α-MATHEMATICS

Grade 11 Alpha Mathematics

Term 3 Test 2023

Examiner: Lanice Liebenberg **Time: 90 minutes**

Moderator: Rika Grobler **Total: 80**

INSTRUCTIONS AND INFORMATION

Read through the following instructions before answering the question paper.

1. This question paper consists of 6 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. 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. Mark the correct answer with an **X** on the answer sheet.

1.1 The unit vector of $\boldsymbol{u} = 4i - 3j + 5k$ is: (2)

A $\left(\frac{5\sqrt{2}}{4}; \frac{-5\sqrt{2}}{3}; \sqrt{2}\right)$

B $5\sqrt{2}$

C $\left(\frac{4}{5\sqrt{2}}; \frac{-3}{5\sqrt{2}}; \frac{1}{\sqrt{2}}\right)$

D $1{,}43$

1.2 In the cross product formula: (2)

$$\boldsymbol{a} \times \boldsymbol{b} = |\boldsymbol{a}||\boldsymbol{b}| \sin\theta . n$$

n is a unit vector that is _____ to the plane $\boldsymbol{a} - \boldsymbol{b}$.

A perpendicular

B parallel

C equal

D None of the above.

1.3 Two vectors $\boldsymbol{a}$ and $\boldsymbol{b}$ are perpendicular if (2)

A $\boldsymbol{a}.\boldsymbol{b} = 0$

B $\boldsymbol{a} = \boldsymbol{b}$

C $\boldsymbol{a} \times \boldsymbol{b} = 0$

D vectors cannot be perpendicular to one another.

1.4 The derivative of $y = \tan 3x^2$ is: (2)

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

B $\sec^2 6x$

C $\sec^2(3x^2).6x$

D $\dfrac{1.6x}{1+(3x^2)^2}$

1.5 Given that $f(a) = 2a^6x^6$ then $f'(a) =$ (2)

A $12a^6x^5$

B $72a^5x^5$

C $72a^5x^6$

D $12a^5x^6$

1.6 $\int a\,dx =$ (2)

A 0

B $ax + c$

C $x + c$

D $\dfrac{a^2}{2} + c$

1.7 The integral of $y = \cos 3x$ is: (2)

A $-\sin 3x \,.\, 3 + c$

B $\dfrac{-\sin 3x}{3} + c$

C $\sin 3x \,.\, 3 + c$

D $\dfrac{\sin 3x}{3} + c$

1.8 If the limit of a function f exists at a, but $f(a)$ does not exist, then the discontinuity is (2)

A Asymptotic

B Removable

C Jump

D None of the above.

1.9 The following vectors are given: (2)

$\boldsymbol{C}(-3; 4; -5)$ and $\boldsymbol{D}(5; 8; 3)$

Then $\boldsymbol{DC} =$

A $(8; 4; 8)$

B $(2; 12; -2)$

C $(-8; -4; -8)$

D $(-15; 32; -15)$

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

A their cross product equals to zero.

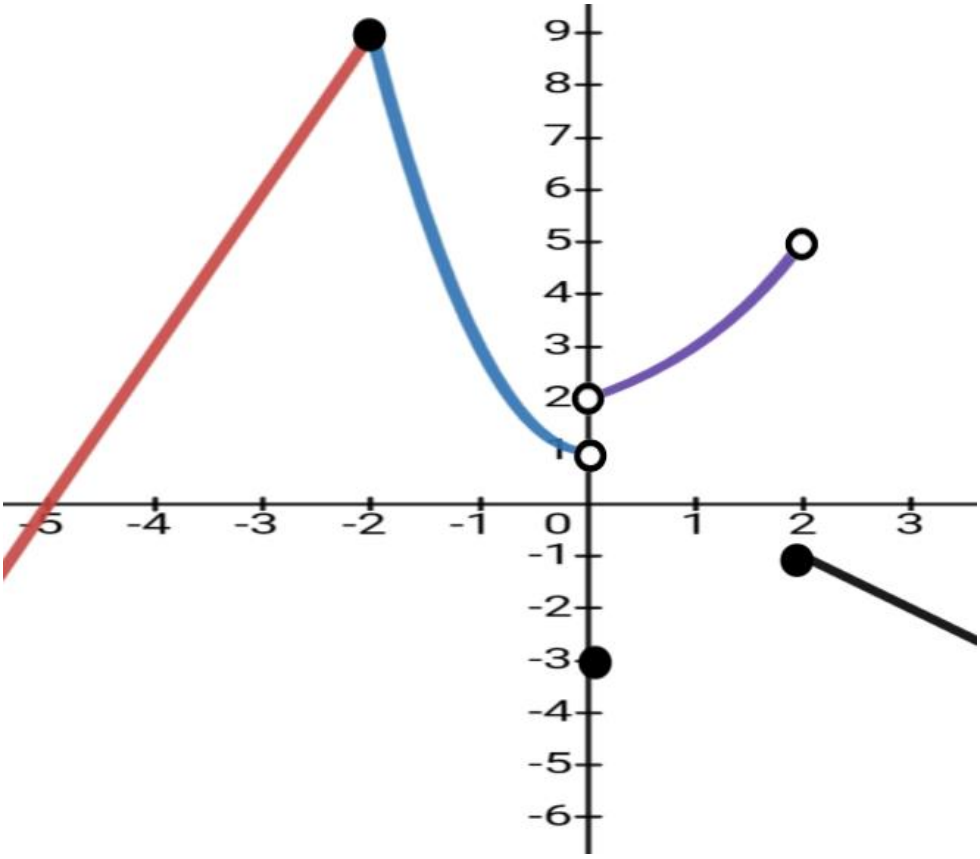
B the two vectors have the same magnitude and direction.

C their dot product equals to zero.

D the two vectors have the same magnitude.

Question 2 **[24 marks]**

2.1



The function $f(x)$ is drawn above, for which value(s) of x will:

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

2.1.2 f be differentiable? (2)

2.1.3 f have a removable discontinuity? (2)

2.1.4 f have a jump discontinuity? (2)

2.1.5 f not be differentiable? (2)

2.2 Refer to the graph in question 2.1. Write down the domain and range of f. (4)

2.3 Determine the values of a and b such that $f(x)$ is differentiable at $x = 2$. (10)

$$f(x) = \begin{cases} ax^2 + 10; & x < 2 \\ x^2 - 6x + b; & x \geq 2 \end{cases}$$

Question 3 **[15 marks]**

Given the vectors $\boldsymbol{u} = i + 7j - k$, $\boldsymbol{v} = (6\,;2\,;3)$, $\boldsymbol{w} = 5i - 2j + k$

3.1 Determine the unit vector of $\boldsymbol{v}$. (3)

3.2 Determine the magnitude of the angle between $\boldsymbol{u}$ and $\boldsymbol{w}$. (5)

3.3 Determine the area of the parallelogram formed by vectors $\boldsymbol{v}$ and $\boldsymbol{w}$. (7)

Question 4 **[12 marks]**

Differentiate each of the following:

4.1 $f(x) = \left[\frac{x}{2} \times \cot\left(\frac{2}{x}\right)\right]$ (4)

4.2 $y = \arctan\sqrt{x}$ (3)

4.3 $g(x) = \left(\frac{x^3}{x^2 - 1}\right)^4$ (5)

Question 5 **[9 marks]**

5.1 Integrate each of the following:

5.1.1 $\int \frac{1}{\sqrt{144 - x^2}}\,dx$ (4)

5.1.2 $\int_1^4 \sqrt{x}(1 - 2x)\,dx$ (5)

END OF PAPER

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Term 3 Test 2023 Answer sheet

Name and Surname: _____

Question Total	1 [20]	2 [24]	3 [15]	4 [12]	5 [9]
Learner mark					

TOTAL 80

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