Supplementary Page

Question Number: _____

PERTH MODERN SCHOOL
Exceptional schooling. Exceptional students.
Independent Public School

Year 12 Methods
TEST 2
Monday 8 April 2019
TIME: 45 minutes working
One page of notes allowed
Calculator Assumed
43 marks 5 Questions

Name: _____ Teacher: _____

Note: All part questions worth more than 2 marks require working to obtain full marks.

Question 1 (7 marks)

(a) Differentiate $\frac{x}{e^x}$ and simplify your answer if necessary. (3 marks)

(b) Using your result from (a) above and **without the use** of a Classpad, show how to determine the definite integral $\int_0^1 \frac{1-x}{2e^x}\,dx$. (4 marks)

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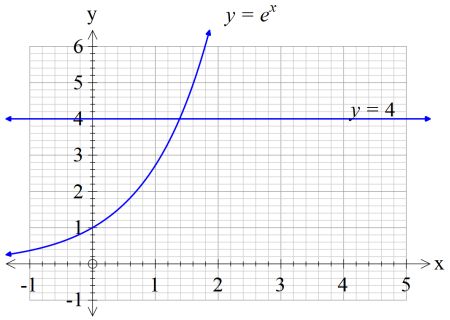
Question 5 **(8 marks)**



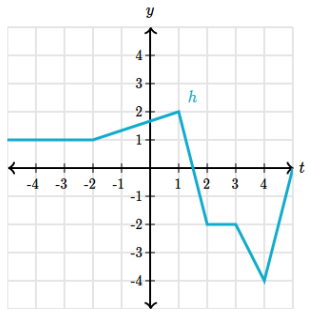
a) Using the solve facility on your Classpad, determine to two decimal places the x value where the two graphs above intersect. (2 marks)

b) Determine to two decimal places the area bounded by $y = e^x, y = 4$ and the y- axis. (3 marks)

c) Let $y = k$ where $1 \le k \le 4$, determine the value of k, to two decimal places, such that the area between $y = 4, y = k, y = e^x$ and the y-axis equals 1.5 sq units. (3 marks)

Question 2 **(8 marks)**

The graph of $h(x)$ is shown on the right.



(a) Evaluate the following definite integrals

(i) $\int_{-2}^{2} h(x)\,dx$ (2 marks)

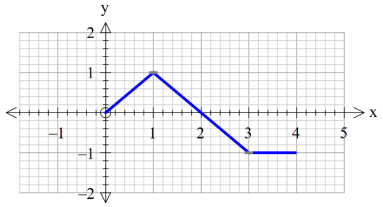
(ii) $\int_{-2}^{2} h'(x)\,dx$ (2 marks)

(b) Determine the area bounded by the graph of $h'(x)$ and the x axis between $x = -2$ and $x = 2$. Justify your answer. (4 marks)

Question 3 **(10 marks)**

Let $F(x)=\int_0^x f(t)dt$, where $f(t)$ in the picture on the right.

(a) Determine the value of x for a maximum of $F(x)$. Briefly explain your reasons. (3 marks)



(b) Evaluate $F(3)$. (2 marks)

(c) Determine the value of x for a maximum of $F'(x)$. Briefly explain your reasons. (3 marks)

(d) Evaluate $F'(4)$. (2 marks)

Question 4 **(10 marks)**

A new substance labelled **XX** is found to decay by the rule $N=1200e^{-0.116t}$, where N equals the mass of the substance in kilograms at time t minutes.

Determine the following:

a) the initial mass of **XX**. (1 mark)

b) the time taken for half of the mass to decay away to the nearest minute. (3 marks)

The radiation is safe for humans when the rate of decay is less than 100 kg per minute.

c) Determine after how long the radiation will become safe for humans. (3 marks)

A different substance **YY** has a rate of decay given by $\frac{dN}{dt}=-50e^{-0.447t}$, where N equals the mass of the substance in kilograms at time t minutes.

d) Determine the total change in the mass from $t=3$ to $t=7$ minutes. (3 marks)