

α - MATHEMATICS

Grade 11

Time: 2 hours

Examiner: Pieter van Onselen

Total: 120 marks

Moderator: Anna Muller

INSTRUCTIONS AND INFORMATION

Read through the following instructions before answering the question paper.

1. This question paper consists of 8 pages and an answer sheet of 2 pages.
2. Answer ALL 6 questions.
3. Number the answers according to the numbering system used in this question paper.
4. Non-programmable calculators may be used, unless otherwise indicated in the question.
5. Unless indicated otherwise, all answers, must be given correct to two decimal places, where necessary.
6. Clearly show all calculations, diagrams, graphs etcetera that you have used in determining the answers.
7. Answers only will not necessarily be awarded full marks.
8. The diagrams in the question paper are not necessarily drawn to scale.
9. All angles are given in radians. Answers must also be given in radians where necessary.
10. A formula sheet is included at the end of this question paper.
11. Write neatly and legibly.

Question 1**[20 marks]**

This question must be answered on the answer sheet.

Every question has **ONLY** one correct answer for **TWO** marks each. Mark the correct answer with an X on the answer sheet.

1.1 Solve $|x - 1| = x$:

- (A) No solution (B) $x = -\frac{1}{2}$ (C) $x = \frac{1}{2}$ (D) $x \in \mathbb{R}$

1.2 If we decompose $\frac{x+1}{(x^2+x)(x-2)}$ into partial fractions we get:

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

1.3 The inverse of $f(x) = \cos\left(\frac{x}{2}\right) + 1$ is

- (A) $y = \frac{\arccos(x+1)}{2}$
(B) $f^{-1}(x) = 2\arccos(x-1)$
(C) $y = 2\arccos(x+1)$
(D) $f^{-1}(x) = \arccos\left(\frac{x}{2}\right) - 1$

1.4 If $x + 1 - i$ is a factor of $h(x)$, then:

- (A) $h(-1 - i) = 0$
(B) $x - 1 + i$ is a factor
(C) $x^2 - 2x + 2$ is a factor
(D) $h(-1 + i) \neq 0$

1.5 How many terms are in the expansion of $(x + 1)(x + 3)^6$?

- (A) 6 (B) 7 (C) 8 (D) 9

1.6 According to the principle of mathematical induction, if $P(k + 1) = m^{k+1} + 5$, which of the following is true?

- (A) $P(k) = m^k + 5$
 (B) $P(k) = 3m^k$
 (C) $P(k) = m^{(k+2)} + 5$
 (D) $P(k) = m^k$

1.7 Given $|x - 1| > -1$, the correct answer is:

- (A) $x = 0$
 (B) $x \in \mathbb{R}$
 (C) $x > 0$
 (D) No solution

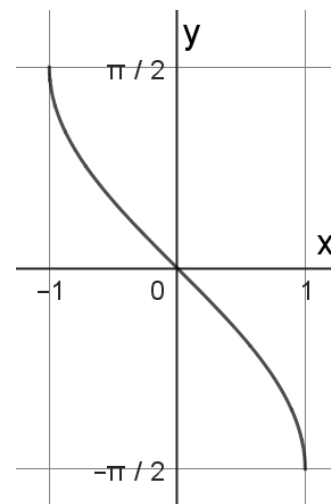
1.8 Give the n^{th} term of:

$$\sum_{r=1}^n (k)^{2+r}$$

- (A) n^{2+i} (B) k^{2+k} (C) k^{2+n} (D) n^{2+n}

1.9 Choose the correct function for the sketch:

- (A) $y = \arcsin(x)$
 (B) $y = \arccos(x)$
 (C) $y = -\arcsin(x) - \frac{\pi}{2}$
 (D) $y = \arccos(x) - \frac{\pi}{2}$



1.10 A sector with area A has its radius halved and its angle doubled. The area of the new sector is:

- (A) A (B) $\frac{A}{2}$ (C) $2A$ (D) $4A$

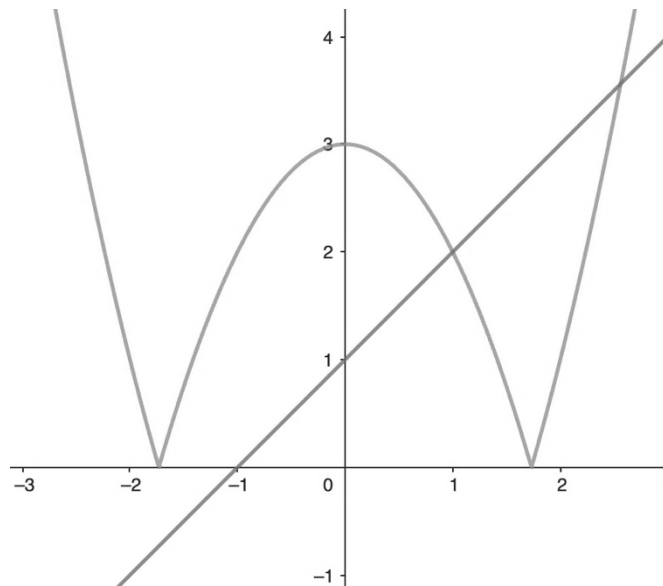
Question 2**[27 marks]**2.1 Solve x :

(a) $|x - 5| - 2 = 0$ (4)

(b) $-|x + 1| + 1 < 0$ (5)

2.2 Given $f(x) = |x - 2| - 3$ and $g(x) = 3x + 1$.(a) Write down the coordinate of the salient point of $f(x)$. (2)(b) Sketch the function $y = |x - 2| - 3$.

Indicate all intercepts with the axes and the turning point, as well as important points clearly on the sketch. Use **DIAGRAM SHEET 1** for the sketch.. (5)

(c) Determine the x -coordinate of the intercept of $f(x)$ and $g(x)$. (5)2.3 Given $g(x) = |x^2 - 3|$ and $h(x) = x + 1$. (6)Use the sketch and determine with algebra the x -values where $g(x) = f(x)$.

Question 3**[26 marks]**

3.1 Decompose the following functions into partial fractions.

$$\frac{x^3 + 3x^2 + 2}{(x^2 + x)(x^2 + 1)}$$

(10)

3.2 Given $f(x) = 4x^3 - 4x^2 - 13x - 5$.Show that $x = -1$ is a solution of $f(x)$.

(2)

3.3 Given $g(x) = 8x^4 - 82x^3 + 201x^2 - 16x - 69$.If $x - 5 - \sqrt{2}$ is a factor of $g(x)$. Solve x if $g(x) = 0$ with $x \in \mathbb{R}$.

(7)

3.4 Given $x = -2 + 2i$ is a zero of $h(x) = 3x^3 + 17x^2 + 44x + 40$.

(a) Give the other non-real factor.

(1)

(b) Factorise $h(x)$ completely in $\mathbb{C}[x]$.

(6)

Question 4**[23 marks]**4.1 Given $\left(\frac{1}{3x} - 2x^3\right)^8$.

(a) Determine which term would be the constant term.

(3)

(b) Use the binomial theorem and determine the constant term.

(3)

4.2 (a) Determine the first 3 terms in the power series of $\sqrt[3]{1 - \frac{x}{2}}$.

(5)

(b) Determine for which value of x the expression $\sqrt[3]{1 - \frac{x}{2}}$ is valid.

(2)

4.3 Prove the following using mathematical induction:

$$\sum_{p=1}^n (7 - 5p) = \frac{n(9 - 5n)}{2}$$

(10)

Question 5**[12 marks]**

Given: $f(x) = 2\arctan(x - 2) + \frac{\pi}{3}$.

5.1 Determine the x -intercept. (3)

5.2 Determine the y -intercept of $f(x)$. (2)

5.3 The asymptotes of $\arctan(x - 2)$ is $y = \frac{\pi}{2}$ en $y = -\frac{\pi}{2}$.

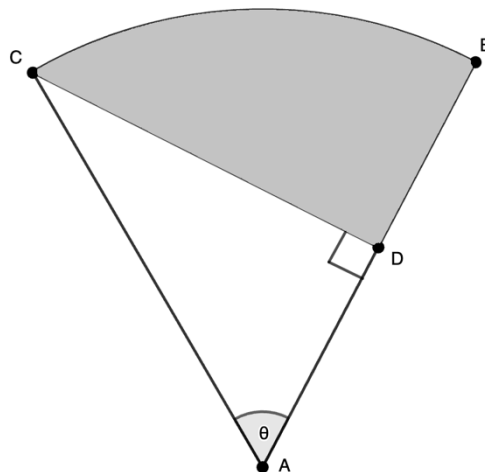
Determine the asymptotes of $f(x)$. (2)

5.4 Sketch $f(x)$. (5)

Indicate all intercepts with the axes and the asymptotes clearly on the sketch. Use **DIAGRAM SHEET 2** for the sketch.

Question 6**[12 marks]**

The sketch shows a sector ABC with an angle $\theta = \frac{\pi}{3}$ and radius $AB = 10$ cm, and a right-angled triangle ACD .



6.1 Determine the length of CD . (2)

6.2 Calculate the perimeter of the shaded region BCD . (4)

6.3 Calculate the area of the shaded region BCD . (6)

- END OF PAPER -

ALPHA MATHEMATICS FORMULA SHEET

ALGEBRA:

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

$$(1 + x)^n = 1 + \frac{nx}{1!} + \frac{n(n-1)x^2}{2!} + \dots ; \text{mits / if } |x| < 1$$

MATRICES AND VECTORS:

Cramer's rule:: $x_i = \frac{|A_i|}{|A|}$

$$\mathbf{a} \cdot \mathbf{b} = |\mathbf{a}||\mathbf{b}| \cos \theta$$

$$\mathbf{a} \cdot \mathbf{b} = a_x b_x + a_y b_y$$

CALCULUS:

$$V = \pi \int_a^b [f(x)]^2 dx$$

$$\int_a^b x^n dx = \left[\frac{x^{n+1}}{n+1} \right]_a^b$$

TRIGONOMETRY:

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

TABEL WITH DERIVATIVES:

$F(x)$	$F'(x)$
ax^n	nax^{n-1}
$f[g(x)]$	$f'[g(x)] \cdot g'(x)$

Alpha Mathematics Grade 11 - June examination 2025
ANSWER SHEET

Name en Surname: _____

Question Total	1 [20]	2 [27]	3 [26]	4 [23]	5 [12]	6 [12]	TOTAL 120
Learner mark							

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
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

DIAGRAM SHEET 1 Question 2.2 (b)

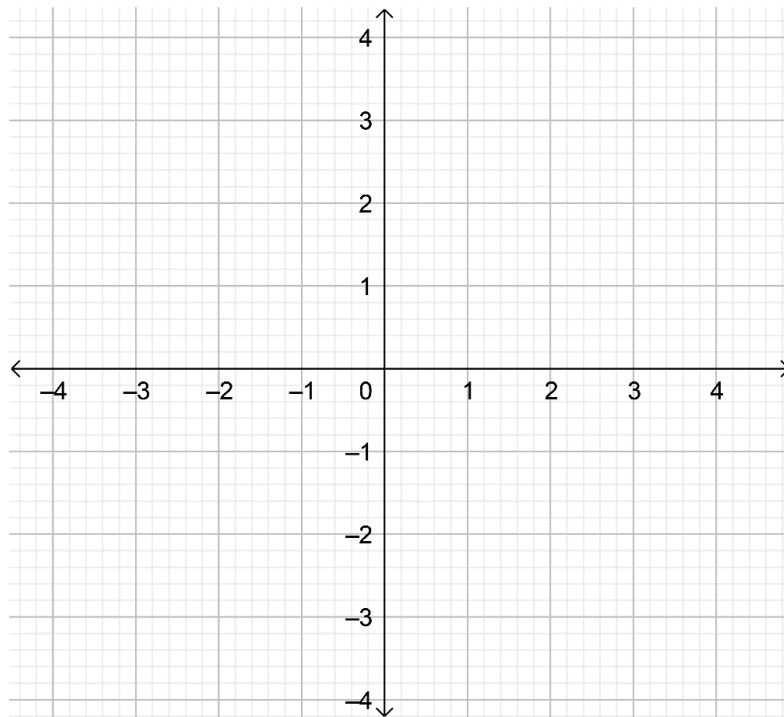


DIAGRAM SHEET 2 Question 5.4

