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MATHEMATICS**0580/31**

Paper 3 (Core)

May/June 2020**2 hours**

You must answer on the question paper.

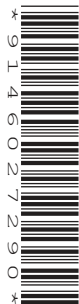
You will need: Geometrical instruments

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For π , use either your calculator value or 3.142.

INFORMATION

- The total mark for this paper is 104.
- The number of marks for each question or part question is shown in brackets [].

This document has **20** pages. Blank pages are indicated.

2

- 1** Gabriela designs the seating layout for a new theatre.
There are three sections of seats, A, B and C.

- (a)** Section A has 152 seats.
Section B has 12.5% more seats than Section A.
Section C has $\frac{3}{8}$ of the number of seats in Section A.

- (i)** Show that the number of seats in Section B is 171.

[1]

- (ii)** Show that the total number of seats is 380.

[2]

- (b)** Write down and simplify the ratio of the number of seats in each section A : B : C.

A : B : C = : : [2]

- (c)** In Section A:

- There are 12 seats in the front row.
- Each row has 2 more seats than the row in front of it.

Work out the number of rows for the 152 seats in Section A.

..... rows [2]

3

- (d)** For a concert in the theatre, the ticket prices are in the ratio

$$A : B : C = 9 : 7 : 4.$$

A ticket for Section C costs \$6.

- (i)** Show that a ticket for Section B costs \$10.50 .

[1]

- (ii)** Find the cost of a ticket for Section A.

\$ [1]

- (iii)** The table shows the number of tickets sold in each section.

Section	Number of tickets sold
A	120
B	136
C	30

Calculate the total amount received from the ticket sales.

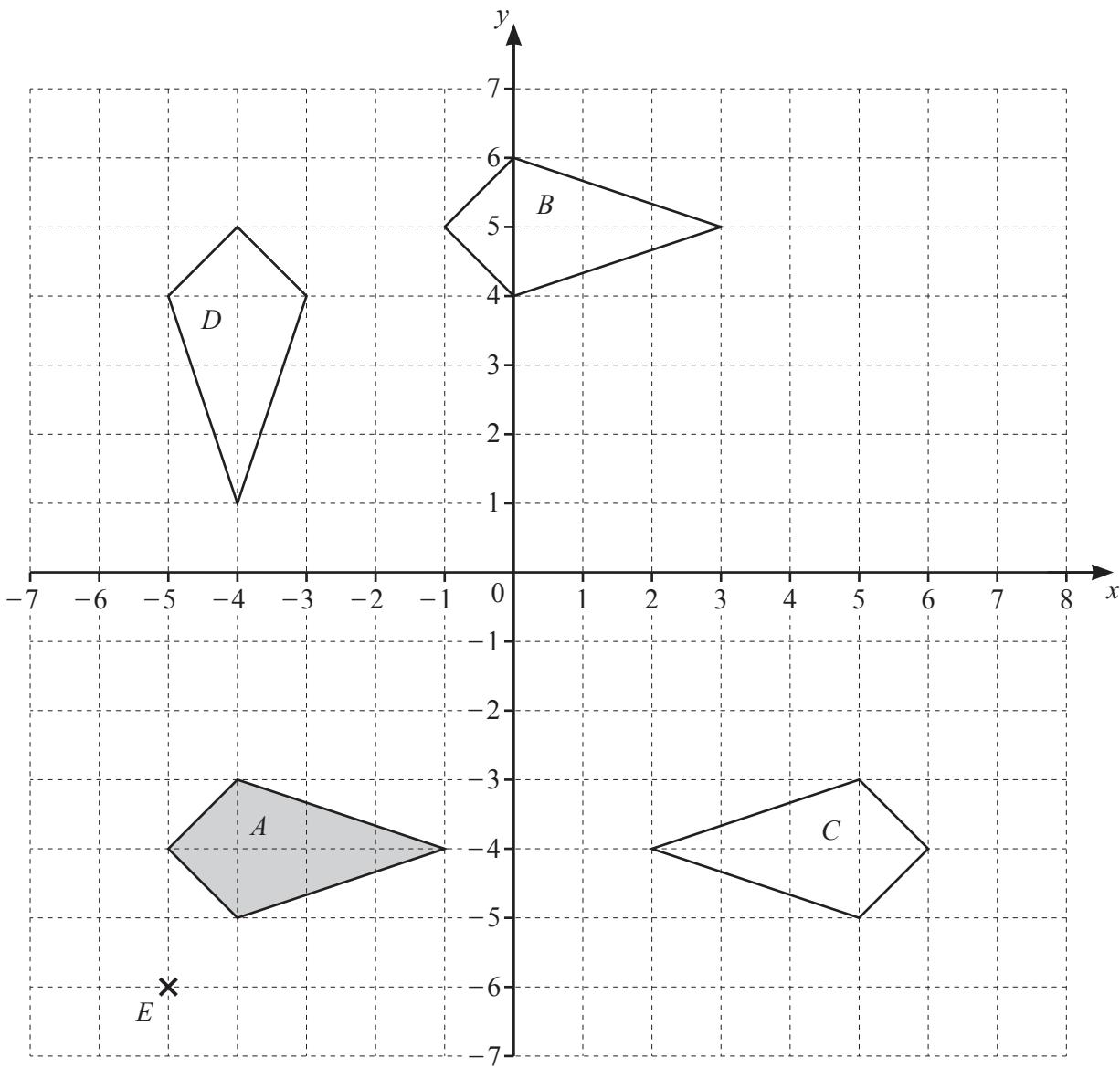
\$ [3]

- (iv)** The concert costs \$4500 to organise.

Calculate the amount received from the ticket sales as a percentage of the \$4500.

..... % [1]

2 The grid shows a point E and four quadrilaterals, A , B , C and D .



(a) Write down the mathematical name of shape A .

..... [1]

5

(b) Describe fully the **single** transformation that maps

(i) shape A onto shape B ,

.....
 [2]

(ii) shape A onto shape C ,

.....
 [2]

(iii) shape A onto shape D .

.....
 [3]

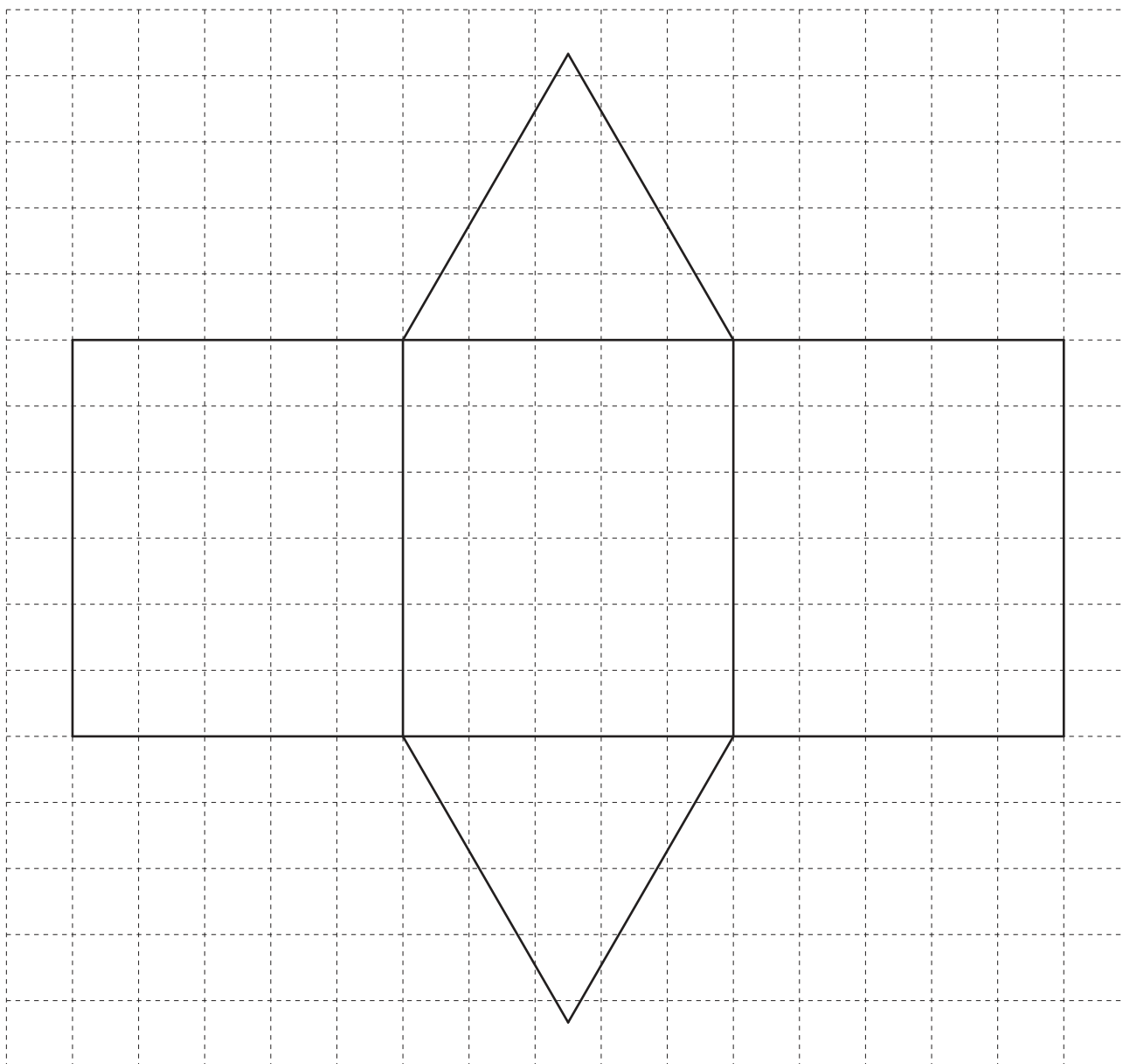
(c) (i) Write down the coordinates of the point E .

(..... ,) [1]

(ii) On the grid, draw the image of shape A after an enlargement by scale factor 3, centre E . [2]

6

- 3 The diagram shows the net of a triangular prism on a 1 cm^2 grid.



- (a) Write down the mathematical name for the type of triangle shown on the grid.

..... [1]

7

(b) (i) Measure the perpendicular height of the triangle.

..... cm [1]

(ii) Calculate the area of the triangle.

..... cm² [2]

(iii) Calculate the volume of the triangular prism.

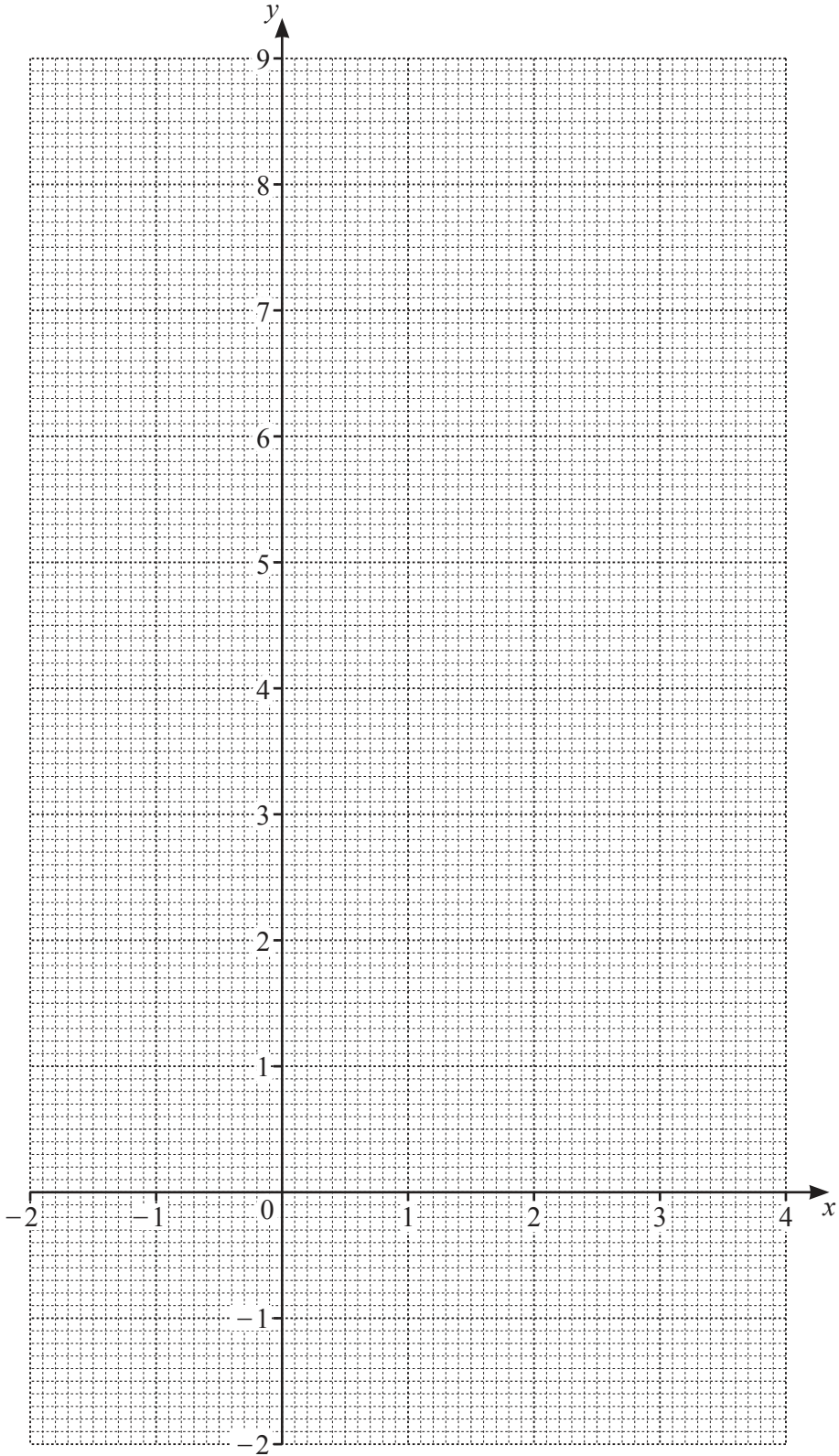
..... cm³ [2]

4 (a) Complete the table of values for $y = 7 + 2x - x^2$.

x	-2	-1	0	1	2	3	4
y	-1			8	7		-1

[2]

(b) On the grid, draw the graph of $y = 7 + 2x - x^2$ for $-2 \leq x \leq 4$.



[4]

9

(c) Write down the equation of the line of symmetry of the graph.

..... [1]

(d) Use your graph to solve the equation $7 + 2x - x^2 = 0$.

$x = \dots\dots\dots$ or $x = \dots\dots\dots$ [2]

10**5 (a)** Using the integers from 60 to 75 only, find**(i)** a multiple of 17,

..... [1]

(ii) the prime numbers.

..... [2]

(b) Find**(i)** the square root of 4489,

..... [1]

(ii) 4^3 ,

..... [1]

(iii) $\sqrt[3]{274\,625}$,

..... [1]

(iv) $2^{-3} \times 24^2$.

..... [1]

11

- (c) Write down the reciprocal of 7.

..... [1]

- (d) Write 3.72194 correct to 3 decimal places.

..... [1]

- (e) Find the lowest common multiple (LCM) of 8 and 14.

..... [2]

- (f) The average temperature at the North Pole is -23°C in January and -11°C in March.

- (i) Find the difference between these temperatures.

..... $^{\circ}\text{C}$ [1]

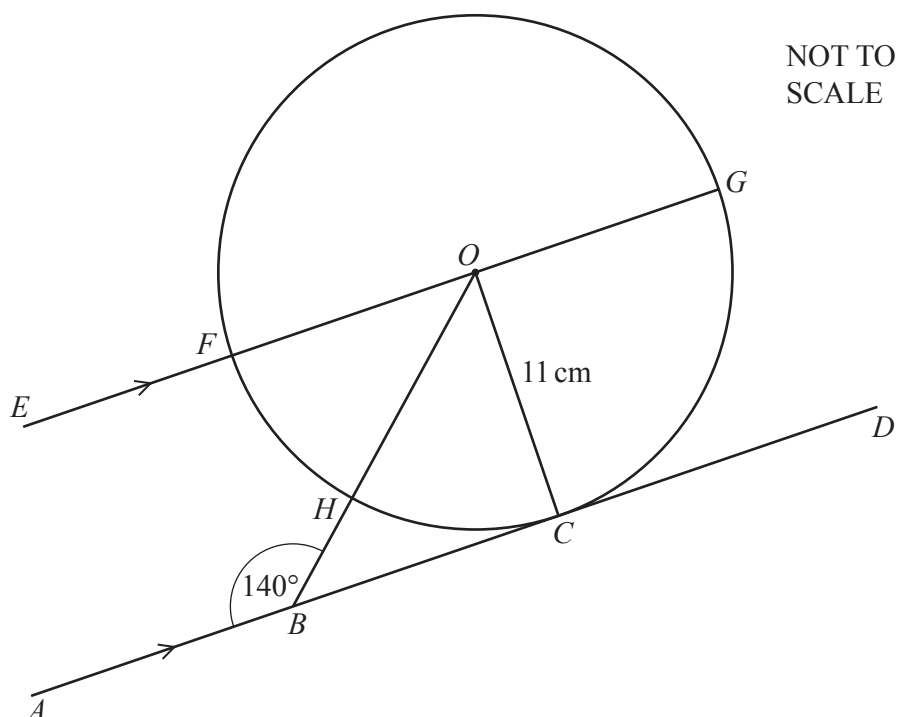
- (ii) The average temperature in July is 28°C higher than the average temperature in March.

Find the average temperature in July.

..... $^{\circ}\text{C}$ [1]

12

6



The diagram shows a circle, centre O , radius 11 cm.
 C , F , G and H are points on the circumference of the circle.
 The line AD touches the circle at C and is parallel to the line EG .
 B is a point on AD and angle $ABO = 140^\circ$.

- (a) Write down the mathematical name of the straight line AD .

..... [1]

- (b) (i) Find, in terms of π , the circumference of the circle.

..... cm [2]

- (ii) Work out angle FOH .

Angle $FOH =$ [2]

- (iii) Calculate the length of the minor arc FH .

..... cm [2]

13

- (c) (i) Give a reason why angle BCO is 90° .

..... [1]

- (ii) Show that $BC = 13.11$ cm, correct to 2 decimal places.

[3]

- (iii) Calculate BH .

$BH =$ cm [3]

- 7 (a) 20 students from College A each run 5 km.
The times, correct to the nearest minute, are recorded.

32	51	25	40	47	21	37	32	48	36
46	39	30	29	44	39	53	35	40	31

- (i) Complete the stem-and-leaf diagram.

2	
3	
4	
5	

Key: 3 | 4 represents 34 minutes [2]

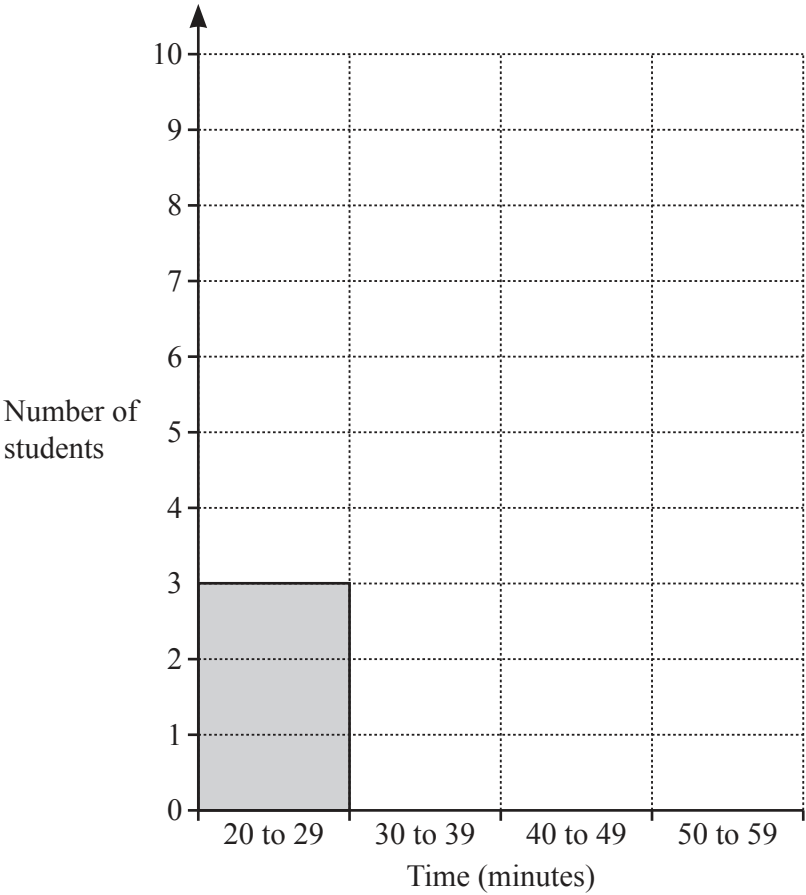
- (ii) Find the range of the times.

..... min [1]

- (iii) Find the median of the times.

..... min [1]

- (iv) Complete the bar chart for the times of the students.

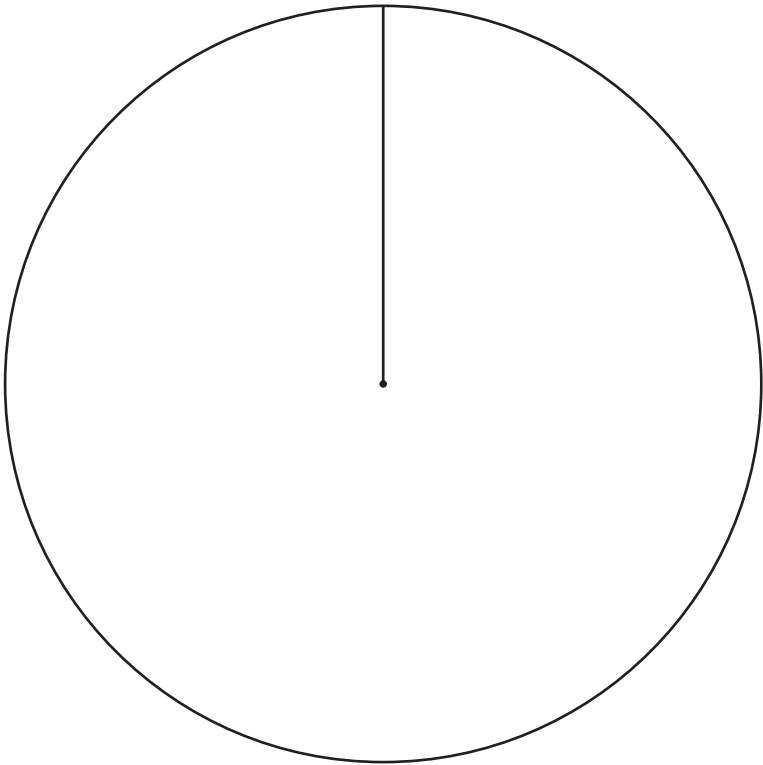


[2]

- (b) 20 students from College B each run 5 km.
Their times, correct to the nearest minute, are recorded and the results are shown in the table.

Time (minutes)	Number of students	Pie chart sector angle
30 to 39	5	90°
40 to 49	8	
50 to 59	7	

- (i) Complete the table. [2]



- (ii) Complete the pie chart. [2]

- (c) Write down two comments comparing the times of students from College A with the times of students from College B.

1
.....

2
..... [2]

16

- 8 (a) Simplify $3c - 5d - c + 2d$.

..... [2]

- (b) Solve the equation $12x - 7 = 23$.

$x =$ [2]

- (c) Multiply out.

$$9(3 - x)$$

..... [1]

- (d) $A = \frac{(a+b)h}{2}$

Work out the value of h when $A = 38.64$, $a = 5.5$ and $b = 3.7$.

$h =$ [3]

17

- (e) Alphonse is x years old and Beatrice is y years old.
Three times Alphonse's age is equal to 5 times Beatrice's age.
Twice Beatrice's age is 4 years more than Alphonse's age.
- (i) Use this information to write down two equations in x and y .

.....

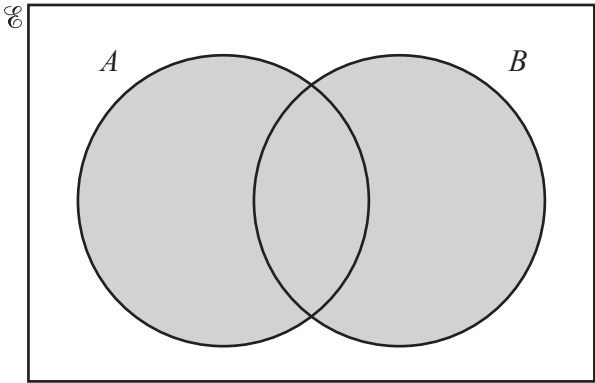
..... [2]

- (ii) Find the age of Alphonse and the age of Beatrice.

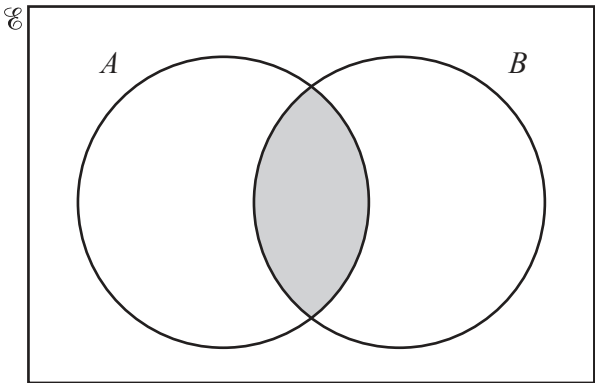
Alphonse years old

Beatrice years old [3]

9 (a) Use set notation to describe the shaded region in each Venn diagram.



.....

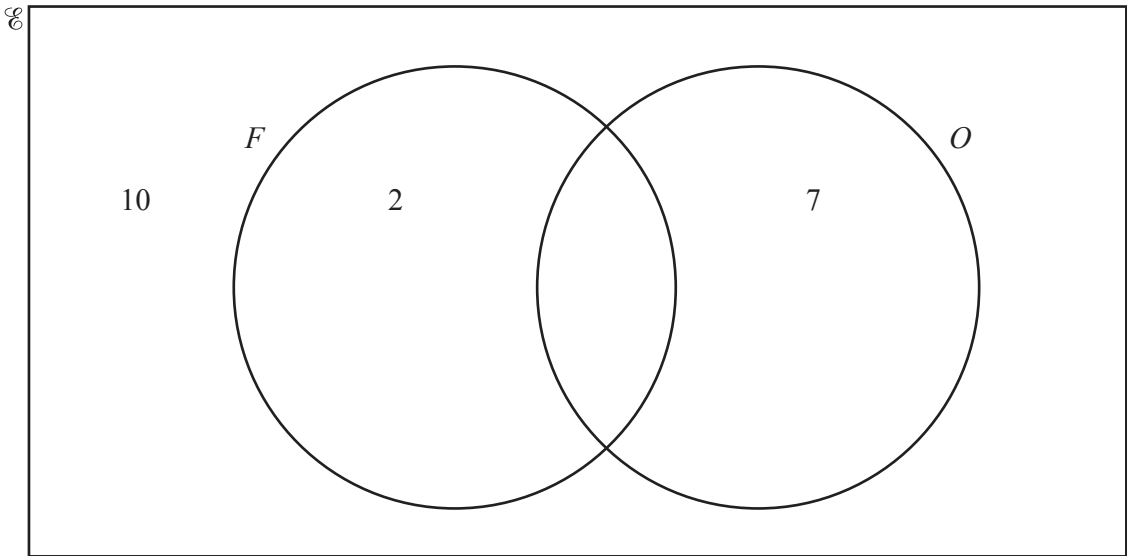


.....

[2]

- (b) $\mathcal{E} = \{x : x \text{ is a natural number } \leq 15\}$
 $F = \{x : x \text{ is a factor of } 12\}$
 $O = \{x : x \text{ is an odd number}\}$

(i) Complete the Venn diagram to show the elements of these sets.



[2]

19

- (ii) Write down one number that is in set O , but not in set F .

..... [1]

- (iii) Find $n(F \cup O)$.

..... [1]

- (iv) A number is chosen at random from $\mathcal{C}$.

Work out the probability that this number is in set O .

..... [1]

Question 10 is printed on the next page.

10 Point B is 36 km from point A on a bearing of 140° .

(a) Using a scale of 1 centimetre to represent 4 kilometres, mark the position of B .



Scale: 1 cm to 4 km

[2]

(b) (i) Point C is 28 km from A and 20 km from B .
The bearing of C from A is less than 140° .

Using a ruler and compasses only, construct triangle ABC .
Show all your construction arcs.

[3]

(ii) Measure angle ACB .

Angle $ACB = \dots\dots\dots$ [1]

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