Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME

CENTER NUMBER

CANDIDATE NUMBER

MATHEMATICS (US)	**0444/31**
Paper 3 (Core)	**May/June 2014**
	2 hours

Candidates answer on the Question Paper.

Additional Materials: Geometrical instruments
                                Electronic calculator

READ THESE INSTRUCTIONS FIRST

Write your Center number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use a #2 pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
If work is needed for any question it must be shown in the space provided.
Electronic calculators should be used.
If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant digits.
Give answers in degrees to one decimal place.
For π, use either your calculator value or 3.142.

The number of points is given in parentheses [ ] at the end of each question or part question.
The total of the points for this paper is 104.

Write your calculator model in the box below.

This document consists of **16** printed pages.

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[Turn over

Formula List

Area, A, of triangle, base b, height h. $\qquad A = \frac{1}{2}bh$

Area, A, of circle, radius r. $\qquad A = \pi r^2$

Circumference, C, of circle, radius r. $\qquad C = 2\pi r$

Lateral surface area, A, of cylinder of radius r, height h. $\qquad A = 2\pi rh$

Surface area, A, of sphere of radius r. $\qquad A = 4\pi r^2$

Volume, V, of prism, cross-sectional area A, length l. $\qquad V = Al$

Volume, V, of cylinder of radius r, height h. $\qquad V = \pi r^2 h$

Volume, V, of sphere of radius r. $\qquad V = \frac{4}{3}\pi r^3$

1 **(a)** For these sequences, write down the next two terms and the rule for finding the next term.

(i) 84, 75, 66, 57, …

Answer(a)(i) .... , ... rule .... [3]

(ii) 2, 6, 18, 54, …

Answer(a)(ii) .... , ... rule .... [3]
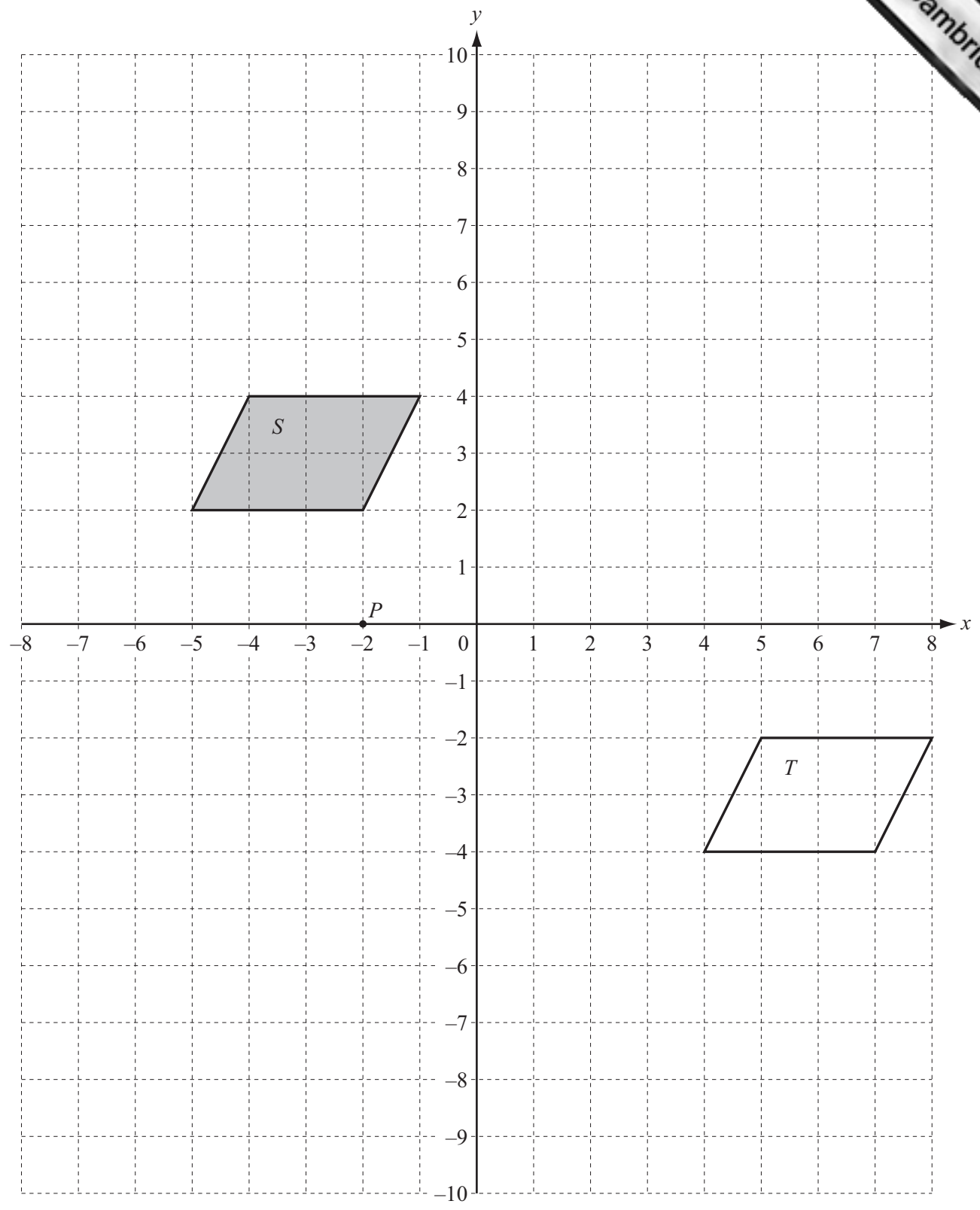
(b) For the sequence in **part (a)(i)**,

(i) write down an expression, in terms of n, for the nth term,

Answer(b)(i) .... [2]

(ii) find the 21st term.

Answer(b)(ii) .... [2]

2

The diagram shows two shapes, *S* and *T*, on a 1 cm² grid.

P is the point (–2, 0).

(a) (i) Write down the mathematical name of shape *S*.

Answer(a)(i) ....

(ii) How many lines of symmetry does shape *S* have?

Answer(a)(ii) .... [1]

(b) Describe the **single** transformation that maps shape *S* onto shape *T*.

Answer(b) ....

.... [2]

(c) On the grid,

(i) draw the reflection of shape *S* in the *y*-axis, [2]

(ii) draw the rotation of shape *S* about (0, 0) through 90° counter-clockwise. [2]

(d) On the grid, draw the enlargement of shape *S* with scale factor 2 and center *P* (–2, 0).
Label the image *E*. [2]

(e) (i) Work out the area of shape *S*.

Answer(e)(i) .... cm^2 [2]

(ii) How many shapes, identical to shape *S*, will fill shape *E* completely?

Answer(e)(ii) .... [1]

(iii) Work out the area of shape *E*.

Answer(e)(iii) .... cm^2 [1]

[Turn over

3 Denzil grows tomatoes. He selects a random sample of 15 plants.
The number of tomatoes on each plant is shown below.

25	15	21	8	13
22	25	22	25	25
18	19	34	18	10

(a) (i) Write down the mode.

Answer(a)(i) .... [1]

(ii) Find the range.

Answer(a)(ii) .... [1]

(iii) Find the median.

Answer(a)(iii) .... [2]

(iv) Work out the mean.

Answer(a)(iv) .... [2]

(b) Denzil picks 800 tomatoes.
4% of the 800 tomatoes are damaged.

How many of these tomatoes are **not** damaged?

Answer(b) .... [2]

(c) Denzil sells 750 of his tomatoes.

   (i) The mean mass of a tomato is 66 g.

   Calculate the mass of the 750 tomatoes in kilograms.

Answer(c)(i) .... kg [3]

   (ii) Denzil sells his tomatoes at $1.40 per kilogram.

   Calculate the total amount he receives from selling the 750 tomatoes.

Answer(c)(ii) $ .... [1]

   (iii) The cost of growing these tomatoes was $33.

   Calculate his percentage profit.

Answer(c)(iii) .... % [3]

[Turn over

4 Use a ruler and compass only in parts (a) and (c) of this question.
   Show all your construction arcs.

A

100 m

B

120 m

C

100 m

D

E

150 m

Scale: 1 cm to 20 m
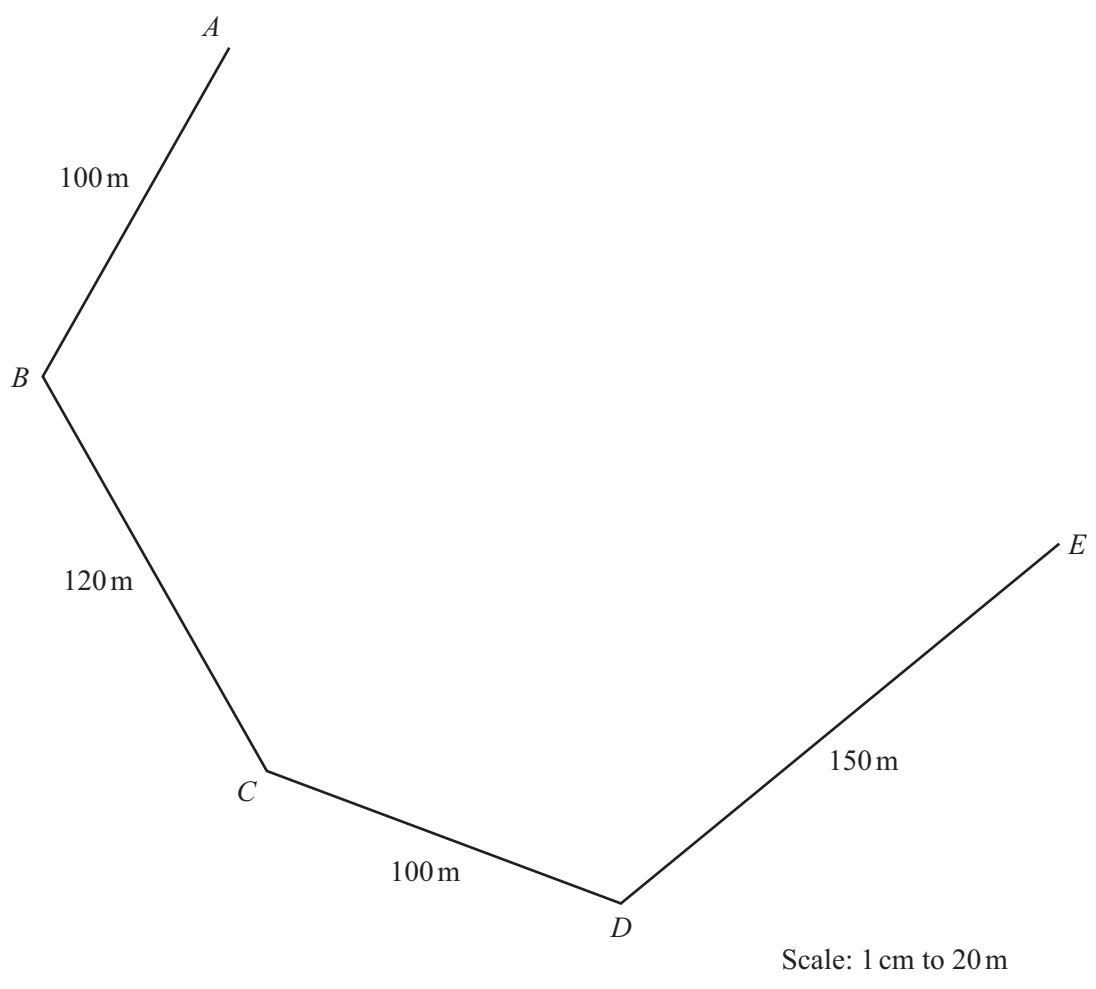
Maria owns a farm.
The scale drawing shows part of the boundary of the farm.
The scale is 1 centimeter represents 20 meters.

(a) The point *F* is such that *AF* = 140 m and *EF* = 160 m.
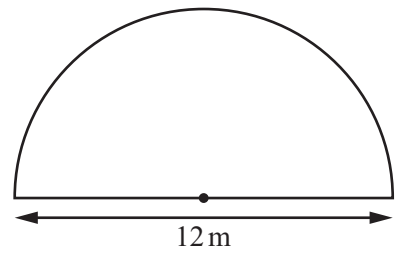Angle *BAF* and angle *DEF* are both **obtuse** angles.

Complete the scale drawing of the farm boundary *ABCDEF*.

(b) Write down the name of the polygon *ABCDEF*.

Answer(b) .... [1]

(c) **(i)** Construct the perpendicular bisector of the side *CD*. [2]

　　(ii) Construct the bisector of angle *ABC*. [2]

(d) The diagram shows a semicircular pigpen on the farm.

NOT TO
SCALE

12 m

The pigpen has a diameter of 12 meters.

Giving your answers correct to 2 decimal places, calculate

(i) the area of the pigpen,

Answer(d)(i) .... m^2 [2]

(ii) the perimeter of the pigpen.

Answer(d)(ii) .... m [3]

5 **(a)** **(i)** Complete the table of values for $y = \dfrac{8}{x}$, $x \neq 0$.

x	–8	–4	–2	–1		1	2	4	8
y		–2						2	

[3]

(ii) On the grid, draw the graph of $y = \dfrac{8}{x}$ for $-8 \leqslant x \leqslant -1$ and $1 \leqslant x \leqslant 8$.
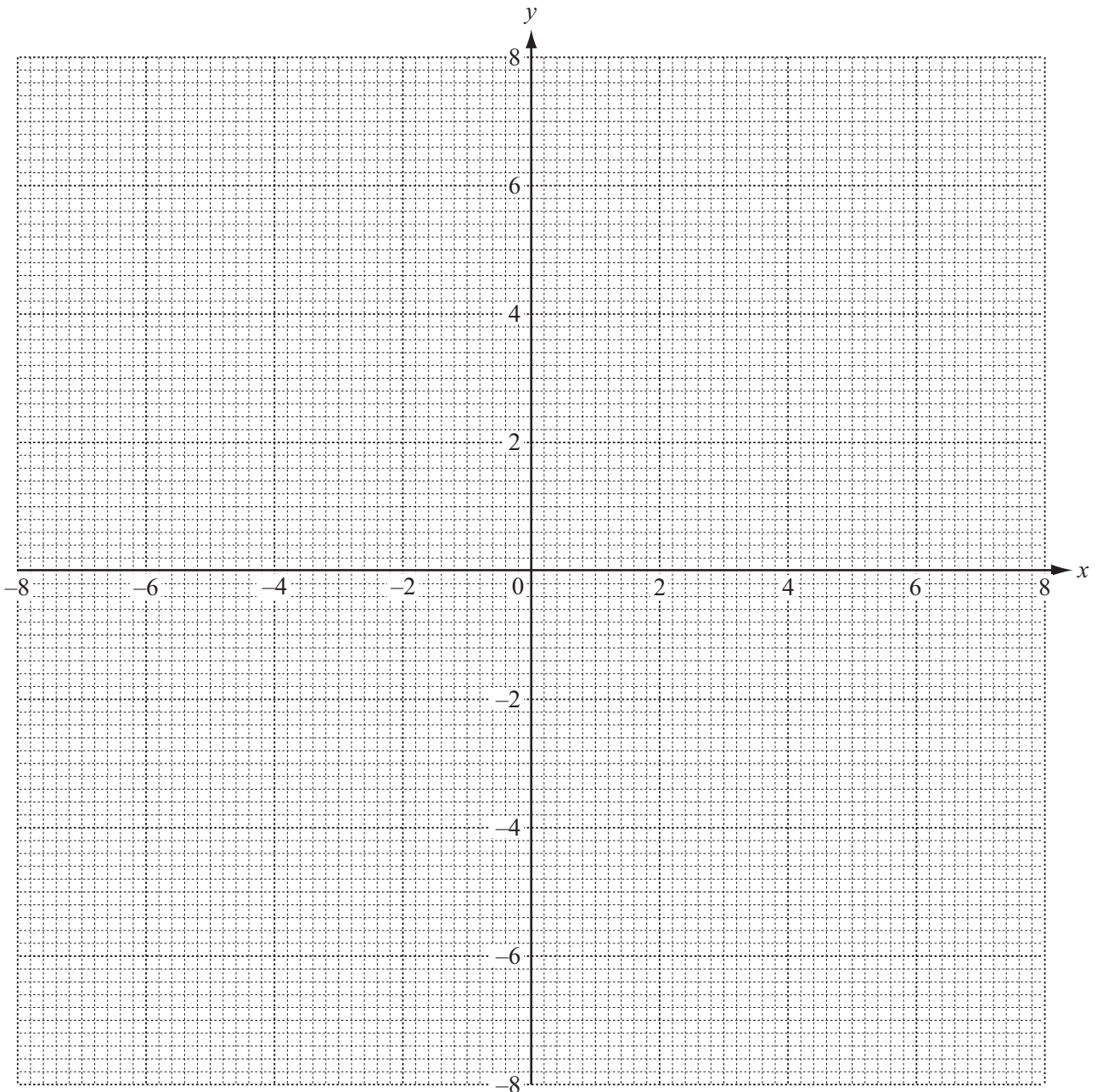
[4]

(iii) Write down the order of rotational symmetry of your graph.

Answer(a)(iii) .... [1]

(b) (i) Complete this table of values for $y = 1.5x + 3$.

x	-6	-4	-2	0	2
y	-6			3	

[2]

    (ii) On the grid, draw the graph of $y = 1.5x + 3$.   [1]

(c) Use your graphs to solve the equation $\dfrac{8}{x} = 1.5x + 3$.

Answer(c) x = ... or *x =* .... [2]

(d) Write down the slope of the graph of $y = 1.5x + 3$.

Answer(d) .... [1]

_____

6 (a) From the integers 50 to 100, find

    (i) a multiple of 43,

Answer(a)(i) .... [1]

    (ii) a factor of 165,

Answer(a)(ii) .... [1]

    (iii) an odd number that is also a square number,

Answer(a)(iii) .... [1]

    (iv) a number which is a square number and also a cube number.

Answer(a)(iv) .... [1]

(b) Solve for *x*.
$$y = 3x - 1$$

Answer(b) x = ... [2]

_____

[Turn over

7 120 people are asked how they travel to work.
The pie chart shows the results.
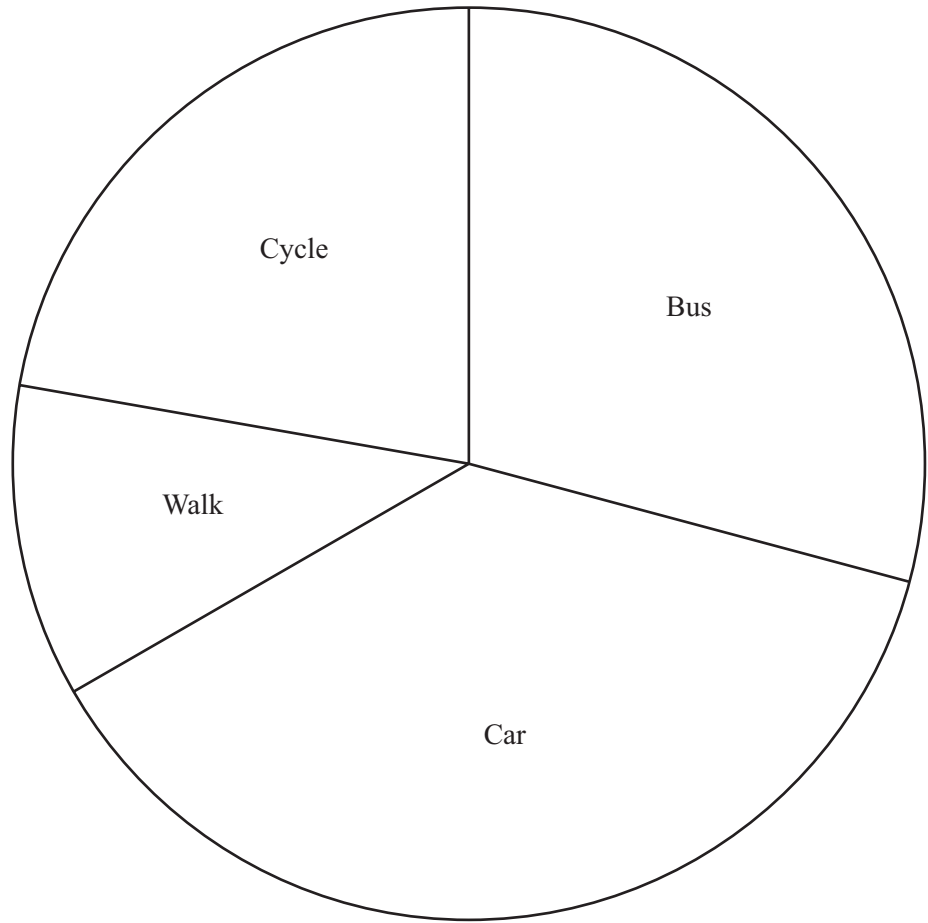
(a) **(i)** Show that 45 people travel by car.

Answer(a)(i)

[2]

(ii) A person is chosen at random from the 120 people.

Find the probability that this person travels to work by bus or by car.

Answer(a)(ii) .... [2]

(b) One year later, the same 120 people were again asked how they travel to work.

Here is the information.

	Number of people
Walk	x
Cycle	31
Bus	17 more than the number of people who walk
Car	2 times the number of people who walk

(i) Use this information to complete the following equation, in terms of x.

.... = 120 [3]

(ii) Solve the equation to find the number of people who walk to work.

Answer(b)(ii) .... [3]

8
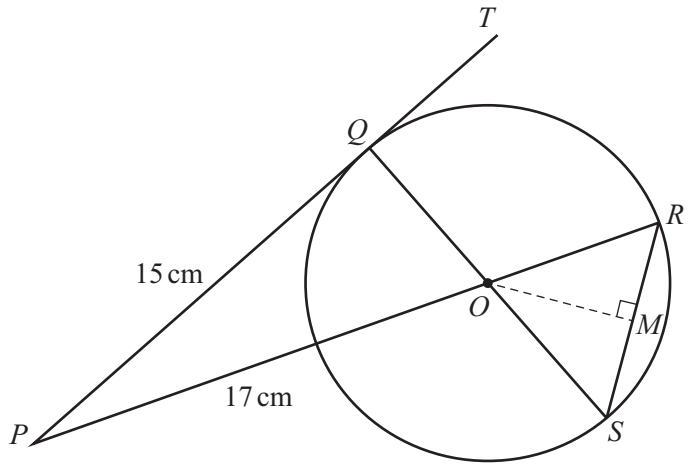
The diagram shows a circle, center *O*.
Q, *R* and *S* are points on the circumference.
PT touches the circle at *Q*.
M is the midpoint of *RS*.
PQ = 15 cm and *OP* = 17 cm.

(a) Write down the mathematical name for *PT*.

Answer(a) .... [1]

(b) Explain why angle *PQO* is 90°.

Answer(b) ....

.... [1]

(c) Calculate the radius of the circle.

Answer(c) .... cm [3]

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(d) Using trigonometry, show that angle $OPQ = 28°$, correct to the nearest degree.

Answer(d) .... [2]

(e) Work out the size of angle ROM, giving a reason for each step of your answer.

Answer(e)

[3]

(f) Using trigonometry, calculate the length of RS.

Answer(f) .... cm [3]

[Turn over

9 **(a)** The angles in a triangle are in the ratio $3:4:8$.

  (i) Show that the smallest angle of the triangle is 36°.

  Answer(a)(i)

[2]

  (ii) Work out the other two angles of the triangle.

Answer(a)(ii) .... and .... [2]

(b) Another triangle *ABC* has angle *BAC* = 35° and angle *ABC* = 65°.

  (i) **Using a protractor and straight edge** complete an accurate drawing of the triangle *ABC*.
  The side *AB* has been drawn for you.

A ———————————————————— *B*
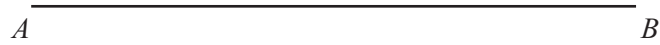
[2]

  (ii) Measure the length, in centimeters, of the shortest side of your triangle.

Answer(b)(ii) .... cm [1]

(c) A different triangle has base 7.0 cm and height 5.6 cm.
  Calculate the area of this triangle, giving the units of your answer.

Answer(c) .... [3]