α-MATHEMATICS

Grade 10 Alpha Mathematics

June Examination 2021

Examiner: L Liebenberg **Time: 2 hours**

Moderator: A Muller **Total: 110**

INSTRUCTIONS AND INFORMATION

Read through the following instructions before answering the question paper.

1. This question paper consists of 7 pages and an answer sheet.
2. Answer ALL 7 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, where necessary, must be given correct to two decimal places.
6. Cleary 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 are not necessarily drawn to scale.
9. All angles are given in radians. Answers must also be given in radians where necessary.
10. 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 Given $x = 6 + 7i$ the conjugate of x is

A $x^* = -6 + 7i$

B $x^* = -7 + 6i$

C $x^* = 6 - 7i$

D $x^* = -6 - 7i$

1.2 The matrix $A = \begin{pmatrix} 1 & 0 & 1 \\ 0 & 1 & 0 \end{pmatrix}$

A Is a 2×3 matrix.

B Is a square matrix.

C Is a 3×2 matrix.

D Is an identity matrix.

1.3 Convert $60°$ to radians

A $34{,}37{,}746771$

B $\frac{\pi}{6}$

C 10800

D $\frac{\pi}{3}$

1.4 Given $A = (2 \quad 5)$ and $B = \begin{pmatrix} 1 & 5 & 7 \\ 0 & 3 & 2 \end{pmatrix}$.
Which of the following calculations is possible?

A $A + B$

B $B.A$

C $A.B$

D A^2

1.5 The direction of the vector $(8\,;6)$ is

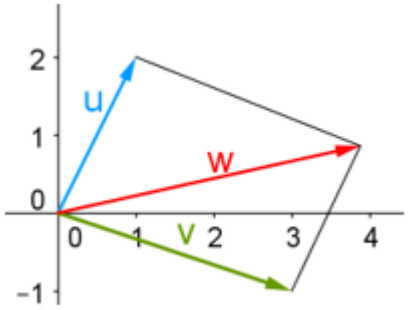
A $0{,}6435$

B $0{,}9273$

C 10

D None of the above.

1.6 The diagram can represents the vector calculation



A $(1\,;2) - v = w$

B $u + w = v$

C $w - (3\,;\,-1) = u$

D $w + v = u$

1.7 Given $B = \begin{bmatrix} 1 & -4 \\ -2 & 5 \\ 3 & -6 \end{bmatrix}$ then $B^T =$

A $\begin{bmatrix} -4 & 1 \\ 5 & -2 \\ -6 & 3 \end{bmatrix}$

B $\begin{bmatrix} -4 & 5 & -6 \\ 1 & -2 & 3 \end{bmatrix}$

C $\begin{bmatrix} 1 & -2 & 3 \\ -4 & 5 & -6 \end{bmatrix}$

D $\begin{bmatrix} -1 & 4 \\ 2 & -5 \\ -3 & 6 \end{bmatrix}$

1.8 $\sqrt{-16i^2} =$

A $-4i$

B $4i$

C 4

D -4

1.9 The arc length of a sector of a circle with radius 2 units and an angle of $\frac{\pi}{2}$ radians is

A 2π units

B π units

C 4π units

D $\frac{\pi}{4}$ units

1.10 If $f(x) = \sqrt{x}$ and $g(x) = x^2$, then $(f \circ g)(-2) =$

A 2

B 4

C -2

D $\sqrt{-2}$

Question 2 **[26 marks]**

2.1 Simplify

2.1.1 $Re(i^2 - 2i)$ (2)

2.1.2 i^{110} (2)

2.1.3 $3i - 5 + 2i - 3i^2 + 7 - i$ (3)

2.1.4 $(2 + 5i)(3 - i)$ (4)

2.1.5 $\dfrac{2 - i}{3 + i}$ (5)

2.2 Solve for a and b if (10)
$(1 + 2i)^2 = (a + bi)(2 - i)$

Question 3 **[10 marks]**

Decompose

$$\frac{2x^2 + 5x - 1}{x^3 - x}$$

into partial fractions, show all steps.

Question 4 **[10 marks]**

Given the vectors $u = (3\,;9)$ and $v = (12\,;-4)$.

4.1 Determine θ, the angle between u and v. (6)

4.2 Name the type of angle formed between u and v. (2)

4.3 State the properties of equal vectors. (2)

Question 5 **[25 marks]**

5.1 Do the following matrix calculations, show all your steps.

5.1.1 $(5 \quad -2 \quad 3 \quad 0) - (1 \quad 3 \quad -4 \quad 6)$ (2)

5.1.2 $-2\begin{bmatrix} 0 & 4 \\ 3 & -6 \end{bmatrix} + 3\begin{bmatrix} 1 & -2 \\ 4 & 3 \end{bmatrix}$ (4)

5.1.3 $\begin{pmatrix} -2 & 3 \\ 4 & -1 \\ 6 & 2 \end{pmatrix}\begin{pmatrix} -5 \\ 3 \end{pmatrix}$ (6)

5.1.4 $\begin{vmatrix} 2 & -2 & 2 \\ -3 & 3 & 3 \\ 4 & 0 & 4 \end{vmatrix}$ (7)

5.2 Given

$2x + y = 11 \quad \& \quad -3x - y = -15$

5.2.1 Write the system of equations in matrix form. (2)

5.2.2 Make use of Cramer's rule to determine the value of x. (4)

Question 6 **[12 marks]**

6.1 Determine the functions of f and g if (4)

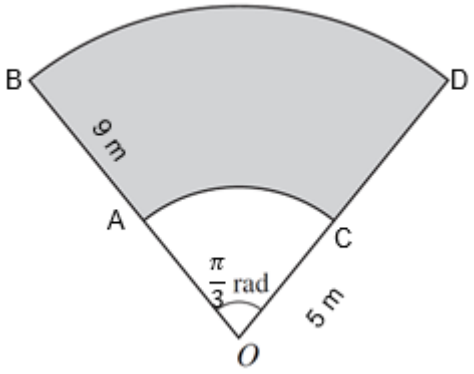
$F(x) = (f \circ g)(x) = \sqrt{x-2} + \frac{1}{\sqrt{x-2}}$.

6.2 Sketch the piecewise function on the DIAGRAM SHEET provided. (8)

$$h(x) = \begin{cases} x^2 & if \quad x < 0 \\ 2x & if \quad 0 < x < 2 \\ 4 - x & if \quad x \geq 2 \end{cases}$$

Question 7 **[7 marks]**

In the diagram below $OA = OC = 5\,m$, $AB = CD = 9\,m$ and $A\hat{O}C = \frac{\pi}{3}$ radians.



7.1 Calculate the perimeter of $ABCD$. (4)

7.2 Calculate the area of the shaded area. (3)

- END OF PAPER -

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June Examination 2021 Answer sheet

Name and Surname: _____

Question Total	1 [20]	2 [26]	3 [10]	4 [10]	5 [25]	6 [12]	7 [7]
Learner mark							

TOTAL 110

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

6.2