

OXFORD CAMBRIDGE AND RSA EXAMINATIONS  
**GCSE**  
**B392/02**  
**METHODS IN MATHEMATICS**  
Methods in Mathematics 2 (Higher Tier)  
**FRIDAY 13 NOVEMBER 2015: Morning**  
**DURATION:** 2 hours  
plus your additional time allowance  
**MODIFIED ENLARGED 24pt**

Candidate forename						Candidate surname					
Centre number						Candidate number					

Candidates answer on the Question Paper.

**OCR SUPPLIED MATERIALS:**

None

**OTHER MATERIALS REQUIRED:**

Scientific or graphical calculator

Geometrical instruments

Tracing paper (optional)

**You are permitted to use a  
calculator for this paper**

**READ INSTRUCTIONS OVERLEAF**

## INSTRUCTIONS TO CANDIDATES

Write your name, centre number and candidate number in the boxes on the first page. Please write clearly and in capital letters.

Use black ink. HB pencil may be used for graphs and diagrams only.

Answer **ALL** the questions.

Read each question carefully. Make sure you know what you have to do before starting your answer.

Your answers should be supported with appropriate working. Marks may be given for a correct method even if the answer is incorrect.

Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).

## INFORMATION FOR CANDIDATES

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

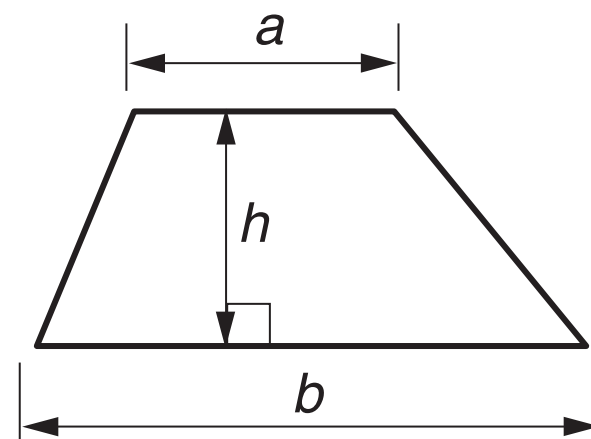
Your quality of written communication is assessed in questions marked with an asterisk (\*).

The total number of marks for this paper is **90**.

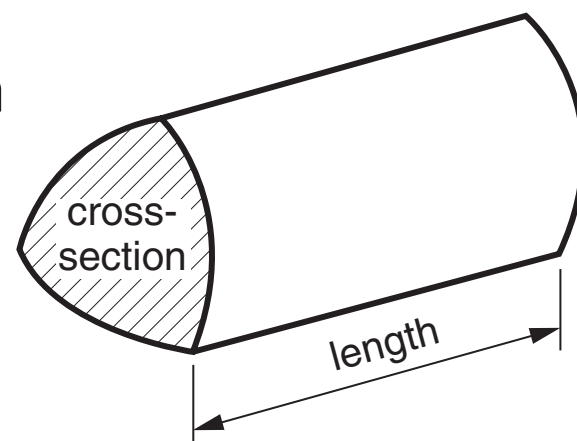
Any blank pages are indicated.

## Formulae Sheet: Higher Tier

**Area of trapezium**  $= \frac{1}{2}(a + b)h$



**Volume of prism**  $= (\text{area of cross-section}) \times \text{length}$

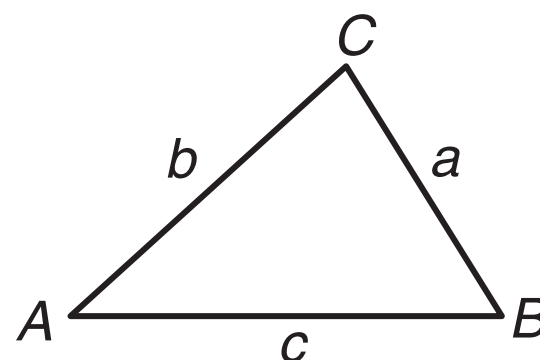


**In any triangle  $ABC$**

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

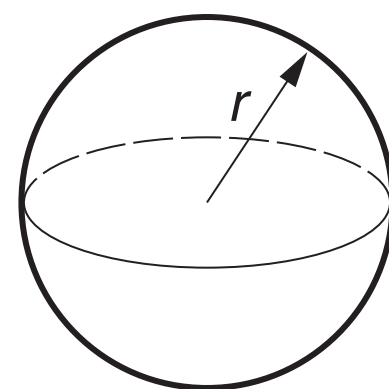
**Cosine rule**  $a^2 = b^2 + c^2 - 2bc \cos A$

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



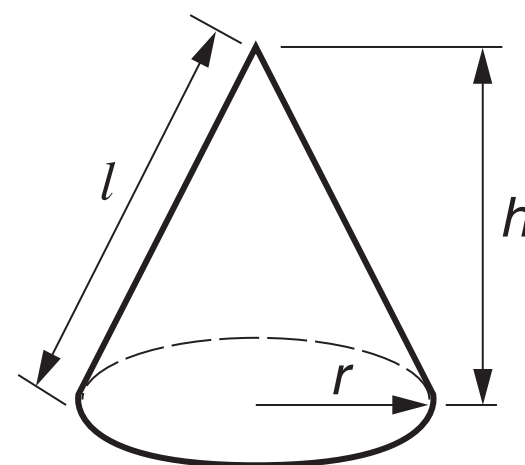
**Volume of sphere**  $= \frac{4}{3} \pi r^3$

**Surface area of sphere**  $= 4\pi r^2$



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

**Curved surface area of cone**  $= \pi r l$



### The Quadratic Equation

The solutions of  $ax^2 + bx + c = 0$ ,  
where  $a \neq 0$ , are given by

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Answer **ALL** the questions.

1 (a) Calculate.

(i)  $2.7^3$

(a)(i) \_\_\_\_\_ [1]

(ii)  $\frac{3 \times \sqrt{104.04}}{7.2 \times 0.5}$

(ii) \_\_\_\_\_ [2]

(b) Sammy reads that there are an estimated 200 million insects for each person on earth.

He looks up the number of people and finds that it is 7 214 769 948.

(i) Write 7 214 769 948 correct to two significant figures.

(b)(i) \_\_\_\_\_ [1]

(ii) Estimate the number of insects on earth. Give your answer in standard form.

(ii) \_\_\_\_\_ [3]

**(c) (i)** Work out.

$$\frac{3}{8} \times \frac{1}{6}$$

Give your answer in its simplest form.

**(c)(i)** \_\_\_\_\_ **[2]**

**(ii)** Fill in the missing numbers in this fraction calculation. The missing numbers are whole numbers.

$$\frac{22}{35} \times \frac{25}{32} = \frac{\boxed{\phantom{000}}}{7} \times \frac{5}{16} = \frac{\boxed{\phantom{000}}}{\boxed{\phantom{000}}}$$

**[2]**

2\* Kezia is using sticks to make a sequence of house patterns. One house uses 6 sticks.



Kezia has 100 sticks to make one pattern in the sequence.

What is the greatest number of houses she can have in her pattern?  
You must explain your reasoning.

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[4]

**3 (a)** Write 3.6 as an improper fraction in its simplest form.

**(a)** \_\_\_\_\_ **[2]**

**(b)** Write 76% as a fraction in its simplest form.

**(b)** \_\_\_\_\_ **[2]**

**4 (a)** Reduce this ratio to its simplest form.

24 : 12 : 40

**(a)** \_\_\_\_\_ **[2]**

**(b)** The sides of a triangle are in the ratio 3 : 4 : 5.  
The shortest side of the triangle is 21 cm.

Find the perimeter of the triangle.

**(b)** \_\_\_\_\_ cm **[2]**



**5 (a)** Solve.

$$3(x - 7) = 5x + 1$$

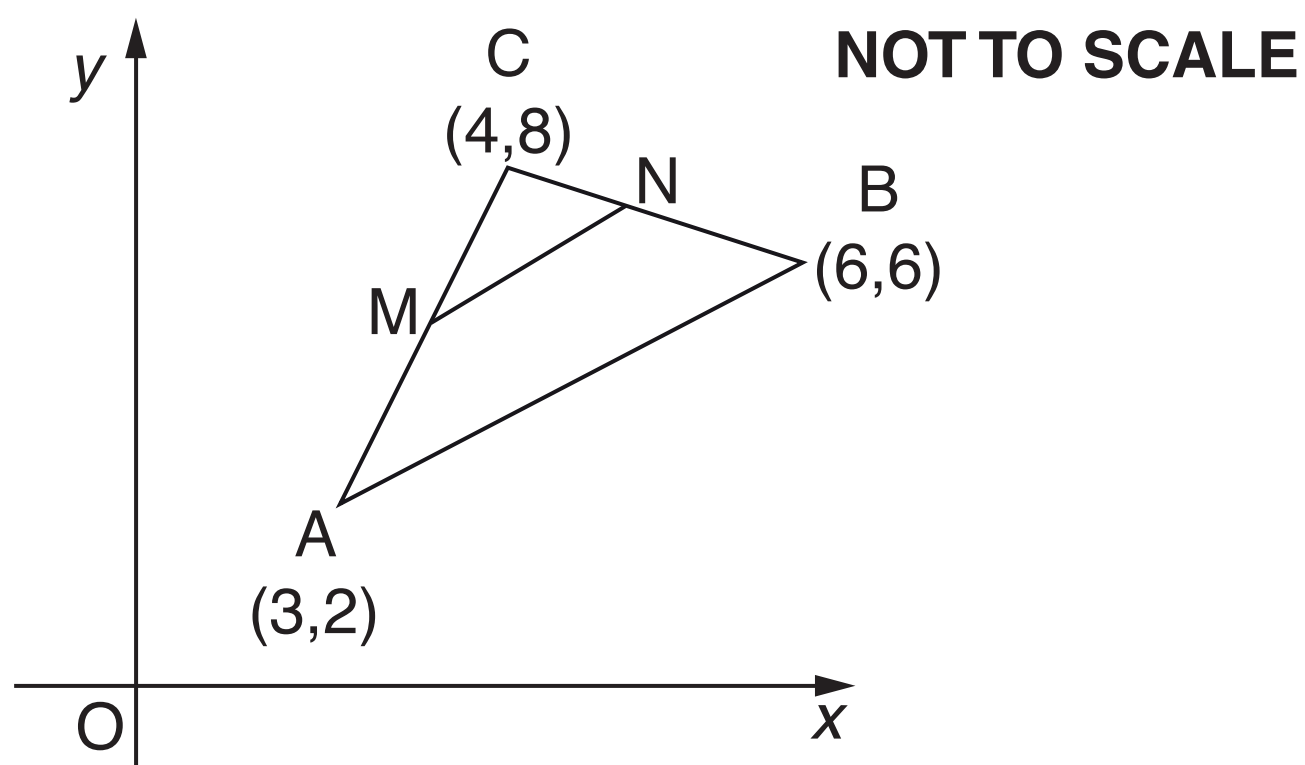
**(a)**  $x =$  \_\_\_\_\_ **[3]**

**(b)** Evaluate  $f(2)$  for the following function.

$$f(x) = 3x - 1$$

**(b)** \_\_\_\_\_ **[1]**

- 6** In the diagram below, A is the point (3, 2), B is the point (6, 6) and C is the point (4, 8).  
M is the midpoint of AC. N is the midpoint of BC.



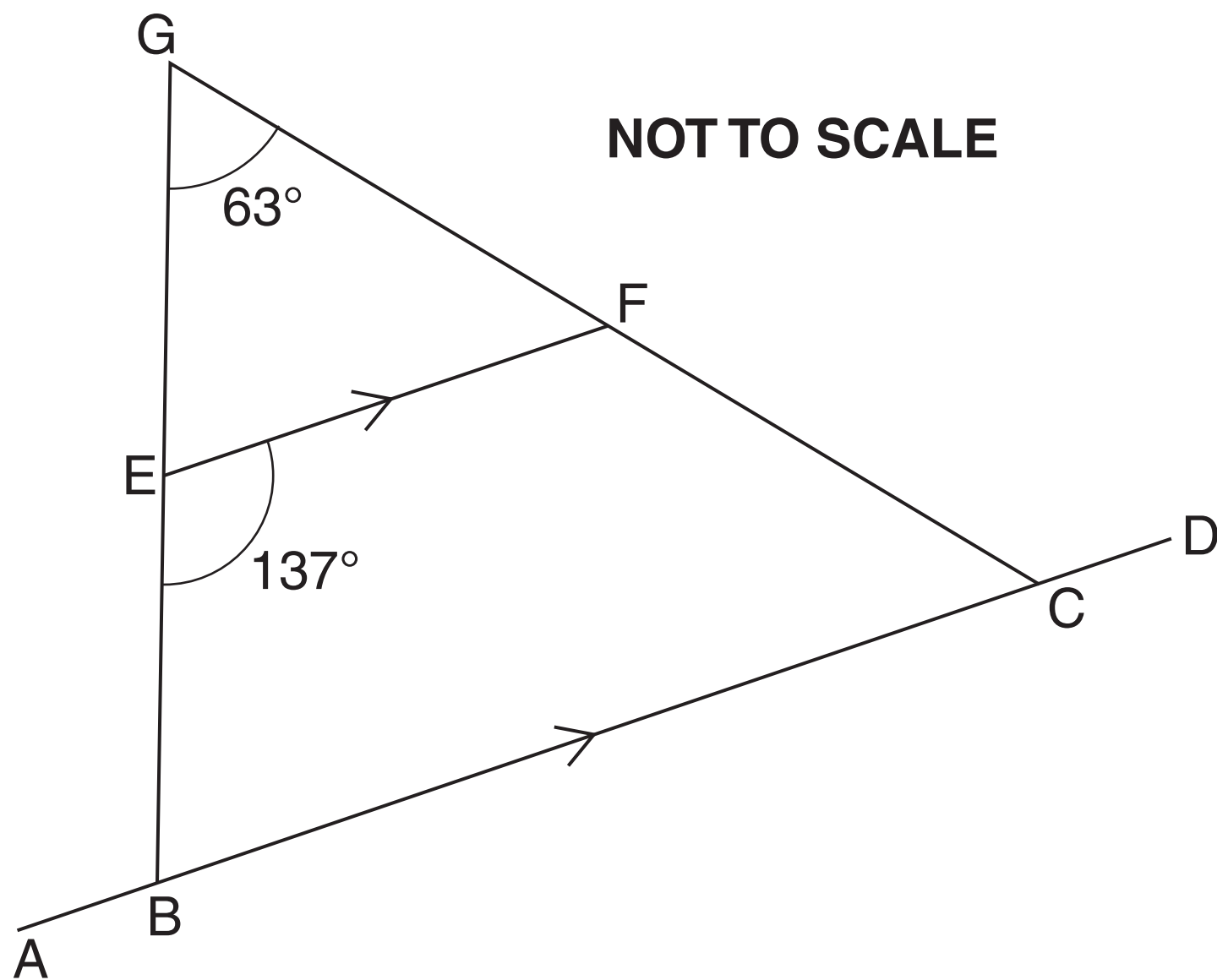
**(a)** Work out the coordinates of M.

**(a)** \_\_\_\_\_ [2]

**(b)** Calculate the length of MN.

**(b)** \_\_\_\_\_ units [3]

- 7\* In the diagram GB and GC are straight lines. E is on GB and F is on GC. EF is parallel to ABCD. Angle EGF =  $63^\circ$  and angle BEF =  $137^\circ$ .



Calculate angle BCF, giving a reason for each angle you calculate.

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[4]

- 8** Bob has some 1p coins and some 2p coins.  
He has 35p altogether.  
He has 25 coins altogether.  
Bob uses  $x$  to stand for the number of 1p coins and  $y$  to stand for the number of 2p coins.

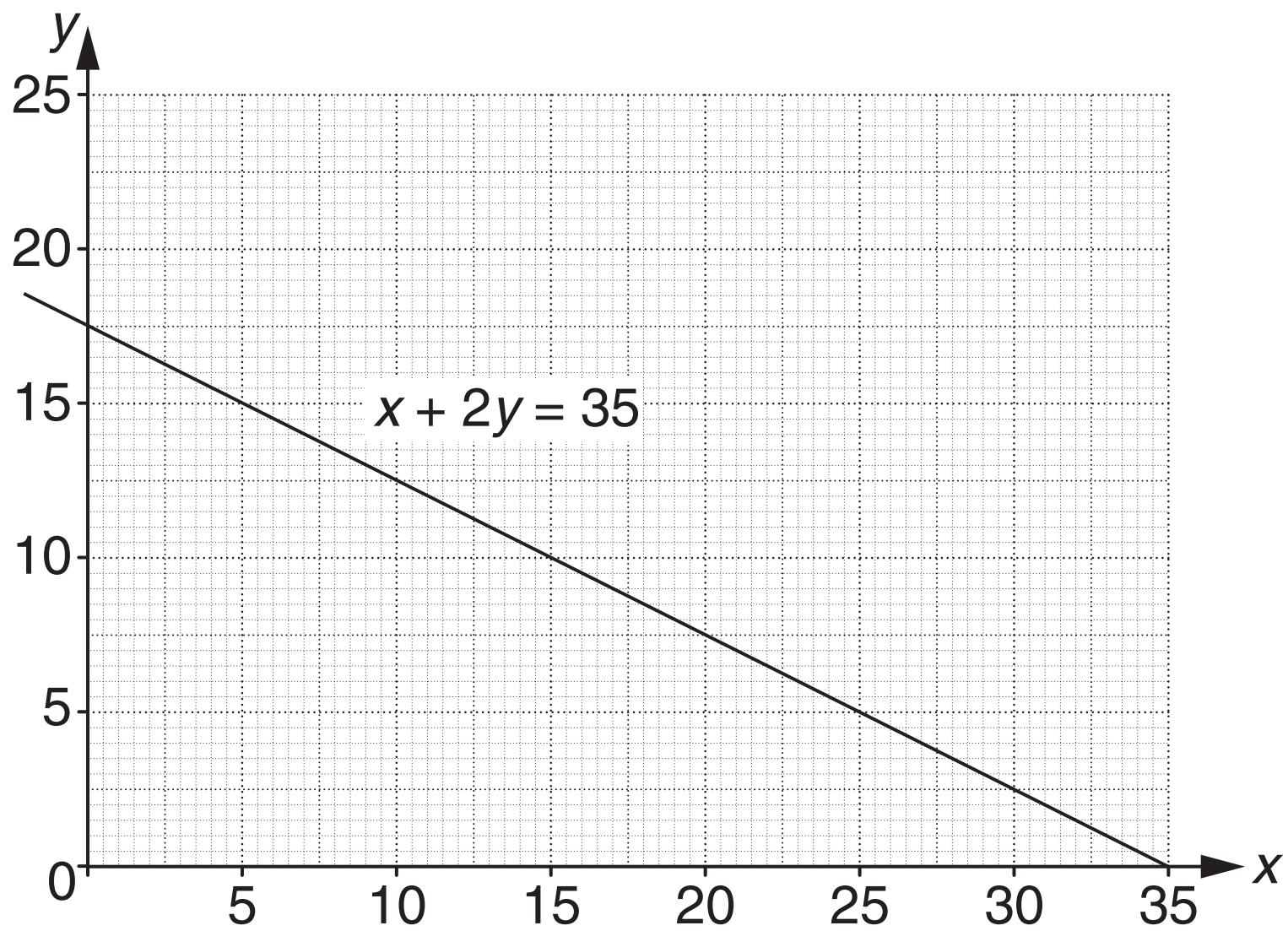
**(a)** Explain why the equation  $x + 2y = 35$  is true for Bob's coins.

\_\_\_\_\_  
\_\_\_\_\_ **[1]**

**(b)** Write another equation that is true for Bob's coins.

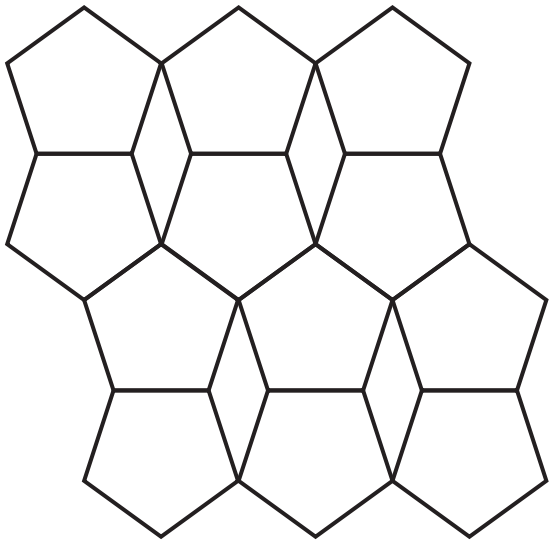
**(b)** \_\_\_\_\_ **[1]**

**(c)** Find the values of  $x$  and  $y$ . You may use the graph below.



**(c)**  $x =$  \_\_\_\_\_,  $y =$  \_\_\_\_\_ [3]

- 9 The tiling pattern below is made of pentagons and rhombuses.



All the pentagons are regular and congruent.

All the rhombuses are congruent.

Each rhombus has two different sizes of angle in it.

Calculate the sizes of the angles in each rhombus.

\_\_\_\_\_° , \_\_\_\_\_° [5]

**10 (a)** Expand and simplify.

$$(2x - 9)(4x - 3)$$

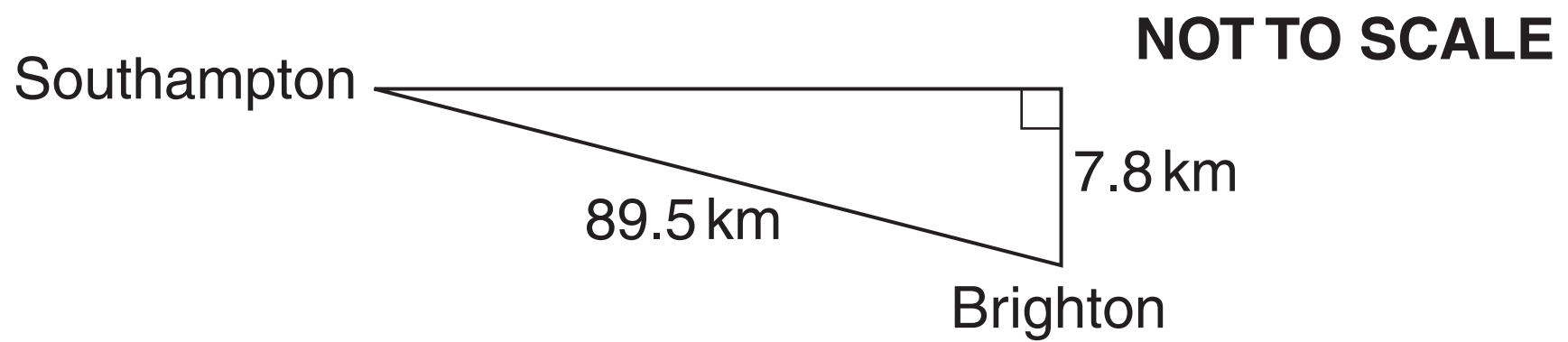
**(a)** \_\_\_\_\_ **[3]**

**(b)** Solve.

$$x^2 + 7x - 8 = 0$$

**(b)** \_\_\_\_\_ **[4]**

- 11 (a)** The direct distance from Southampton to Brighton is 89.5 km. Brighton is 7.8 km further South than Southampton, and to the East.

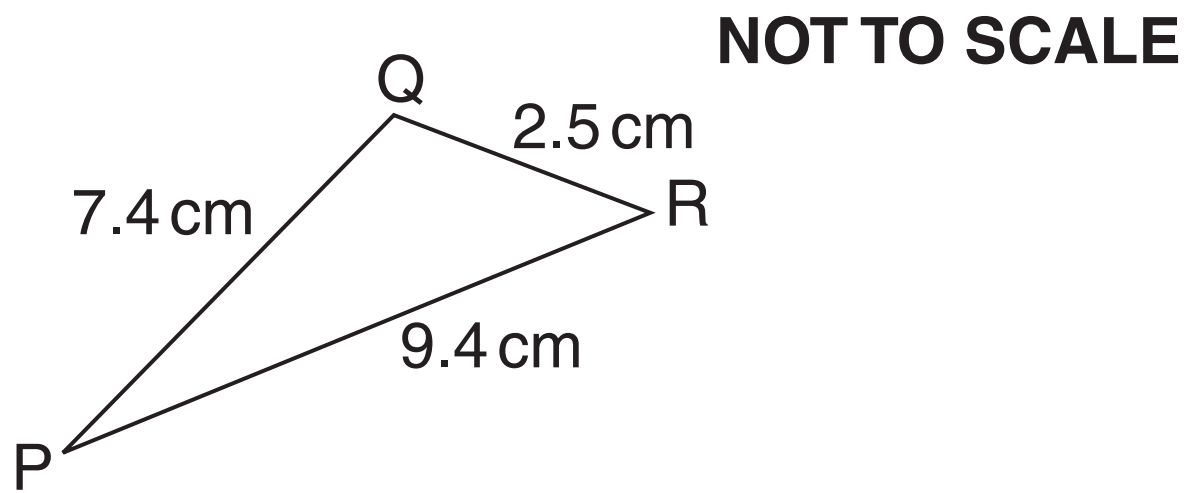


Calculate the bearing of Brighton from Southampton.

**(a)** \_\_\_\_\_ ° [4]



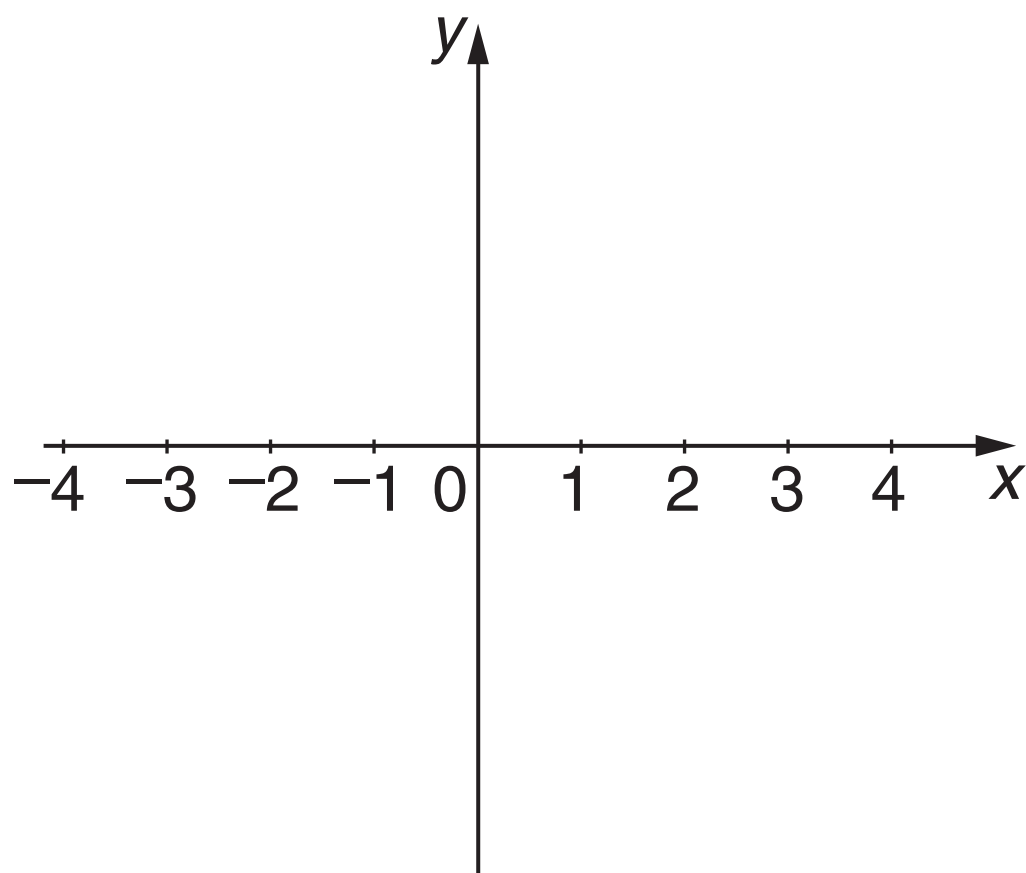
- (b)** In triangle PQR,  $PQ = 7.4\text{ cm}$ ,  $QR = 2.5\text{ cm}$  and  $PR = 9.4\text{ cm}$ .



Calculate the size of angle PQR.

**(b)** \_\_\_\_\_° **[3]**

- 12 (a) (i)** Sketch the graph of  $y = 2^x$ , for values of  $x$  between  $-4$  and  $4$ , on the axes below.

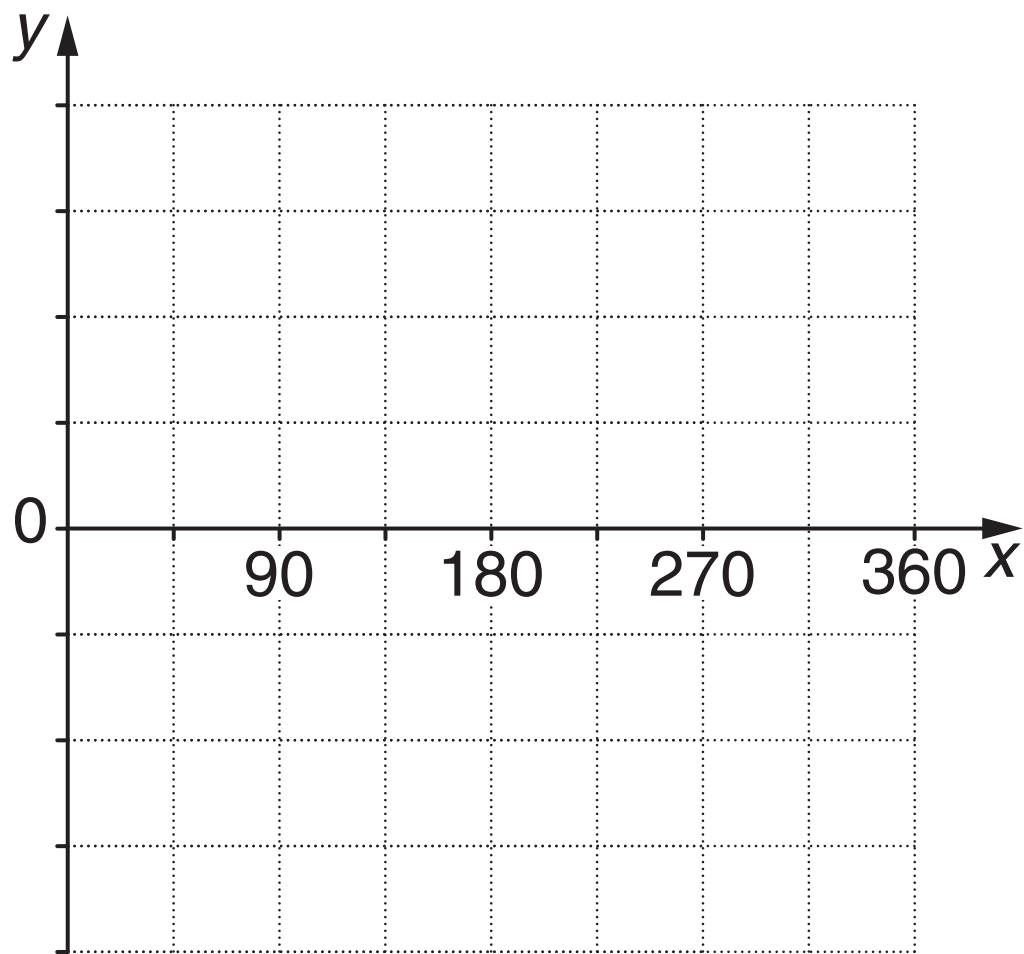


**[2]**

- (ii)** Give the coordinates of the point where your graph crosses the  $y$ -axis.

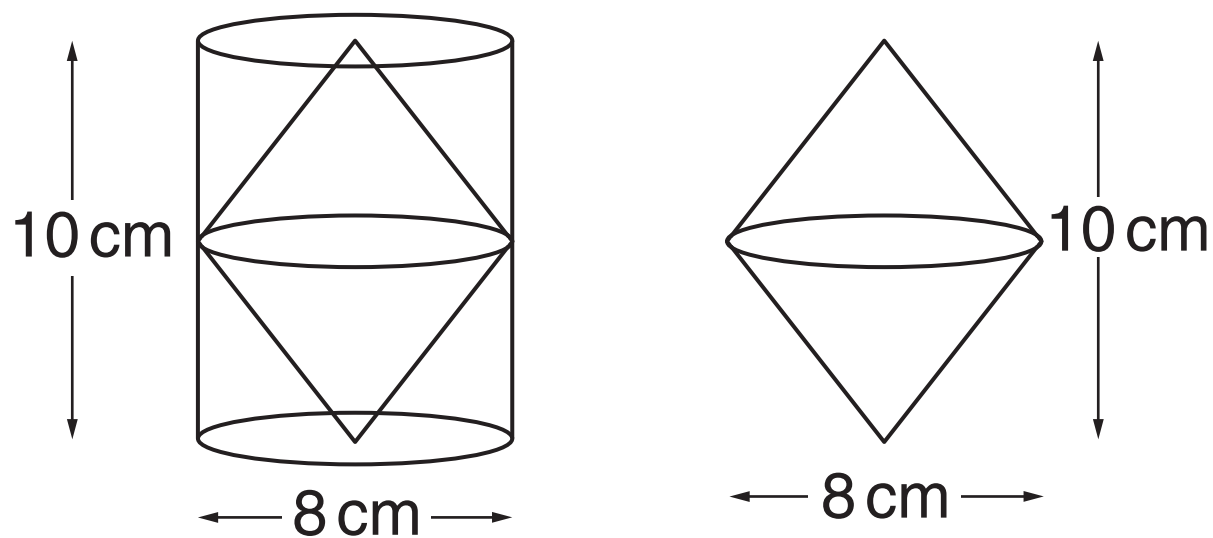
**(a)(ii)** ( \_\_\_\_\_ , \_\_\_\_\_ ) **[1]**

**(b)** Sketch the graph of  $y = 3 \sin x^\circ$  on the axes below. Number the  $y$ -axis.



**[4]**

- 13** A solid cylinder has diameter 8 cm and height 10 cm. Some of the cylinder is cut away. This leaves a shape consisting of two congruent cones, joined at their circular faces. The diameter of each cone is 8 cm. The total height of the double cone is 10 cm.



- (a)** Show that the volume of the double cone is exactly  $\frac{1}{3}$  of the volume of the cylinder.

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[3]

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

**(b)** \_\_\_\_\_  $\text{cm}^2$  **[4]**

**14** A sequence has  $n$ th term given by  $\frac{1}{n} - \frac{1}{n+1}$ .

**(a)** Write down the first two terms of the sequence.  
Give each term as a single fraction.

**(a)** \_\_\_\_\_ , \_\_\_\_\_ [3]

**(b)** Find  $\frac{1}{n} - \frac{1}{n+1}$  as a single algebraic fraction.  
Give your answer in its simplest form.

**(b)** \_\_\_\_\_ [2]

**(c)** Is there a term of the sequence equal to  $\frac{1}{100}$ ? You must explain your reasoning.

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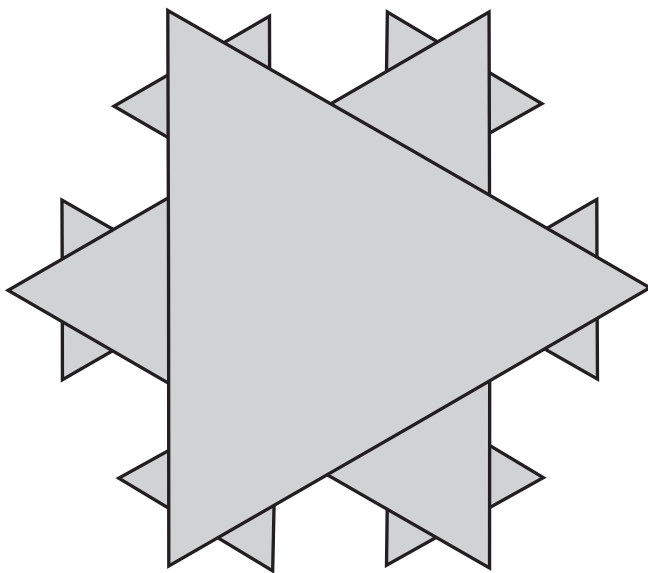
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[2]

- 15** The shape below is made of three sizes of similar equilateral triangles. The sizes are small, medium and large. The lengths of the sides of the triangles are in the ratio small : medium : large = 1 : 3 : 9. The smallest triangle has area  $1 \text{ cm}^2$ .

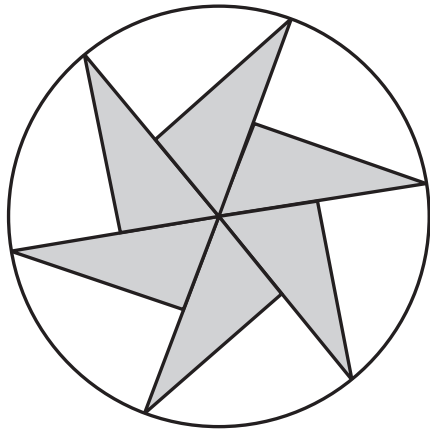


Work out the area of the shape.

\_\_\_\_\_  $\text{cm}^2$  [4]



- 16** The design below has rotational symmetry of order 6.  
Six congruent **RIGHT-ANGLED** triangles each have one vertex at the centre of a circle and another vertex on the circumference of the circle.  
The triangles fit together at the centre of the circle without overlapping.  
The six triangles are shaded.



What percentage of the circle is shaded?

\_\_\_\_\_ % **[5]**

**END OF QUESTION PAPER**

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