Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

0123456789

CAMBRIDGE INTERNATIONAL MATHEMATICS **0607/06**

Paper 6 Investigation and Modelling (Extended) **For examination from 2025**

SPECIMEN PAPER B **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 **12** pages. Any blank pages are indicated.

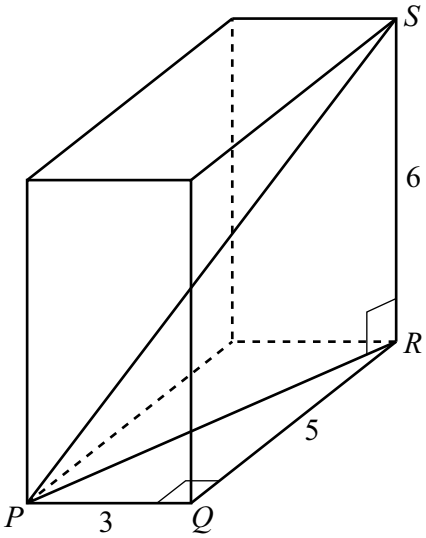
Section A

INVESTIGATION PYTHAGOREAN SETS OF FOUR

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

In this investigation, you will look at finding the integer lengths of the edges of a cuboid that has a diagonal with integer length.

1



NOT TO SCALE

The diagram shows a cuboid with edges of length 3, 5 and 6.

(a) Using Pythagoras' theorem in triangle PQR gives $PR^2 = 3^2 + 5^2$.

Find the value of PR^2.

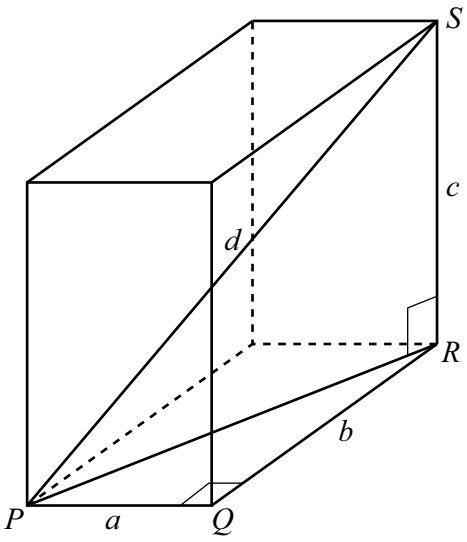
..... [1]

(b) Using Pythagoras' theorem in triangle PRS gives $PS^2 = PR^2 + 6^2$.

Find the value of PS^2.

..... [2]

2



NOT TO SCALE

The diagram shows a cuboid with integer dimensions a, b and c.
Its diagonal, PS, has integer length d.

(a) Use Pythagoras' theorem in triangle PQR to write down an expression for PR^2 in terms of a and b.

..... [1]

(b) Use your answer to **part (a)**, and Pythagoras' theorem in triangle PRS, to show that

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

[1]

3 A cuboid has integer dimensions a, b and c, where $a \leqslant b \leqslant c$.
When the length of the diagonal, d, is also an integer then (a, b, c, d) is called a Pythagorean set of four.

Use $d^2 = a^2 + b^2 + c^2$ to show that a cuboid with dimensions 4, 17 and 28 gives a Pythagorean set of four.
Complete the Pythagorean set of four.

(4, 17, 28, ...) [3]

4 **(a)** Which of these sets is a Pythagorean set of four?

(18, 24, 72, 72) (18, 24, 72, 78) (18, 24, 72, 84) (18, 24, 72, 90)

(18, 24, 72, ...) [2]

(b) k is a positive integer greater than 1.
(ka, kb, kc, kd) is a Pythagorean set of four.

Use algebra to show that (a, b, c, d) must also be a Pythagorean set of four.

[2]

(c) (a, b, c, d) is a *basic* Pythagorean set of four if a, b, c and d do not have a common factor greater than 1.

Find the basic Pythagorean set of four for your answer to **part (a)**.

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

5 **(a)** In a Pythagorean set of four (a, b, c, d), $d^2 = a^2 + b^2 + c^2$.

When $d = a + c$, show that $ac = \frac{b^2}{2}$.

[2]

(b) Explain why b **must** be even.

.....

.....

..... [2]

6 Here is the start of a method to find Pythagorean sets of four.

- Choose any even integer for b.
- Use **Question 5(a)** to calculate ac.
- Find all the possible pairs of integers for a and c, where $a < c$.

Use this method to find all the **basic** Pythagorean sets of four when you choose $b = 8$.

..... [7]

Section B

MODELLING DRIVING TO MY PLACE OF WORK

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

In this task you will look at a model for the time that I take to drive from my home to my place of work.

I live 20 km from my place of work.

7 **(a)** I leave home at 7.00 am.
I drive at an average speed of 50 km/h.

Calculate the time, in minutes, that it takes me to drive to work.

..... [3]

(b) I take m minutes to drive to work.
My average speed is v km/h.

Find a model for m.
Give your answer in its simplest form.

..... [1]

8 When I leave home after 7.00 am, there is more traffic, and my average speed is less than 50 km/h.

My average speed decreases steadily by 1 km/h, for every 2 minutes after 7.00 am that I leave home. For example, when I leave 6 minutes after 7.00 am, my average speed is 3 km/h less, which is 47 km/h.

(a) I leave home at 7.40 am.

(i) Find my average speed.

..... [2]

(ii) Show that I take 40 minutes to drive to work.

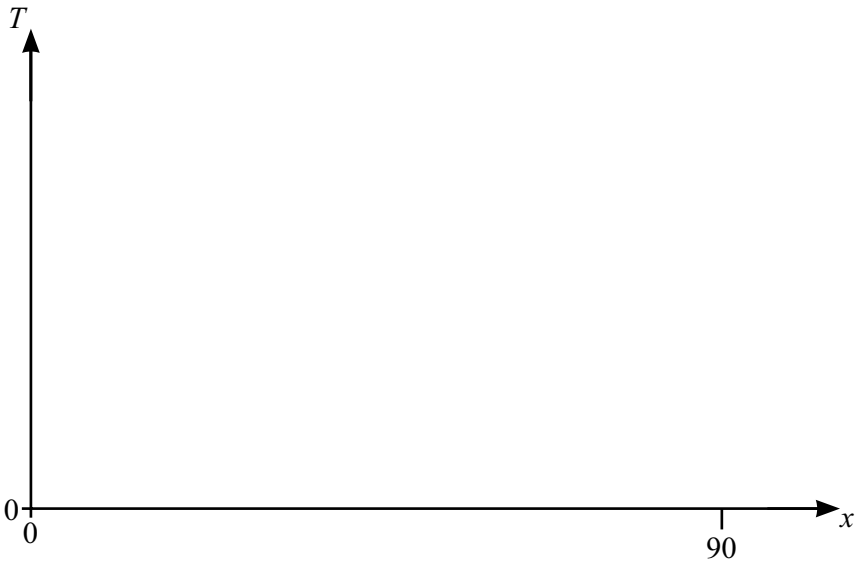
[1]

(b) I leave home x minutes after 7.00 am.

Show that a model for the time, T minutes, that I take to drive to work is $T = \frac{2400}{100 - x}$.

[2]

(c) Sketch the graph of the model $T = \dfrac{2400}{100 - x}$ for $0 \leqslant x \leqslant 90$.



[2]

(d) I want to drive for at most 30 minutes.

Find the latest time that I should leave home.

..... [2]

(e) I must be at work by 9.00 am.
One day I wake up late and leave home at 8.35 am.

(i) Use the model to find how late I will be for work.
Give your answer in hours and minutes.

..... [3]

(ii) Comment on the suitability of the model.

..... [1]

9 I leave home x minutes after 7.00 am.

(a) A is the number of minutes after 7.00 am when I arrive at work.

Give a reason why a model for A is

$$A = x + \frac{2400}{100 - x} .$$

.....

..... [1]

(b) I must be at work by 9.00 am. This is two hours (120 minutes) after 7.00 am.
So the maximum value of A is 120.

(i) Use this maximum value of A to show that

$$x^2 - 220x + 9600 = 0 .$$

[3]

(ii) Find the value of x.

..... [3]

(iii) Find the latest time that I can leave home and arrive at work on time.

..... [1]

BLANK PAGE

