Additional working space

Question number(s):_____

Semester One Examination 2011

Question/answer booklet

MATHEMATICS 3CMAT

Section One: Calculator-free

Student Name: _____

Teacher's Name: _____

Time allowed for this section

Reading time before commencing work: 5 minutes
Working time for paper: 50 minutes

Material 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, highlighter, eraser, ruler, correction fluid/tape

Special items: nil

Important note to candidates

No other items may be taken into the examination room. 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.

Structure of this paper

	Number of questions available	Number of questions to be attempted	Suggested working time (minutes)	Marks available
Section One Calculator—free	**7**	**7**	**50 minutes**	**40**
Section Two Calculator—assumed	13	13	100 minutes	80
			Total marks	120

Instructions to candidates

1. Answer the questions in the spaces provided.
2. Spare answer pages are provided 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. Fill in the number of the question(s) that you are continuing to answer at the top of the page.
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 to receive full marks. 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.

Question 7 **(4 marks)**

If $g(x)=\frac{5x+1}{3x+2}$ and $f(x)=\frac{7x+2}{6x+1}$, prove that $g(f(x))=f(g(x))$.

Question 6 **(5 marks)**

A dice has two faces white, one blue and three red. It is thrown three times. What is the probability that

(i) a white face is uppermost at each throw. (1)

(ii) the same colour is uppermost at each throw. (2)

(iii) a different colour is uppermost at each throw. (2)

QUESTION	MARKS ALLOCATED
1	8
2	6
3	6
4	4
5	7
6	5
7	4
TOTAL	40

Section One: Calculator–free

50 marks

This section has **seven (7)** questions. Attempt **all** questions.

Question 1 **(8 marks)**

Differentiate the following, without simplifying.

(a) $y=\dfrac{2x-3}{(x-1)(x+1)}$ (3)

(b) $y=(x+3)^4 e^{-5x}$ (2)

(c) $y = 5(x^2-4)^3$ where $u = x^2-4$ Use the chain rule notation $\frac{dy}{dx}=\frac{dy}{du}\times\frac{du}{dx}$ to differentiate. (3)

Question 5 **(7 marks)**

(a) Simplify $\dfrac{2x+1}{x^2-1}-\dfrac{3}{x^2+x-2}$ (4)

(b) Simplify $\dfrac{5x^2-5}{x^2+4x-5}\div\dfrac{x^2-2x-3}{2x^2-18}$ (3)

Question 4 **(4 marks)**

Variables x and y are related by the equation $y=\frac{2x-6}{x}$.

(i) Find an expression for $\frac{dy}{dx}$. (2)

(ii) Hence, find an expression for the approximate increase in y as x increases from 4 to 4 + p, where p is small.

(2)

Question 2 **(6 marks)**

(a) Evaluate $\int_1^2 (x+3)(x-1)\,dx$ (3)

(b) Find $\int 6x^2(1-x^3)^5\,dx$ (3)

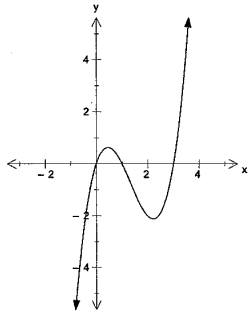
Question 3 **(6 marks)**

(a) A curve contains the point (1, 9) and the gradient of the curve at any point is given by $\frac{dy}{dx} = 6x - 6x^2$.

(i) Find the equation of the curve, (2)

(ii) State the number of solutions to the equation y = 8. (2)

(b)



The area bounded by the curve $f(x) = x^3 - 4x^2 + 3x$ (drawn above) and the x-axis is calculated by integrating *f(x)* from *x* = 0 to *x* = 3 and this area is $\frac{37}{12}$ units^2.

However, on the CAS calculator, $\int_0^3 x^3 - 4x^2 + 3x \, dx$ results in an answer of $-\frac{9}{4}$.

Explain why the answers are different. (2)