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 2 -2024:**

**Exponential Function, Calculus of Trigonometric Function, Discrete Random Variables and Bernoulli and Binomial distributions.**

**Calculator Free Section**

Time: 25 minutes

Total Marks: \_\_\_\_\_\_ / 20 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, 3 = 7 marks]** |

Differentiate the following with respect to *x*:

a)

b)

c)

|  |  |
| --- | --- |
| **Question 2** | **[3, 2, 2, 2 = 9 marks]** |

Determine each of the following:

a)

b)

c)

d)

Given,

|  |  |
| --- | --- |
| **Question 3** | **[4 marks]** |

Determine *p* and *n* for

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

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**MATHEMATICS METHODS Unit 3**

**TEST 2 -2024:**

**Exponential Function, Calculus of Trigonometric Function, Discrete Random Variables and Bernoulli and Binomial distributions.**

**Calculator Assumed Section**

Time: 35 minutes

Total Marks: \_\_\_\_\_\_ / 30 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 4** | **[ 3, 3 = 6 marks]** |

Scientists are studying a population of endangered small mammals in a protected environment. They conclude the population is increasing at a rate given by  5.2*e*0.4*t* where *t* is the number of weeks since the study began.

a) What is the change in the population in the fourth week?

b) When the study began there were 500 of these mammals. The study will conclude when the population reaches 2000. When will this occur?

|  |  |
| --- | --- |
| **Question 5** | **[1, 3 = 4 marks]** |

Brandon is the designated penalty taker for his soccer team and is practicing his penalty attempts. Past statistics show that the probability Brandon scores a goal at each penalty attempt is 70%.

Brandon takes ten penalties. Determine the probability that:

* 1. he scores all 10 penalties.
  2. he scores less than 8 penalties if he scores at least five.

|  |  |
| --- | --- |
| **Question 6** | **[2, 1, 1, 1 = 5 marks]** |

A discrete random variable *T* is defined as the number of flips of a coin required before a head appears.

a) Calculate the probabilities required to complete the probability distribution table below:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| *t* | 1 | 2 | 3 | 4 | 5 | 6 |
| P *(T = t)* | 0.5 |  | 0.125 |  |  |  |

b) Explain why the sum of these probabilities is not one.

c) Determine:

1. *P*(*T*  4)
2. *P*(*T*  6)

|  |  |
| --- | --- |
| **Question 7** | **[3, 2, 2, 3 = 10 marks]** |

The discrete random variable *X* has the probability function:

a) Show that

b) Determine

c) Show that

d) Given ,

hence or otherwise determine

|  |  |
| --- | --- |
| **Question 8** | **[1, 2, 2 = 5 marks]** |

A particular rock is dropped into a swimming pool and it sinks vertically to the bottom. Due to water resistance, the rock does not have a constant velocity on the way to the bottom. Its velocity, centimetres per second, seconds after it hits the surface of the water is given by:

a) What is the initial velocity of the rock (on the surface of the water)?

b) What is the acceleration of the rock after 4 seconds?

c) Terminal velocity is an expression used to describe the velocity that is approached but never exceeded. Determine the terminal velocity reached by the rock in the water.

**End of Test**