

If required by your examination administrator, please place your student identification label in this box

--	--	--	--	--	--	--	--	--	--

Your name

In words

**Time allowed for this section**  
Reading time before commencing work: five minutes  
Working time: 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 material. 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 examination
Section One: Calculator-free	8	8	50	52	35
Section Two: Calculator-assumed	13	13	100	98	65
Total					100

Instructions to candidates

1.

The rules for the conduct of examinations are detailed in the school handbook. Sitting this examination implies that you agree to abide by these rules.
2.

Write your answers in this Question/Answer booklet preferably using a blue/black pen. Do not use erasable or gel pens.
3.

You must be careful to confine your answer to the specific question asked and to follow any instructions that are specified to a particular question.
4.

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

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

Supplementary pages for planning/continuing your answers to questions are provided at the end of this Question/Answer booklet. If you use these pages to continue an answer, indicate at the original answer where the answer is continued, i.e. give the page number.
7.

The Formula sheet is not to be handed in with your Question/Answer booklet.

Supplementary page

Question number: \_\_\_\_\_

DO NOT WRITE IN THIS AREA AS IT WILL BE CUT OFF

DO NOT WRITE IN THIS AREA AS IT WILL BE CUT OFF

(4 marks)

(2 marks)

(1 mark)

(1 mark)

See next page

SN07B-14S-1

(c)  $\frac{d}{dx} \int_x^3 (2t + 1) dt.$

(b)  $\frac{d}{dx} \cos(2x + 1).$

(a)  $\int 12(2x + 1)^2 dx.$

Determine the following:

Question 1

DO NOT WRITE IN THIS AREA AS IT WILL BE CUT OFF

(6 marks)

Question 8  
Let  $f(x) = \frac{x}{x+1}$ .  
(a) Determine  $f(x)$  and  $f(x + \delta x)$  when  $x = 70$  and  $\delta x = 5$ .  
(1 mark)

(b) Use  $f(x)$  and the increments formula to estimate the difference between  $\frac{89}{90}$  and  $\frac{92}{93}$ .  
(5 marks)

SN07B-14S-1

End of questions

DO NOT WRITE IN THIS AREA AS IT WILL BE CUT OFF

Question 2

(7 marks)

The velocity of a small body moving in a straight line at time  $t$  seconds is given by

$$v = \frac{8}{1+t} \text{ m/s}, \quad t \geq 0.$$

- (a)
- Determine the velocity of the body when its acceleration is  $-2 \text{ m/s}^2$ .
- (4 marks)

- (b)
- Calculate the distance travelled by the body in the first 3 seconds.
- (3 marks)

DO NOT WRITE IN THIS AREA AS IT WILL BE CUT OFF

Question 7

(7 marks)

In a class of 25 students, 20 are right-handed.

- (a)
- One student is selected at random from the class and the random variable  $X$  is the number of right-handed students in the selection. Determine the mean and standard deviation of  $X$ .
- (3 marks)

- (b)
- Two students are selected at random from the class without replacement and the random variable  $Y$  is the number of right-handed students in the selection.

- (i)
- Complete the probability distribution table below.
- (3 marks)

$y$	0	1	2
$P(Y = y)$			

- (ii)
- Determine  $E(Y)$ .
- (1 mark)

DO NOT WRITE IN THIS AREA AS IT WILL BE CUT OFF

(2 marks)

(2 marks)

See next page

SN07B-14S-1

CALCULATOR-FREE

5

Question 3

(a) Write  $1 + \log_5 3 - 2 \log_5 7$  in the form  $\log_5 k$ .

(b)

Solve for  $x$  the equation  $e^{x-2} = \sqrt{3}$ .

(c)

Determine  $\frac{dx}{d} \log_e \left( \frac{1}{5x^2 + 1} \right)$ .

DO NOT WRITE IN THIS AREA AS IT WILL BE CUT OFF

CALCULATOR-FREE

8

(8 marks)

(a) Determine the coordinates of the stationary point of the graph of  $y = f(x)$  and use the second derivative test to determine its nature. (6 marks)

Let  $f(x) = (1 - x)e^{-2x}$ .

(b)

Determine the coordinates of the point of inflection of the graph of  $y = f(x)$ . (2 marks)

See next page

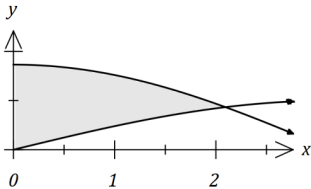
SN07B-14S-1

DO NOT WRITE IN THIS AREA AS IT WILL BE CUT OFF

Question 4 (6 marks)

Let  $f(x) = \sqrt{3} \cos\left(\frac{x}{2}\right)$  and  $g(x) = \sin\left(\frac{x}{2}\right)$ .

The shaded region on the graph below is enclosed by  $x = 0$ ,  $y = f(x)$  and  $y = g(x)$ .



(a) Show that  $f\left(\frac{2\pi}{3}\right) = g\left(\frac{2\pi}{3}\right)$ . (2 marks)

(b) Determine the area of the shaded region. (4 marks)

DO NOT WRITE IN THIS AREA AS IT WILL BE CUT OFF

Question 5 (7 marks)

The random variable  $X$  has probability density function  $f(x)$  shown below, where  $k$  is a positive constant.

$$f(x) = \begin{cases} kx + \frac{1}{20} & 0 \leq x \leq 4 \\ 0 & \text{elsewhere} \end{cases}$$

(a) Deduce that  $k = \frac{1}{10}$ . (3 marks)

(b) Determine the value of  $a$  if  $P(1 < X < a) = \frac{1}{5}$ . (4 marks)

DO NOT WRITE IN THIS AREA AS IT WILL BE CUT OFF