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Cambridge Assessment International Education

Cambridge IGCSE™

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CAMBRIDGE INTERNATIONAL MATHEMATICS **0607/62**

Paper 6 Investigation and Modelling (Extended) **February/March 2025**

1 hour 30 minutes

You must answer on the question paper.

No additional materials are needed.

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 graphic display calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly, including sketches, to gain full marks for correct methods.
- In this paper you will be awarded marks for providing full reasons, examples and steps in your working to communicate your mathematics clearly and precisely.

INFORMATION

- The total mark for this paper is 50.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **16** pages. Any blank pages are indicated.

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Section A

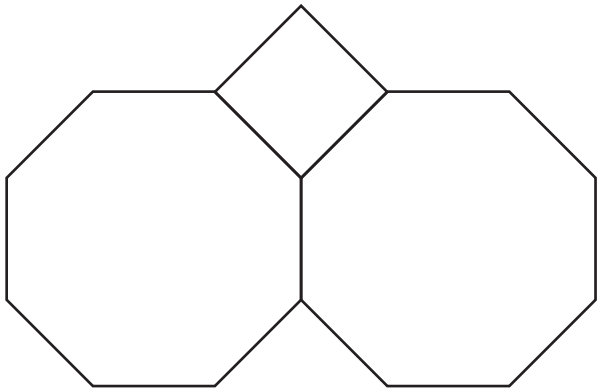
INVESTIGATION REGULAR POLYGONS

You are advised to spend no longer than 45 minutes on this section.

In this task you will investigate fitting 3 regular polygons together at a point.

All the polygons have sides of the same length.
The 3 polygons fit together exactly with one corner from each polygon meeting at a point with no gaps or overlaps.

1 The diagram shows a square and 2 regular octagons fitting together at a point.



This is the formula for the size of each interior angle, $a°$, of a regular polygon with n sides.

$$a = 180 - \frac{360}{n}$$

(a) Show that the size of each interior angle of a regular octagon is 135°.

[1]

(b) Use angles to show that 2 regular octagons and a square fit together at a point.

[2]

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2 Use the formula in **Question 1** to complete the table.

Number of sides, n	5	6	8	9	10
Interior angle, $a°$			135		144

[3]

3 Rearrange the formula $a = 180 - \frac{360}{n}$ to show that $n = \frac{360}{180 - a}$.

[2]

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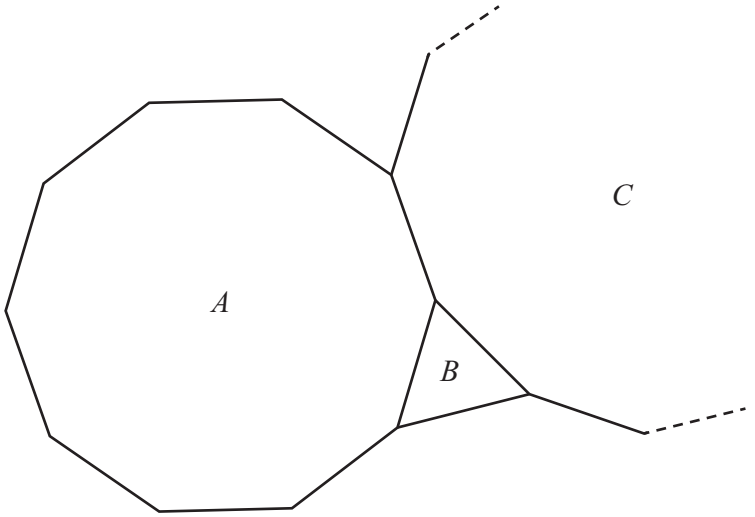
4 The diagram shows regular polygons *A* and *B* and part of regular polygon *C*.



A is a regular 10-sided polygon.
B is an equilateral triangle.
C is a different regular polygon.

Work out the number of sides of polygon *C*.

..... [3]

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5 Charlie finds other ways to fit 3 regular polygons together at a point.

The first polygon has p sides.
The second polygon has q sides.
The third polygon has r sides.

(a) Consider the angles around a point and use the formula $a = 180 - \frac{360}{n}$ to show that

$$\frac{1}{p} + \frac{1}{q} + \frac{1}{r} = \frac{1}{2} .$$

[3]

(b) $p \leqslant q \leqslant r$

(i) When $p = 6$, use $\frac{1}{p} + \frac{1}{q} + \frac{1}{r} = \frac{1}{2}$ to find the value of q and the value of r.

$q =$ .....

$r =$ .....

[1]

(ii) p cannot be greater than 6.

Give an example to show this.

[1]

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6 In this question, the value of p is 3 and $p \leqslant q \leqslant r$.
Charlie wants to find all the possible ways to fit 3 regular polygons at a point.

(a) Use $\frac{1}{p}+\frac{1}{q}+\frac{1}{r}=\frac{1}{2}$ to show that $\frac{1}{q}+\frac{1}{r}=\frac{1}{6}$.

[1]

(b) q and r are positive integers.

Give a reason why $q \geqslant 7$.

[1]

(c) Complete the table.

Number of sides of first polygon, p	Number of sides of second polygon, q	Number of sides of third polygon, r
3	7	
3	8	24
3	9	
3	10	
3	12	12

[3]

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7 Find all the possible ways to fit a square and 2 other regular polygons at a point.

..... [4]

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Section B

MODELLING STREET LIGHTS

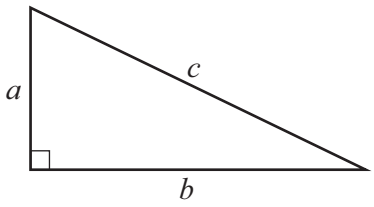
You are advised to spend no longer than 45 minutes on this section.

In this task you will be modelling how to place lights on paths.

In this task:

- paths are straight
- lights are shown as large dots
- lights shine on an area that is a circle called the *circle of light*
- lights must shine on all parts of the path
- lights are placed as far apart as possible.

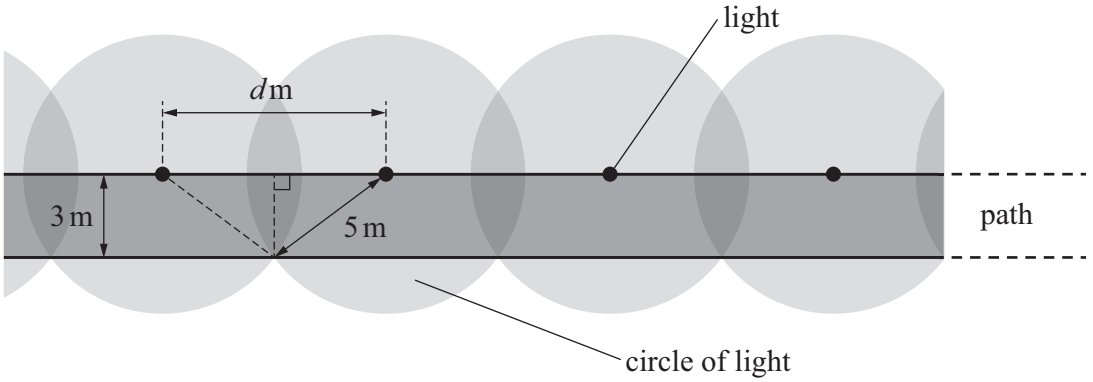
In this task you will find Pythagoras' theorem useful.



$a^2 + b^2 = c^2$

8 This path has a width of 3 m.
The radius of each circle of light is 5 m.
The distance along the path between the lights is d metres.

(a) The lights are placed on the same side of the path as shown.



Use Pythagoras' theorem to find the value of d.

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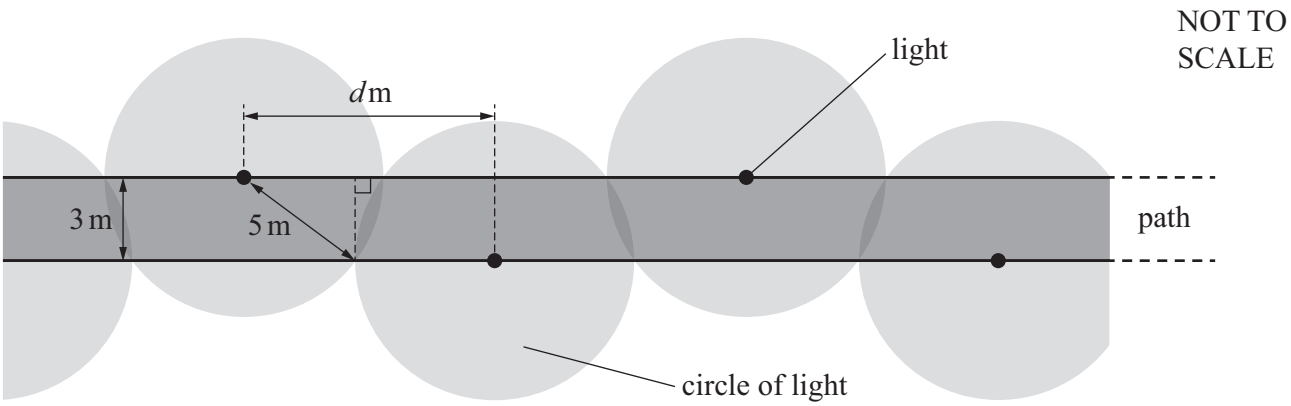
(b) The lights are placed on both sides of the path as shown.



Show that the value of d is now 9.

[1]

(c) Lights are placed on a long path.

Which arrangement, **part (a)** or **part (b)**, uses the smaller number of lights?
Give a reason for your answer.

..... [1]

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9 A different path has a width of 4 m.
The radius of each circle of light is 5 m.

Calculate the distance along the path between lights

(a) when the lights are all on the **same** side of the path

..... [2]

(b) when the lights are on **both** sides of the path.

..... [2]

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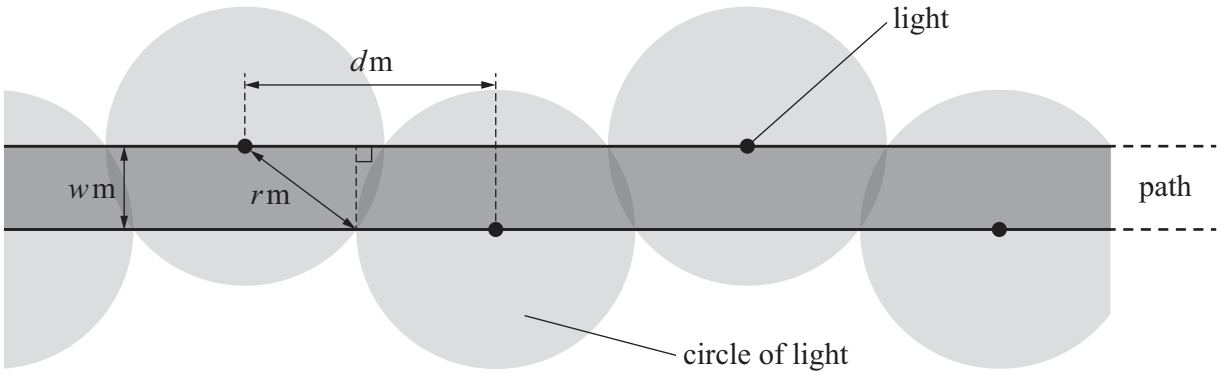

For this path:

- the width of the path is w metres
- the radius of the circle of light is r metres
- lights are on both sides of the path.

(a) A model for d in terms of r and w is $d = r + \sqrt{r^2 - w^2}$.

Draw and label a diagram to show this is correct.

[2]

(b) Find the value of d when $w = 6$ and $r = 6.8$.

..... [2]

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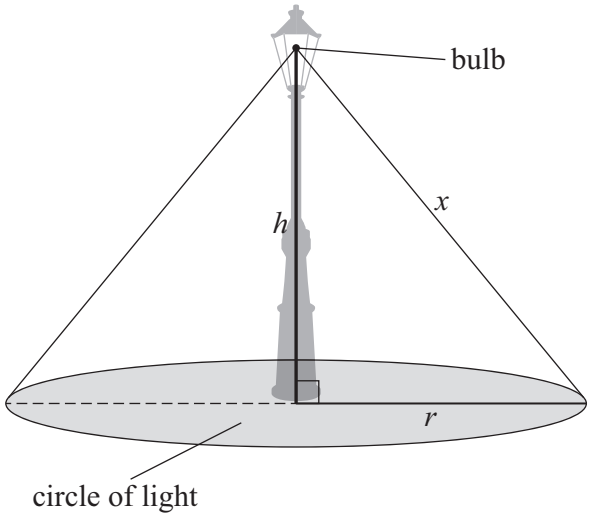

The diagram shows a light with height h metres and its circle of light.

A model for the intensity of light, L, at distance x metres from the bulb is

$$L = \frac{B}{x^2}.$$

B is a number called the *brightness index* of the bulb.
When B is larger the light is brighter.

The intensity of light on the circumference of the circle of light must be 0.05 units.

(a) Show that $r = \sqrt{20B - h^2}$.

[3]

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(b) The height of the light is 6 m.
The radius of the circle of light is 10 m.

Find the value of B.

..... [3]

(c) The height of the lights is h metres.

Change the model $d = r + \sqrt{r^2 - w^2}$ to find a model for d in terms of B, h and w.

..... [1]

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12 The height of the lights is 3.0 m.
The lights are on both sides of the path.
The brightness index is 3.5 .
The intensity of light on the circumference of the circle of light is still 0.05 units.

Find the greatest possible width for the path.

..... [5]

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