PENRHOS COLLEGE

STRIVE FOR THE HIGHEST

Penrhos College
Semester 2 Examination, 2010

Question/Answer Booklet

MATHEMATICS SPECIALIST: 3C/3DMAS

Section One: Calculator-free

Student Name:_____

Time allowed for this section

Reading time before commencing work: 5 minutes
Working time for this section: 50 minutes

Materials required/recommended for this section

To be provided by the supervisor

This Question/Answer Booklet
Formula Sheet

To be provided by the candidate

Standard items: pens, pencils, pencil sharpener, eraser, correction fluid, ruler, highlighters

Special items: nil

Important note to candidates

No other items may be used in this section of the examination. It is your responsibility to ensure that you do not have any unauthorised notes or other items of a non-personal nature in the examination room. If you have any unauthorised material with you, hand it to the supervisor before reading any further.

1234567-8

Instructions to candidates

1. **All** questions should be attempted.

2. Write your answers in the spaces provided in this Question/Answer Booklet. Spare answer pages may be found at the end of this booklet. If you need to use them, indicate in the original answer space where the answer is continued (i.e. give the page number).

3. **Show all your working clearly.** Your working should be in sufficient detail to allow your answers to be checked readily and for marks to be awarded for reasoning. Incorrect answers given without supporting reasoning cannot be allocated any marks. For any question or part question worth more than two marks, valid working or justification is required. If you repeat an answer to any question, ensure that you cancel the answer you do not wish to have marked.

4. It is recommended that you **do not use pencil** except in diagrams.

Structure of this paper

Questions	Marks available	Your score
1	5	
2	7	
3	4	
4	7	
5	8	
6	6	
7	3	
Total:	**40**	
8	6	
9	8	
10	9	
11	10	
12	6	
13	7	
14	7	
15	6	
16	5	
17	10	
18	6	
Total:	**80**	
Total marks = 120		
		%

See next page

Section One: Calculator-free **(40 Marks)**

This section has **seven (7)** questions. Answer **all** questions. Write your answers in the space provided.

Suggested working time for this section is 50 minutes.

Question 1 **(5 marks)**

The transformation matrix **T** is defined by **T** = **AB**, where **A** and **B** are the transformations:

A: a rotation about the origin through 210° anticlockwise;

B: a reflection in the line through the origin that makes an angle of 120° with the x-axis.

Determine matrix **T** and describe **T** geometrically.

Question 2 **(7 marks)**

Use an algebraic method to solve $3|x-2|>|2x+1|$.

Question 3 **(4 marks)**

A body in simple harmonic motion passes from rest to rest through a distance of 20 cm in 2.5 seconds. Find the maximum velocity this body attains.

Question 4 **(7 marks)**

Find the following antiderivatives.

(a) $\int e^{\sin x} \cos x \, dx$ [1]

(b) $\int \frac{x^2}{x^3+2} dx$ [2]

(c) $\int \sin^3 x \, dx$ by using the substitution $u = \cos x$ [4]

DO NOT WRITE IN THIS AREA

Question 5 **(8 marks)**

(a) Given that $xy+\cos y-x^2=1$, find $\frac{dy}{dx}$. [3]

(b) Evaluate $\int_0^{0.5} \frac{x}{\sqrt{1-x^2}}\,dx$ using the substitution $x=\sin\theta$. [5]

DO NOT WRITE IN THIS AREA

Question 6 **(6 marks)**

(a) Given that $y=\ln x$, where $x>0$, show that the small increment in y corresponding to a small positive increment of h in x is approximately $\frac{h}{x}$. [2]

The difference between the approximate and true increments, for a fixed value of h, is denoted by $f(x)$, so that

$$f(x)=\frac{h}{x}-\left[\ln(x+h)-\ln x\right].$$

(b) Show that $f'(x)=\frac{-h^2}{x^2(x+h)}$. [3]

(c) Explain how this result shows that $f(x)$ decreases as x increases. [1]

Question 7 **(3 marks)**

Show that $\tan\theta + \frac{\cos\theta}{\sin\theta} = \frac{2}{\sin 2\theta}$.

End of questions

Additional working space

Question number(s):_____

Additional working space

Question number(s):_____

DO NOT WRITE IN THIS AREA