

SUPERVISOR TO ATTACH PROCESSING LABEL HERE

**STUDENT NUMBER**

Letter

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VICTORIAN CURRICULUM AND ASSESSMENT AUTHORITY



# Victorian Certificate of Education 2001

## MATHEMATICAL METHODS (CAS) PILOT STUDY

### Sample written examination 1 (Facts, skills and applications)

**For November examination period**

**Reading time: 15 minutes**

**Writing time: 1 hour 30 minutes**

### PART II

### QUESTION AND ANSWER BOOK

#### Directions to students

This examination has two parts: Part I (multiple-choice questions) and Part II (short-answer questions). Part I consists of a separate question book and must be answered on the answer sheet provided for multiple-choice questions.

Part II consists of this question and answer book.

You must complete **both** parts in the time allotted. When you have completed one part continue immediately to the other part.

A detachable formula sheet for use in both parts is in the centrefold of the Part I question book.

#### **At the end of the examination**

Place the answer sheet for multiple-choice questions (Part I) inside the front cover of this question and answer book (Part II).

## Structure of book

| <i>Number of questions</i> | <i>Number of questions to be answered</i> | <i>Number of marks</i> |
|----------------------------|-------------------------------------------|------------------------|
| 8                          | 8                                         | 23                     |

### Materials

- Question and answer book of 10 pages, including two blank pages for rough working.
- Up to four pages (two A4 sheets) of pre-written notes typed or handwritten.
- An approved CAS calculator, ruler, protractor, set-square and aids for curve-sketching.

### Instructions

- Detach the formula sheet from the centre of the Part I book during reading time.
- Write your **student number** in the space provided on the cover of this book.
- A decimal approximation will not be accepted if an exact answer is required to a question.
- Appropriate working should be shown if more than one mark is available.
- Unless otherwise indicated, the diagrams in this book are **not** drawn to scale.
- All written responses must be in English.

### At the end of the examination

- Place the answer sheet for multiple-choice questions (Part I) inside the front cover of this question and answer book (Part II).

Working space

**TURN OVER**

**Instructions for Part II**

Answer **all** questions in the spaces provided.

**Question 1**

A canteen serves coffee and tea. It is found that 10% of customers who have tea on a particular day choose coffee the next day and 60% of customers who choose coffee on a particular day choose tea on the next day. It is found that 700 people use the canteen each day and they all have tea or coffee but not both. On a particular Monday 350 have tea and 350 have coffee.

- a. How many people will have tea and how many will have coffee on the Friday of that week?

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- b. In the long term, how many people will have each drink?

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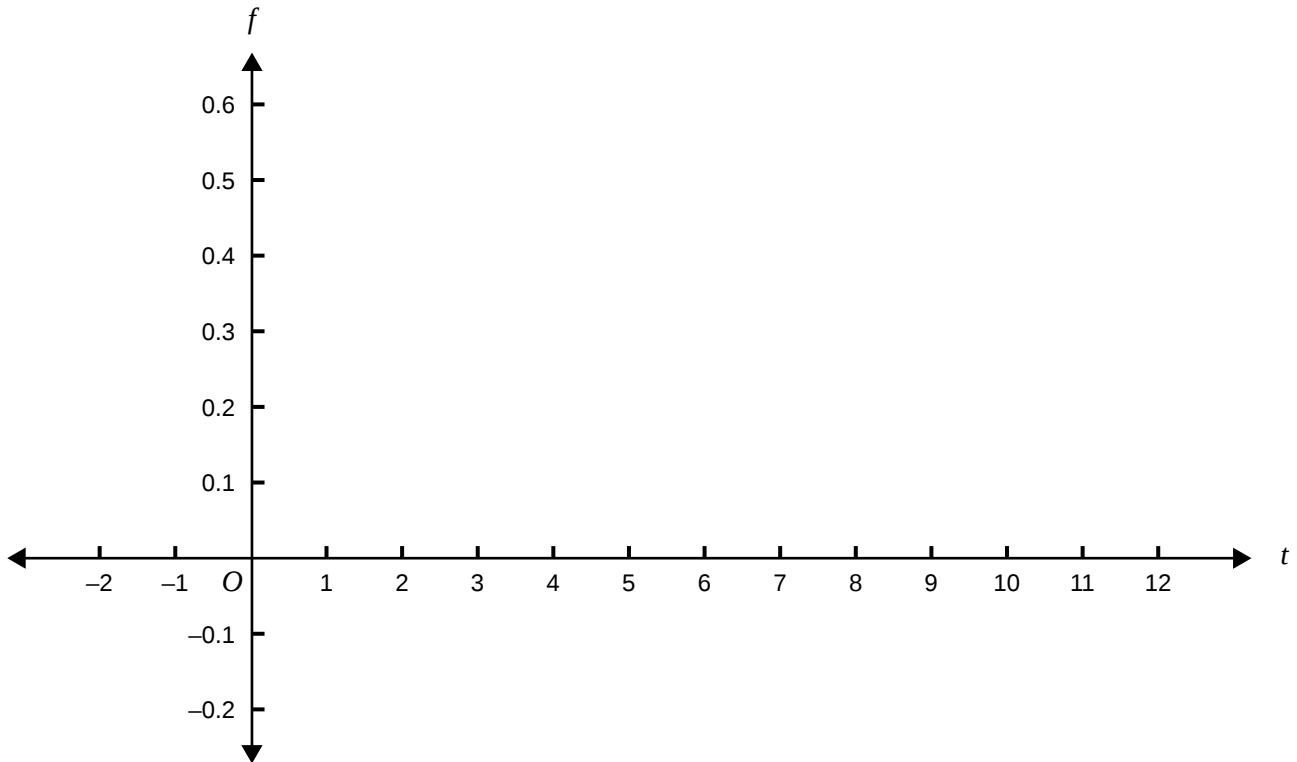
2 + 2 = 4 marks

**Question 2**

The first symptoms for a certain disease appear between 5 and 10 days after contact. The probability of the first symptoms of this disease appearing at various times,  $t$  days after contact, is described by the probability density function

$$f(t) = \begin{cases} \frac{6}{125}(t-5)(10-t) & \text{for } 5 \leq t \leq 10 \\ 0 & \text{elsewhere} \end{cases}$$

- a. Sketch the graph of  $f$  on the set of axes provided below.



- b. Find the exact value of the probability that the first symptoms appear between 5 and 7 days after contact.

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2 + 2 = 4 marks

**TURN OVER**

**Question 3**

Let  $f$  and  $g$  be functions with domain  $R$  where  $f(x) = -x^3 + 4x^2 + 9x - 9$  and  $g(x) = x + 1$ .

- a. Write  $g(x) - f(x)$  as a product of linear factors over  $R$ .

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- b. Find all values of  $x$  for which  $g(x) > f(x)$ .

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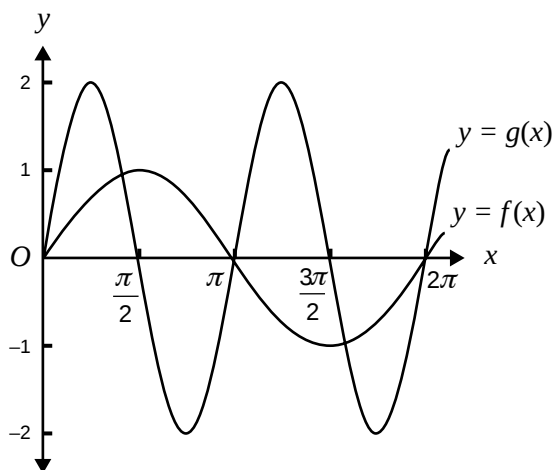


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1 + 1 = 2 marks

**Question 4**

The diagram below shows the graphs of two circular functions,  $f$  and  $g$ .



State the type of transformation, together with any relevant scale factors, distances or directions, required to transform the graph whose equation is  $y = f(x)$  into the graph whose equation is  $y = g(x)$ .

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2 marks

**Question 5**

Consider the family of parabolas that pass through the point (1, 1) with gradient 2 at this point.

- a. Find the general rule for this family of parabolas, in the form  $y = ax^2 + bx + c$ , expressing  $a$  and  $b$  in terms of  $c$ .

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- b. Find the rule of the particular member of this family of parabolas that also passes through the point (0,1).

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3 + 1 = 4 marks

**TURN OVER**

**Question 6**

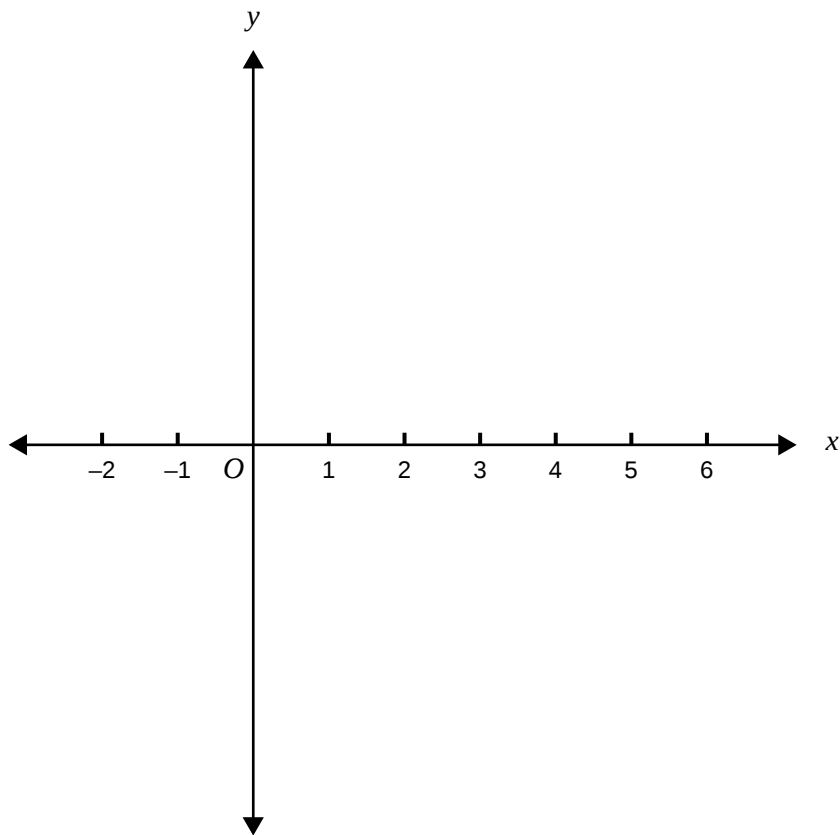
On the set of axes provided below, sketch a continuous curve with equation  $y = f(x)$  having the following properties

$$f(0) = 0 \quad f'(0) = 0$$

$$f(4) = 0 \quad f'(3) = 0$$

$$f'(x) < 0 \text{ for } \{x : x > 3\}$$

$$f'(x) > 0 \text{ for } \{x : x < 3\} \setminus \{0\}$$



3 marks

**Question 7**

Given  $f: (0, 200] \rightarrow \mathbb{R}$ ,  $f(x) = (100 - x) \log_{10}(x)$  find

- i. the maximum value of  $f(x)$ , correct to three decimal places

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- ii. the values of  $x$  for which  $f(x) = 0$

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- iii. the value of  $f'(x)$  when  $f(x) = 0$  and  $x > 1$ .

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1 + 1 + 1 = 3 marks

**Question 8**

Let  $g(x) = \cos(f(x))$ . If  $g'(x) = -2x \sin(x^2)$ , find the rule for  $f$ .

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1 mark

**TURN OVER**

Working space



