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INSIGHT
YEAR 12 Trial Exam Paper

2011

SPECIALIST MATHEMATICS
UNIT 3

Written examination 1

STUDENT NAME:

QUESTION AND ANSWER BOOK

Reading time: 15 minutes

Writing time: 1 hour

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 the following items into the examination: pens, pencils, highlighters, erasers, sharpeners and rulers.
- Students are NOT permitted to bring sheets of paper, notes of any kind or white out liquid/tape into the examination.
- Calculators are not permitted in this examination.

Materials provided

- The question and answer book of 15 pages with a separate sheet of miscellaneous formulas.
- Working space is provided throughout this book.

Instructions

- Write your **name** in the box provided.
- Remove the formula sheet during reading time.
- You must answer the questions in English.

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Consider the function defined by $e^{x+y} = y + x^2 + e - 1$.

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[illegible]

Total 1 + 3 = 4 marks

Question 2

The position of a particle at any time t seconds is $\mathbf{r}(t) = \cos t \mathbf{i} + \sin 2t \mathbf{j}$, $t \geq 0$.

- a.** Show that the relation which describes the position of the particle is $y^2 = 4x^2(1 - x^2)$.

2 marks

- b.** Show that the angle, θ , between the direction of motion of the particle at $t = \frac{\pi}{2}$ and $t = \frac{3\pi}{2}$ is $\theta = \cos^{-1} 0.6$.

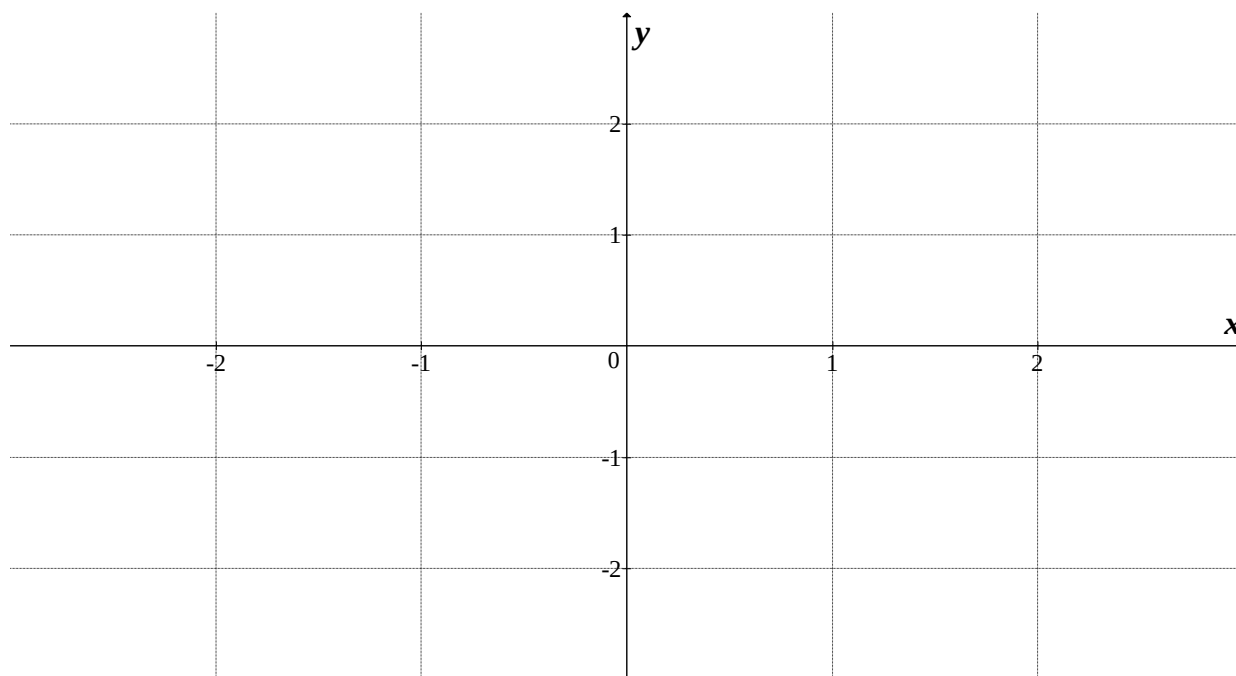
3 marks

Total 2 + 3 = 5 marks

TURN OVER

Question 3

- a. On the set of axes below, sketch the slope field of the differential equation $\frac{dy}{dx} = y + 1$ for $y = -2, -1, 0, 1, 2$ at the x values $x = -2, -1, 0, 1, 2$.

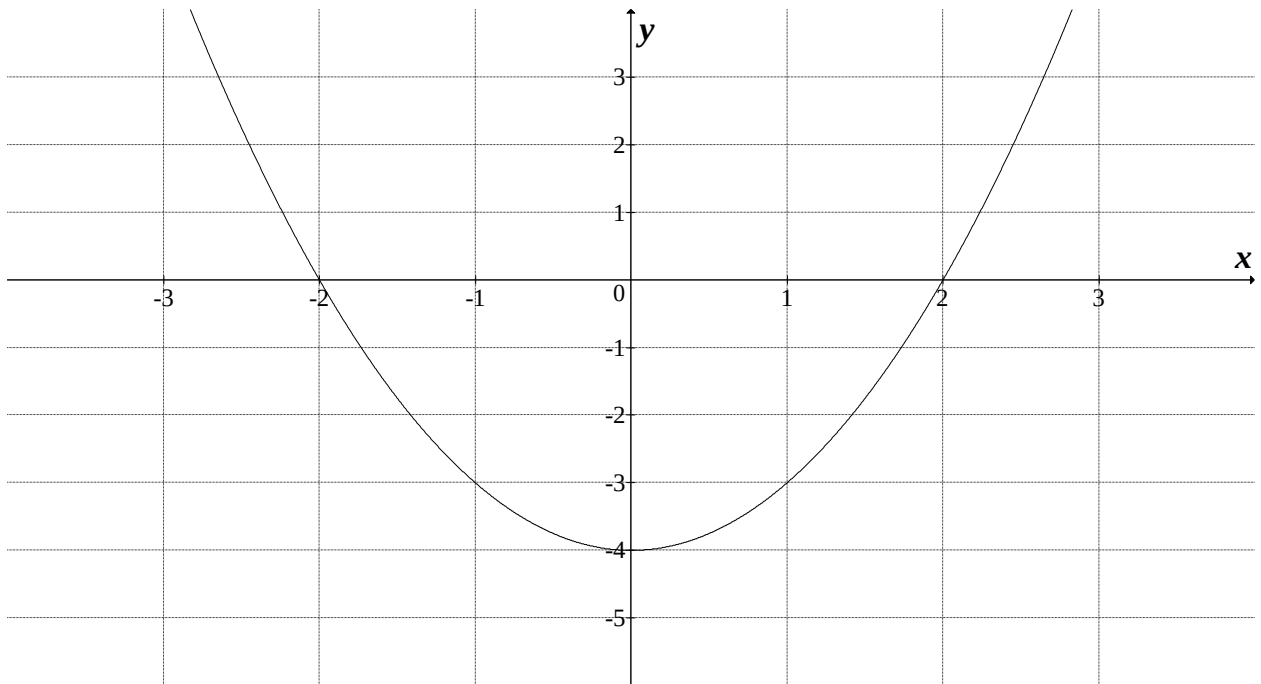


1 mark

Question 4

The graph of $f(x) = x^2 - 4$ is shown below.

On the same axes sketch the graph of $g(x) = \frac{1}{f(x)}$. Clearly label any asymptotes and axes intercepts.



2 marks

Question 5

- a.** Show that $z - 1$ is a factor of $z^3 - (1+i)z^2 + (2+i)z - 2$.

1 mark

- b.** Hence, or otherwise, find all the solutions of $z^3 - (1+i)z^2 + (2+i)z - 2 = 0$.

3 marks

Total 1 + 3 = 4 marks

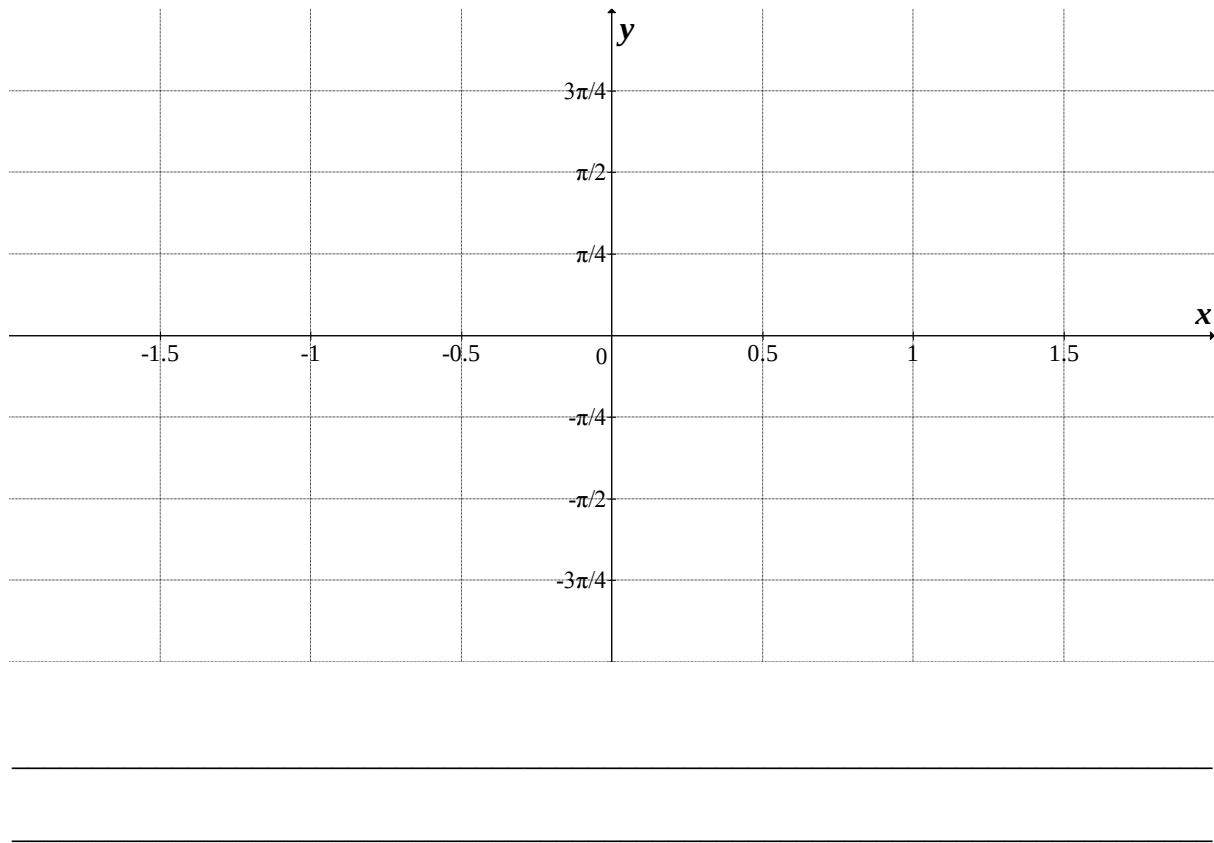
Question 6

Three points, A , B and C , have coordinates $A(1, 1, 1)$, $B(2, 3, -6)$ and $C(5, -3, -3)$ respectively. If M is the midpoint of $\overrightarrow{AC}$, use a vector method to show that $\overrightarrow{MB}$ is perpendicular to $\overrightarrow{AC}$.

3 marks

Question 8

- a.** Sketch the graph of $f(x) = \sin^{-1}(2x)$ on the set of axes below. Clearly label the endpoints.



2 marks

- b.** On the graph shown in part **a**, shade the area between $f(x)$ and the x -axis from $x = -\frac{1}{2}$ to $x = \frac{1}{2}$.

1 mark

[illegible]

Total $2 + 1 + 3 = 6$ marks

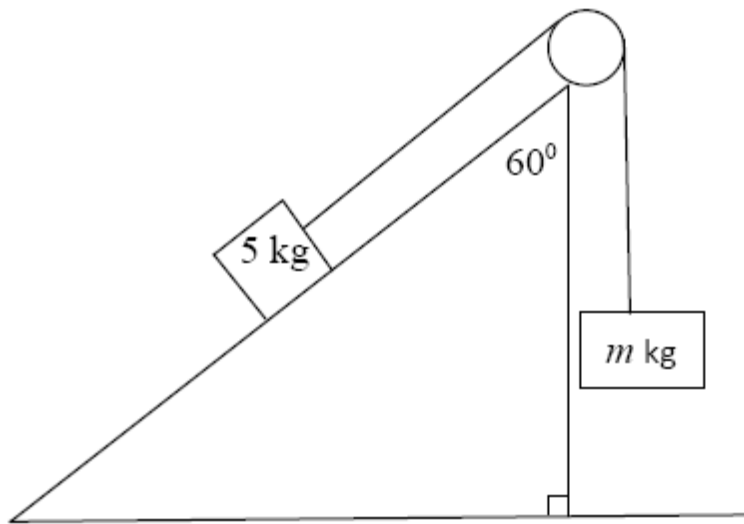
- b.** Calculate the exact volume generated when the area bounded by $f(x)$, the x -axis and the lines $x = \frac{\pi}{8}$ and $x = \frac{3\pi}{8}$ is rotated about the x -axis.

2 marks

Total 3 + 2 = 5 marks

Question 10

A block of mass 5 kg rests on an incline which makes an angle of 60° to the vertical. The coefficient of friction between the block and the table surface is 0.4. The block is connected to another block of mass m kg by a light inextensible string over a smooth pulley at the edge of the incline. The mass, m , is hanging vertically.



On the diagram above, label all the forces acting on the two masses.

Hence, find the **maximum** value of m for the system to remain in equilibrium.

3 marks

END OF QUESTION AND ANSWER BOOK