

Trial Examination 2020

## VCE Specialist Mathematics Units 1&2

Written Examination 1

### Question and Answer Booklet

Reading time: 15 minutes

Writing time: 1 hour

Student's Name: \_\_\_\_\_

Teacher's Name: \_\_\_\_\_

#### Structure of booklet

<i>Number of questions</i>	<i>Number of questions to be answered</i>	<i>Number of marks</i>
7	7	40

Students are permitted to bring into the examination room: pens, pencils, highlighters, erasers, sharpeners and 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 booklet of 8 pages

Formula sheet

Working space is provided throughout the booklet.

#### Instructions

Write your **name** and your **teacher's name** 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.

#### At the end of the examination

You may keep the formula sheet.

**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.

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 booklet are **not** drawn to scale.

Take the **acceleration due to gravity** to have magnitude  $g \text{ ms}^{-2}$ , where  $g = 9.8$ .

**Question 1** (7 marks)

- a. A difference equation has the rule  $t_{n+1} = 4t_n - 2$ ,  $t_1 = 3$ .

Find the value of  $t_3$ .

2 marks

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- b. The first, second, and third terms of a geometric sequence are  $x - 2$ ,  $x$  and  $x + 3$ .

- i. Find the value of  $x$ .

2 marks

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- ii. Find the common ratio between the terms.

1 mark

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- iii. Show that the sum of the first  $n$  terms in the sequence can be expressed

as  $S_n = \frac{3^n}{2^{n-3}} - 8$ .

2 marks

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**Question 2** (7 marks)

Let  $f(x) = |x - 4| + |x - 6| - 4$ .

- a.** Find  $f(0)$ . 1 mark

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- b.** Solve  $f(x) = 0$ . 3 marks

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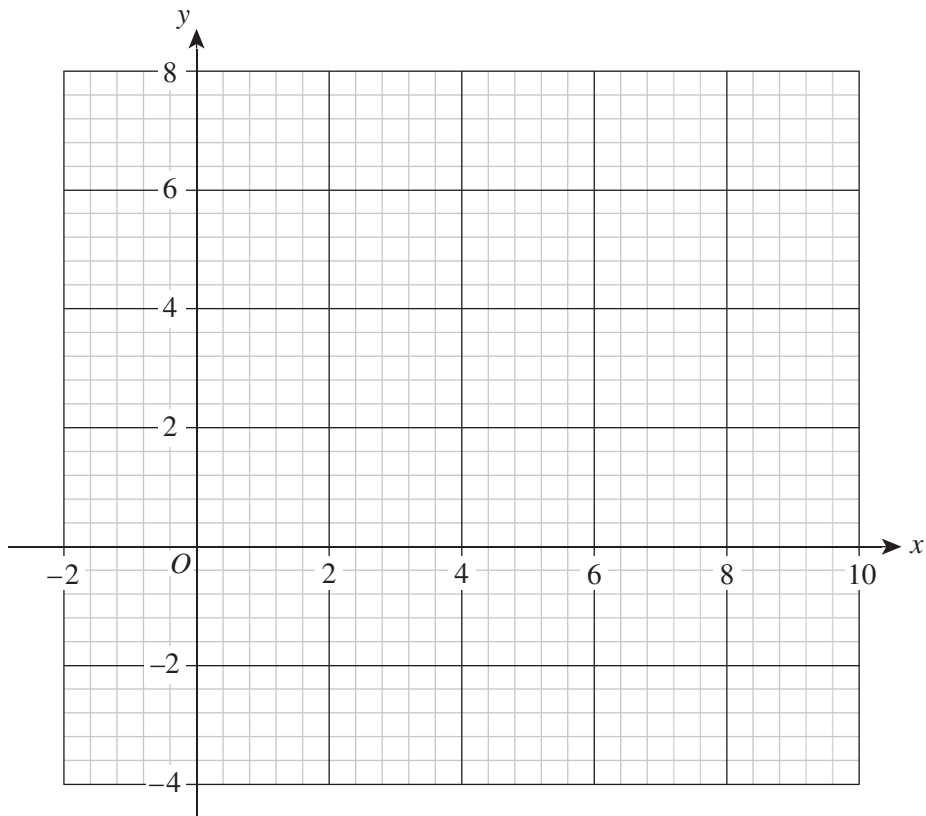


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- c.** Sketch the graph of  $y = f(x)$  on the set of axes below, showing coordinates of all intercepts and cusp points. 3 marks



**Question 3** (6 marks)

A curve is defined by the parametric equations  $x = 2^t$  and  $y = 2^{t+2} - 5$  for  $t \in [0, 3)$ .

- a.** State the domain and range of the curve. 2 marks

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- b.** Find cartesian equation of the curve. 2 marks

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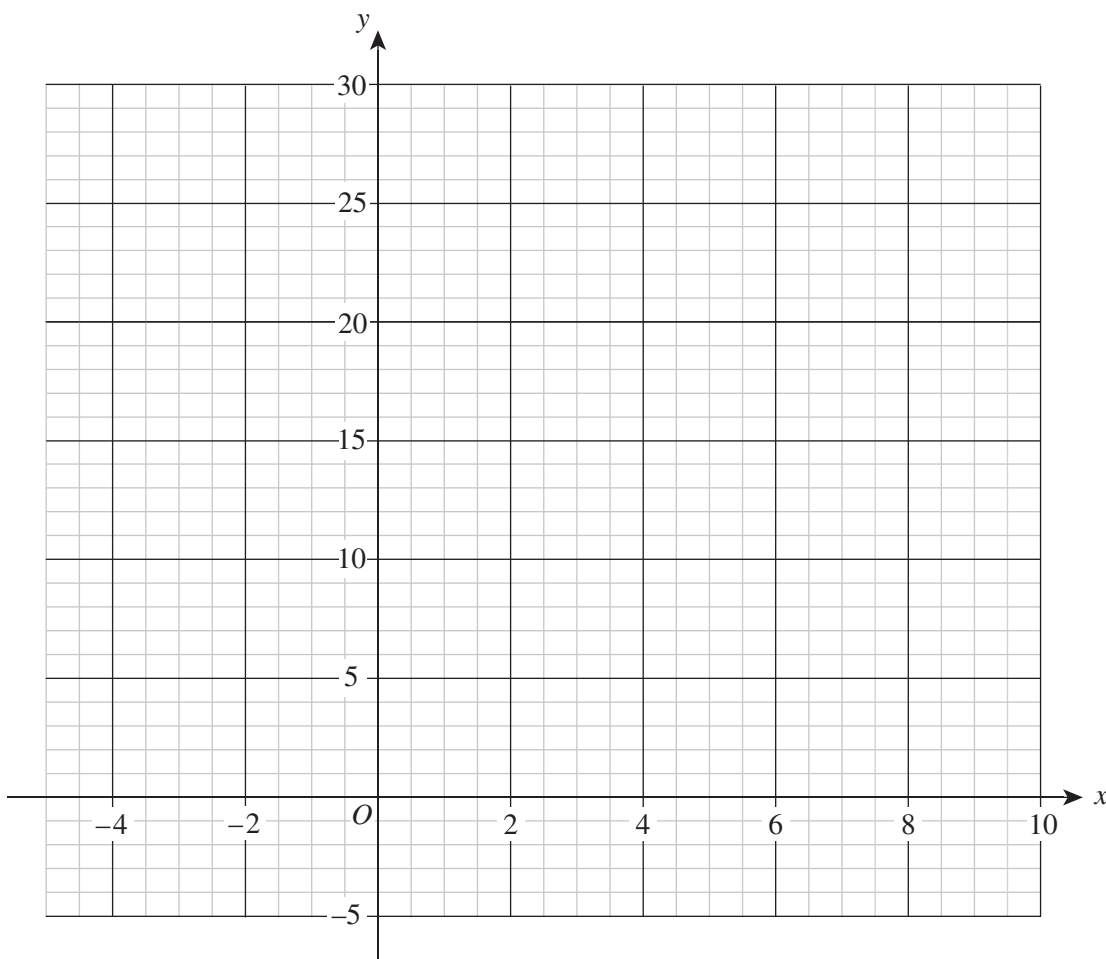


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- c.** Graph the curve over the required domain on the axes below, showing the coordinates of any end points. 2 marks







**Question 6** (7 marks)

The position vectors of two points  $A$  and  $B$  relative to an origin  $O$  are  $10\mathbf{i} + 20\mathbf{j}$  and  $25\mathbf{i} + 5\mathbf{j}$  respectively.

- a. i.** Given that  $\vec{OC} = \frac{1}{10}\vec{OA}$  and  $\vec{OD} = \frac{1}{5}\vec{OB}$ , state the position vectors  $\vec{OC}$  and  $\vec{OD}$ . 2 marks

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- ii.** Hence, find  $|\vec{CD}|$ . 2 marks

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- b.** Given that  $\vec{OE} = p\vec{OA}$  and  $\vec{OF} = p\vec{OB}$ , find the value of  $p$  such that  $\vec{EF}$  is a unit vector. Give your answer in the form  $\frac{\sqrt{a}}{b}$ , where  $a$  and  $b$  are integers. 3 marks

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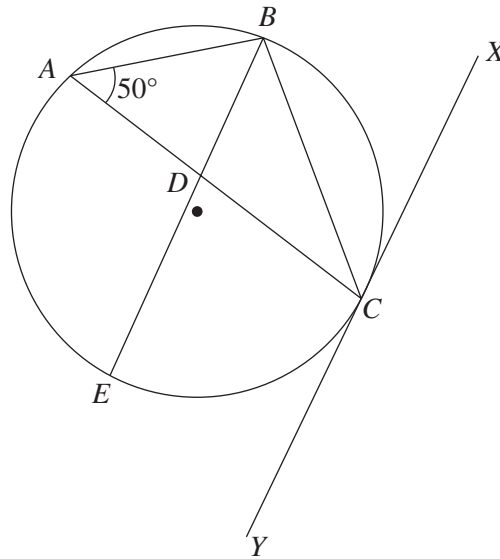
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**Question 7** (5 marks)

In the diagram below, the triangle  $ABC$  is inscribed in a circle, and the tangent to the circle at  $C$  is parallel to the line  $BE$ . The line  $BE$  is also the bisector of angle  $ABC$ . The point  $D$  is the intersection of  $AC$  and  $BE$ .



- a. Find the magnitude of  $\angle BCX$ . 1 mark

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- b. Find the magnitude of  $\angle CBD$ . 1 mark

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- c. Find the magnitude of  $\angle ABC$ . 1 mark

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- d. If  $AD = 4$  cm and  $DC = 6$  cm, find the length of  $ED$  if it is known that  $ED$  is twice as long as  $BD$ . 2 marks

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**END OF QUESTION AND ANSWER BOOKLET**



Trial Examination 2020

## VCE Specialist Mathematics Units 1&2

Written Examination 2

### Formula Sheet

#### Instructions

This formula sheet is provided for your reference.  
A question and answer booklet is provided with this formula sheet.

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

**SPECIALIST MATHEMATICS FORMULAS****Mensuration**

area of a trapezium	$\frac{1}{2}(a + b)h$
curved surface area of a cylinder	$2\pi rh$
volume of a cylinder	$\pi r^2 h$
volume of a cone	$\frac{1}{3}\pi r^2 h$
volume of a pyramid	$\frac{1}{3}Ah$
volume of a sphere	$\frac{4}{3}\pi r^3$
area of a triangle	$\frac{1}{2}bc \sin(A)$
sine rule	$\frac{a}{\sin(A)} = \frac{b}{\sin(B)} = \frac{c}{\sin(C)}$
cosine rule	$c^2 = a^2 + b^2 - 2ab \cos C$

**Circular functions**

$\cos^2(x) + \sin^2(x) = 1$	
$1 + \tan^2(x) = \sec^2(x)$	$\cot^2(x) + 1 = \operatorname{cosec}^2(x)$
$\cos(2x) = \cos^2(x) - \sin^2(x) = 2\cos^2(x) - 1 = 1 - 2\sin^2(x)$	
$\sin(2x) = 2 \sin(x) \cos(x)$	

**Vectors in two dimensions**

$\underline{r} = x\underline{i} + y\underline{j} + z\underline{k}$
$ \underline{r}  = \sqrt{x^2 + y^2 + z^2} = r$
$\underline{r}_1 \cdot \underline{r}_2 = r_1 r_2 \cos(\theta) = x_1 x_2 + y_1 y_2 + z_1 z_2$

**Polar coordinates**

$x = r \cos \theta$
$y = r \sin \theta$

**END OF FORMULA SHEET**