

**‘2016 Examination Package’ -
Trial Examination 2 of 5**

STUDENT NUMBER

Figures

Words

Letter

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SPECIALIST MATHEMATICS

Units 3 & 4 – Written examination 1

(TSSM’s 2012 trial exam updated for the current study design)

Reading time: 15 minutes

Writing time: 1 hour

QUESTION & ANSWER BOOK

Structure of book

<i>Number of questions</i>	<i>Number of questions to be answered</i>	<i>Number of marks</i>
10	10	40

- Students are permitted to bring into the examination room: pens, pencils, highlighters, erasers, sharpeners, and rulers.
- Students are NOT permitted to bring into the examination room: notes of any kind, a calculator, blank sheets of paper and/or white out liquid/tape.

Materials supplied

- Question and answer book of 13 pages.
- Working space is provided throughout the book.

Instructions

- Print your name in the space provided on the top of this page.
- All written responses must be in English.

Students are NOT permitted to bring mobile phones and/or any other electronic devices into the examination room.

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Instructions

Answer **all** questions in the spaces provided.

A decimal approximation will not be accepted if an **exact** answer is required to a question.

In questions where more than one mark is available, appropriate working must be shown.

Unless otherwise indicated, the diagrams in this book are **not** drawn to scale.

Take the **acceleration due to gravity** to have magnitude $g \text{ m/s}^2$, where $g = 9.8$.

Question 1

State the values of $p \in \mathbb{R}$ for which the equation $\frac{1}{2} \tan^{-1}(x-20) + \frac{2\pi}{3} = p$ has no solutions.

[illegible]

2 marks

TURN OVER

Question 2

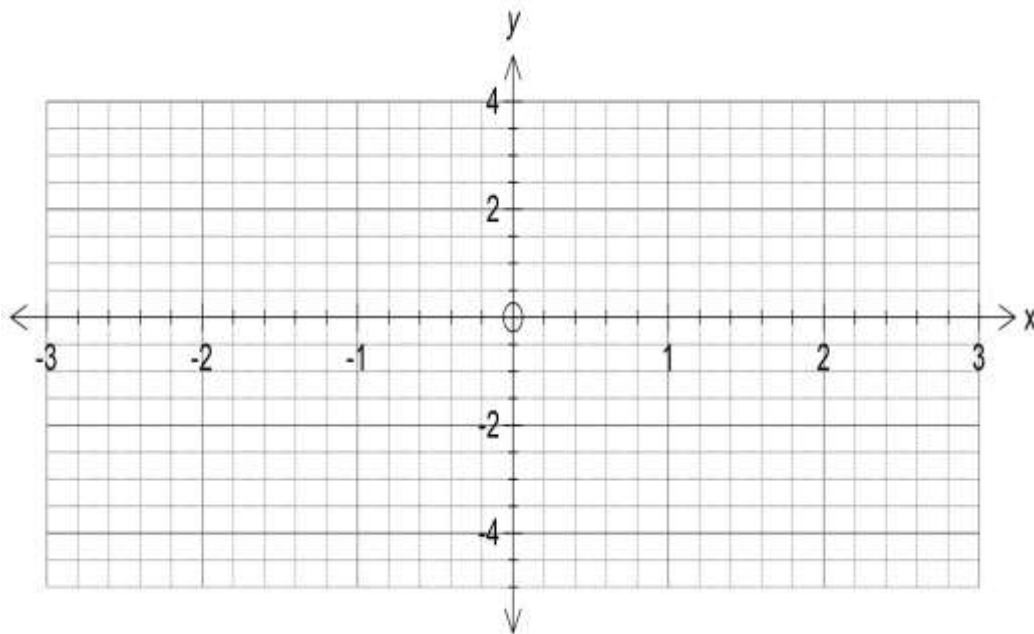
- a. Show that $y = \frac{(x-1)^2}{2x}$ can be written in the form $\frac{x}{2} - 1 + \frac{1}{2x}$.

1 mark

- b. Give the coordinates of any turning points and intercepts and state the equations of any straight line asymptotes.

3 marks

- c. Hence, sketch the graph of $y = \frac{(x-1)^2}{2x}$ on the axes provided.



2 marks

Question 3

If $z = 2 - 2i$ and $w = 2\sqrt{3} + 2i$ find $\text{Arg}\left(\frac{z}{w}\right)^3$.

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

3 marks

TURN OVER

Question 4

If $f(x) = \sin^{-1}\left(\frac{1}{2x}\right)$, find $f'(x)$ over the appropriate domain(s).

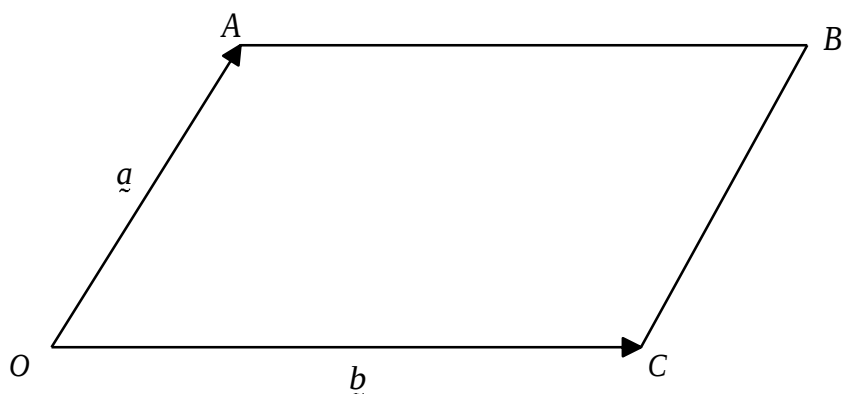
Express the derivative(s) in the form $f'(x) = \frac{a}{bx\sqrt{cx^2+d}}$, where a, b, c, d are **integers**.

[illegible]

4 marks

Question 6

In the parallelogram $OABC$, $\overrightarrow{OA} = \underline{a}$ and $\overrightarrow{OC} = \underline{b}$.



- a.** Find expressions for the vectors $\overrightarrow{OB}$ and $\overrightarrow{AC}$ in terms of $\underline{a}$ and $\underline{b}$.

1 mark

- b.** If $\overrightarrow{OB} \perp \overrightarrow{AC}$ then prove that $OABC$ is a rhombus.

3 marks

Question 7

Find the equation of the normal to the curve $x^2y + 2y^2 = 6$ at the point where $x = 1$ and $y > 0$.

[illegible]

4 marks

TURN OVER

Question 8

Evaluate the definite integral $\int_0^{\frac{\pi}{4}} \frac{(\sec^2 \theta - 1)}{\cos^2 \theta} d\theta$.

[illegible]

4 marks

Question 9

The area enclosed by the curve $y = \log_e x$, the line $x = e^2$ and the x -axis is rotated 2π radians about the y -axis.

Find the volume of the solid of revolution formed.

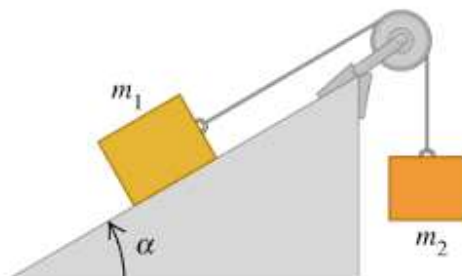
[illegible]

4 marks

TURN OVER

Question 10

A block of mass 4 kg on a smooth inclined plane inclined at an angle of 30° is connected by a cord over a small, frictionless pulley to a second block of mass 5 kg hanging vertically.



- a. Calculate the acceleration with which the block moves, in terms of the gravitational constant g .

3 marks

- b.** Calculate the tension in the cord in terms of g .

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2 marks

END OF QUESTION AND ANSWER BOOK