**2020**

**VCE**

**Mathematical Methods**

**Trial Examination 1**



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Victorian Certificate of Education

**2020**

###### STUDENT NUMBER

 Letter

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| FiguresWords |  |  |  |  |  |  |  |  |  |  |  |
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**MATHEMATICAL METHODS**

**Trial Written Examination 1**

Reading time: 15 minutes

Total writing time: 1 hour

**QUESTION AND ANSWER BOOK**

**Structure of book**

|  |
| --- |
|  *Number of Number of questions Number of* *questions to be answered marks* |
|  10 10 40 |

* Students are permitted to bring into the examination room: pens, pencils, highlighters, erasers, sharpeners, rulers.
* Students are NOT permitted to bring into the examination room: any technology (calculators or software) notes of any kind, blank sheets of paper, and/or correction fluid/tape.

**Materials supplied**

* Question and answer book of 19 pages.
* Detachable sheet of miscellaneous formulas at the end of this booklet.
* Working space is provided throughout the booklet.

**Instructions**

* Detach the formula sheet from the end of this book during reading time.
* Write your **student number** in the space provided above on this page.
* Unless otherwise indicated, the diagrams in this booklet are **not** drawn to scale.
* All written responses must be in English.

**Students are NOT permitted to bring mobile phones and/or any other unauthorised electronic devices into the examination room.**

**Instructions**

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

In all questions where a numerical answer is required an exact value must be given unless otherwise specified.

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.

##### Question 1 (4 marks)

**a.** Let . Evaluate . 2 marks

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**b.** Let .

**i.** Find .

**ii.** Find an antiderivative of *g*.

 1 + 1 = 2 marks

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**Question 2** (3 marks)

Consider the function .

**a.** Find the largest possible value of *b*, such that *f* is a one-to-one function.

 1 mark

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**b.** Find the inverse function, .

 2 marks

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**Question 3** (4 marks)

Consider the simultaneous equations

 where *k* is a real constant.

Find the value(s) of *k*, for which there is

**i.** a unique solution.

**ii.** infinitely many solutions.

**iii.** no solution.

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**Question 4** (3 marks)

Part of the graph of the function  is shown below.



Determine the coordinates of the stationary point on the graph of .

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**Question 5** (5 marks)

Let 

**a.** Express *f* in the form , stating the values of *a* and *b*, and *D*.

 1 mark

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**b.** Sketch the graph of *f*, on the axes below. Label all asymptotes with their equations and the axial intercepts with their coordinates.

 2 marks



**c.** Find the area bounded by the graph of *f*, the *x*-axis, and the line 

 2 marks

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Question 6** (6 marks)

**a.** Let  be the function obtained by applying the transformation *T* to the function , where

  and  Find the values of  and 

 2 marks

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**b.** State in words the transformations required for the graph of  to be obtained from the function.

 2 marks

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**c.** Let 

Sketch the graph of *h* on the axes below. Label the coordinates of all axial intercepts,

the turning points and the endpoints.

 2 marks

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**Question 7** (4 marks)

Given  ,  and .

Find the possible values of *p*.

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**Question 8** (3 marks)

**a.** Differentiate  with respect to *x*.

 1 mark

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**b.** Using the results from **a.** determine the mean value of the function 

 over the interval .

 Give your answer in the form  where *a*, *b* and *c* are integers.

 2 marks

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**Question 9** (4 marks)

A binomial distribution of the random variable *X*, with four independent trials, is such that, where *p* is the probability of a success on any trial and .

If , determine the values of *a* and *b*.

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**Question 10** (4 marks)

**a.** Consider the curve , find the equation of the tangent to the curve, which passes through the origin.

 2 marks

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**b.** Hence find values of *k*, for which the equation  has

**i.** exactly one real solution.

**ii.** exactly two real solutions.

**iii.** exactly three real solutions.

**iv.** exactly four real solutions. 2 marks

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##### End of question and answer book for the

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**EXTRA WORKING PAGE**

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**MATHEMATICAL METHODS**

**Written examination 1**

FORMULA SHEET

Directions to students

Detach this formula sheet during reading time.

 This formula sheet is provided for your reference.

## Mathematical Methods formulas

##  Mensuration

|  |  |  |  |
| --- | --- | --- | --- |
| area of a trapezium |  | volume of a pyramid  |  |
| curved surface area of a cylinder |  | volume of a sphere  |  |
| volume of a cylinder |  | area of triangle  |  |
| volume of a cone |  |  |  |

##  Calculus

|  |  |
| --- | --- |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
| product rule |  | quotient rule  |  |
| chain rule |  |  |

##  Probability

|  |  |
| --- | --- |
|  |  |
|  |  |

|  |  |  |
| --- | --- | --- |
| **Probability distribution** | **Mean** | **Variance** |
| Bernoulli |  |  |  |
| Binomial |  |  |  |
| normal |  |  |  |

##

##

**END OF FORMULA SHEET**

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