α-MATHEMATICS

Graad 11 Alpha Mathematics
March 2024

Grade 11 **Time: 1 hour**

Examiner: M. Botha **Total: 60 punte**

Moderator: P. Marx

INSTRUCTIONS

Read the following instructions carefully before answering the question paper:

1. This question paper consists of 5 pages and an answer sheet.
2. Answer ALL 5 questions.
3. Number the answers according to the paper.
4. Non-programmable calculators may be used, unless otherwise stated.
5. Unless otherwise specified, all answers, where applicable, must be rounded correctly to two decimal places.
6. Clearly indicate all necessary calculations, diagrams, graphs etc. that you used to determine your answers.
7. Full marks will not necessarily be awarded to answers only.
8. The diagrams in the question paper are not necessarily drawn to scale.
9. All angles are given in radians. Answers should be given in radians if necessary.
10. Write neatly and legibly.

Question 1 – Multiple Choice [10 marks]

This question should be answered on the answer sheet.

Each question has **ONLY** one correct answer, worth (2) marks each. Indicate the correct answer with an **X** on the answer sheet.

1.1 If $x = -1$ is a zero of f, then

(A) $f(1) = 0$

(B) $x - 1$ is a factor

(C) $f(0) = -1$

(D) $x + 1$ is a factor

1.2 Which propperties of absolute values are true?

1	$\|x\| \geq 0$
2	If $\|x - y\| = 0$ then $x = y$
3	$\|x + y\| = \|x\| + \|y\|$
4	$\|x\| = (\sqrt{x})^2$

(A) Only 1 and 4

(B) Only 1 and 2

(C) Only 1, 2 and 4

(D) Only 1

1.3 How many terms will $(1 - 2x)^{12}$ contain?

(A) 11

(B) 12

(C) 13

(D) Non of the above

1.4 Solve for x, in $-|x - 1| + 1 = 0$.

(A) $x \in 0{,}2$

(B) $x \in \{0,2\}$

(C) $x \in \mathbb{R}$

(D) No real solution for x

1.5 In doing the partial fraction decomposition of $\frac{x^2-2x+1}{(x^2-2x)(x-1)}$, we find:

(A) $\frac{A}{(x^2-2x)}+\frac{\mathrm{B}}{(x-1)}$

(B) $\frac{1}{x}+\frac{1}{x-2}+\frac{1}{x-1}$

(C) $\frac{Ax+B}{(x^2-2x)}+\frac{\mathrm{C}}{(x-1)}$

(D) $\frac{A}{x}+\frac{B}{x-2}+\frac{\mathrm{C}}{x-1}$

Question 2 - Absolute Value [19 marks]

2.1 Solve for x, $x \in \mathbb{R}$, in:

(a) $||x| - 4| > 5$ (4)

(b) $|4x - 3| = |x^2 + 1|$. (6)

2.2 Given $y = |x + 3| + 1$

a) Write down the coordinate of the salient point (2)

b) Determine the x- and y −intercepts. (3)

c) Sketch the graph of $y = |x + 3| + 1$ **for** $x \geq -5$**.**
Inidcate, clearly, **all** intercepts with the axis, the salient point, and all other points of importance. Use the **DIAGRAM SHEET** for the sketch. (4)

Question 3 - Polynomials [15 marks]

3.1 A polinomial $P(x)$, is factorized as follows $P(x) = (x^2 + 9)(x^2 - 3)(x^2 - 9)$

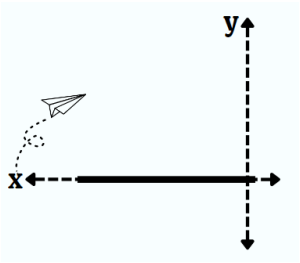
Write down ALL roots of $P(x)$ IN the following number systems:

a) $\mathbb{Q}[x]$ (1)

b) $\mathbb{R}[x]$ (1)

c) $\mathbb{C}[x]$ (1)

3.2 Carel's paper plane's altitude, h, (in meters) is given by the equation $h(t) = t^4 - 8t^3 + 28t^2 - 48t + 32$, where t, is the time (in seconds).



3.2.1 Carel knows that $t = 2 + 2i$ is one of the soltuions of $h(t) = 0$.
Factorise $h(t)$ fully in $\mathbb{C}[x]$, then solve for t. (10)

3.2.2 How much time will it take for the plane to reach the ground?
(the ground is at an altitude of $0\ m$) (2)

Question 4 – Partial Fractions [8 marks]

4.1 Decompose $\frac{4x^2}{(x-2)^2(x-1)}$ into partial fractions. (8)

Question 5 – Binomial Theorem & Pascal [8 marks]

Given the Binomial Theorem,

$$(a+b)^n = \sum_{r=0}^{n} \binom{n}{r} a^{n-r}b^r$$

5.1 Determine the constant term in the expansion of $\left(2x^2 + \frac{3}{x^4}\right)^6$. (5)

5.3 Complete the numbered table below, Fill in 5.3.1 to 5.3.6. (3)

a Part of Pascal's Triangle							Row Number
	1	5.3.1	10	5.3.2	5	1	
1	5.3.3	5.3.4	20	15	5.3.5	1	5.3.6

- END OF THE PAPER -

ALPHA WISKUNDE FORMULA PAGE

ALGEBRA:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \qquad |x| = \begin{cases} x & \text{as} \quad x \geq 0 \\ -x & \text{as} \quad x < 0 \end{cases}$$

$$(a+b)^n = \sum_{r=0}^{n} \binom{n}{r} a^{n-r} b^r \qquad (1+x)^n = 1 + \frac{nx}{1!} + \frac{n(n-1)x^2}{2!} + \cdots \text{ ; mits } |x| < 1$$

VECTORS:

$$\boldsymbol{a} \bullet \boldsymbol{b} = |\boldsymbol{a}||\boldsymbol{b}| \cos\theta \qquad \boldsymbol{a} \bullet \boldsymbol{b} = a_x b_x + a_y b_y + a_z b_z$$

CALCULUS:

$$\int_a^b x^n \, dx = \left[\frac{x^{n+1}}{n+1}\right]_a^b \qquad V = \pi \int_a^b [f(x)]^2 \, dx \qquad a_{n+1} = a_n - \frac{f(a_n)}{f'(a_n)}$$

TRIGONOMETRY:

In a sector: $s = r\theta$ en $A = \frac{1}{2} r^2 \theta$

Identities: $\sin^2 x + \cos^2 x = 1$ $\quad \tan^2 x + 1 = \sec^2 x$ $\quad \cot^2 x + 1 = \text{cosec}^2 x$

$$\text{cosec}\, x = \frac{1}{\sin x} \qquad \sec x = \frac{1}{\cos x} \qquad \cot x = \frac{1}{\tan x}$$

$$y - y_1 = m(x - x_1) \qquad m = \frac{y_2 - y_1}{x_2 - x_1} \qquad m = \tan\theta$$

In ΔABC: $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$ $\qquad a^2 = b^2 + c^2 - 2bc.\cos A$

area $\Delta ABC = \frac{1}{2} ab.\sin C$

TABEL WITH DERIVATIVES:

$F(x)$	$F'(x)$
ax^n	nax^{n-1}
$\sin x$	$\cos x$
$\cos x$	$-\sin x$
$\tan x$	$\sec^2 x$
$\cot x$	$-\text{cosec}^2 x$
$\sec x$	$\sec x \,.\tan x$
$\text{cosec}\, x$	$-\text{cosec}\, x \,.\cot x$

$F(x)$	$F'(x)$
bgsin x arcsin x	$\frac{1}{\sqrt{1-x^2}}$
bgcos x arccos x	$\frac{-1}{\sqrt{1-x^2}}$
bgtan x arctan x	$\frac{1}{x^2+1}$
$f(x).g(x)$	$f'(x).g(x) + f(x).g'(x)$
$\frac{f(x)}{g(x)}$	$\frac{f'(x).g(x) - f(x).g'(x)}{[g(x)]^2}$
$f[g(x)]$	$f'[g(x)].g'(x)$

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ANSWER SHEET

Naam and Surname: _____

Question Total	1 [10]	2 [19]	3 [15]	4 [8]	5 [8]
Learner Mark					

TOTAL 60

Question 1

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

DIAGRAM SHEET [Question 2.3 c)]