α-Mathematics

Graad 11 Alpha Mathematics
March 2024

MEMORANDUM

Totaal / *Total*: 60 punte / *marks*

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Moderator: Petrolene Marx

Hierdie memorandum bestaan uit 8 bladsye. /
This memorandum consists of 8 pages.

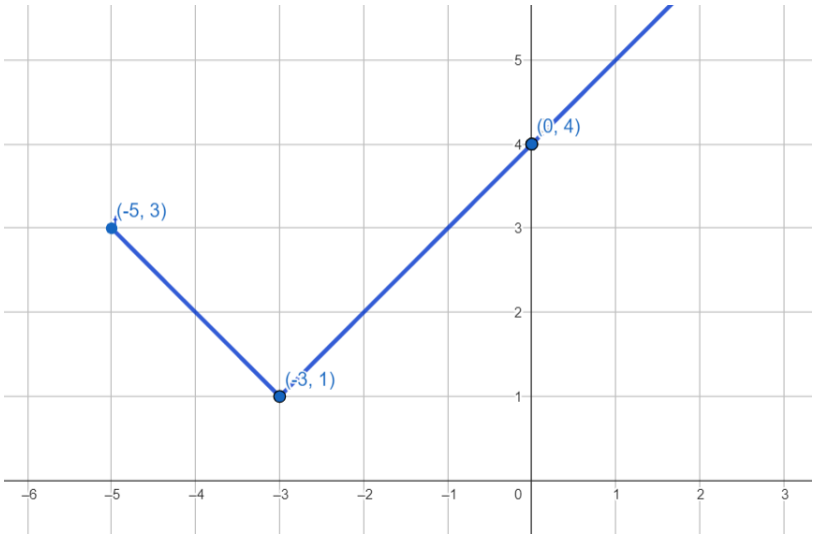
Vraag / *Question* 1 [10 punte / *marks*]

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**

NR. NO	ANTWOORD *ANSWER*	BEREKENINGE (nie vir nasien doeleindes nie) *CALCULATIONS (not for marking purpose)*	PUNTE *MARKS*
1.1	D	$x = -1 \Rightarrow x + 1 = 0 \Rightarrow x + 1$ 'n faktor / a factor	**2**
1.2	B	1. Ja / Yes, eienskap / property 2. Ja / Yes, $\lvert x - y \rvert = 0 \Rightarrow x - y = 0$ 3. Nee / No, Probeer / Try $x = 1, y = -1$ 4. Nee / No, vir / for $x = -1,\ (\sqrt{-1})^2 = i^2 = -1$	**2**
1.3	C	Koëffisiente / Coefficients: $\binom{12}{0}$, $\binom{12}{1}, \binom{12}{2}, \ldots, \binom{12}{12}$. Dus $n + 1$ terme / Thus $n + 1$ terms	**2**
1.4	B	$-\lvert x - 1 \rvert + 1 = 0$ $\lvert x - 1 \rvert = 1$ $\therefore x = 2$ of / or $x = 0$	**2**
1.5	D	$\frac{x^2 - 2x + 1}{(x^2 - 2x)(x - 1)} = \frac{x^2 - 2x + 1}{x(x-2)(x-1)} = \frac{A}{x} + \frac{B}{x-2} + \frac{C}{x-1}$ B is 'n strik / is a setup.	**2**

Vraag / *Question* 2 **[19 punte / *marks*]**

NR. NO	ANTWOORD / *ANSWER*	PUNTE / *MARKS*
2.1 (a)	$\big\|\|x\|-4\big\|>5$ $\|x\|-4>5$ of / *or* $-(\|x\|-4)>5$ $\|x\|>9$ of / or $\|x\|<-1$ $x<-9$ of / or $x>9$ of / *or* *geen oplossing / no solution*	✓$\|x\|-4>5$ ✓$-(\|x\|-4)>5$ or $(\|x\|-4)<-5$ ✓Answer $x<-9$ of / or $x>9$ ✓ "Geen oplossing" / "No solution" **[4 punte / *marks*]**
2.1 (b)	$\|4x-3\|=\|x^2+1\|$ $\|x^2+1\|=x^2+1$, want / because $x^2+1\geq 0$ As $4x-3\geq 0 \implies x\geq\frac{3}{4}$, dan: $4x-3=x^2+1$ $x^2-4x+4=0$ $(x-2)^2=0$ $\therefore x=2$ As $4x-3<0 \implies x<\frac{3}{4}$, dan: $-(4x-3)=x^2+1$ $x^2+4x-2=0$ $\therefore x=-2\pm\sqrt{6}$	✓Voorwaarde ✓Vergelyking ✓Antwoord ✓Voorwaarde ✓Vergelyking ✓Antwoord **[6 punte / *marks*]**

NR. NO	ANTWOORD / *ANSWER*	PUNTE / *MARKS*
2.2 (a)	$y = \|x + 3\| + 1$ $y = \|x - (-3)\| + 1$ $\therefore$ Knakpunt: $(-3; 1)$	✓✓Knakpunt $(-3; 1)$ **[2 punte / *marks*]**
2.2 (b)	<u>y-afsnit / intercept:</u> $y = \|x + 3\| + 1$ $= \|3\| + 1$ $= 4 \quad \therefore (0; 4)$ <u>x-afsnit / intercept:</u> $0 = \|x + 3\| + 1$ $\|x - 3\| = -1$ Geen Oplossings / No solution $\therefore$ Geen x-afsnitte / No x intercepts	✓Antwoord ✓ Vervang in $y = 0$ ✓ "Geen oplossing" / "No solution" **[3 punte / *marks*]**
2.2 (c)		✓Knakpunt ✓y-afsnit / intercept ✓Vorm / Form ✓Slegs geskets vir / only plotted for $x \geq -5$ **[4 punte / *marks*]**

Vraag / *Question* 3 **[15 punte / *marks*]**

NR. NO	ANTWOORD / ANSWER	PUNTE / MARKS
3.1	$P(x) = (x^2+9)(x^2-3)(x^2-9)$ $= (x-3i)(x+3i)(x-\sqrt{3})(x+\sqrt{3})(x-3)(x+3)$ a) $x = -3$ of $x = 3$ b) $x = -3$ of $x = 3$ ASOOK $x = -\sqrt{3}$ of $x = \sqrt{3}$ c) $x = -3$ of $x = 3$ $x = -\sqrt{3}$ of $x = \sqrt{3}$ ASOOK $x = -3i$ of $x = 3i$	✓Antwoord ✓Antwoord ✓ Antwoord **[3 punte / *marks*]**
3.2.1	As $t = 2+2i$ 'n nulpunt is dan is $t = 2-2i$ ook 'n nulpunt. $(t-2-2i)(t-2+2i)$ $= t^2-4t+8$ $= t^2-4t+8$ is 'n faktor / is a factor **OF / *OR*** $t = 2 \pm 2i$ $(t-2)^2 = (\pm 2i)^2$ $t^2-4t+4 = -4$ t^2-4t+8 is 'n faktor / is a factor Langdeling of inspeksie , dan is / Longidvision or inspection, then : $h(t) = t^4-8t^3+28t^2-48t+32$ $= (t^2-4t+8)(t^2-4t+4)$ $= (t-2-2i)(t-2+2i)(t-2)^2 \in \mathbb{C}[x]$ $\therefore t = 2 \pm 2i$ of / or $t = 2$	✓ 2 hakies / brackets ✓ Vereenvoudig /simplify ✓ Faktor / Factor **OF / OR** ✓ Vergelyking / equation ✓ Kwadreer beide kante / square both sides ✓ Faktor / Factor ✓✓✓(t^2-4t+4) ✓✓ $(t-2)^2$ ✓✓ Oplossings / Solutions **[10 punte / *marks*]**
3.2.2	$h(t) = 0$ is reeds opgelos / already solved in 3.2.1 Slegs, positiewe reële oplossing / only positive real solution: $t = 2$ $\therefore$ 2 sekondes	✓✓ $t = 2$ **[2 punte / *marks*]**

Vraag / *Question* 4 **[8 punte / *marks*]**

NR. NO	ANTWOORD / *ANSWER*	PUNTE / *MARKS*
4.1	$\frac{4x^2}{(x-2)^2(x-1)} \equiv \frac{A}{x-1}+\frac{B}{x-2}+\frac{C}{(x-2)^2}$ $4x^2 \equiv A(x-2)^2 + B(x-2)(x-1) + C(x-1)$ Stel / set $x = 1$: $4 = A \implies A = 4$ Stel / set $x = 2$: $16 = C$ $C = 16$ Stel / set $x = 0$ (enige waarde / any value): $0 = 4A + 2B - C$ $0 = 4(4) + 2B - (16)$ $B = 0$ $\therefore \frac{4x^2}{(x-2)^2(x-1)} \equiv \frac{4}{x-1}+\frac{16}{(x-2)^2}$ **OF / *OR*** $\frac{4x^2}{(x-2)^2(x-1)} \equiv \frac{A}{x-1}+\frac{B}{x-2}+\frac{C}{(x-2)^2}$ $4x^2 \equiv A(x-2)^2 + B(x-2)(x-1) + C(x-1)$ $\equiv Ax^2 - 4AX + 4A + Bx^2 - 3Bx + 2B + Cx - C$ $\equiv x^2(A+B) + x(-4A-3B+C) + (4A+2B-C)$ $A + B = 4 \qquad -4A - 3B + C = 0 \qquad 4A + B - C = 0$ $\therefore A = 4, \quad B = 0, \quad C = 16$ $\therefore \frac{4x^2}{(x-2)^2(x-1)} \equiv \frac{4}{x-1}+\frac{16}{(x-2)^2}$	✓✓ Ontbind ✓Vermenigvuldig met KGV ✓$A = 4$ ✓$C = 16$ ✓Vergelyking ✓$B = 0$ ✓Antwoord **OF / *OR*** ✓✓ Ontbind ✓Vermenigvuldig met KGV ✓Groepeer ✓$A = 4$ ✓$B = 0$ ✓$C = 16$ ✓Antwoord **[8 punte / *marks*]**

Vraag / *Question* 5 [8 punte / *marks*]

NR. NO	ANTWOORD / *ANSWER*	PUNTE / *MARKS*
5.1	$\left(2x^2+\frac{3}{x^4}\right)^6$ $\binom{6}{r}(2x^2)^{6-r}(3x^{-4})^r$ $=\binom{6}{r}2^{6-r}x^{12-2r}(3)^r(x^{-4r})$ $\therefore 12-2r-4r=0 \Longrightarrow 6r=12 \Longrightarrow r=2$ Koëffisiënt / Coefficient: $\binom{6}{2}(2)^{6-2}(3)^2$ $=15(16)(9)=2160$ ∴ Koëffisiënt / Coefficient is 2160	✓Vervang / Substitute in formula ✓Vereenvoudig / Simplify ✓✓ $r=2$ (Indien r verkeerd, maks 3/5) ✓Coefficient **[5 punte / *marks*]**
5.3	5.3.1 $\binom{5}{1}=5$ 5.3.2 $\binom{5}{3}=10$ 5.3.3 $\binom{6}{1}=6$ of $1+5=6$ 5.3.4 $\binom{6}{2}=15$ of $10+5=15$ 5.3.5 $\binom{6}{5}=\binom{6}{1}=6$ of $5+1=6$ 5.3.6 Ry 7	$\frac{1}{2}$ mark per answer (Bewerkings is selgs vir nasiennings doeleindes, Workings only for marking purposes) **[3 punte / *marks*]**

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