

INSIGHT
Trial Exam Paper

2007

SPECIALIST MATHEMATICS

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> |
|----------------------------|---|------------------------|
| 9 | 9 | 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 11 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.

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

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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.

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

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

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

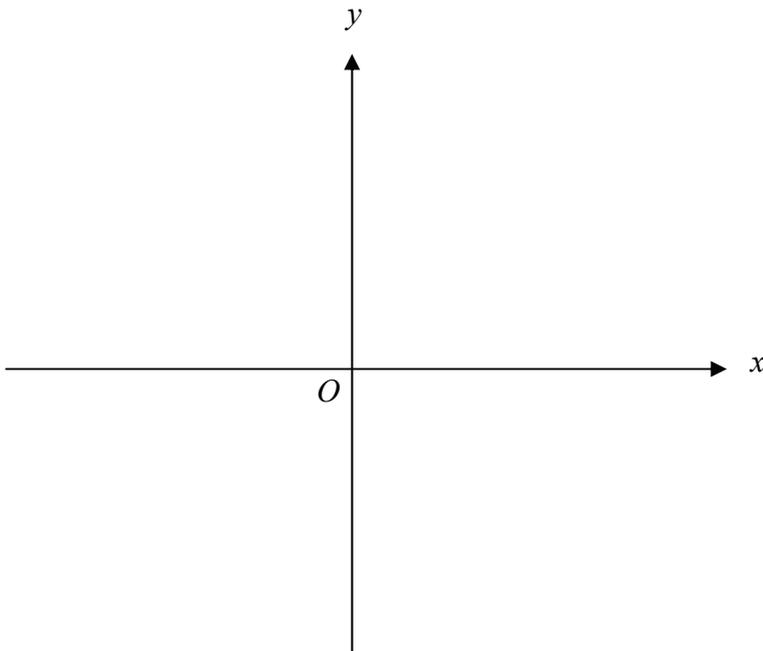
Question 1

Let $x = \sqrt{t+4}$ and $y = 1 - t$ for $-4 \leq t \leq 4$.

- a. Find the Cartesian equation of the curve.

2 marks

- b. Sketch a graph of the curve, showing all features clearly.



2 marks

Question 2

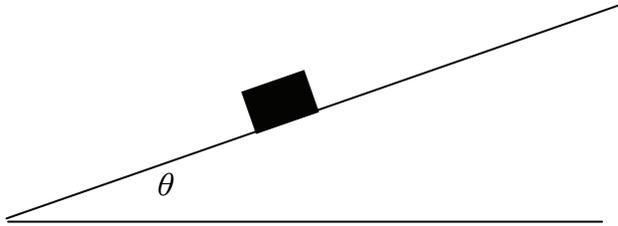
Express $(\sqrt{3} - i)^7$ in the form $x + iy$ where $x, y \in R$.

4 marks

Question 3

A 10 kg mass is pulled up a rough plane inclined at an angle of θ to the horizontal by a force of 120 newtons acting parallel to the plane.

The coefficient of friction between the mass and the plane is $\frac{1}{3}$, $\cos(\theta) = \frac{3}{5}$ and the acceleration due to gravity is $g \text{ m/s}^2$.



- a. Show all forces acting on the mass on the diagram above.

1 mark

- b. Find the acceleration of the mass up the plane in terms of g .

4 marks

Question 4

a. Show that $\frac{\sin(x)}{1 - \cos(x)} = \cot\left(\frac{x}{2}\right)$.

2 marks

b. Hence or otherwise, solve the equation $\sin(x) = \cos(x) - 1$ over $0 \leq x \leq 2\pi$.

2 marks

Question 5

The position of a particle at time t seconds, $t \geq 0$, is given by the vector $\mathbf{r} = t\mathbf{i} + (1 - 2t)\mathbf{j} + (t - 6)\mathbf{k}$. Find the time when the particle's velocity vector is perpendicular to its position vector.

3 marks

Question 7

$$f : D \rightarrow R, \quad f(x) = \arccos\left(\frac{1}{\sqrt{x}}\right)$$

- a.** Determine the domain D of function f .

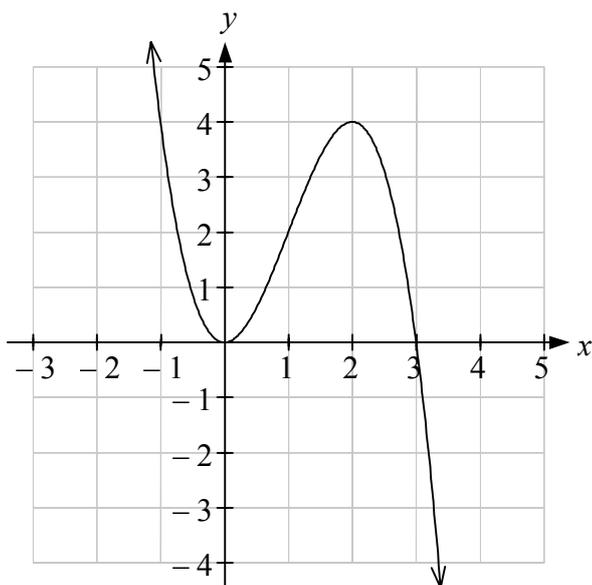
1 mark

- b.** Find $f'(x)$.

3 marks

Question 9

The graph of $f(x) = 3x^2 - x^3$ is shown on the axes below.



- a. Draw the graph of $g(x) = \frac{1}{3x^2 - x^3}$ on the axes above, showing all features clearly.

2 marks

- b. Given $\frac{1}{3x^2 - x^3} = \frac{Ax + B}{x^2} + \frac{C}{3 - x}$, find the exact values of A , B , and C .

2 marks

