

Students Name:………………………………………

### SPECIALIST MATHEMATICS 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 notes or calculators into the exam.

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

An exact answer is required to a question unless otherwise specified.

Unless otherwise indicated, diagrams in this exam are not drawn to scale.

The acceleration due to gravity should be taken to have magnitude where 

Formula sheets can be found on pages 12 - 14 of this exam.

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**Question 1** (4 marks)

Two masses of 4 kg and 5 kg are connected by a light inextensible string that passes over a smooth pulley.



1. Draw all the forces acting on the two masses on the diagram above. 1 mark
2. Find the magnitude of the acceleration, in ms-2, of the system when it is released and state the direction of movement of the 4 kg mass. 3 marks

**Question 2** (3 marks)

Evaluate .

**Question 3** (4 marks)

Let .

1. Evaluate  giving your answer in polar form. 2 marks
2. Given that  are both solutions to the equation , find the other solutions, expressing them in the form . 2 marks

**Question 4** (3 marks)

Sketch the graph of on the axes provided below, labelling any asymptotes with their equations and any axis intercepts with their coordinates.



**Question 5** (4 marks)

Given that  is a solution to the differential equation

,

find the values of *a*, *b* and *c*, where .

**Question 6** (4 marks)

Find the area enclosed between the graph of , the *x*-axis and the lines .

**Question 7** (5 marks)



A trapezium has vertices .

Let .

1. Find . 2 marks
2. Find . 1 mark
3. Find the area of the trapezium. 2 marks

**Question 8** (4 marks)

Solve the differential equation . Express *y* as a function of *x*.

**Question 9** (4 marks)

Given that  at the point .

Give your answer in the form .

**Question 10** (5 marks)

Consider the function with the rule .

1. Find the area of the region enclosed by the graph of *f*, the *x*-axis and the line with equation . 2 marks
2. The region described in part **a.** is rotated about the *x*-axis to form a solid of revolution. Find the volume of this solid of revolution. 3 marks

# Specialist Mathematics Formulas

## Mensuration

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

## Circular functions

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## Circular functions – continued

|  |  |  |  |
| --- | --- | --- | --- |
| **Function** |  |  |  |
| **Domain** |  |  |  |
| **Range** |  |  |  |

**Algebra (complex numbers)**

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| --- | --- |
|  |  |
|  |  |
|  |  |
| (de Moivre’s theorem) |  |

**Calculus**

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|  |  |
|  |  |
| product rule |  |
| quotient rule |  |
| chain rule |  |
| Euler’s method |  |
| acceleration |  |
| arc length |  |

**Vectors in two and three dimensions Mechanics**

|  |  |
| --- | --- |
| momentum |  |
| equation of motion |  |

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