Cambridge Assessment International Education

Cambridge O Level

CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER				

7986218105

MATHEMATICS (SYLLABUS D) **4024/22**

Paper 2 **October/November 2022**

2 hours 30 minutes

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 100.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **20** pages. Any blank pages are indicated.

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1 **(a)** Hala travels from London to Marseille by train.
She must change trains in Paris.

The journey from London to Paris takes 2 hours 28 minutes.
The journey from Paris to Marseille takes 3 hours 30 minutes.

The local time in Marseille and in Paris is 1 hour ahead of the local time in London.

(i) Complete the timetable for Hala's journey.

	Local time
London depart	.....
Paris arrive	16 50

	Local time
Paris depart	19 31
Marseille arrive	.....

[2]

(ii) Work out how long Hala waits in Paris before the train to Marseille departs.

.....hours ..... minutes [1]

(b) The exchange rate between dollars ($) and pounds (£) is $1 = £0.75 .
The exchange rate between dollars ($) and euros (€) is $1 = €$r$.

Hala changes £250 into euros.
She receives €290.

Calculate the value of r.

r = ... [3]

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(c) **(i)** Josef books a holiday for 3 people.
The holiday costs $420 per person.
Josef pays a deposit of 20% of the total cost of the holiday.

Calculate the amount Josef pays as the deposit.

$ ..... [2]

(ii) Josef pays a total of $85.68 for airport parking for 8 days.
This price includes a reduction of 15% of the full price for booking early.

Calculate the full price for airport parking for 1 day.

$ ..... [3]

2 **(a)** Marco grows two types of tomato plants, type A and type B.
He counts the number of tomatoes growing on each tomato plant.

The results for type A plants are shown in the table.

Number of tomatoes on plant	17	18	19	20	21	22
Frequency	5	2	7	3	2	1

(i) Calculate the mean number of tomatoes per plant.

..... [2]

(ii) Calculate the range.

..... [1]

(iii) The mean number of tomatoes per plant for type B plants is 17.1 and the range is 8.

Make two comments comparing the number of tomatoes growing on type A and type B plants.

1 .....

.....

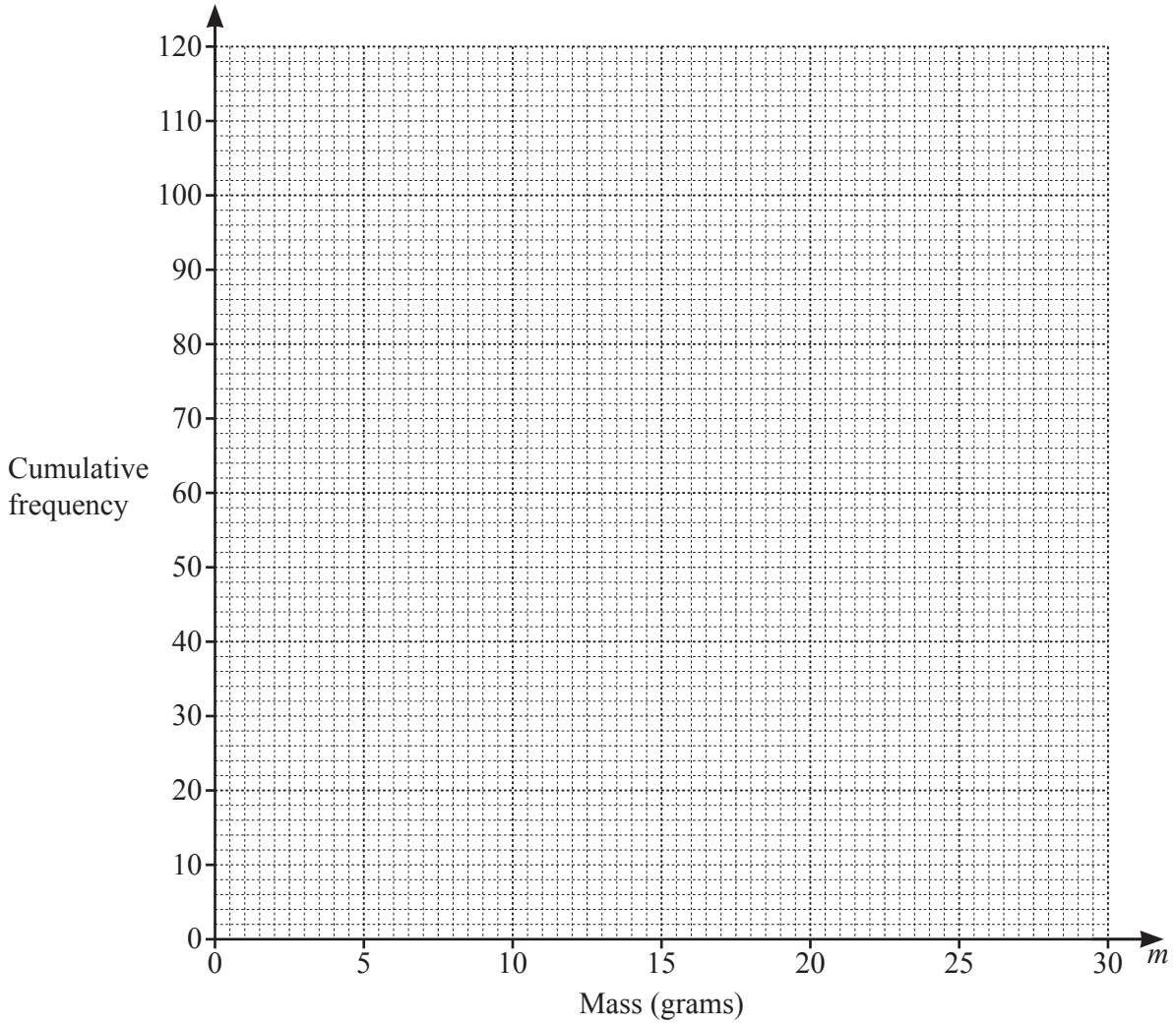
2 .....

..... [2]

(b) Marco also grows strawberries.
He records the masses, m grams, of 120 of his strawberries.
The frequency table shows the results.

Mass (m grams)	$5 < m \leqslant 10$	$10 < m \leqslant 15$	$15 < m \leqslant 20$	$20 < m \leqslant 25$	$25 < m \leqslant 30$
Frequency	15	38	45	17	5

(i) Draw a cumulative frequency diagram to represent these results.



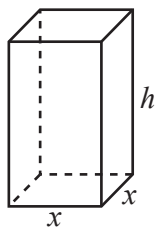
[3]

(ii) Marco uses strawberries with a mass greater than 21 grams to make jam.

Use your diagram to find an estimate for the percentage of strawberries he uses to make jam.

..... % [3]

3



A cuboid has height h cm and a square base of edge x cm.
The volume of the cuboid is 60 cm^3.

(a) Show that the surface area, A cm^2, of the cuboid is given by $A = 2x^2 + \frac{240}{x}$.

[2]

(b) Complete the table for $A = 2x^2 + \frac{240}{x}$.

x	1	2	3	4	5	6	7	8
A	242	128	98	92			132	158

[2]

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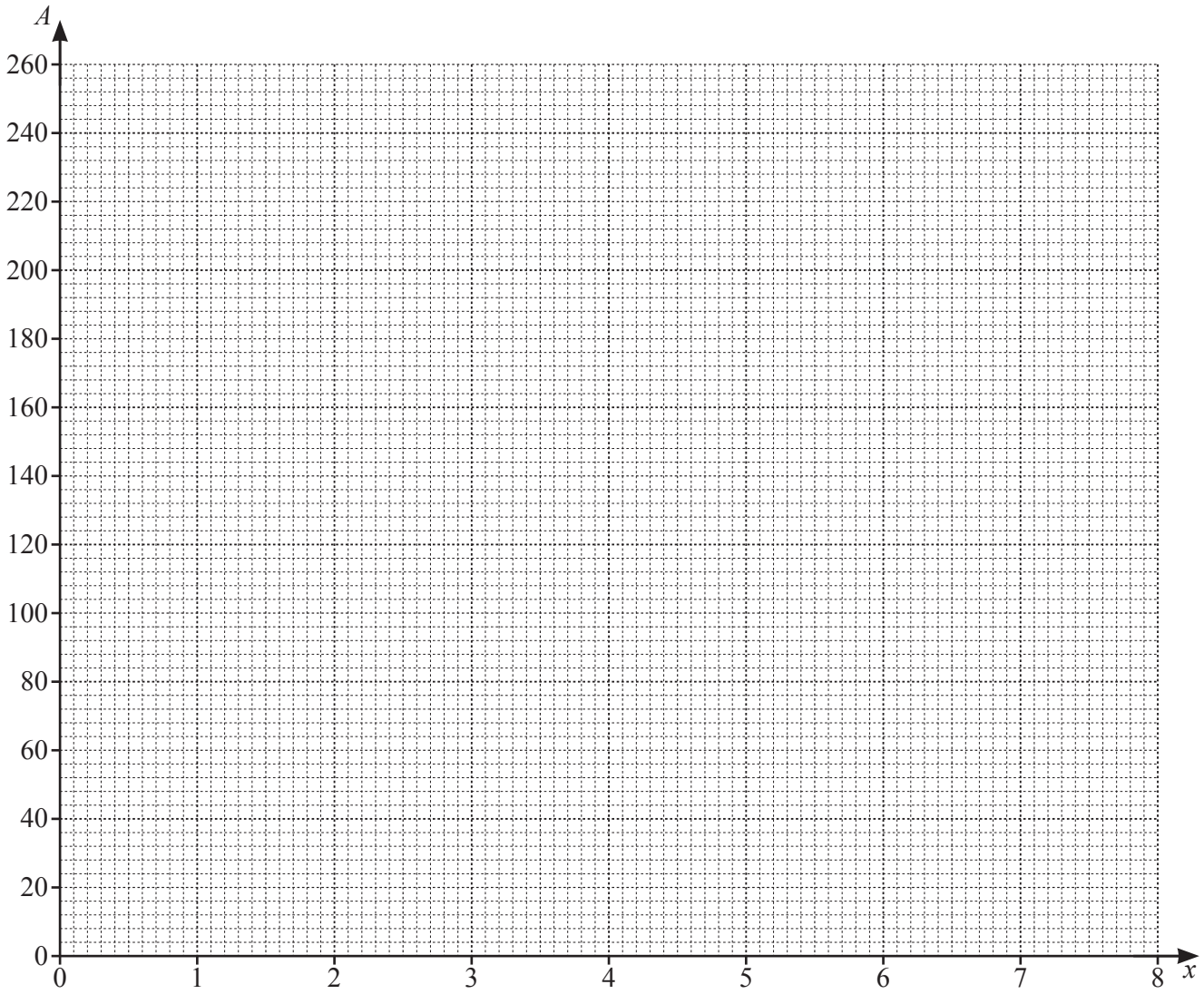
(c) On the grid, draw the graph of $A = 2x^2 + \frac{240}{x}$ for $1 \leqslant x \leqslant 8$.



[3]

(d) Find the minimum possible surface area of the cuboid.

..... cm^2 [1]

(e) The cuboid has a surface area of $120\,cm^2$.
The height of the cuboid is greater than the length of the edge of its base.

Find the dimensions of the cuboid.

..... cm by ..... cm by ..... cm [3]

4 **(a)** $\mathscr{E} = \{x : x \text{ is an integer } 10 \leqslant x \leqslant 40\}$
$P = \{x : x \text{ is a multiple of } 6\}$
$Q = \{x : x \text{ is a square number}\}$

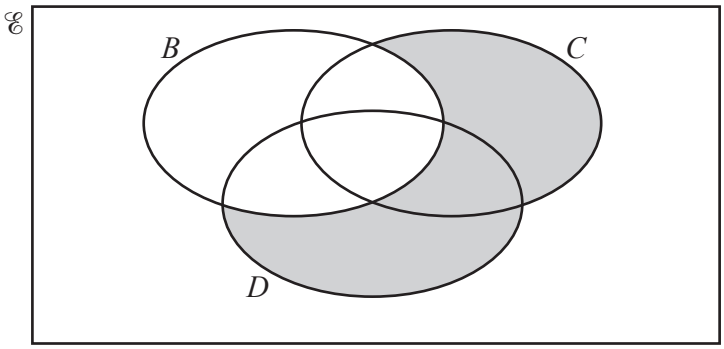
(i) Write down the elements of $P \cup Q$.

..... [1]

(ii) Find $\mathrm{n}(P' \cap Q)$.

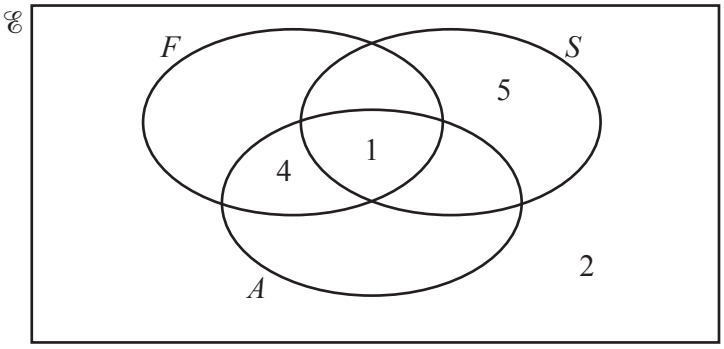
..... [1]

(b) Use set notation to describe the shaded region in the Venn diagram.



..... [1]

(c) In a college, students can study French (F), Spanish (S) and Arabic (A).
A group of 25 students are asked which languages they study.
Some of the results are shown in the Venn diagram.



(i) All students who study both Arabic and Spanish also study French.
7 students study French only.
8 students study Arabic.

Use this information to complete the Venn diagram.

[2]

(ii) Two of the 25 students are selected at random.

Find the probability that they both study Spanish only.

..... [2]

(iii) Three of the students are selected at random from those who study French.

Find the probability that only one of them also studies Arabic.

..... [3]

5 **(a)** A bag contains x five-cent coins and y ten-cent coins.

(i) There is a total of 130 coins in the bag.

Write down an equation, in terms of x and y, for the total number of coins in the bag.

..... [1]

(ii) The total value of the coins in the bag is \$8.15 .

Write down an equation, in terms of x and y, for the total value of the coins in the bag.

..... [1]

(iii) Solve the two simultaneous equations to find the number of each type of coin in the bag.
Show your working.

Five-cent coins = ...

Ten-cent coins = ... [3]

(b) A machine makes five-cent coins.
It makes 720 coins per minute.
The machine operates for 24 hours per day.

Calculate the total value, in dollars, of the coins made by the machine in 300 days.
Give your answer in standard form, correct to 3 significant figures.

\$ ..... [3]

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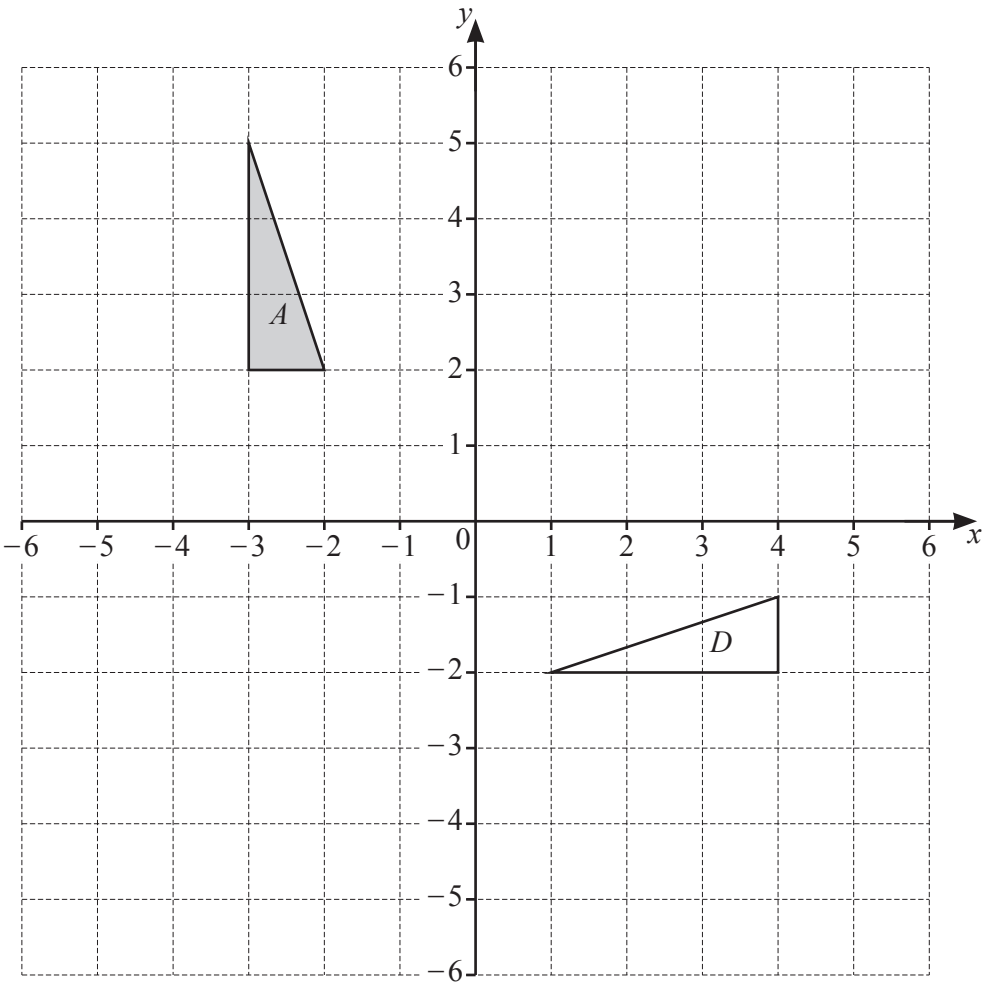
(c) The diameter of a five-cent coin is 21.2 mm, correct to the nearest 0.1 mm.
The diameter of a ten-cent coin is 17.9 mm, correct to the nearest 0.1 mm.
Marlon makes a line of 10 five-cent coins and a line of 10 ten-cent coins.

Calculate the upper bound of the difference between the lengths of the two lines.

..... mm [3]

6



(a) Reflect triangle A in the line $x = 1$.

Label the image B. [2]

(b) Triangle A is mapped onto triangle D by a combination of two transformations.
Triangle A is first mapped onto triangle C by transformation Y.

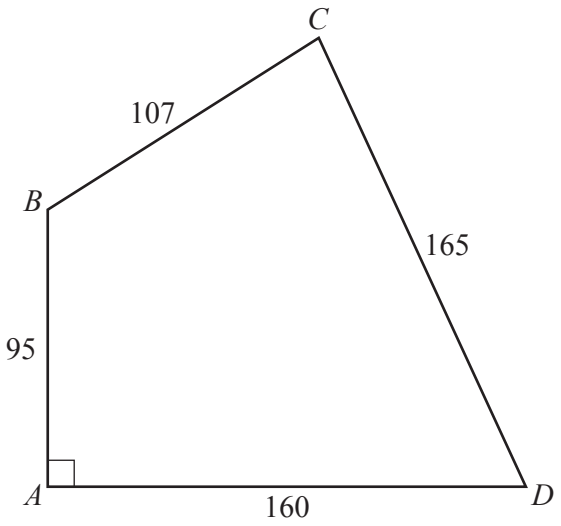
Triangle C is then mapped onto triangle D by a translation of $\begin{pmatrix} 6 \\ 1 \end{pmatrix}$.

Describe fully transformation Y.

.....

..... [5]

7



NOT TO SCALE

ABCD is the floor plan of an exhibition hall with dimensions shown in metres.
Points *A*, *B*, *C* and *D* all lie on the same horizontal plane.

(a) Calculate angle *BCD*.

Angle *BCD* = ... [4]

(b) A light is attached to the ceiling vertically above *B*.
The angle of elevation of the light from *C* is 8.2°.

Calculate the angle of elevation of the light from *A*.

..... [4]

8 **(a)** Simplify.

$6v + 3w - 5w - v$

..... [2]

(b) Solve.

$5x - 7 = 10$

$x =$ ..... [2]

(c) Simplify.

(i) $a \times a \times a^2$

..... [1]

(ii) $b^3 \div b^5$

..... [1]

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(d) $r = 4p - 3t$

(i) Find the value of r when $p = 7$ and $t = -5$.

$r =$ ..... [1]

(ii) Rearrange the formula to make p the subject.

$p =$ ..... [2]

(e) Solve.

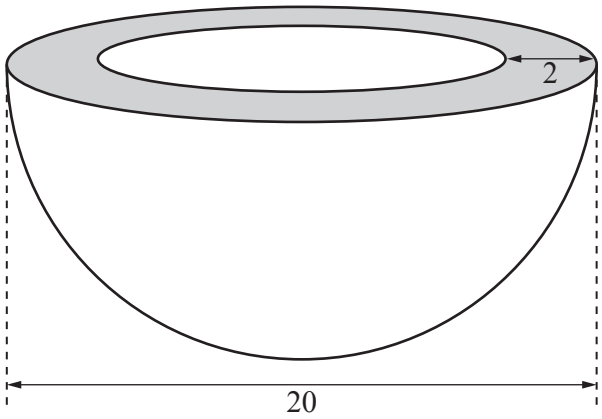
$5x^2 + 3x - 6 = 0$

Show all your working and give your answers correct to 3 significant figures.

$x =$ ..... or $x =$ ..... [3]

9 **[Volume of a sphere $= \frac{4}{3}\pi r^3$]**

[Surface area of a sphere $= 4\pi r^2$]



The diagram shows a wooden bowl.
It is made in the shape of a large hemisphere with a small hemisphere removed from the centre.
The diameter of the large hemisphere is 20 cm.
The width of the rim of the bowl is 2 cm.

(a) Show that the total surface area of the bowl is $364\pi\,\text{cm}^2$.

[3]

(b) The bowl is made from wood.
The mass of $1\,cm^3$ of the wood is $0.74\,g$.

Calculate the mass of the bowl.

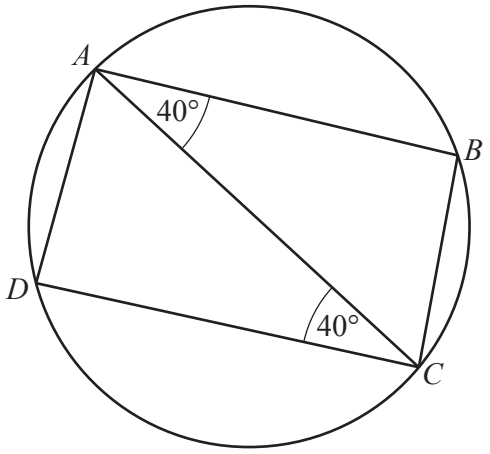
..... g [3]

(c) Another bowl is mathematically similar to the first bowl and is made from the same type of wood.
The total surface area of the second bowl is $546\pi\,cm^2$.

Calculate the mass of the second bowl.

..... g [3]

10 (a)



NOT TO SCALE

A, B, C and D are points on a circle.
AC is a diameter of the circle.
$A\hat{C}D = C\hat{A}B = 40°$.

(i) Show that triangle ABC is congruent to triangle CDA.
Give a reason for each statement you make.

.....

.....

.....

..... [3]

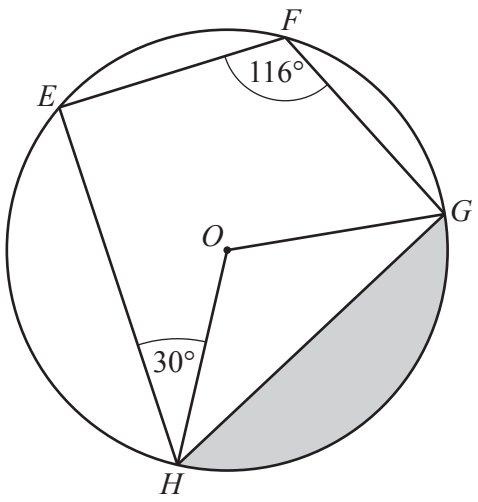
(ii) Explain why $ABCD$ is a rectangle.

.....

.....

..... [2]

(b)



NOT TO SCALE

E, F, G and H are points on a circle with centre O and radius 6 cm.
$E\hat{H}O = 30°$ and $E\hat{F}G = 116°$.

Calculate the shaded area.

..... cm^2 [5]

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