Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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Full Test (Calc Free + Calc Assumed)

Total Time: 60 minutes

Total Marks: 50 marks

Student Result \_\_\_\_\_\_\_\_/ 50

**MATHEMATICS METHODS Unit 3**

**TEST 1 -2023: Further differentiation, integration and applications.**

**Calculator Free Section**

Time: 31 minutes

Total Marks: \_\_\_\_\_\_ / 27 marks

Resources allowed: SCSA Formula Sheet

**Instructions to candidates**

Show all your working clearly. Your working should be in sufficient detail to allow your answers to be checked readily and for marks to be awarded for reasoning. Incorrect answers given without supporting reasoning cannot be allocated any marks**. For any question or part question worth more than two marks, valid working or justification is required to receive full marks.** If you repeat any question, ensure that you cancel the answer you do not wish to have marked.

|  |  |
| --- | --- |
| **Question 1** | **[2, 2, 2 = 6 marks]** |

Determine for each of the following. Do not simplify your answer.

a)

b)

c)

|  |  |
| --- | --- |
| **Question 2** | **[3 marks]** |

Find the value of for

|  |  |
| --- | --- |
| **Question 3** | **[4, 2 = 6 marks]** |

Consider the function, .

a) Determine the coordinates of all the stationary points for and use the second derivative to determine their nature.

b) Find the coordinates of the global minimum and maximum points of over the

interval .

|  |  |
| --- | --- |
| **Question 4** | **[2, 2 = 4 marks]** |

Determine each of the following indefinite integrals. Express you answers with positive indices where appropriate.

a)

b)

|  |  |
| --- | --- |
| **Question 5** | **[1, 2, 2 = 5 marks]** |

Consider the function shown below.

<EFOFEX>
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FXData:
</EFOFEX>

Evaluate the following integrals.

a)

b)

c)

|  |  |
| --- | --- |
| **Question 6** | **[1, 2 = 3 marks]** |

Determine

a)

b)

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**MATHEMATICS METHODS Unit 3**

**TEST 1 -2023: Further differentiation, integration and applications.**

**Calculator Assumed Section**

Time: 29 minutes

Total Marks: \_\_\_\_\_\_ / 23 marks

Resources allowed:

SCSA Formula Sheet

Up to three Calculators and

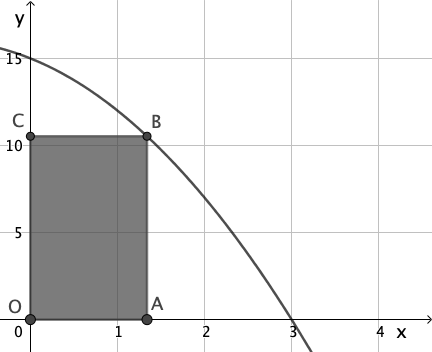
One A4 sheet, both sides of notes

**Instructions to candidates**

Show all your working clearly. Your working should be in sufficient detail to allow your answers to be checked readily and for marks to be awarded for reasoning. Incorrect answers given without supporting reasoning cannot be allocated any marks. **For any question or part question worth more than two marks, valid working or justification is required to receive full marks.** If you repeat any question, ensure that you cancel the answer you do not wish to have marked.

|  |  |
| --- | --- |
| **Question 7** | **[1, 2, 4, 2, 1 = 10 marks]** |

A rectangle OABC is such that O is always at the origin, A lies on the -axis, C lies on the -axis and B lies in the first quadrant on the curve .



1 unit on each axis is 1 cm.

a) Find the area of the rectangle when .

b) Show that the area of rectangle OABC is given by , where is the -coordinate of corners A and B

c) Use calculus (first and second derivatives) to determine the maximum area of the rectangle.

d) i) Use the increments formula to find the approximate change in area of the rectangle when increases from 2 to 2.1 cm.

ii) Interpret this answer in the context of this question.

|  |  |
| --- | --- |
| **Question 8** | **[1, 2, 3, 1 = 7 marks]** |

The rate of flow of water from a reservoir is given by for , where is measured in litres and is the number of minutes since the sluice gates have be further opened. The sluice gates are initially slightly open and are fully open after 24 minutes.

a) Find the rate of flow (in litres per minute) when and .

b) Sketch the graph of against for .

<EFOFEX>
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FXData:
</EFOFEX>

c) Determine the area under the curve of between and .

d) What does this area represent?

|  |  |
| --- | --- |
| **Question 9** | **[2, 4 = 6 marks]** |

A small body with an initial displacement and velocity of 8 m and respectively, travels in a straight line with acceleration at time of , .

a) Determine an expression for the velocity.

b) Calculate the displacement of the body when it has a velocity of .

**End of Test**