

Please write clearly in block capitals.

Centre number

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Candidate number

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Surname

Forename(s)

Candidate signature

I declare this is my own work.

GCSE MATHEMATICS

H

Higher Tier

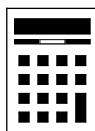
Paper 2 Calculator

Time allowed: 1 hour 30 minutes

Materials

For this paper you must have:

- a calculator
- mathematical instruments.



Instructions

- Use black ink or black ball-point pen. Draw diagrams in pencil.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 80.
- You may ask for more answer paper, graph paper and tracing paper. These must be tagged securely to this answer book.

For Examiner's Use	
Pages	Mark
2–3	
4–5	
6–7	
8–9	
10–11	
12–13	
14–15	
16–17	
18–19	
20–21	
22–23	
24	
TOTAL	

Advice

In all calculations, show clearly how you work out your answer.



Answer **all** questions in the spaces provided.

Do not write
outside the
box

- 1 Circle the factor of $x^2 - 5x$ $x(x - 5)$ [1 mark]

$x - 1$

$-5x$

$x - 5$

$5x$

- 2 A is half of B .
Work out the ratio $A : B$
Circle your answer. [1 mark]

$1 : 2$

$2 : 1$

$1 : 3$

$3 : 1$

- 3 The first three terms of a geometric progression are $\frac{2}{3}$ $\frac{4}{9}$ $\frac{8}{27}$
Circle the fourth term. [1 mark]

$\frac{10}{81}$

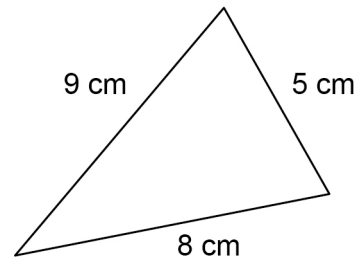
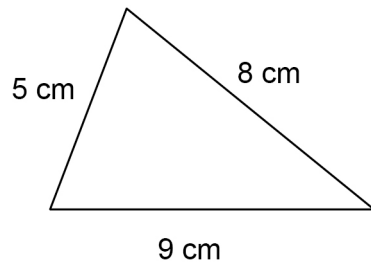
$\frac{14}{81}$

$\frac{16}{81}$

$\frac{32}{81}$



4

Not drawn
accurately

Circle the reason why these triangles are congruent.

[1 mark]

ASA

RHS

SAS

SSS

5

Solve $10x = 62.4 - 3x$

[2 marks]

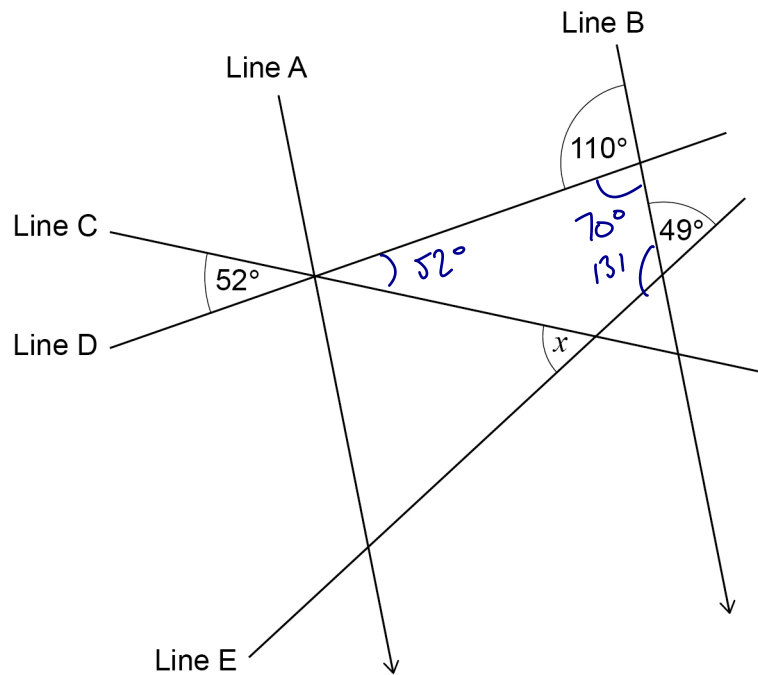
$$13x = 62.4$$

$$x = \frac{62.4}{13}$$

$$x = 4.8$$



- 6 Lines A, B, C, D and E intersect as shown.
Lines A and B are parallel.



Not drawn
accurately

Work out the size of angle x .

[3 marks]

$$52 + 70 + 131 = 253$$

$$360 - 253 = 107$$

$$x = 180 - 107$$

$$= 73$$

Answer 73 degrees



- 7 102 boys and 85 girls took a test.
The table shows information about the mean marks.

	Boys	Girls
Number of students	102	85
Mean mark	68.5	72.4

The pass mark for the test was 70

Was the mean mark for **all** of these students greater than the pass mark?

You **must** show your working.

[3 marks]

$$102 \times 68.5 = 6987$$

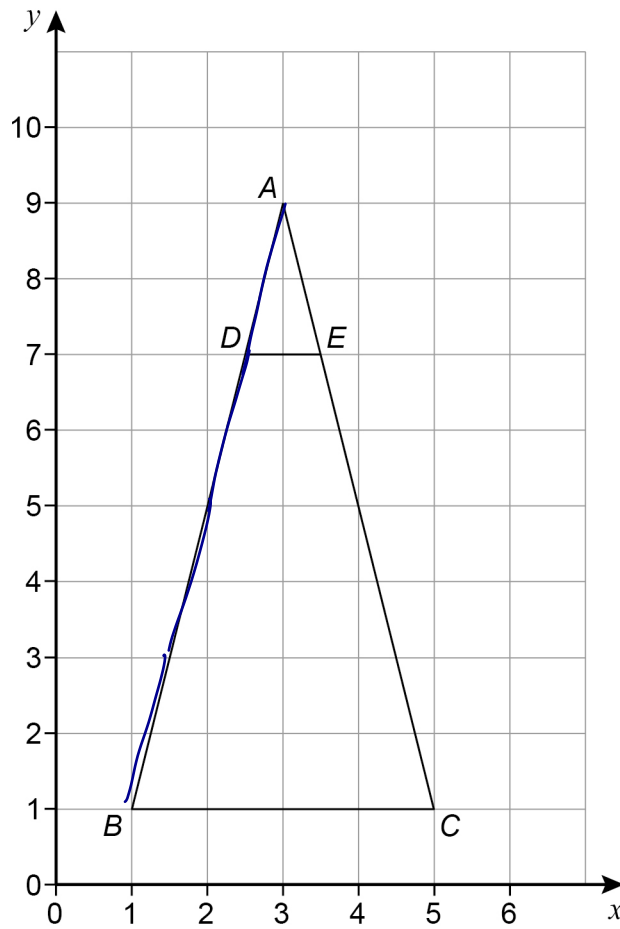
$$85 \times 72.4 = \frac{6154}{13141}$$

$$\frac{13141}{187} = 70.27$$

So yes the mean for everyone is > 70



8



Describe fully the **single** transformation that maps triangle ABC to triangle ADE .

[3 marks]

Enlargement, scale factor $\frac{1}{4}$ about $(3, 9)$



9

A ball contains 5000 cm^3 of air.

More air is pumped into the ball at a rate of 160 cm^3 per second.

The ball is full of air when it becomes a sphere with radius 15 cm



$$\text{Volume of a sphere} = \frac{4}{3}\pi r^3 \text{ where } r \text{ is the radius}$$

Does it take **less than** 1 minute to fill the ball?

You **must** show your working.

[4 marks]

$$V = \frac{4}{3} \times \pi \times 15^3 = 14137.2 \text{ (A)}$$

$$14137.2 - 5000 = 9137.2$$

$$\frac{9137.2}{160} = 57.1 \text{ seconds}$$

So yes less than 1 minute.



10

 p is a positive number. n is a negative number.

For each statement, tick the correct box.

[4 marks]

	Always true	Sometimes true	Never true
$p + n$ is positive	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
$p - n$ is positive	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
$p^2 + n^2$ is positive	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
$p^3 \div n^3$ is positive	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

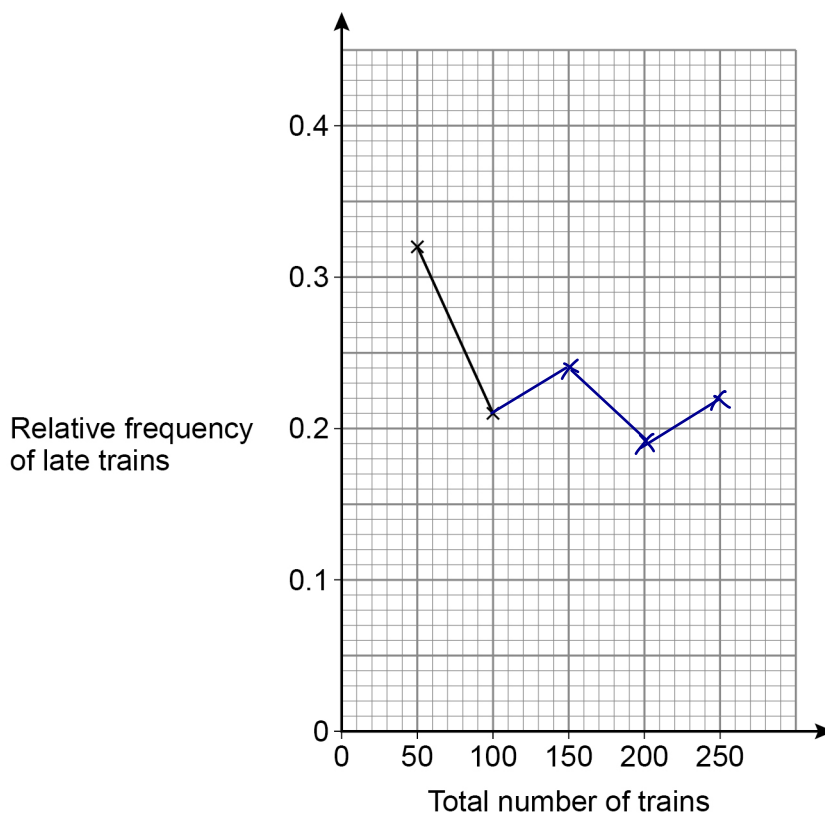


- 11 250 trains arrived at a station.
The number of trains that were late was recorded after every 50 trains.
The table shows some information about the results.

Total number of trains	50	100	150	200	250
Total number of late trains	16	21	36	38	55
Relative frequency of late trains	0.32	0.21	0.24	0.19	0.22

- 11 (a) Complete the relative frequency graph.

[3 marks]



- 11 (b) Write down the best estimate of the probability that a train arriving at the station is late.

[1 mark]

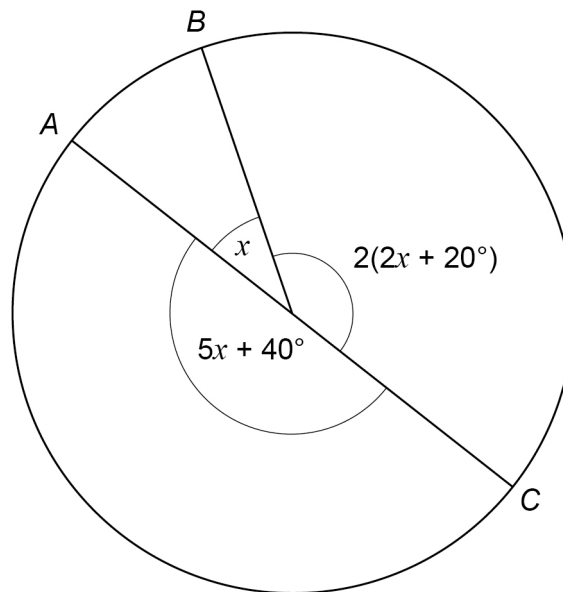
Answer 0.22



12

A , B and C are three points on a circle.
The radii from A , B and C are shown.

Not drawn
accurately



Is AC a diameter of the circle?

You **must** show your working.

[3 marks]

$$\text{Diameter if } 5x + 40 = 180$$

$$x + 2(2x + 20) + 5x + 40 = 360$$

$$x + 4x + 40 + 5x + 40 = 360$$

$$10x + 80 = 360$$

$$10x = 280$$

$$x = 28$$

$$5x + 40 = 5 \times 28 + 40 = 180$$

So yes AC is a diameter



13

A straight line

has gradient 6

and

passes through the point (3, 19)

Work out the equation of the line.

Give your answer in the form $y = mx + c$ **[3 marks]**

$$y = 6x + c$$

$$19 = 6(3) + c$$

$$19 = 18 + c$$

$$c = 1$$

$$y = 6x + 1$$

Answer _____

Turn over for the next question**Turn over ►**

14 The population of butterflies in a park is 4200

14 (a) Assume that the population increases by 12% each day.

Show that after 20 days the population would be greater than 40 000

[2 marks]

$$4200 \times 1.12^{20} = 40514$$

$$40514 > 40000$$

14 (b) In fact, the population
increases by 13% each day for 19 days
then
decreases by 8% for 1 day.

After the 20 days, is the actual population greater than 40 000 ?

Tick a box.

Yes

No

Show working to support your answer.

[2 marks]

$$4200 \times 1.13^{19} \times 0.92 = 39402.8$$



- 14 (c) The expected number of visitors to the park each day depends on the temperature.

Temperature	Expected number of visitors each day
Less than 21°C	700
21°C or more	900

On each of the 30 days in June

the park is open

the probability that the temperature is less than 21°C is 0.4

Work out the **total** number of expected visitors to the park in June.

[3 marks]

$$0.4 \times 700 + 0.6 \times 900$$

$$= 820$$

$$\times 30$$

$$\underline{\hspace{1cm}}$$

$$24600$$

Answer _____



15 L is directly proportional to D^2

$$L = 85 \text{ when } D = 10$$

15 (a) Work out an equation connecting L and D .

[3 marks]

$$L = kD^2$$

$$85 = 100k$$

$$k = 0.85$$

Answer $L = 0.85D^2$

15 (b) Work out the value of L when $D = 5$

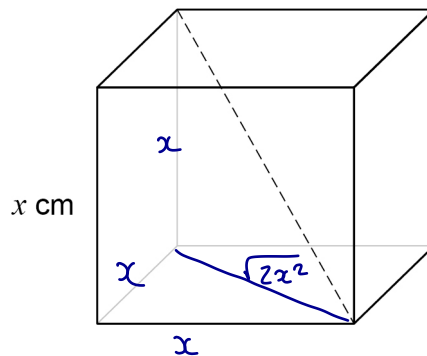
[2 marks]

$$L = 0.85 \times 5^2$$

Answer 21.25



- 16 Here is a cube with edge length x cm
One diagonal is shown.



$$2x^2 + x^2 = \sqrt{3x^2}$$

- 16 (a) Circle the length, in centimetres, of the diagonal.

[1 mark]

$$\sqrt{3x}$$

$$\sqrt[3]{3x^2}$$

$$\sqrt{x^3}$$

$$\sqrt[3]{3x}$$

- 16 (b) The total length, in centimetres, of the edges of the cube is a multiple of 18
Circle the correct statement.

[1 mark]

x is a
whole number

x is not a
whole number

x might be a
whole number

12 edges

$$12x = 18y$$

$$x = \frac{18y}{12} = \frac{3y}{2}$$

Turn over for the next question

Turn over ►



- 17 20 people were asked which device they used more often, laptop or phone.
The table shows the results.

	Laptop	Phone
Male	2	9
Female	4	5

- 17 (a) One male and one female are chosen at random.

Work out the probability that **exactly** one of them said laptop.

[3 marks]

$$\frac{2}{11} \times \frac{5}{9} = \frac{10}{99}$$

$$+ \frac{9}{11} \times \frac{4}{9} = \frac{36}{99}$$

Answer $\frac{46}{99}$

- 17 (b) Two males are chosen at random.

Work out the probability that they **both** said phone.

[2 marks]

$$\frac{9}{11} \times \frac{8}{10} = \frac{72}{110} = \frac{36}{55}$$

Answer _____

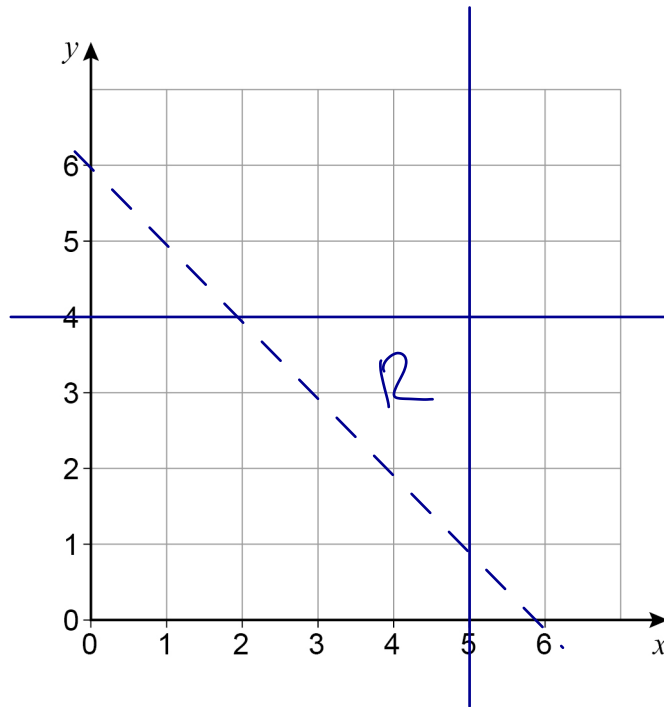


18 On the grid, identify the region represented by

$$x \leq 5 \quad y \leq 4 \quad x + y > 6$$

Label the region R.

[3 marks]

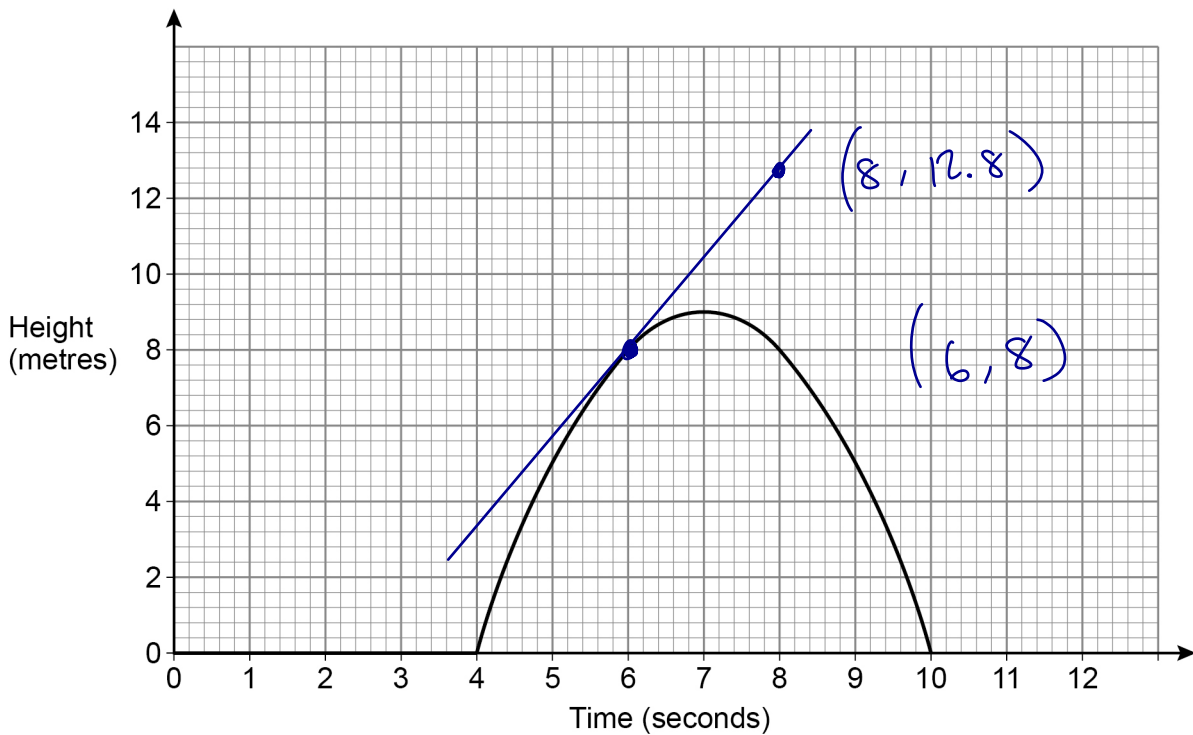


Turn over for the next question

Turn over ►



- 19 The graph shows the height above ground of a toy rocket for 10 seconds.



- 19 (a) For how long is the rocket in the air?
Circle your answer.

[1 mark]

10 seconds

9 seconds

6 seconds

4 seconds



- 19 (b) Using the graph, estimate the speed of the rocket after 6 seconds.
State the units of your answer.

[3 marks]

$$\frac{12.8 - 8}{8 - 6} = \frac{4.8}{2} = 2.4$$

Answer 2.4 m/s.

- 20 A square has an area of 0.25 square metres.
Circle the length, in **centimetres**, of one side of the square.

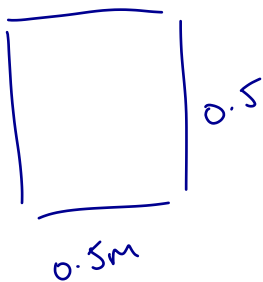
[1 mark]

0.5 cm

5 cm

50 cm

500 cm



$$0.5m = 50cm$$

Turn over for the next question

Turn over ►



21

 x is an integer.Prove that $35 + (3x + 1)^2 - 2x(4x - 3)$ is a square number.**[4 marks]**

$$35 + 9x^2 + 6x + 1 - 8x^2 + 6x$$

$$= 35 + x^2 + 12x + 1$$

$$= x^2 + 12x + 36$$

$$= (x+6)^2$$

which is always a square number



22

Liam is trying to remember a 3-digit code.

He knows the rule that

the first digit is a cube number $1, 8$

the second digit is a factor of 16 $1, 2, 4, 8$

the third digit is an odd number. $1, 3, 5, 7, 9$

Liam tries at random a code that matches the rule.

Work out the probability that this is the correct code.

[4 marks]

$$2 \times 4 \times 5 = 40$$

$$\frac{1}{40}$$

Answer _____

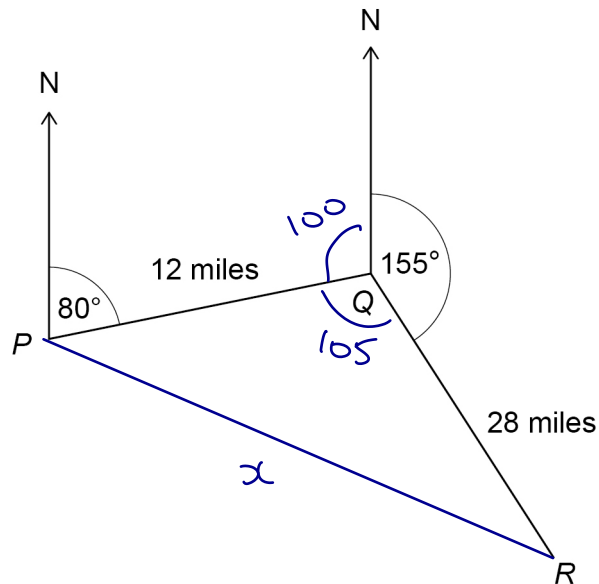


23

A ship sails from P to Q and then from Q to R .

Q is 12 miles from P , on a bearing of 080°

R is 28 miles from Q , on a bearing of 155°



Not drawn
accurately

Work out the direct distance from P to R .

[4 marks]

$$x^2 = 12^2 + 28^2 - 2 \times 12 \times 28 \cos 105$$

$$x = 33.2 \text{ miles.}$$

Answer _____ miles



24

The flight of a plane was in two stages.
The table shows information about the flight.

	Distance (miles)	Speed (mph)	Time (hours)
1st stage	731	x	$\frac{731}{x}$
2nd stage	287	$x - 24$	$\frac{287}{x - 24}$

In total, the flight lasted 2 hours.

Work out the value of x .

[5 marks]

$$\frac{731}{x} + \frac{287}{x-24} = 2$$

$$731(x-24) + 287x = 2x(x-24)$$

$$731x - 17544 + 287x = 2x^2 - 48x$$

$$2x^2 - 1066x + 17544 = 0$$

$$x^2 - 533x + 8772 = 0$$

$$x = \frac{533 \pm \sqrt{533^2 - 4 \times 1 \times 8772}}{2}$$

$$x = 516 \text{ or } 17$$

Answer 516



25 The equation of a curve is $y = x^2 + 14x + 52$

By completing the square, work out the coordinates of the turning point.

You **must** show your working.

[3 marks]

$$y = (x+7)^2 - 49 + 52$$
$$y = (x+7)^2 + 3$$

Answer (-7 , 3)

END OF QUESTIONS



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outside the
box*

**DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED**



