

**JURONG SECONDARY SCHOOL  
2022 GRADUATION EXAMINATION 2  
SECONDARY 4 EXPRESS/  
SECONDARY 5 NORMAL (ACADEMIC)**

<b>CANDIDATE NAME</b>	
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<b>CLASS</b>	
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<b>INDEX NUMBER</b>	
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**MATHEMATICS**

**4048/01**

PAPER 1

**26 Aug 2022  
2 hours**

Candidates answer on the Question paper.

**READ THESE INSTRUCTIONS FIRST**

Write your name, class and index number on all the work you hand in.

Write in dark blue or black pen.

You may use an HB pencil for any diagrams or graphs.

Do not use staples, paper clips, glue or correction fluid.

Answer **all** the questions.

If working is needed for any question it must be shown with the answer.

Omission of essential working will result in loss of marks.

The use of an approved scientific calculator is expected, where appropriate.

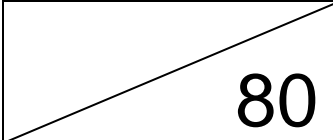
If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.

For  $\pi$ , use either your calculator value or 3.142, unless the question requires the answer in terms of  $\pi$ .

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [ ] at the end of each question or part question.

The total number of marks for this paper is 80.

<b>For Examiner's Use</b>
 <b>80</b>

This document consists of **23** printed pages, including this page.

## Mathematical Formulae

### *Compound interest*

$$\text{Total amount} = P \left( 1 + \frac{r}{100} \right)^n$$

### *Mensuration*

$$\text{Curved surface area of a cone} = \pi r l$$

$$\text{Surface area of a sphere} = 4\pi r^2$$

$$\text{Volume of a cone} = \frac{1}{3} \pi r^2 h$$

$$\text{Volume of a sphere} = \frac{4}{3} \pi r^3$$

$$\text{Area of triangle } ABC = \frac{1}{2} ab \sin C$$

$$\text{Arc length} = r\theta, \text{ where } \theta \text{ is in radians}$$

$$\text{Sector area} = \frac{1}{2} r^2 \theta, \text{ where } \theta \text{ is in radians}$$

### *Trigonometry*

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc \cos A$$

### Statistics

$$\text{Mean} = \frac{\sum fx}{\sum f}$$

$$\text{Standard deviation} = \sqrt{\frac{\sum fx^2}{\sum f} - \left( \frac{\sum fx}{\sum f} \right)^2}$$

- 1 Simplify  $-2(-3x-4)+5$ .

*Answer* .....[1]

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- 2 The ratio of interior angle : exterior angle of a regular polygon is 5:1.  
Calculate the number of sides that the polygon has.

*Answer* .....sides [1]

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- 3 A photocopier can photocopy at a rate of 30 double-sided papers per minute.

Calculate

- (a) in minutes, the time taken to print 600 pages on double-sided setting,

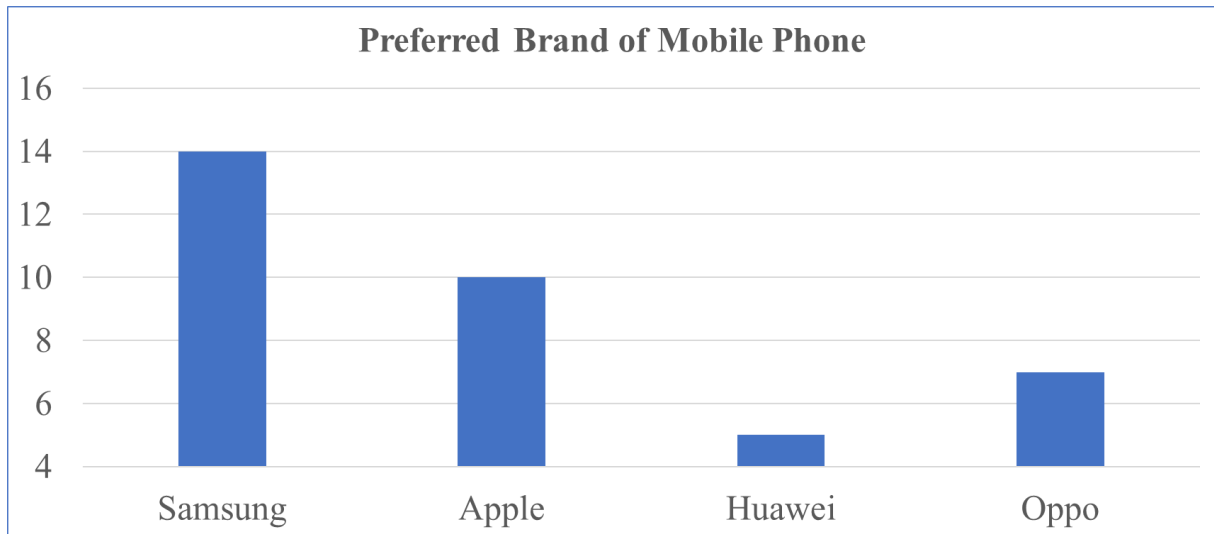
*Answer* .....minutes [1]

- (b) the number of double-sided papers that can be photocopied in 1 hour.

*Answer* .....double-sided papers [1]

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- 4 A survey was conducted to find out the preferred brand of mobile phone that secondary school students like.



State one aspect of the graph that may be misleading and explain how this may lead to a misinterpretation of the graph.

.....

.....

.....[2]

- 5 Solve the inequality  $-2 + x \leq 2 - 3x < 9 + 4x$ .

*Answer* ..... [2]

- 6** Find a possible set of integer values of  $a$  and  $b$  such that the lines  $x + y = 1$  and  $ax + by = 1$

**(a)** do not intersect,

*Answer*  $a = \dots\dots\dots$

$b = \dots\dots\dots$  [1]

**(b)** intersect at exactly one point.

*Answer*  $a = \dots\dots\dots$

$b = \dots\dots\dots$  [1]

---

- 7** Factorise  $4ax^2 - 4ay^2 + 2bx^2 - 2by^2$  completely.

*Answer*  $\dots\dots\dots$  [2]

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8 Simplify  $\left(\frac{a^{16}}{b^{-6}}\right)^{\frac{3}{2}}$ .

*Answer* .....[2]

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9 Given that  $25 \times 125^x = 5$ , find the value of  $x$ .

*Answer*  $x =$  .....[2]

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**10** Solve  $\frac{5}{(2-x)^2} + \frac{1}{x-2} = 4$ .

*Answer*  $x = \dots\dots\dots$ [3]

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**11 (a)** Express  $1+x^2-5x$  in the form of  $(x+a)^2+b$ .

*Answer*  $\dots\dots\dots$ [1]

**(b)** Write down the equation of line of symmetry of the graph of  $y = 1+x^2-5x$ .

*Answer*  $\dots\dots\dots$ [1]

**(c)** Write down the coordinates of intersection between the line of symmetry and the graph of  $y = 1+x^2-5x$ .

*Answer*  $(\dots\dots\dots, \dots\dots\dots)$  [1]

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- 12** The area of triangle  $ABC$  is  $7.5 \text{ cm}^2$ . Two of the sides are of length 5 cm and 6 cm respectively. Find the length of the third side.

*Answer* .....cm [3]

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- 13** The Ideal Gas Law

$$PV = 8.3145nT$$

relates pressure  $P$  (measured in Pascal), volume  $V$  (measured in metres<sup>3</sup>), the number of moles of a gas  $n$  (measured in moles), and temperature  $T$  (measured in Kelvins).

One mole of gas is found to exert a pressure of 101 325 Pascal at room temperature 293 Kelvins. Find the volume of the gas in **cm<sup>3</sup>**.

*Answer* .....cm<sup>3</sup> [2]

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**14** A map of the United States of America has a scale of 1:8 000 000.

- (a) The length of the Mississippi River is 3766 km.  
Calculate the length, in centimetres, of Mississippi River on the map.

*Answer* .....cm [1]

- (b) The area of California on the map is  $66.25 \text{ cm}^2$ .  
Calculate the actual area, in square kilometres, of California.

*Answer* ..... $\text{km}^2$  [2]

- 15** (a)  $n$  is a positive integer.  
Show that, for all  $n$ ,  $6n^2 + 25n + 11$  is not a prime number.

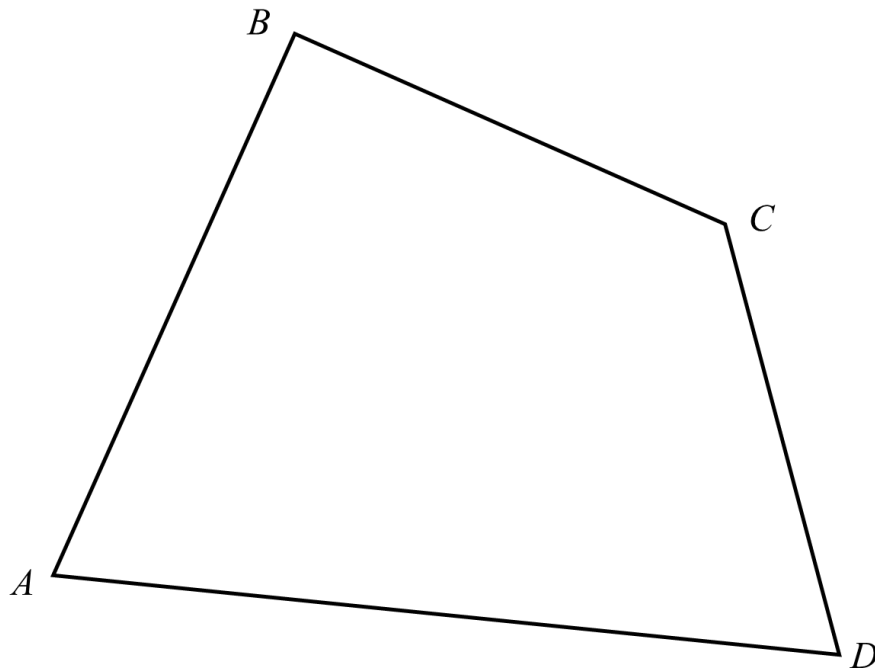
.....  
.....  
.....[2]

- (b) Hence, determine whether 16261 is a prime number. Show your working clearly.

.....  
.....  
.....[2]

- 16** The diagram represents a plot of land,  $ABCD$ . The police is looking for a robber hiding in the land.

Scale: 1 cm represents 1 km



Here are the accounts from three witnesses:

Witness 1: The robber is located more than 6 km away from  $A$ .

Witness 2: The robber is located nearer to  $B$  than  $A$ .

Witness 3: The robber is located nearer to  $AD$  than  $AB$ .

**Shade** the region where the robber is hiding.

[4]

**17**  $\xi = \{\text{integers } x : 1 < x < 21\}$

$A = \{\text{integers that are perfect squares}\}$

$B = \{\text{integers that are not prime numbers}\}$

$C = \{\text{integers that are divisible by 5}\}$

- (a)** List down all the elements in  $A$ ,  $B$  and  $C$ .

*Answer*  $A = \dots\dots\dots$

$B = \dots\dots\dots$

$C = \dots\dots\dots$  [2]

A number is chosen randomly from  $\xi$ .

- (b)** Find the number of elements in  $B \cap C'$ .

*Answer* ..... [1]

- (c)** Hence, find the probability that the chosen number is not a prime number and is not divisible by 5.

*Answer* ..... [1]

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- 18 (a)** The prime factorisation of 450 is  $2 \times 3^2 \times 5^2$ .  
Express 648 as a product of its prime factors.

*Answer*  $648 = \dots\dots\dots$ [1]

- (b)** Using your answer to **part (a)**, determine whether 583200 is a perfect square.

.....  
.....  
.....[2]

- (c)** Find the smallest integer  $n$  such that  $450n$  is a multiple of 648.

*Answer*  $n = \dots\dots\dots$ [1]

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- 19 (a)** The points  $A(0,2)$  and  $B(1,0)$  lie on the graph  $y = x^2 + ax + b$ .  
Find the values of  $a$  and  $b$ .

*Answer*  $a = \dots\dots\dots$

$b = \dots\dots\dots$  [2]

- (b)**  $C$  is another point on the graph such that the gradient of line  $AB$  is twice the gradient of  $AC$ . Find the coordinates of point  $C$ .

*Answer* ( $\dots\dots\dots$ ,  $\dots\dots\dots$ ) [3]

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**20** It is given that  $\overrightarrow{AB} = \begin{pmatrix} -12 \\ a \end{pmatrix}$ ,  $a > 0$  and  $|\overrightarrow{BA}| = 37$  units.

**(a)** Find the value of  $a$ .

*Answer*  $a = \dots\dots\dots$  [2]

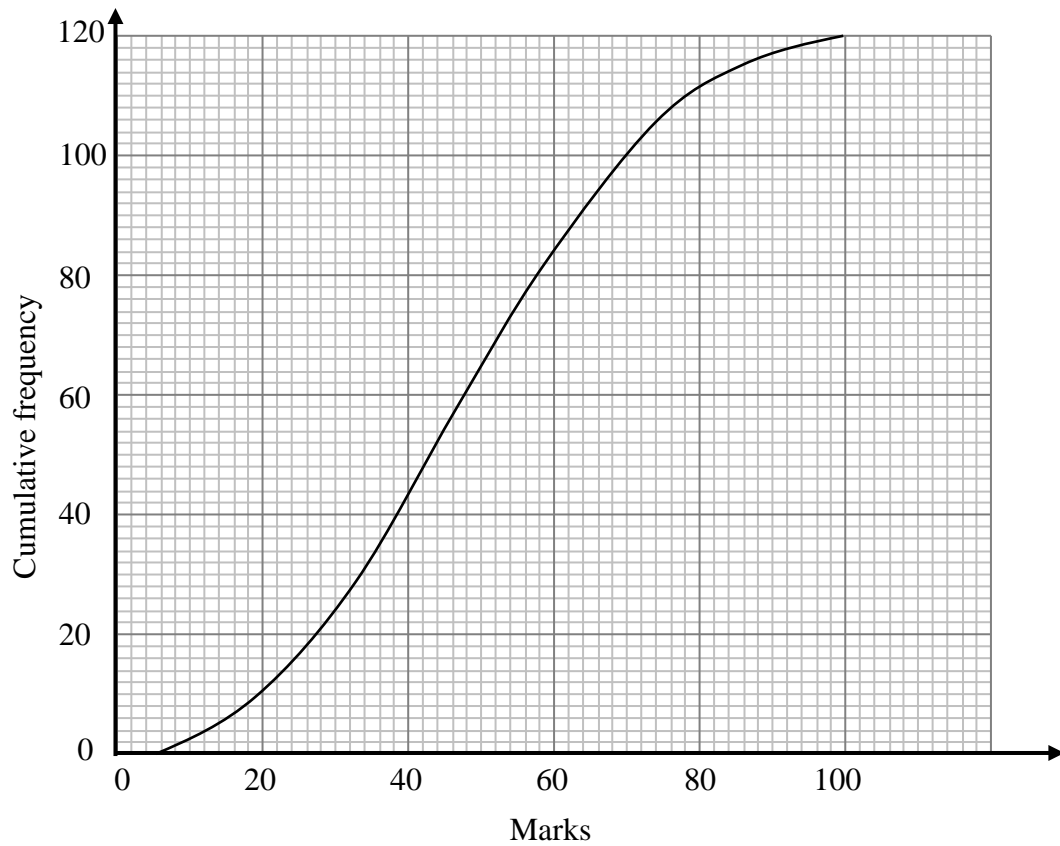
**(b)**  $C$  is a point  $(0,10)$  and  $\overrightarrow{AB} = \overrightarrow{DC}$ .  
Find the coordinates of  $D$ .

*Answer*  $(\dots\dots\dots, \dots\dots\dots)$  [2]

**(c)** What type of quadrilateral is  $ABCD$ ? Explain your answer.

.....  
.....  
..... [1]

- 21** The cumulative frequency curve shows the marks obtained by the 120 students in a recent Mathematics Test. The maximum mark is 100.



- (a) Complete the grouped frequency table for the marks obtained.

Marks obtained by students, $x$	Frequency
$0 \leq x < 20$	10
$20 \leq x < 40$	
$40 \leq x < 60$	
$60 \leq x < 80$	28
$80 \leq x < 100$	8

[1]

- (b) Calculate an estimate of the mean mark.

$$0 \leq x < 20$$

$$20 \leq x < 40$$

$$40 \leq x < 60$$

$$60 \leq x < 80$$

$$80 \leq x < 100$$

Answer .....marks [1]

- (c) Calculate an estimate of the standard deviation.

*Answer* .....marks [2]

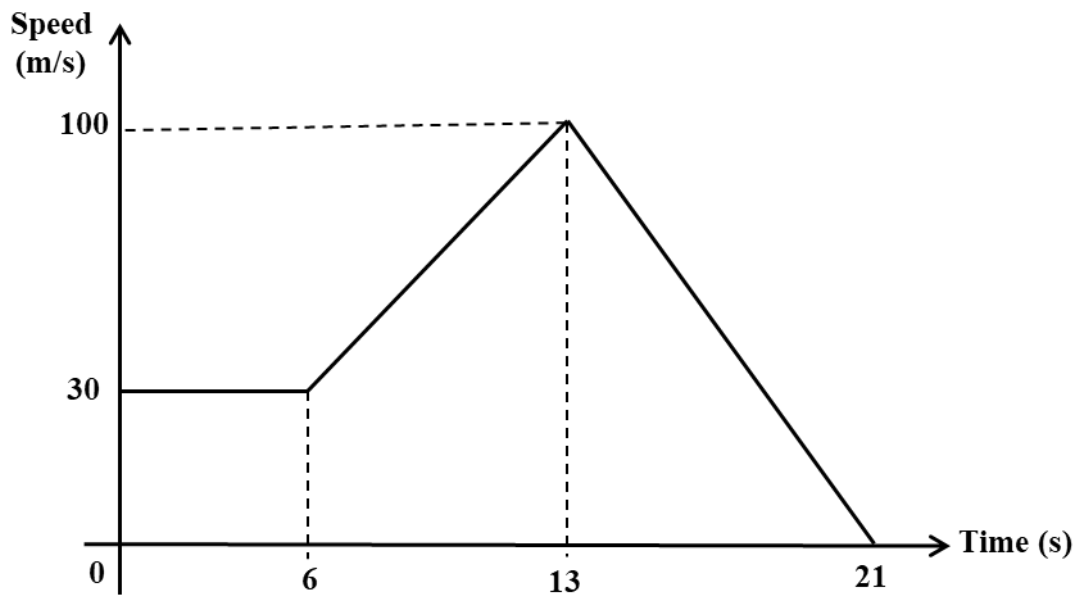
- (d) The passing mark is 50. Two students are chosen at random. Find the probability that both of them passed.

*Answer* ..... [1]

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- 22 The diagram shows the speed-time graph of a particle.



- (a) Find the speed of the particle when  $t = 12\text{s}$ .

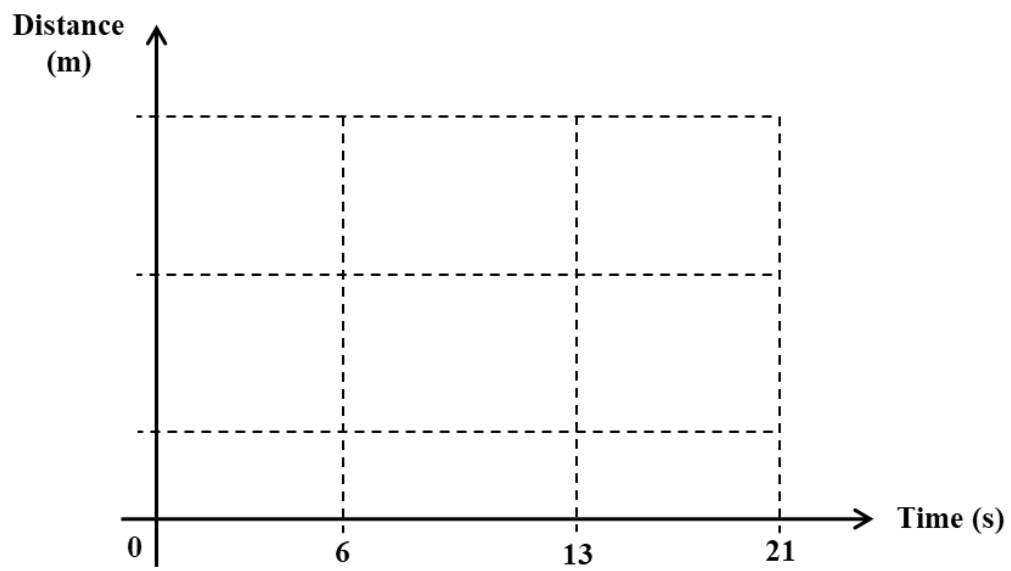
Answer .....m/s [2]

- (b) Find the distance covered before the particle starts to slow down.

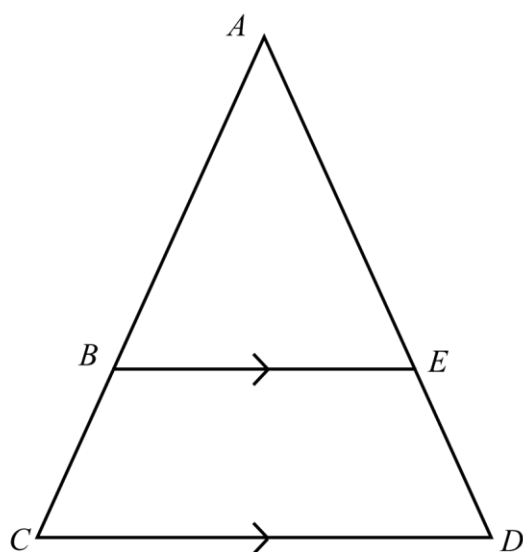
Answer .....m [2]

(c) Complete the distance-time graph of the particle.

[1]



23



In the diagram,  $ABC$  and  $AED$  are straight lines and  $BE$  is parallel to  $CD$ .

- (a) Show that triangle  $ABE$  is similar to triangle  $ACD$ . Give a reason for each statement you make.

.....

.....

.....[2]

- (b) Show that  $\frac{BC}{ED} = \frac{AB}{AE}$ . [2]

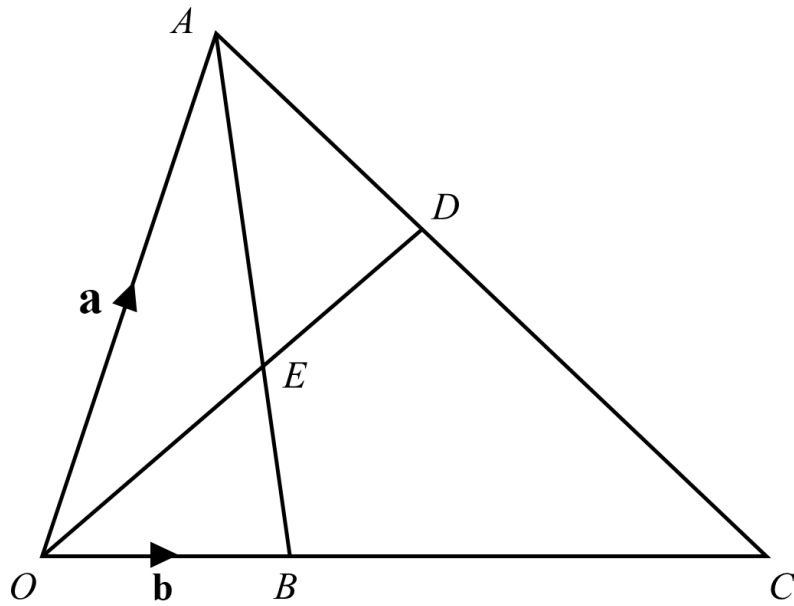
- (c) A circle is drawn with points  $B$ ,  $C$  and  $D$  on its circumference. It is further given that  $\text{angle } BCD + \text{angle } BED > 180^\circ$ . Explain why point  $E$  is **inside** the circle.

.....

.....

.....[1]

24



$OBC$ ,  $ADC$ ,  $AEB$  and  $OED$  are straight lines.

$\overrightarrow{OA} = \mathbf{a}$  and  $\overrightarrow{OB} = \mathbf{b}$ .

$OB = \frac{1}{3}OC$ ,  $AE : EB = 3 : 2$  and  $OE : ED = 1 : 1$ .

(a) Find  $\overrightarrow{OE}$  in terms of  $\mathbf{a}$  and/or  $\mathbf{b}$  as simply as possible.

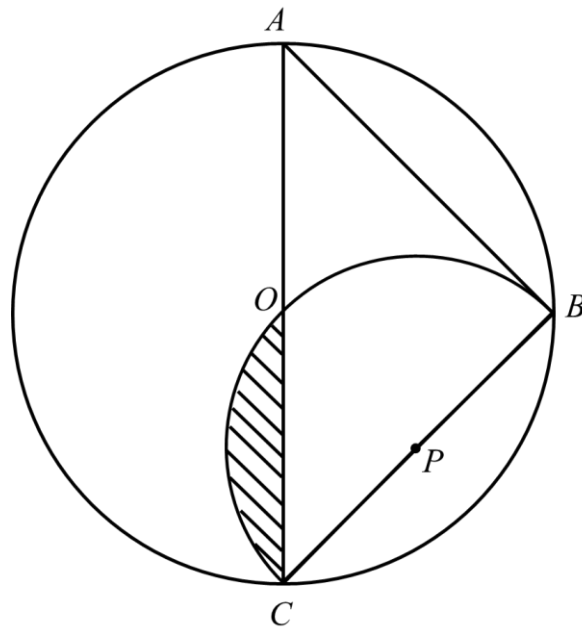
Answer:  $\overrightarrow{OE} = \dots\dots\dots[2]$

- (b) Find the value of  $\frac{\text{area of } \triangle OBE}{\text{area of } BEDC}$ .

*Answer* ..... [2]

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25



$AC$  is a diameter of a circle with centre  $O$ .  $AC = \sqrt{2}r$  and  $AB = BC$ .  
 $COB$  is a semi-circular arc, centre  $P$ .

What percentage of the circle is **not** shaded?

Answer .....% [5]