

α -MATHEMATICS

Grade 11 Alpha Mathematics Term 3 Test 2022

Examiner: Lanice Liebenberg

Time: 2 hours

Moderator: Anna Muller

Total: 100

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 5 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. 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 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. Mark the correct answer with an **X** on the answer sheet.

1.1 If the limit of a function $g(x)$ exists when x approaches $x = 4$, it can be written as: (2)

A $\lim_{x \rightarrow 4^-} g(x) > \lim_{x \rightarrow 4^+} g(x)$

B $\lim_{x \rightarrow 4^-} g(x) = \lim_{x \rightarrow 4^+} g(x)$

C $\lim_{x \rightarrow 4^-} g(x) \neq \lim_{x \rightarrow 4^+} g(x)$

D $\lim_{x \rightarrow 4^-} g(x) > \lim_{x \rightarrow 4^+} g(x)$

1.2 The derivative of $\cos 5x \cdot \sqrt{x}$ is: (2)

A $-5 \sin 5x \cdot \sqrt{x} + 2 \cos 5x \cdot \frac{1}{\sqrt{x}}$

B $\sin 5x \cdot \sqrt{x} + \cos 5x \cdot \frac{\sqrt{x}}{2}$

C $5 \sin 5x \cdot \sqrt{x} + \cos 5x \cdot \frac{1}{2\sqrt{x}}$

D $-5 \sin 5x \cdot \sqrt{x} + \cos 5x \cdot \frac{1}{2\sqrt{x}}$

1.3 Two vectors a and b are parallel if (2)

A $a \cdot b = 0$

B $a = b$

C $a \times b = 0$

D vectors cannot be parallel to one another.

1.4 Which of the following statements is false? (2)

- A A function can be differentiable without being continuous.
- B A function that is differentiable is also continuous.
- C A function can be continuous without being differentiable.
- D A function that is not continuous is also not differentiable.

1.5 The following statement is false with regard to a unit vector of vector u . (2)

- A The magnitude is 1.
- B The magnitude is the same as the magnitude of u .
- C The direction is the same as the direction of u .
- D $\frac{1}{|u|}(u_1; u_2; u_3)$

1.6 If $y = \arccos x$ then $y' =$ (2)

- A $\frac{1}{\sqrt{1-x^2}}$
- B $\frac{1}{\sqrt{x^2-1}}$
- C $-\frac{1}{\sqrt{1-x^2}}$
- D $\frac{1}{1+x^2}$

1.7 $-2(1; 6; -3) + 4(0; -2; 4) =$ (2)

- A $(2; -20; 22)$
- B $(2; 4; -10)$
- C $(-2; -20; 22)$
- D No solution

1.8 $\int \sin 5x \, dx =$ (2)

- A $-\frac{\cos 5x}{5} + k$
- B $\frac{\cos 5x}{5} + k$
- C $-\frac{\cos 6x}{6} + k$
- D $\frac{\cos 6x}{6} + k$

1.9 The derivative of $y = \sin 3x$ is (2)

- A $3\cos 3x$
- B $-3\cos 3x$
- C $\frac{1}{3}\cos 3x$
- D $-\frac{1}{3}\cos 3x$

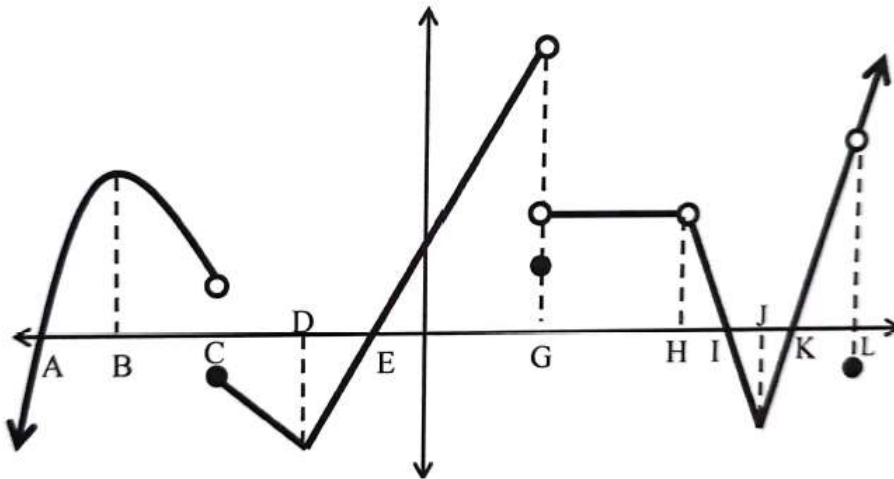
1.10 Two vectors are equal to one another if (2)

- A their cross product equals to zero.
- B the two vectors have the same magnitude and direction.
- C their dot product equals to zero.
- D the two vectors have the same magnitude.

Question 2**[25 marks]**

2.1 Given the piecewise function:

$$f(x) = \begin{cases} x + 1 & \text{if } x \leq a \\ -2x^2 + 3x + 5 & \text{if } x > a \end{cases}$$

2.1.1 Determine the value(s) of a such that f will be continuous everywhere. (5)2.1.2 If $a = 2$ write down the f' . (2)2.1.3 Is f differentiable at $x = 2$ if $a = 2$? Motivate your answer. (3)2.2 Given the sketch of $f(x)$ For which value(s) of x will:

2.2.1 the left and right limits be different? (2)

2.2.2 f be undefined? (2)2.2.3 f have a removable discontinuity? (2)2.2.4 f have a jump discontinuity? (2)2.2.5 f not be differentiable? (3)2.3 Refer to the graph in question 2.2, write down the domain and range of f . (4)

Question 3**[20 marks]**

Given the vectors $a = 3i - j + 2k$, $b = (4; 2; 1)$, $u = -3i + j + k$ and $v = (2; 1; 3)$

- 3.1 Determine the vectors ab and vu . (2)
- 3.2 Determine the magnitudes of the vectors ab and vu . (2)
- 3.3 Determine the dot product $ab \cdot vu$. (1)
- 3.4 Determine the magnitude of the angle between ab and vu . (2)
- 3.5 Determine a vector that is perpendicular to a and b . (8)
- 3.6 Calculate the area of the parallelogram which has sides a and b . (2)
- 3.7 Determine the magnitude of the angle that v makes with the z –axis. (3)

Question 4**[21 marks]**

Differentiate each of the following:

4.1 $f(x) = 10x^{15} - 3x + 2\sqrt{x} - 9 + \frac{4}{x}$ (4)

4.2 $y = (x^2 - 2x)\left(x + \frac{1}{x}\right)$ (4)

4.3 $h(t) = (5t^4 + 4t^3 - 3t^2 - 2t + 1)^3$ (7)

4.4 $g(x) = \frac{3x^2 - 5}{2x + 1}$ (3)

4.5 $t(x) = \cot(1 - 9x)$ (3)

Question 5**[14 marks]**

5.1 Integrate each of the following:

5.1.1 $\int \frac{1}{\sqrt{81 - 25x^2}} dx$ (5)

5.1.2 $\int_{-1}^2 (2 - 3x)^5 dx$ (5)

5.2 It is given that: (4)

$f''(x) = x + 2$; $f'(2) = 0$ and $f(1) = \frac{5}{6}$
determine $f(x)$.

END OF PAPER

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Grade 11 Alpha Mathematics Term 3 Test 2022 Answer sheet

Name and Surname: _____

Question Total	1 [20]	2 [25]	3 [20]	4 [21]	5 [14]	TOTAL 100
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