

'2016 Examination Package' - Trial Examination 2 of 5

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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

Number of questions	Number of questions to be answered	Number of marks
10	10 be answered	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 m/s², where g = 9.8.

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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.
		2 marks

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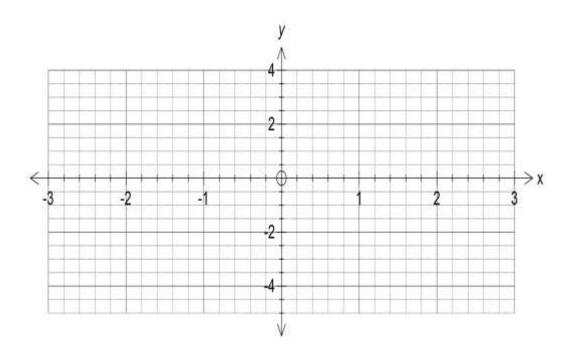
a. Show that $y = \frac{(x-1)^2}{2x}$ can be written in the form $\frac{x}{2} - 1 + \frac{1}{2x}$.

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 $Arg\left(\frac{z}{w}\right)^3$.	
	3 marks

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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**.

 $4\;marks$

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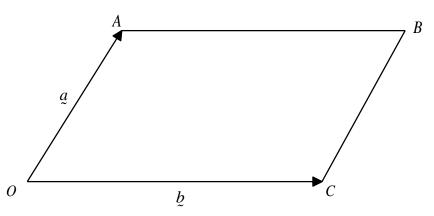
Question 5

A particle moves in a straight line such that its displacement, x metres from a fixed origin, o
and its acceleration, $a \text{ ms}^{-2}$, are related by the function $a(x) = \frac{x}{1 - x^2}$. The velocity of the
particle, $v = -1 \text{ ms}^{-1}$ when it is 2 metres to the right of the origin.
Assuming the right of the origin is positive, find an expression for the velocity, $v(x)$.
4 marks

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



a. Find expressions for the vectors \overrightarrow{OB} and \overrightarrow{AC} in terms of $\overset{a}{\sim}$ and $\overset{b}{\sim}$.

1 mark

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

3 marks

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

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Question 8

Evaluate the definite integral $\int_{0}^{\frac{\pi}{4}} \frac{(\sec^2 \theta - 1)}{\cos^2 \theta} d\theta$.	
	4 marks

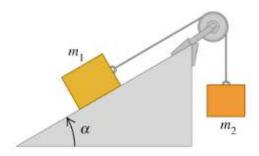
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The area enclosed by the curve $y = \log_e x$, the line $x = e^2$ and the x -axis is rotated 2π radians about the y -axis.
Find the volume of the solid of revolution formed.
4 marks

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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.



Calculate the acceleration with which the block moves, in terms of the gravitational

constant g		

3 marks

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	Calculate the tension in the cord in terms of g .								
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2 marks

END OF QUESTION AND ANSWER BOOK

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