



STUDENT NUMBER

Letter

Figures

Words

Teacher	Mr. Woodlock	Mrs. Bergamin	Mr. Truffitt
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MATHEMATICAL METHODS

School Assessed Task – 1.2

Wednesday 9th May 2018
Reading time: 10 minutes
Writing time: 60 minutes

Modelling Task

<i>Number of questions</i>	<i>Number of questions to be answered</i>	<i>Number of marks</i>
3	3	38

- Students are permitted to bring into the Assessment room: pens, pencils, highlighters, erasers, sharpeners, rulers, one CAS calculator, one bound notebook
- Students are **not** permitted to bring into the Assessment room: blank sheets of paper and/or white out liquid/tape.
- **Students are NOT permitted to bring mobile phones and/or any other unauthorised electronic devices into the examination room. Students must not disclose the contents of the task; to do so will be a breach of VCE guidelines and will be dealt with according to VCAA regulations.**

Materials supplied

- Question and answer book of 7 pages.
- Working space is provided throughout the book.

Instructions

- Write your name in the space provided above on this page.
- All responses must be written in English.
- Answer **all** questions in the spaces provided.
- Unless otherwise specified an **exact** answer is required to a question.
- In questions where more than one mark is available, appropriate working **must** be shown.
- Unless otherwise indicated, the diagrams in this book are **not** drawn to scale.

Families of Curves – functions

Question 1 (12 marks)

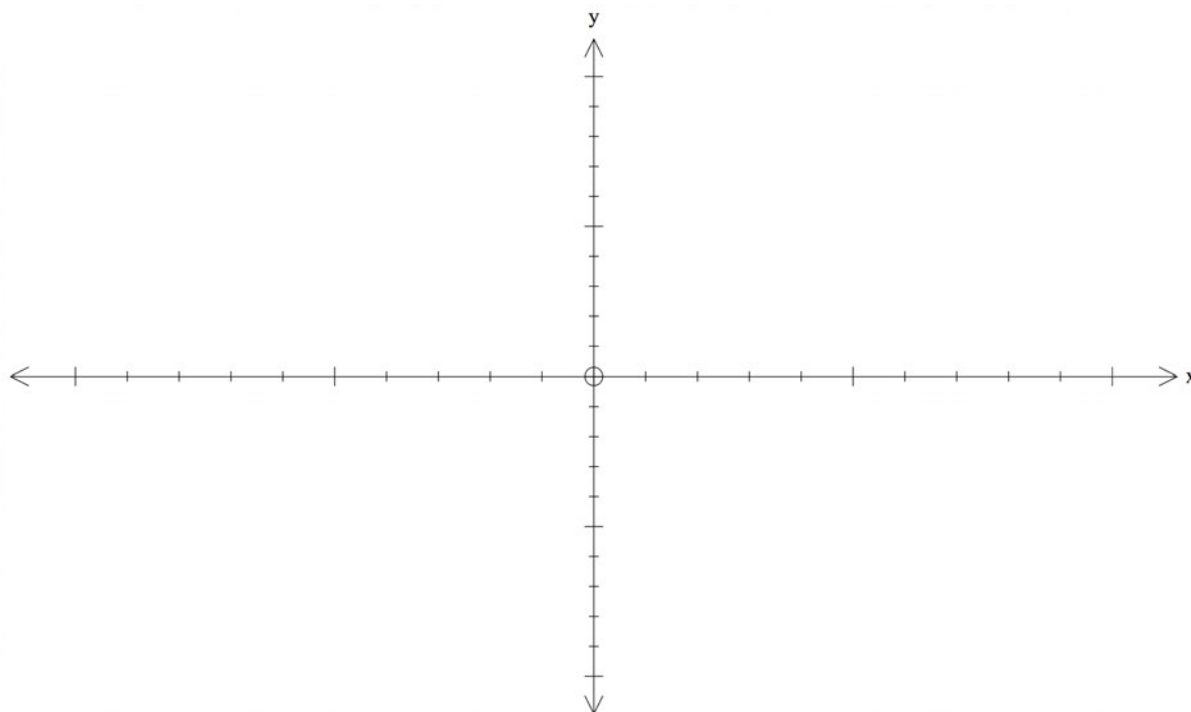
$$f: [-5,5] \rightarrow \mathbb{R}, f(x) = -x$$

$$j: \mathbb{R} \setminus \{0\} \rightarrow \mathbb{R}, j(x) = \frac{1}{x}$$

$$m: [-2,10] \rightarrow \mathbb{R}, m(x) = -2e^{-\frac{x}{2}}$$

a) Let $n(x) = f(x) + j(x)$

- i) Draw the graphs of $f(x)$ and $j(x)$ on the same set of axes, labelling key features.



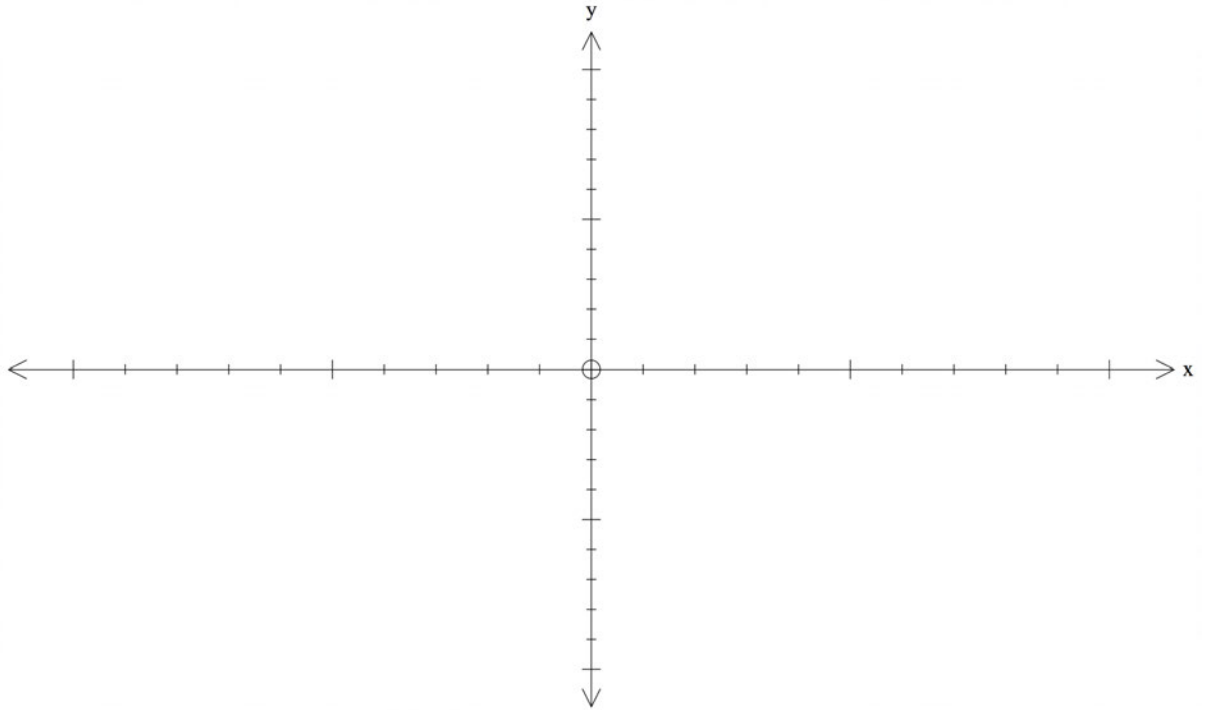
- ii) Hence draw the graph of $n(x)$, labelling key features.

- iii) Give the domain of $n(x)$

3+2+1=6 marks

b) Let $p(x) = f(x) \cdot m(x)$

i) Draw the graphs of $f(x)$ and $m(x)$ on the same set of axes, labelling key features.



ii) Hence draw the graph of $p(x)$, labelling key features.

iii) Give the domain of $p(x)$

3+2+1=6 marks

- iii) The transformation $R^2 \rightarrow R^2$ that maps $b(t)$ to $c(t)$ is given by the matrix equation $X' = AX + B$. Find A and B

2+3+2=7 marks

b) $z(x) = 2 \tan\left(\frac{\pi}{2}(x - 1)\right)$ and $n(x) = -2x$

- i) State the restrictions (if any) on $z(x)$ for $z(n(x))$ to be defined

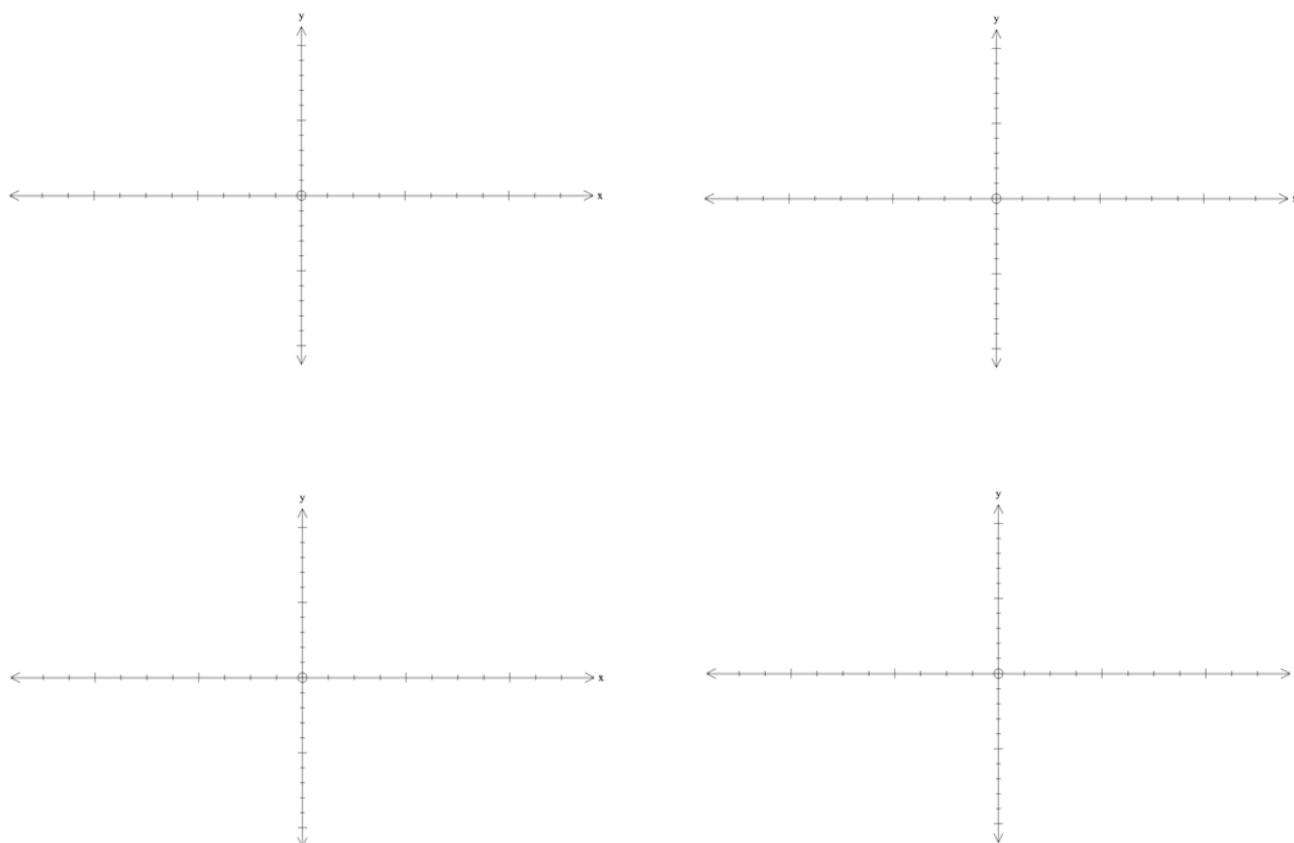
- ii) Find the function $k(x) = z(n(x))$

2+1= 3 marks

Question 3(16 marks)

Consider the family of functions $f_n: R \rightarrow R, f_n(x) = -x^n e^{-x}$, where n is a positive integer.

- a) Draw graphs of f_n for $n \in [1,4]$, and, **using your calculator**, identify the location of any stationary points and axial intercepts to 3 decimal places



8 marks

- b) Using these graphs or otherwise **and** considering **both** the odd and even values of n :

- i) Give the solution(s) of any points of intersections between the graph $y = e^{-x}$ and the graph of f_n

ii) Give the coordinates of the stationary points, in terms of n

iii) State, in generalized form, using n in your answers, the intervals over which f_n is strictly increasing and the intervals over which it is strictly decreasing

2+2+4 = 8 marks