

INSIGHT

Trial Exam Paper

2008

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>
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 13 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 $u = 10 - 5i$ and $v = 2 - i$.

Find $\frac{iu}{\bar{v}}$ in Cartesian form.

2 marks

Question 2

The position of particles A and B at any time t seconds, $t \geq 0$, is given by $\underline{r}_A(t) = (t^2 - 2t)\underline{i} + (6t - 2)\underline{j}$ and $\underline{r}_B(t) = (5t - 12)\underline{i} + (t^2 + 6)\underline{j}$, respectively.

Determine the time when the particles collide.

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

3 marks

Question 4

- a.** Show that $\cot(x) - \operatorname{cosec}(2x) = \cot(2x)$

2 marks

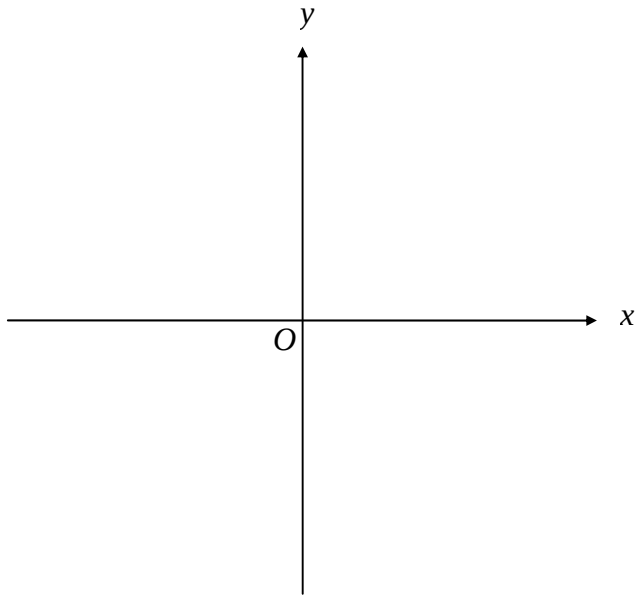
- b.** Hence, solve the equation $\cot(x) - \operatorname{cosec}(2x) = \sqrt{3}$, $x \in [-\pi, \pi]$.

2 marks

Total: $2 + 2 = 4$ marks

Question 5

- a. Sketch the graph of $f(x) = 3 \arcsin(x+1) - \frac{\pi}{2}$ on the axes below, showing the intercepts and endpoints in exact form.



3 marks

- b. Find $f^{-1}(x)$ stating its domain.

2 marks

Total 3 + 2 = 5 marks

Question 6

Find $\int \frac{x+1}{x^2+2} dx$.

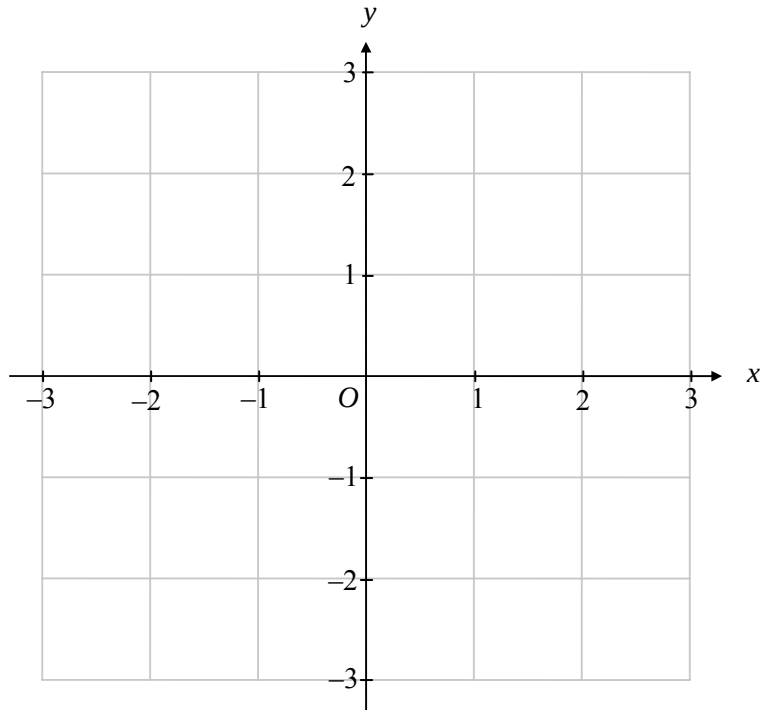
[illegible]

3 marks

Question 7

Given the differential equation $\frac{dy}{dx} = \frac{y+3}{2}$

- a. Use $y = -3, -2, -1, 0, 1, 2, 3$ to sketch a slope field of the differential equation at each of the values $x = -3, -2, -1, 0, 1, 2, 3$.



2 marks

- b.** If $y = -2$ when $x = 1$, solve the differential equation to find y in terms of x .

3 marks

Total $2 + 3 = 5$ marks

Question 9

Let $y = x\sqrt{1-x^2} - \cos^{-1}(x)$.

a. Show that $\frac{dy}{dx} = 2\sqrt{1-x^2}$.

[illegible]

3 marks

b. Hence, determine the exact value of $\int_{\frac{1}{2}}^1 \sqrt{1-x^2} \, dx$.

2 marks

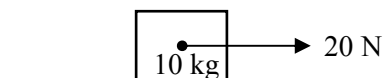
Total 3 + 2 = 5 marks

TURN OVER

Question 10

A crate of toys of mass 10 kg is sitting on the floor of a room.

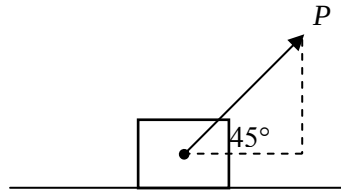
- a. A child starts to pull the crate with a horizontal force of 20 newtons so that it is on the point of moving. Show that the coefficient of friction between the floor and the crate of toys is $\frac{2}{g}$.



2 marks

- b.** Determine the maximum force, P newtons, that can be applied to the crate at an angle of 45° to the horizontal level without moving it.

Express your answer in the form $P = \frac{ag}{g+b}$, where $a, b \in R$.

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

4 marks

Total $2 + 4 = 6$ marks