Semester 1 (Unit 3) Examination, 2016

Question/Answer Booklet

MATHEMATICS METHODS

Section One: Calculator-free

Student Name/Number: _____

Teacher Name: _____

Time allowed for this section
Reading time before commencing work: five minutes
Working time for this section: fifty 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 (blue/black preferred), pencils (including coloured),
sharpener,   correction fluid/tape, eraser, ruler, highlighters

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

Section	Number of questions available	Number of questions to be answered	Working time (minutes)	Marks available	Percentage of exam
Section One: Calculator-free	9	9	50	50	35
Section Two: Calculator-assumed	13	13	100	98	65
					100

Instructions to candidates

1.   The rules for the conduct of School exams are detailed in the
_____*School/College assessment policy*.
Sitting this examination implies that you agree to abide by these rules.

2.   Write your answers in this Question/Answer Booklet.

3.   You must be careful to confine your responses to the specific questions asked and to
follow any instructions that are specific to a particular question.

4.   Spare pages are included at the end of this booklet. They can be used for planning
your responses and/or as additional space if required to continue an answer.
   *   Planning: If you use the spare pages for planning, indicate this clearly at the top of
the page.
   *   Continuing an answer: If you need to use the space to continue an answer, indicate
in the original answer space where the answer is continued, i.e. give the page
number. Fill in the number of the question that you are continuing to answer at the
top of the page.

5.   **Show all 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 any question, ensure that you cancel the
answer you do not wish to have marked.

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

7.   The Formula Sheet is **not** to be handed in with your Question/Answer Booklet.

Section One: **Calculator-free**   **(50 Marks) Weighting 35%**

This section has **9 (nine)** questions. Answer **all** questions. Write your answers in the spaces provided.

Suggested working time: **50 minutes**.

Question 1   **(7 marks)**
(a)   Determine the derivative of the following. (Do not simplify).

      (i) $y = \dfrac{1}{\sqrt{\cos(x)}}$, $\cos(x) > 0$ **(2 marks)**

      (ii) $y = \dfrac{\sin(1-x)}{2e^{2x}}$ **(2 marks)**

(b)   Given the function $y = 3x^2(2x+1)^5$, show that $\dfrac{dy}{dx} = 6x(2x+1)^4(7x+1)$ **(3 marks)**

Question 2 **(8 marks)**

Determine the following indefinite integrals.

(a) $\displaystyle\int \frac{x^3}{2} - x + 1 \; dx$ (2 marks)

(b) $\displaystyle\int \frac{x^2 - 2}{\sqrt{x}} \; dx$ (2 marks)

(c) $\displaystyle\int 2x(x + 1)^2 \; dx$ (2 marks)

(d) $\displaystyle\int e^{\frac{x}{2}} - \cos\left(\frac{2x}{3}\right) \; dx$ (2 marks)

Question 3 **(6 marks)**

The probability distribution for a random variable Y is shown in the table below.

y	4	5	6	7	8
$P(Y = y)$	0.1	d	0.3	0.2	0.1

(a) What is the value of d? (1 mark)

(b) Determine the expected value of Y. (2 marks)

(c) Determine

(i) $P(Y \geq 6)$ (1 mark)

(ii) $P(Y$ is a prime number) (1 mark)

(iii) $P(Y < 7 / Y > 4)$ (1 mark)

Question 4 **(5 marks)**

The first derivative of the function $f(x)$ is given by: $f'(x) = (x^2+1)^3(2x+6)$.

(a) Determine $f''(x)$, the second derivative of $f(x)$. (Do not simplify your answer)

(2 marks)

(b) Determine $f''(-3)$. (1 mark)

(c) What can be said about the graph of $f(x)$ at the point where $x = -3$? (2 marks)

Question 5 **(4 marks)**

A discrete random variable, X, has a mean of 27 and standard deviation of 5.

(a) Consider the random variable $H = X + 3$. Determine

(i) the expected value of H (1 mark)

(ii) the variance of H (1 mark)

(b) G is a discrete random variable equal to $2H$. Determine

(i) the expected value of G (1 mark)

(ii) the standard deviation of G (1 mark)

Question 6 **(4 marks)**

Given that $\dfrac{d^2y}{dx^2} = 3\sqrt{2x-3} - 2$, determine y in terms of x if $\dfrac{dy}{dx} = 4$ when $x = \dfrac{7}{2}$ and $y = -\dfrac{4}{5}$ when $x = 2$.

Question 7 **(5 marks)**

Determine the equation of the tangent to the curve $y = \dfrac{x+1}{(2x-1)^2}$ at the point $(1, 8)$.

Question 8 **(6 marks)**

Amy is a keen archer and the probability that she hits the bulls-eye with an arrow is $\frac{1}{3}$.

In a competition she is given three shots at the target. Calculate the following probabilities, giving your answers as simplified fractions.

(a) She hits the bull's- eye with each shot. (1 mark)

(b) She hits the bull's-eye with the first and third shot but misses the bulls-eye with the second shot. (1 mark)

(c) She hits the bull's-eye only once. (2 marks)

(d) She hits the bull's-eye at least once with her three shots. (2 marks)

Question 9 **(5 marks)**

Determine the following

(a) $\displaystyle\int_{\frac{\pi}{6}}^{\pi} \cos(3x)\ dx$ (2 marks)

(b) $\displaystyle\frac{d}{dx}\left(\int_{2}^{x} \sqrt{3 - 2t^2}\, dt \right)$ (1 mark)

(c) $\displaystyle\int_{0}^{2} \frac{d}{dx}\left(\frac{1 - x^2}{1 + x} \right)\ dx$ (2 marks)

End of Questions

Additional working space

Question number: _____

Acknowledgements