

Student Name……………………………………

### MATHEMATICAL METHODS UNITS 3 & 4

### TRIAL EXAMINATION 1

**2020**

**(Adjusted Study Design)**

#### Reading Time: 15 minutes

Writing time: 1 hour

###### Instructions to students

This exam consists of 10 questions.

All questions should be answered in the spaces provided.

There is a total of 40 marks available.

The marks allocated to each of the questions are indicated throughout.

Students may **not** bring any calculators or notes into the exam.

Where a numerical answer is required, an exact value must be given unless otherwise directed.

Where more than one mark is allocated to a question, appropriate working must be shown.

Diagrams in this trial exam are not drawn to scale.

A formula sheet can be found on pages 13 and 14 of this exam.

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**Question 1** (3 marks)

1. If  find . 1 mark
2. Let .

Evaluate . 2 marks

**Question 2** (4 marks)

1. Evaluate  2 marks
2. Find  given that . 2 marks

Give your answer in the form , where *a*, *b* and *c* are positive integers.

**Question 3** (3 marks)

Let 

1. Solve  1 mark
2. The graph of  is shown below.



Sketch the graph of  on the set of axes above. Label the endpoints of the graph and the axis intercepts with their coordinates. 2 marks

**Question 4** (2 marks)

A continuous random variable *X* has a normal distribution with a mean of 12 and a variance of 9. The random variable *Z* has the standard normal distribution.

**a.** Find . 1 mark

**b.** Find *a* such that . 1 mark

**Question 5** (3 marks)

Solve 

**Question 6** (4 marks)

Let .

1. Find the rule and domain of , the inverse function of *f*. 2 marks
2. The point *P* lies on the graph of *f* and the point *Q* is .

The distance between point *P* and point *Q* is a minimum.

Find the *x*-coordinate of point *P*. 2 marks

**Question 7** (3 marks)

The area of the region enclosed by the curve with equation , and the *x* and *y* axes is square units.

Find the values of *a* and *b.*

**Question 8** (5 marks)

Let  where *c* is a real number and .

1. State the range of *g*. 1 mark
2. State the rule of . 1 mark
3. State the domain of . 1 mark
   1. Find the coordinates of the stationary point of the graph of . 2 marks

**Question 9** (6 marks)

Let .

Part of the graph of *f* is shown below. The graph crosses the *x*-axis at the origin and at the point *B* and has a minimum turning point at point *A*.



1. Find the coordinates of point *B*. 1 mark
2. Find the *x*-coordinate of point *A*. 2 marks
   1. Find the range of *f*. 1 mark
   2. Find the area enclosed by the graph of *f* and the *x*- axis. 2 marks

**Question 10** (7 marks)

Let  where *a* is a positive real number.

The graph of *f* is shown below.



1. Find the average value of *f*  between . 2 marks
2. Find the equation of the tangent to the graph of *f* at the point *P* where . 3 marks
3. The transformation  with rule , where *n* is a positive integer, maps the graph of  onto the graph of .

A tangent to the graph of *g* is drawn at the point where .

Find the coordinates of the *x*-intercept of this tangent for all values of *n*. 2 marks

**Mathematical Methods formulas**

## Mensuration

|  |  |  |  |
| --- | --- | --- | --- |
| area of a trapezium |  | volume of a pyramid |  |
| curved surface area of a cylinder |  | volume of a sphere |  |
| volume of a cylinder |  | area of a triangle |  |
| volume of a cone |  |  | |

## Calculus

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| product rule |  | quotient rule |  |
| chain rule |  |  | |

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## Probability

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| --- | --- |
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| --- | --- | --- | --- |
| **Probability distribution** | | **Mean** | **Variance** |
| Bernoulli |  |  |  |
| binomial |  |  |  |
| normal |  |  |  |

**END OF FORMULA SHEET**