Cambridge
O Level

Cambridge International Examinations
Cambridge Ordinary Level

CANDIDATE NAME

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5220937132

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

Paper 2 **May/June 2014**

2 hours 30 minutes

Candidates answer on the Question Paper.

Additional Materials: Geometrical instruments
Electronic calculator

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Section A
Answer **all** questions.

Section B
Answer any **four** questions.

If working is needed for any question it must be shown in the space below that question.
Omission of essential working will result in loss of marks.
You are expected to use an electronic calculator to evaluate explicit numerical expressions.
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 π, use either your calculator value or 3.142, unless the question requires the answer in terms of π.

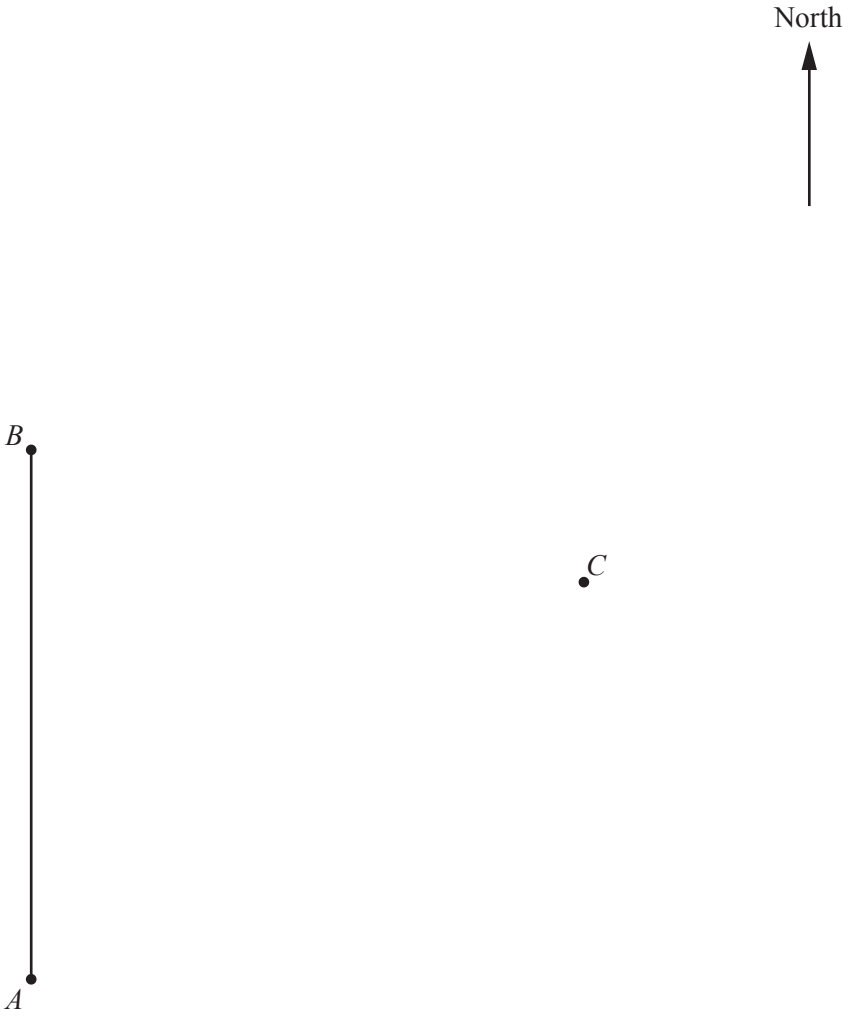
The number of marks is given in brackets [ ] at the end of each question or part question.
The total of the marks for this paper is 100.

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Section A [52 marks]

Answer **all** questions in this section.

1 The scale drawing shows three airfields, *A*, *B* and *C*, with *B* due north of *A*.
The scale is 1 cm to 20 km.



(a) Find the actual distance between *A* and *B*.

Answer ..... km [1]

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(b) A beacon, D, is to the west of the line AB.
It is 100 km from A and 120 km from B.

Construct the position of D on the scale drawing. [2]

(c) Measure the bearing of C from B.

Answer ..... [1]

(d) An aircraft is

- equidistant from A and C,
- 90 km from B.

(i) By constructing suitable loci, mark on the diagram the two possible positions, P and Q, of the aircraft. [3]

(ii) Given that the aircraft is east of the line AB, find, by measuring, its bearing from C.

Answer ..... [1]

2 **(a)** $f = \dfrac{6c^2 - d}{4}$

(i) Find f when $c = 8$ and $d = -4$.

Answer ..... [1]

(ii) Express c in terms of d and f.

Answer ..... [2]

(b) Solve $17 - 5x \leqslant 2x + 3$.

Answer ..... [2]

(c) Factorise $9 - 25x^2$.

Answer ..... [1]

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(d) Factorise completely $8px + 6qy - 3qx - 16py$.

Answer ..... [2]

(e) Solve $5x^2 + 6x - 13 = 0$.

Give your answers correct to two decimal places.

Answer $x =$ ..... or ..... [4]

3 **(a)** Mariam works in a shop.
She earns \$5.20 per hour.
She also earns a bonus of 15% of the value of the items she sells in a week.

(i) In one week she works for 32 hours and sells items with a value of £2450.

Calculate Mariam's total earnings for the week.

Answer \$ ..... [2]

(ii) In another week, Mariam worked for 28 hours and earned a total of \$409.60 .

Calculate the value of the items she sold that week.

Answer \$ ..... [3]

(b) **(i)** Jack opens a bank account paying simple interest.
He pays in \$800 and leaves it in the account for 4 years.
At the end of 4 years he closes the account and receives \$920.

Calculate the percentage rate of simple interest paid per year.

Answer .....% [2]

(ii) Jack uses some of the \$920 to pay for a holiday and a computer.
He saves the remainder.
The money is divided between the holiday, computer and savings in the ratio 4 : 5 : 7 .

Calculate the amount he saves.

Answer \$ ..... [2]

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4 A bag contains six identical balls numbered 2, 3, 4, 5, 6 and 7.

(a) A ball is taken from the bag at random.

Find, as a fraction in its lowest terms, the probability that the number on the ball is

(i) a multiple of 3,

Answer ..... [1]

(ii) prime.

Answer ..... [1]

(b) All six balls are replaced in the bag.
Two balls are taken from the bag, one after the other, without replacement.
The numbers on the two balls are added together.

(i) Complete this possibility diagram to show all the outcomes.

+	2	3	4	5	6	7
2		5	6	7	8	9
3						
4						
5						
6						
7						

[1]

(ii) Find the probability that the sum of the numbers is

(a) odd,

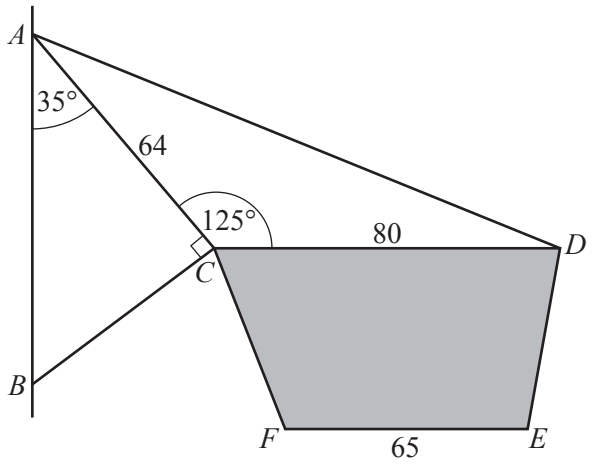
Answer ..... [1]

(b) less than 8.

Answer ..... [1]

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5



The diagram shows a framework $ABCD$ supporting a shop sign.
The framework is fixed to a vertical wall AB with CD horizontal.
$AC = 64$ cm and $CD = 80$ cm.
$B\hat{A}C = 35°$, $B\hat{C}A = 90°$ and $A\hat{C}D = 125°$.

(a) Calculate AB.

Answer ..... cm [2]

(b) Calculate AD.

Answer ..... cm [3]

(c) Calculate $A\hat{D}C$.

Answer ..... [3]

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(d) On the sign *CDEF*, *FE* is parallel to *CD* and is 40 cm below it.
FE = 65 cm.

Calculate the area of the sign *CDEF*.

Answer ..... cm^2 [2]

---

6 **(a)** The first five terms of a sequence are 17, 11, 5, −1, −7.

Find, in terms of *n*, an expression for the *n*th term of this sequence.

Answer ..... [2]

(b) The *n*th term, S_n, of a different sequence is found using the formula $S_n = n^2 + 3n$.

(i) Work out the first four terms of this sequence.

Answer ....., ..., ..., ... [2]

(ii) The *n*th term, T_n, of another sequence is found using the formula $T_n = 5n - 12$.
There are two values of *n* for which $\frac{S_n}{T_n} = 6$.

Form and solve an equation in *n* to find these two values.

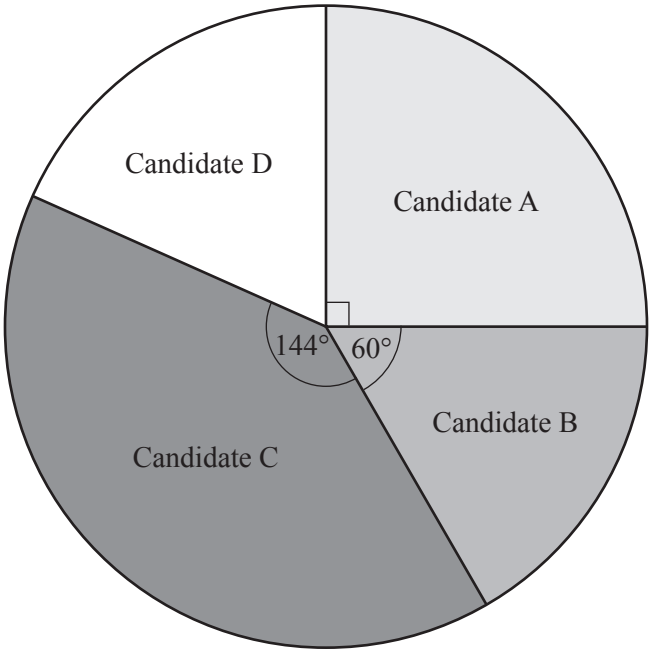
Answer *n* = ... and ..... [4]

Section B [48 marks]

Answer **four** questions in this section.

Each question in this section carries 12 marks.

7 **(a)** The pie chart summarises the results of a local election.



(i) Candidate B received 1600 votes.

Work out the total number of people who voted in the election.

Answer ..... [2]

(ii) What fraction of the vote did candidate D receive?
Give your answer in its lowest terms.

Answer ..... [1]

(iii) How many more votes than candidate A did candidate C receive?

Answer ..... [2]

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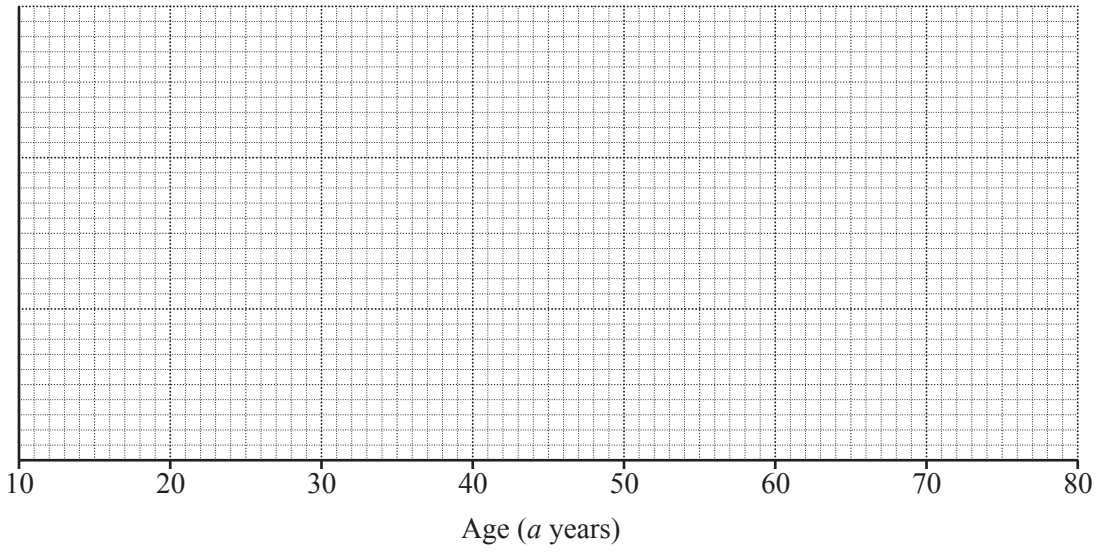
(b) The table summarises the ages of the members of a film club.

Age (a years)	$15 \leqslant a < 20$	$20 \leqslant a < 30$	$30 \leqslant a < 40$	$40 \leqslant a < 60$	$60 \leqslant a < 80$
Frequency	12	36	45	33	24

(i) Calculate an estimate of the mean age of the members.

Answer ..... [3]

(ii) On the grid below, draw a histogram to represent this data.



[3]

(iii) Find an estimate for the number of members of the film club who are over 50.

Answer ..... [1]

8 **(a)** In this question you may use the grid below to help you.

The point P has position vector $\begin{pmatrix} 4 \\ 2 \end{pmatrix}$ and the point Q has position vector $\begin{pmatrix} 8 \\ -3 \end{pmatrix}$.

(i) Find $\overrightarrow{PQ}$.

Answer $\begin{pmatrix} \quad \\ \quad \end{pmatrix}$ [1]

(ii) Find $|\overrightarrow{PQ}|$.

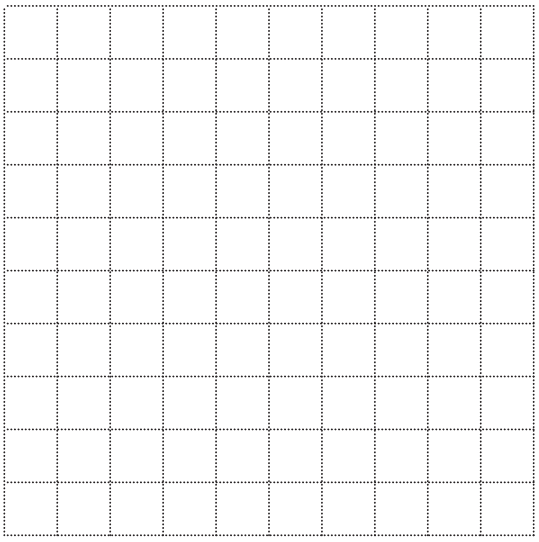
Answer ..... [1]

(iii) Find the equation of the line PQ.

Answer ..... [2]

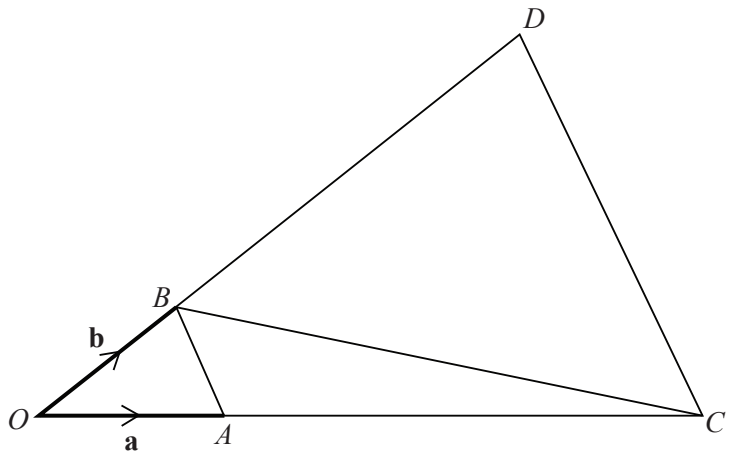
(iv) Given that Q is the midpoint of the line PR, find the coordinates of R.

Answer (..... , ...) [2]



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(b)



In the diagram triangles OAB and OCD are similar.
$\overrightarrow{OA} = \mathbf{a}$, $\overrightarrow{OB} = \mathbf{b}$ and $\overrightarrow{BC} = 4\mathbf{a} - \mathbf{b}$.

(i) Express, as simply as possible, in terms of **a** and/or **b**

(a) $\overrightarrow{AB}$,

Answer ..... [1]

(b) $\overrightarrow{AC}$,

Answer ..... [1]

(c) $\overrightarrow{CD}$.

Answer ..... [2]

(ii) Find, in its simplest form, the ratio

(a) perimeter of triangle OAB : perimeter of triangle OCD,

Answer ..... : ..... [1]

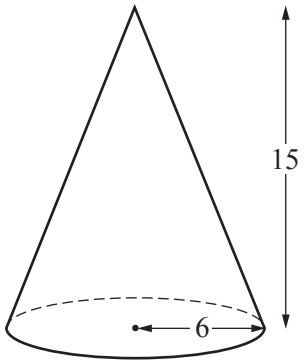
(b) area of triangle OAB : area of trapezium $ABDC$.

Answer ..... : ..... [1]

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9 **[Volume of a cone = $\frac{1}{3}\pi r^2 h$]**

[Curved surface area of a cone = πrl]



The diagram shows a solid cone of height 15 cm and base radius 6 cm.

(a) Show that the slant height of the cone is 16.2 cm, correct to one decimal place.

[1]

(b) Calculate the **total** surface area of the cone.

Answer ..... cm^2 [3]

(c) Calculate the volume of the cone.

Answer ..... cm^3 [2]

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(d) The cone is made from wood.
The mass of $1\,m^3$ of the wood is 560 kg.

Calculate the mass of the cone in grams.

Answer ..... g [2]

(e) Another cone is made of the same material and is geometrically similar to the first.
The mass of the second cone is double the mass of the first.

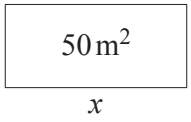
(i) Calculate the height of the second cone.

Answer ..... cm [2]

(ii) Calculate the **total** surface area of the second cone.

Answer ..... cm^2 [2]

10 Adil wants to fence off some land as an enclosure for his chickens.
The enclosure will be a rectangle with an area of $50\,m^2$.



(a) The enclosure is x m long.

Show that the total length of fencing, L m, required for the enclosure is given by

$$L = 2x + \frac{100}{x}.$$

[2]

(b) The table below shows some values of x and the corresponding values of L, correct to one decimal place where appropriate, for $L = 2x + \frac{100}{x}$.

x	2	4	6	8	10	12	14	16	18	20
L	54	33	28.7	28.5	30	32.3	35.1	38.3		

Complete the table. [2]

(c) On the grid opposite
draw a horizontal x-axis for $0 \leqslant x \leqslant 20$ using a scale of 1 cm to represent 2 m
and a vertical L-axis for $0 \leqslant L \leqslant 60$ using a scale of 2 cm to represent 10 m.

On the grid, plot the points given in the table and join them with a smooth curve. [3]

(d) Adil only has 40 m of fencing.

Use your graph to find the range of values of x that he can choose.

Answer ..... $\leqslant x \leqslant$ ..... [2]

(e) **(i)** Find the minimum length of fencing Adil could use for the enclosure.

Answer ..... m [1]

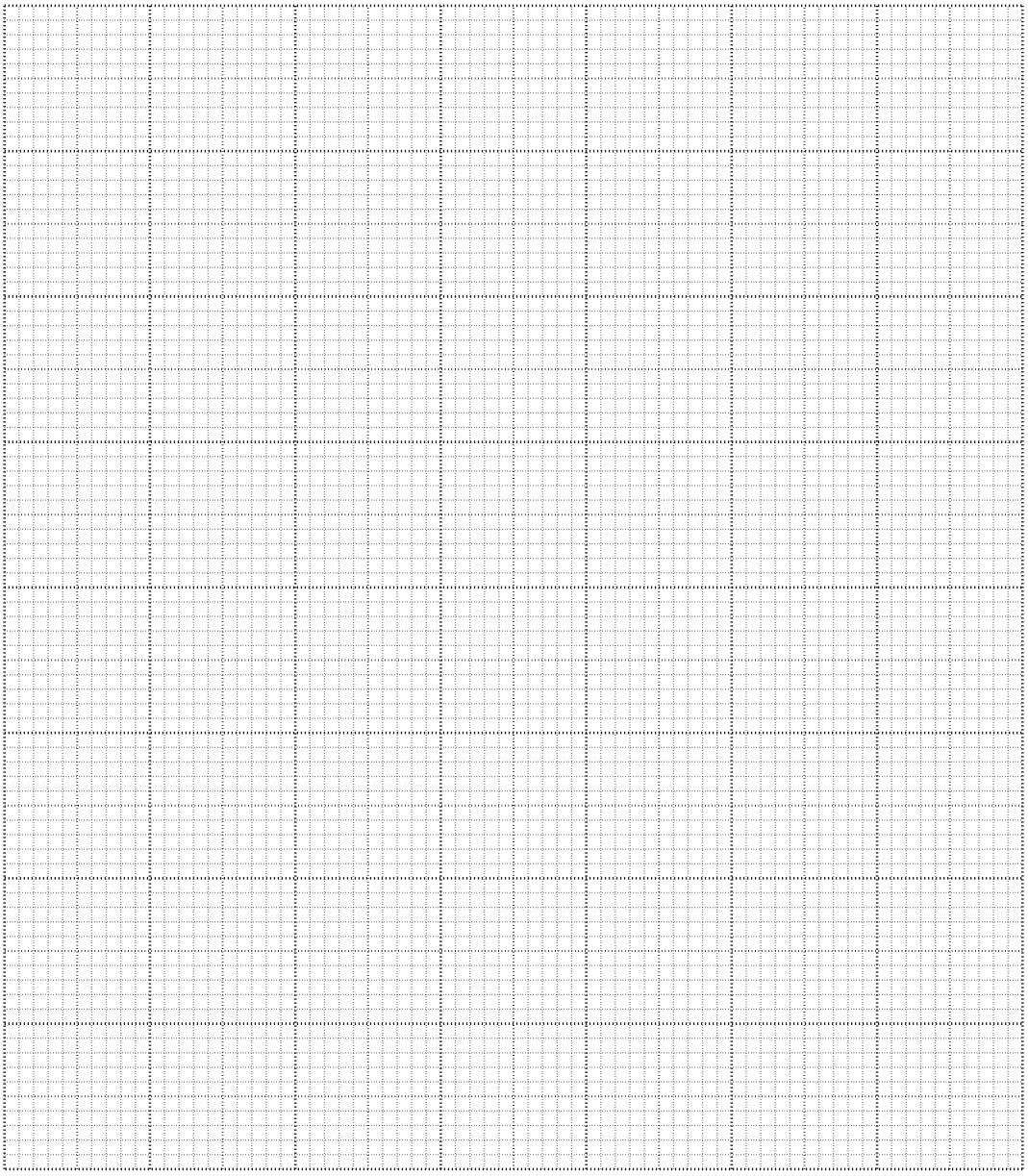
(ii) Find the length and width of the enclosure using this minimum length of fencing.
Give your answers correct to the nearest metre.

Answer Length = ... m Width = ... m [1]

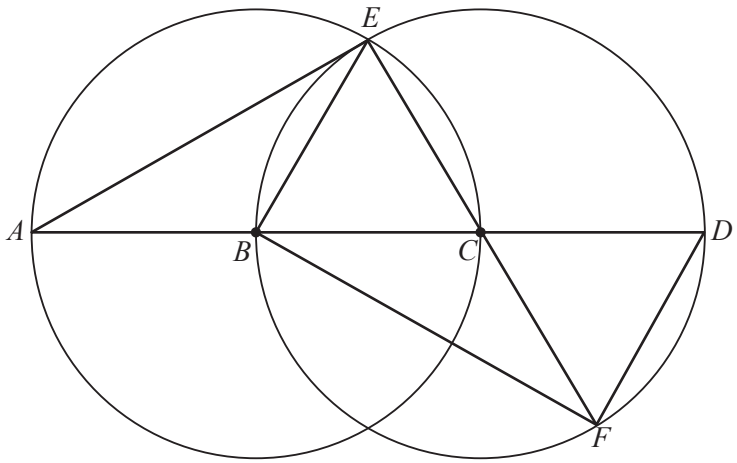
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(f) Suggest a suitable length and width for an enclosure of area $100\,m^2$, that uses the minimum possible length of fencing.

Answer Length = ... m Width = ... m [1]



11 (a) The diagram shows two circles with equal radii.
A, E and C are points on the circle, centre B.
B, E, D and F are points on the circle, centre C.
$ABCD$ is a straight line.



(i) Show that triangles AEC and FBE are congruent.

[3]

(ii) State another triangle that is congruent to triangle AEC.

Answer Triangle ..... [1]

(iii) Explain why EB is parallel to DF.

Answer .....

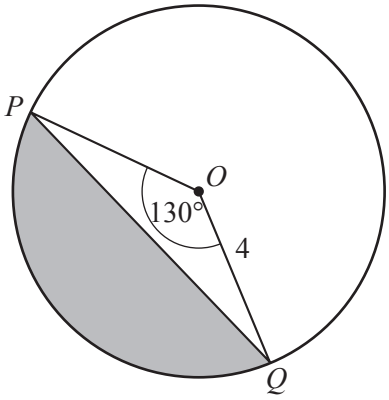
..... [2]

(iv) Work out $A\hat{B}E$.

Answer ..... [1]

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(b) P and Q are points on the circle centre O with radius 4 cm.
$P\hat{O}Q = 130°$.



(i) Calculate the area of triangle POQ.

Answer ..... cm^2 [2]

(ii) Calculate the area of the major segment, shown **unshaded** in the diagram.

Answer ..... cm^2 [3]

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