$	**(2)**
1.4	C $(x+b)^7 \qquad r = 2$ $\binom{7}{2}(x)^{7-2}(b)^2$ $= 21b^2x^5$ $21b^2 = 84$ $b^2 = 4$ $b = 2$ OF/OR $b = -2$	**(2)**
1.5	D $y = \frac{1}{4}\text{bgsin}(x+1)$ Vergroot/*double:* $y = 2\left(\frac{1}{4}\right)\text{bgsin}(x+1)$ Links/*left:* $y = 2\left(\frac{1}{4}\right)\text{bgsin}(x+1+3)$ $y = \frac{1}{2}\text{bgsin}(x+4)$	
1.6	D $\lvert x\rvert = \sqrt{x^2}$ Waar/*true:* x^2 is positief/*positive* $\lvert x\rvert = \left(\sqrt{x}\right)^2$ Onwaar/*false:* $x \geq 0$ $\lvert x\rvert = \lvert -x\rvert$ Waar/*true:*: $\lvert 5\rvert = 5$ en/and $\lvert -5\rvert = 5$ $\lvert x\rvert > 0$ Onwaar/*false:* $\lvert x\rvert \geq 0, \lvert 0\rvert = 0$	**(2)**

NR. NO.	ANTWOORD / *ANSWER*	PUNTE / *MARKS*
1.7	D $0 = bgtan(x) + \frac{\pi}{4}$ $-\frac{\pi}{4} = \text{bgtan}(x)$ $\tan\left(-\frac{\pi}{4}\right) = x$ $x = -1$ 	**(2)**
1.8	B $s = r\theta$ $s = 6\theta$ Sirkel/*circle* $\theta = \frac{2\pi}{3}$ $s = 6\left(\frac{2\pi}{3}\right)$ $= 4\pi$	**(2)**
1.9	C $y = bgcos(x) - \frac{\pi}{2}$ 	**(2)**
1.10	B $6^{de}/6^{th}$ term: $r = 5$ $10^{de}/10^{\text{th}}$ ry/*row:* $n = 10$ $\binom{10}{5} = 252$	**(2)**

Vraag / *Question* 2 **[35 punte / *marks*]**

NR. NO.	ANTWOORD / *ANSWER*	PUNTE / *MARKS*
2.1(a)	$-\|x-1\|+8=0$ $\|x-1\|=8$ ✓ $x-1=8$ OF/*OR* $x-1=-8$ ✓ $x=9$ ✓ $x=-7$ ✓	**(4)**
2.1(b)	$\|x+1\|<3$ $-3<x+1<3$ ✓ -4 ✓$<x<2$ ✓	**(3)**
2.2(a)	$\lfloor x+1\rfloor-2=2x$ $\lfloor x+1\rfloor=2x+2$ As/*if* $x\geq-1$: As/*if* $x<-1$: ✓ $x+1=2x+2$ $x+1=-(2x+2)$ $x=-1$ ✓ $3x=-3$ $x=-1$ ✓ $y=2x$ $=2(-1)$ $(2;-1)$ ✓	**(4)**
2.2(b)	x-afsnit ($y=0$): $0=\lfloor x+1\rfloor-2$ $\|x+1\|=2$ $x+1=-2$ OF/OR $x+1=2$ $x=-3$ $x=1$ y-afsnit ($x=0$): $y=\|1\|-2$ $y=-1$ Knakpunt/*Salient point:* $x+1=0$ $x=-1$ $(-1;-2)$	

NR. NO.	ANTWOORD / *ANSWER*	PUNTE / *MARKS*
		**(6)** $\boldsymbol{x=-3}$ ✓ $\boldsymbol{x=1}$ ✓ $\boldsymbol{(-1;-2)}$ ✓ ***Vorm*** $\boldsymbol{f(x)=\lvert x+1\rvert-2}$ ✓ $\boldsymbol{y=2x}$ $\boldsymbol{(0;0)}$ ✓ ***Reguit lyn /straight line*** $\boldsymbol{(-1;-2)}$ ✓
2.3		**(10)**
2.3.1	$D \quad \lvert x-3\rvert \geq 0 \quad x \in \mathbb{R}$	✓✓
2.3.2	$F\ \lvert x-3\rvert > 0 \quad x \in \mathbb{R}, x \neq 3, \lvert 3-3\rvert = 0$	✓✓
2.3.3	$G \quad \lvert x-3\rvert = 0 \quad x=3;\ x-3=0$	✓✓
2.3.4	$D \quad \lvert x-3\rvert \geq -3 \quad x \in \mathbb{R}$	✓✓
2.3.5	$G \quad \lvert x-3\rvert \leq 0 \quad x=3;\ x-3=0$	✓✓
2.4(a)	$f(x)=\lvert x-a\rvert+b$ $B(3;-2)$ $x-a=0$ ✓ Knakpunt/s*alient point* x $x=a \quad x=3$ $a=3$ ✓ $b=-2$ ✓ Knakpunt/*salient point* y	**(3)**
2.4(b)	$\lvert x-3\rvert-2=-\lvert x-c\rvert+d$ $x-c=0$ ✓ Knakpunt/s*alient point* $x=c$ and $A(-1;y)$ $c=-1$ ✓ $g(x): x<-1: y=x+1+d$ ✓ $y=x+1+d$ by/at $C\left(-\frac{3}{2};\frac{5}{2}\right)$ $\frac{5}{2}=-\frac{3}{2}+1+d$ ✓$\Rightarrow \frac{6}{2}=d \Rightarrow d=3$ ✓	**(5)**

Vraag / *Question* 3 **[18 punte / *marks*]**

NR. NO.	ANTWOORD / *ANSWER*	PUNTE / *MARKS*
3.1	$\frac{x^3+2x^2+5x+2}{(x+1)^2(x^2+1)} \equiv \frac{A}{x+1}+\frac{B}{(x+1)^2}+\frac{Cx+D}{x^2+1}$ ✓ x^3+2x^2+5x+2 $\equiv A(x+1)(x^2+1)+B(x^2+1)+(Cx+D)(x+1)^2$ ✓ x^3+2x^2+5x+2 $\equiv Ax^3+Ax^2+Ax+A+Bx^2+B+Cx^3+2Cx^2+Cx+Dx^2+2Dx+D$ Stel/Set $x=-1$: $-1+2-5+2=B((-1)^2+1) \Rightarrow -2=2B$ $B=-1$ ✓ x^3: $1=A+C$ ✓ $A=1-C$ x: $5=A+C+2D$ ✓ Vervang/*substitute:* $A=1-C$ $5=1-C+C+2D$ $4=2D$ $D=2$ ✓ Stel/Set $x=0$ of/or konstante/*constant:* $2=B+A+D$ ✓ $2=-1+A+2$ $A=1$ ✓ Vervang/*substitute* $A=1-C$*:* $C=0$ ✓ OF/*OR* x^2: $2=A+B+2C+D$ $2=1-1+2C+2$ $C=0$ $\frac{x^3+2x^2+5x+2}{(x+1)^2(x^2+1)} \equiv \frac{1}{x+1}-\frac{1}{(x+1)^2}+\frac{2}{x^2+1}$ ✓	**(10)**

NR. NO.	ANTWOORD / *ANSWER*	PUNTE / *MARKS*
3.2.1	*F* $\frac{f(x)}{x^3+x^2}=\frac{f(x)}{x(x^2+1)}\equiv\frac{A}{x}+\frac{Bx+C}{x^2+1}$	**(2)**
3.2.2	E $\frac{f(x)}{x^4+x^2}=\frac{f(x)}{x^2(x^2+1)}\equiv\frac{A}{x}+\frac{B}{x^2}+\frac{Cx+D}{x^2+1}$	**(2)**
3.2.3	*B* $\frac{f(x)}{x^3+x^2}=\frac{f(x)}{x^2(x+1)}\equiv\frac{A}{x^2}+\frac{B}{x}+\frac{C}{x+1}$	**(2)**
3.2.4	G $\frac{f(x)}{1-x^2}=\frac{f(x)}{((1-x)(1+x)}\equiv\frac{A}{x+1}+\frac{B}{1-x}=\frac{A}{x+1}-\frac{B}{x-1}$	**(2)**

Vraag / *Question* 4 **[14 punte / *marks*]**

NR. NO.	ANTWOORD / *ANSWER*	PUNTE / *MARKS*
4.1(a)	As $x-1+3i$ 'n faktor is dan is $x-1-3i$ ook 'n faktor. *If* $x-1+3i$ *is a factor then* $x-1-3i$ *is also a factor.* ✓ $(x-1-3i)(x-1+3i)$ OF/*OR* $x-1=\pm 3i$ $=(x-1)^2-9i^2$ ✓ $(x-1)^2=9i^2$ ✓ $=x^2-2x+1+9$ $x^2-2x+1=-9$ ✓ $=x^2-2x+10$ is 'n faktor/*is a factor* ✓ 2 ✓$+1$ ✓ $1-2+10$ | $2-3+18+10$ $2-4+20$ $1\ -2+10$ $1-2+10$ 0 $f(x)=(x^2-2x+10)$ ✓$(2x+1)$ ✓	**(7)**
4.1(b)	$(x^2-2x+10)(2x+1)=0$ Oplossing/solution: $x=1\pm 3i$ ✓en/*and* $x=-\frac{1}{2}$ ✓	**(2)**

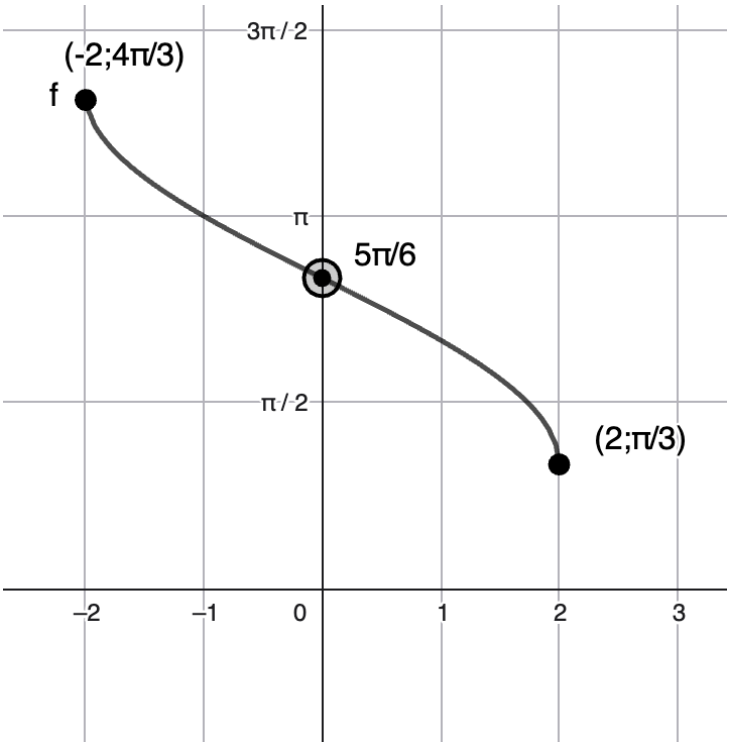
NR. NO.	ANTWOORD / *ANSWER*	PUNTE / *MARKS*
4.2(a)	As $x-\sqrt{2}$ 'n faktor is dan is $x+\sqrt{2}$ ook 'n faktor. *If* $x-\sqrt{2}$ *is a factor then* $x+\sqrt{2}$ *is also a factor.* ✓	**(1)**
4.2(b)	$(x-\sqrt{2})(x+\sqrt{2})$ OF/*OR* $x=\pm\sqrt{2}$ $=x^2-(\sqrt{2})^2$ $x=(\sqrt{2})^2$ $=x^2-2$ ✓ $1+0-2 \;\big|\; 1-1+a \quad +2-a$ (quotient: $1-1+(a+2)$) $1+0-2$ $-1\ (a+2)+2$ $-1+0 \quad +2$ $(a+2)+0-a$ $(a+2)+0-2(a+2)$ $-a+2a+4$ ✓ Res is 0/remainder is 0 $-a+2a+4=0$ ✓ $a=-4$ ✓ OF/*OR* $h(\sqrt{2})$ ✓ $=(\sqrt{2})^4-(\sqrt{2})^3+a(\sqrt{2})^2+2(\sqrt{2})-a=0$ ✓ $4-2\sqrt{2}+2a+2\sqrt{2}-a=0$ ✓ $4+2a=0$ $a=-4$ ✓	**(4)**

Vraag / *Question* 4 **[27 punte / *marks*]**

NR. NO.	ANTWOORD / *ANSWER*	PUNTE / *MARKS*
5.1(a)	$\sum_{k=1}^{n} 3^{k-1}$ Of/*Or* $\sum_{k=1}^{n-1} 3^{k}$	**(2)** 3^{k-1} ✓ $k = 1, n$ ✓
5.1(b)	Bewys as/*Prove if* n$= \mathbf{1}$**:** LHS = 1 RHS = $\frac{3^{1}-1}{2} = 1$ ✓ ∴ LK=RK vir / *LHS=RHS* Die bewering is waar vir $n = 1$/*Statement is true for* $n = 1$ ✓ Aanvaar dat bewering is waar vir $n = k$ / *Assume that statement is true for* $n = k$ ✓ $1 + 3 + 3^{2} + 3^{3} + \cdots + 3^{k-1} = \frac{3^{k}-1}{2}$ ✓ Beskou nou /*Now consider* $n = k + 1$**:** ✓ **LK/*LHS*=** $1 + +3 + 3^{2} + 3^{3} + \cdots + 3^{k-1} + 3^{k}$ $= \frac{3^{k}-1}{2} + 3^{k}$ ✓ $= \frac{3^{k}-1+2(3^{k})}{2}$ ✓$= \frac{3.3^{k}-1}{2}$ ✓ **RK/*RHS*:** $\frac{3^{k+1}-1}{2} = \frac{3.3^{k}-1}{2}$ ✓ ∴**LK=RK/*LHS=RHS*** **Volgens die beginsel van wiskundige induskie is die bewering waar vir alle** $n \in \mathbb{N}$**. /** **The equation is true for all** $n \in \mathbb{N}$ **according to the principal of mathematical.** ✓	**(11)**

NR. NO.	ANTWOORD / *ANSWER*	PUNTE / *MARKS*
5.2	$\left(\mathrm{x}^2-\frac{2}{\mathrm{x}}\right)^{10}=\sum_{r=0}^{10}\binom{10}{r}$ ✓$(x^2)^{10-r}$ ✓$(-2x^{-1})^r$ ✓ $x^5=\ x^{2(10-r)}(x^{-1})^r$ $x^5=x^{20-2r-r}$ $5=20-3r$ $15=3r$ $r=5$ ✓ $\binom{10}{5}(-2)^5$ ✓ $=-8064$ ✓	**(6)**
5.3(a)	$\frac{1}{(4-x)^2}=(4-x)^{-2}$ ✓$=\frac{1}{16}$ ✓$\left(1-\frac{x}{4}\right)^{-2}$ $\frac{1}{16}\left(1-\frac{x}{4}\right)^{-2}=\frac{1}{16}\left(1+(-2)\left(-\frac{x}{4}\right)\right.$ ✓$\left.+\frac{-2(-3)\left(-\frac{x}{4}\right)^2}{2}\right)$ ✓ $=\frac{1}{16}+\frac{x}{32}$ ✓$+\frac{3x^2}{256}$ ✓	**(6)**
5.3(b)	$\left\|-\frac{x}{4}\right\|<1$ ✓ $\|x\|<4$ ✓	**(2)**

Vraag / *Question* 6 **[16 punte / *marks*]**

NR. NO.	ANTWOORD / *ANSWER*	PUNTE / *MARKS*
6.1(a)	Definisie versameling/*domain:* $-1 \leq \frac{x}{2} \leq 1 \Rightarrow -2 \leq x \leq 2$ ✓✓ Waardeversameling/*Range:* $\left[0+\frac{\pi}{3};\pi+\frac{\pi}{3}\right]=\left[\frac{\pi}{3};\frac{4\pi}{3}\right]$ ✓✓	**(4)**
6.1(b)	y-afsnit/*intercept:* $\frac{\pi}{2}+\frac{\pi}{3}=\frac{5\pi}{6}$  	**(4)** $\left(-2;\frac{4\pi}{3}\right)$ $\left(2;\frac{\pi}{3}\right)$ $\left(0;\frac{5\pi}{6}\right)$ Vorm/form
6.1(c)	$f(x)=bgcos\left(\frac{x}{2}\right)+\frac{\pi}{3}$ $x=bgcos\left(\frac{y}{2}\right)+\frac{\pi}{3}$ ✓ $x-\frac{\pi}{3}$ ✓$=bgcos\left(\frac{y}{2}\right)$ $\cos\left(x-\frac{\pi}{3}\right)$ ✓$=\frac{y}{2}$ $y=2\cos\left(x-\frac{\pi}{3}\right)$ ✓	**(4)**

NR. NO.	ANTWOORD / *ANSWER*	PUNTE / *MARKS*
6.2	$sin\left(2x-\frac{\pi}{6}\right)=\frac{1}{2}$ $2x-\frac{\pi}{6}=bgsin\left(\frac{1}{2}\right)$ ✓ $x=\frac{bgsin\left(\frac{1}{2}\right)+\frac{\pi}{6}}{2}$ ✓ $x=\frac{\left(\frac{\pi}{6}\checkmark+\frac{\pi}{6}\right)}{2}$ $x=\frac{\pi}{6}$ of/or $0{,}52$ ✓	(4)

Vraag / *Question* 7 **[20 punte / *marks*]**

NR. NO.	ANTWOORD / *ANSWER*	PUNTE / *MARKS*
7.1(a)	$s=r\theta$ $\theta=\frac{s}{r}$ ✓ $\theta=\frac{(2r+4)}{r}$ ✓ $\theta=2+\frac{4}{r}$ ✓	**(3)**
7.1(b)	$A=\frac{1}{2}r^2\theta$ ✓ $=\frac{1}{2}r^2(2+\frac{4}{r})$ ✓ $=r^2+2r$ ✓	**(3)**
7.1(c)	$r^2+2r=35cm$ ✓ $r^2+2r-35=0$ $(r-5)(r+7)=0$ ✓ $r=5cm$ ✓ $r=-7$ n.v.t *n/a* ✓	**(4)**
7.2(a)	$A_{ABC}=\frac{1}{2}r^2\theta$ ✓ $=\frac{1}{2}(6\ cm)^2(2.2)$ $=39{,}6\ cm^2$ ✓	**(2)**

NR. NO.	ANTWOORD / *ANSWER*	PUNTE / *MARKS*
7.2(b)	$D\hat{A}C + D\hat{A}B + \theta = 2\pi$ ✓ $D\hat{A}C = D\hat{A}B$ gegee/*given* $2D\hat{A}C = 2\pi - 2{,}2$ $D\hat{A}C = \frac{2\pi - 2.,2}{2}$ ✓ $D\hat{A}C = 2{,}04$ radiale/*radials* ✓	**(3)**
7.2(c)	$A_{DAC} = \frac{1}{2}(AC)(AD)\sin D\hat{A}C$ ✓ $= \frac{1}{2}(6\ cm)(4\ cm)\sin(2{,}04)$ ✓ $= 10.69\ cm^2$ of/or $10.7\ cm^2$ ✓ $A_{DAB} = A_{DAC}$ $A_{DCB} = 2A_{DAC} + A_{ABC}$ ✓ $= 2(10.69\ cm^2) + 39{,}6cm^2$ of/or $= 2(10.7\ cm^2) + 39{,}6cm^2$ $= 60{,}98\ cm^2$ ✓ $= 61\ cm^2$	**(5)**

- EINDE VAN DIE MEMORANDUM / *END OF THE MEMORANDUM* -