AQA

Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

Surname _____

Forename(s) _____

Candidate signature _____

I declare this is my own work.

GCSE MATHEMATICS

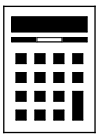
H

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.

Advice

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

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	

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

1 Circle the factor of $x^2 - 5x$

$x(x-5)$

[1 mark]

$x - 1$ $\quad -5x$ $\quad x - 5$ $\quad 5x$

2 A is half of B.

$A = \frac{1}{2}B$

Work out the ratio $A : B$

Circle your answer.

$\frac{A}{B} = \frac{1}{2}$

$A : B = 1 : 2$

[1 mark]

1 : 2 $\quad$ 2 : 1 $\quad$ 1 : 3 $\quad$ 3 : 1

3 The first three terms of a geometric progression are $\frac{2}{3} \quad \frac{4}{9} \quad \frac{8}{27}$

Circle the fourth term.

[1 mark]

$\frac{10}{81} \quad \frac{14}{81} \quad \frac{16}{81} \quad \frac{32}{81}$

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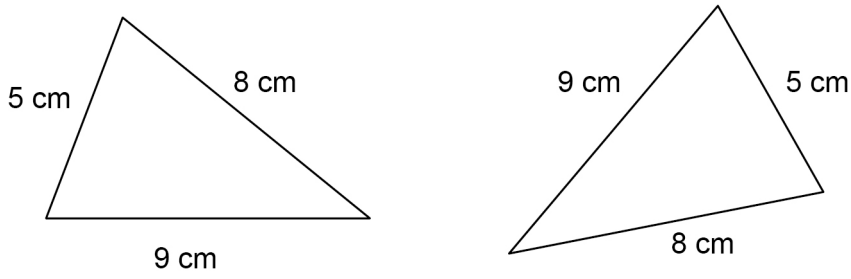
4



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Circle the reason why these triangles are congruent.

[1 mark]

ASA RHS SAS SSS (1)

5 Solve $10x = 62.4 - 3x$

[2 marks]

$10x + 3x = 62.4$ (1)

$13x = 62.4$

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

$= 4.8$ (1)

$x =$ 4.8

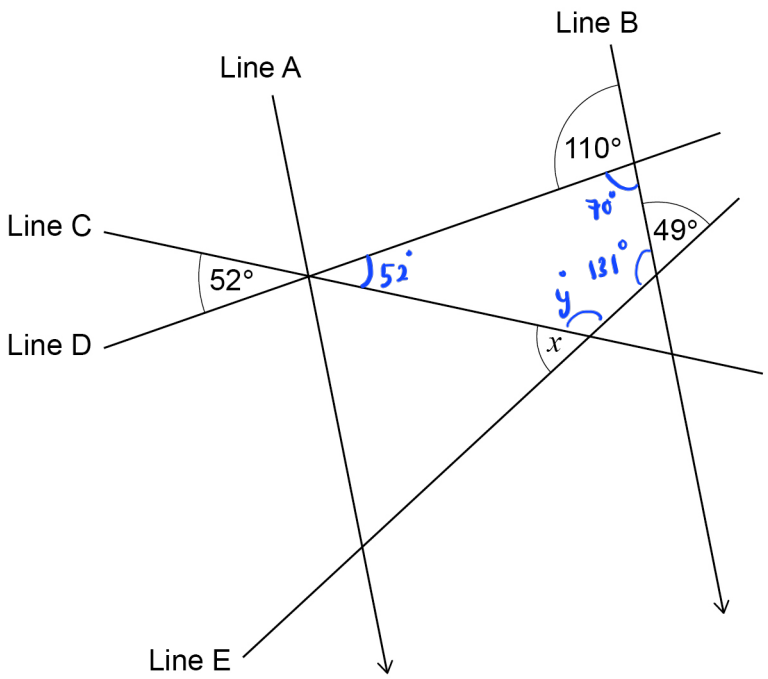
6

Turn over ►

Do not write outside the box

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

Lines A and B are parallel.



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Work out the size of angle x.

[3 marks]

$y^\circ = 360^\circ - 52^\circ - 70^\circ - 131^\circ$

$= 107^\circ$

$x = 180^\circ - 107^\circ$

$= 73^\circ$ (3)

Answer 73 degrees

Do not write outside the box

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]

Total students : $102 + 85 = 187$

Total boys marks : $102 \times 68.5 = 6987$ (1)

Total girls marks : $85 \times 72.4 = 6154$

Total students marks : $6987 + 6154 = 13\,141$

mean students mark : $\frac{13\,141}{187} = 70.27\ldots$ (1) (1)

Yes. The mean marks are greater than 70.

6

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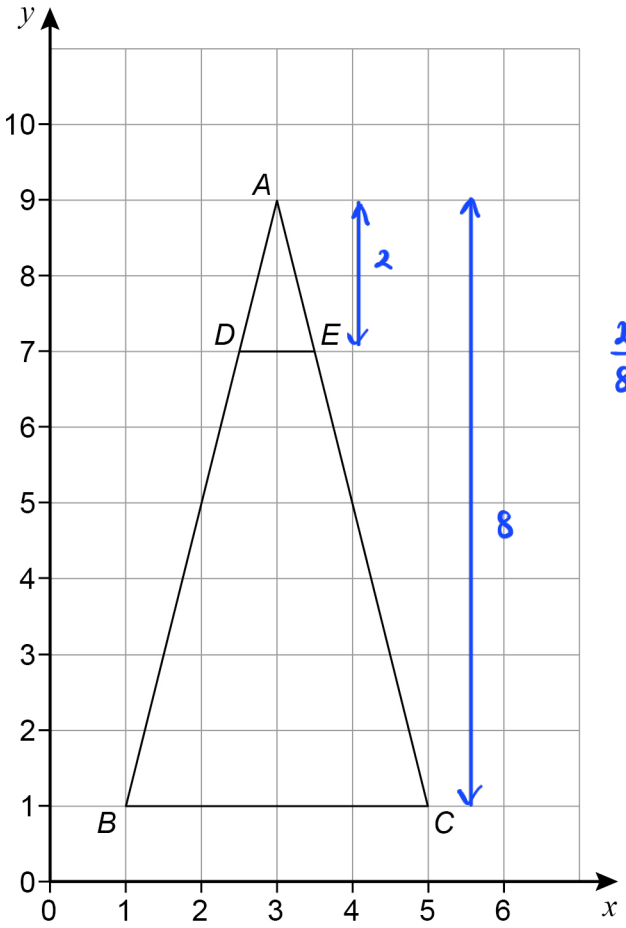

Describe fully the **single** transformation that maps triangle *ABC* to triangle *ADE*.

[3 marks]

Enlargement of scale factor $\frac{1}{4}$ at centre A.

(1) (1) (1)

Do not write outside the box

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

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

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

You **must** show your working.

[4 marks]

Volume of ball $= \frac{4}{3} \times \pi \times 15^3$ (1)

$= 14\,137\ldots$

Air needed : $14\,137 - 5000 = 9137\ cm^3$ (1)

time taken $= \frac{9137\ cm^3}{160\ cm^3 s^{-1}} = 57.1\ s$ (1)

Yes. It takes only 57.1 seconds to fill the ball. (1)

7

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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	☐	✓ (1)	☐
$p - n$ is positive	✓ (1)	☐	☐
$p^2 + n^2$ is positive	✓ (1)	☐	☐
$p^3 \div n^3$ is positive	☐	☐	(1) ✓

Do not write outside the box

11 250 trains arrived at a station.

The number of trains that were late was recorded after every 50 trains.

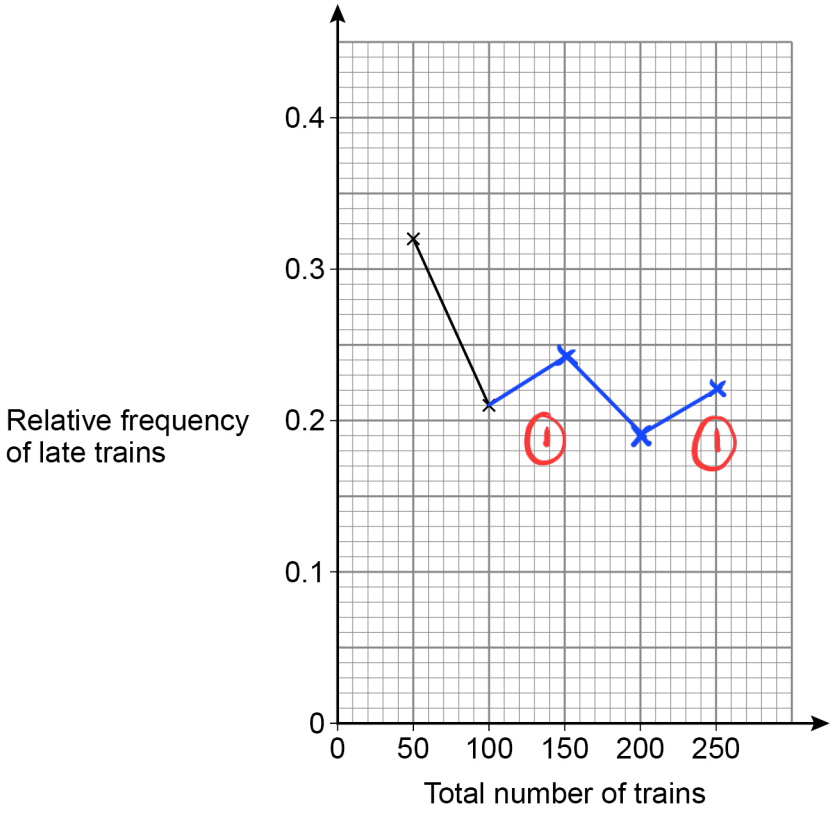
The table shows some information about the results.

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

(1)

11 (a) Complete the relative frequency graph.

[3 marks]



(1) (1)

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

[1 mark]

$55 \div 250 = 0.22$

Answer 0.22 (1)

8

Turn over ►

Do not write outside the box

12 *A*, *B* and *C* are three points on a circle.

The radii from *A*, *B* and *C* are shown.

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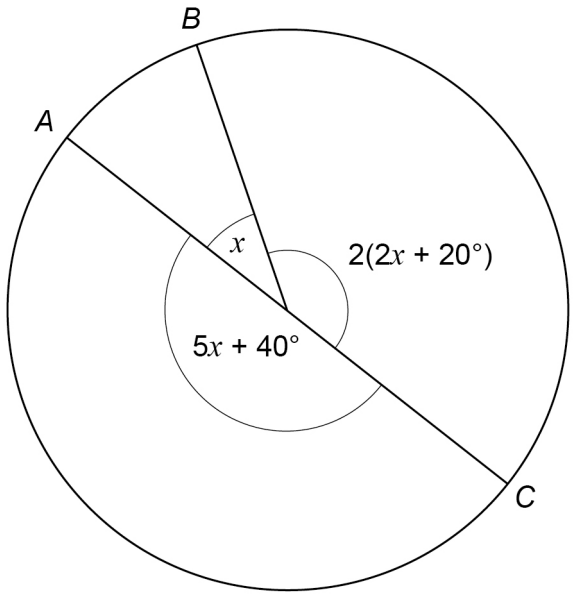

Is *AC* a diameter of the circle?

You **must** show your working.

[3 marks]

(1)

$x + 2(2x + 20^\circ)$

$= x + 4x + 40^\circ$ (1)

$= 5x + 40^\circ$ (1)

Yes.

Do not write outside the box

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]

$19 = 6(3) + c$ (1)

$c = 19 - 18$

$= 1$ (1)

$y = 6x + 1$

Answer $y = 6x + 1$ (1)

Turn over for the next question

6

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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]

$4200 \times 1.12^{20} = 40514\ldots$ (1) (1)

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 (1)

Show working to support your answer.

[2 marks]

$4200 \times 1.13^{19} \times 0.92 = 39402\ldots$ (1)

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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]

Less than 21°C : $0.4 \times 30 \times 700 = 8400$ (1)

21°C or more : $0.6 \times 30 \times 900 = 16\,200$

Total : $8400 + 16\,200$ (1)

$= 24\,600$

Answer 24 600 (1)

7

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15 L is directly proportional to D^2

$L = 85$ when $D = 10$

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

[3 marks]

$L = kD^2$ (1)

$85 = k(10)^2$

$k = \frac{85}{100} = 0.85$ (1)

$L = 0.85D^2$ (1)

Answer $L = 0.85D^2$

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

[2 marks]

$L = 0.85(5)^2$ (1)

$= 0.85 \times 25$

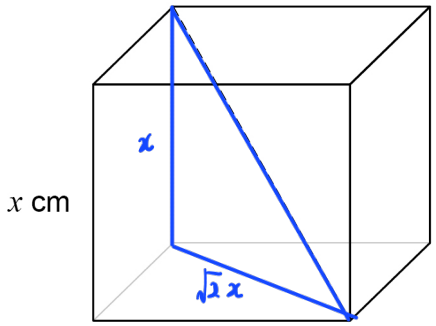
$= 21.25$ (1)

Answer 21.25

Do not write outside the box

16 Here is a cube with edge length x cm

One diagonal is shown.



16 (a) Circle the length, in centimetres, of the diagonal. **[1 mark]**

$\sqrt{x^2 + (\sqrt{2}x)^2}$

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

$= \sqrt{3}\,x$

$\sqrt{3}\,x$ (1)

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

$\sqrt{x^3}$

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

16 (b) The total length, in centimetres, of the edges of the cube is a multiple of 18

Circle the correct statement. **[1 mark]**

↳ 12 edges

$= 12x$

x is a whole number

x is not a whole number

x might be a whole number (1)

Turn over for the next question

7

Do not write outside the box

17 20 people were asked which device they used more often, laptop or phone.

The table shows the results.

	Laptop	Phone	Total
Male	2	9	11
Female	4	5	9

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

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

[3 marks]

$\left(\frac{2}{11} \times \frac{5}{9}\right) + \left(\frac{4}{9} \times \frac{9}{11}\right)$ (1)

$= \frac{10}{99} + \frac{36}{99}$ (1)

$= \frac{46}{99}$ (1)

Answer $\frac{46}{99}$

17 (b) Two males are chosen at random.

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

[2 marks]

$\frac{9}{11} \times \frac{8}{10} = \frac{72}{110}$ (1) (1)

Answer $\frac{72}{110}$

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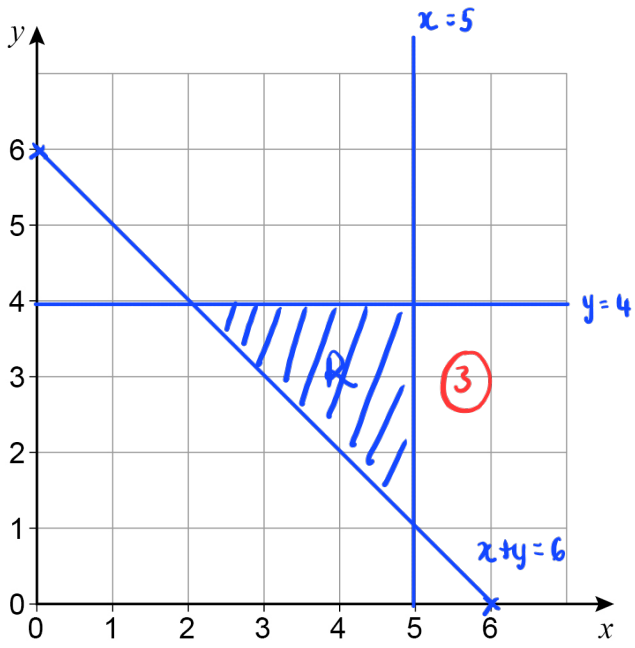
18 On the grid, identify the region represented by

$x \leqslant 5 \qquad y \leqslant 4 \qquad x + y > 6$

Label the region R.

[3 marks]



Turn over for the next question

8

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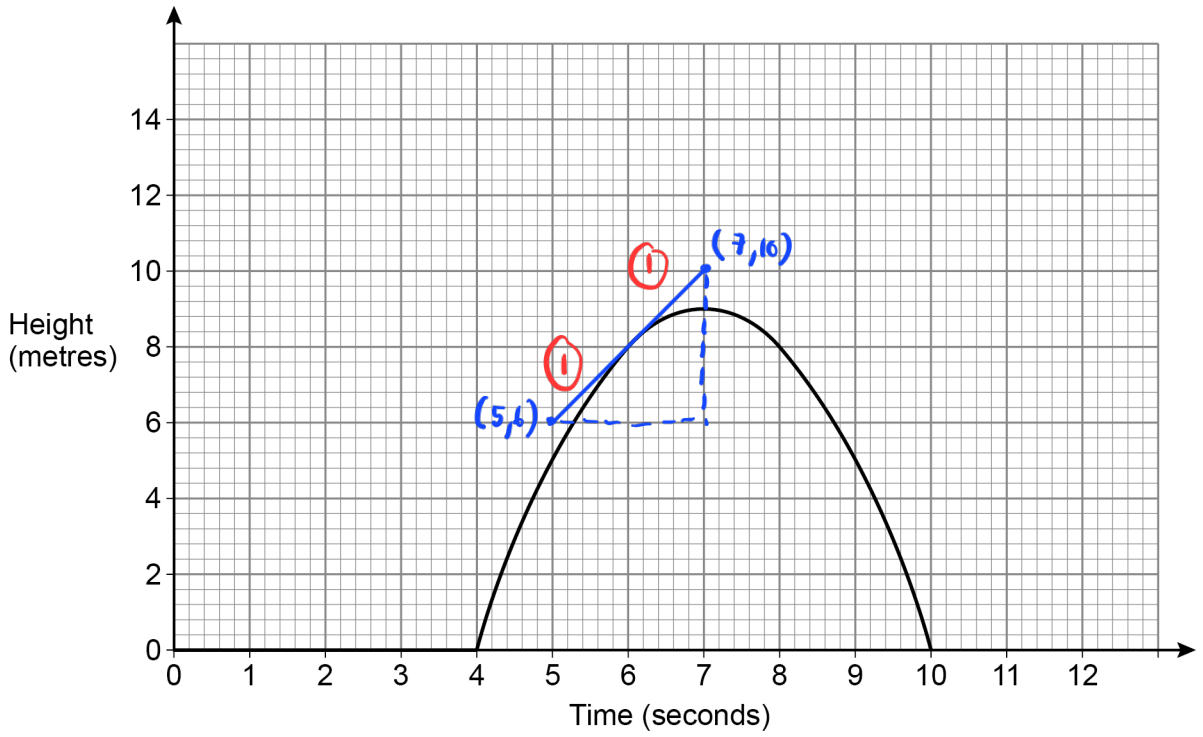
19 The graph shows the height above ground of a toy rocket for 10 seconds.



19 (a) For how long is the rocket in the air?

Circle your answer.

[1 mark]

10 seconds 9 seconds 6 seconds 4 seconds

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19 (b) Using the graph, estimate the speed of the rocket after 6 seconds.

State the units of your answer.

[3 marks]

Speed : distance / time

: $\frac{10-6}{7-5}$: $\frac{4}{2}$: 2 m/s

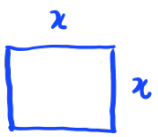
Answer 2 m/s (1)

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 (1) 500 cm



$x^2 = 0.25\ m^2$

$x = 0.5\ m$

$= 50\ cm$

Turn over for the next question

5

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21 x is an integer.

Prove that $35 + (3x + 1)^2 - 2x(4x - 3)$ is a square number.

[4 marks]

$(3x+1)^2 = 9x^2 + 6x + 1$

$2x(4x-3) = 8x^2 - 6x$ (1)

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

$= 9x^2 - 8x^2 + 6x + 6x + 36$ (1)

$= x^2 + 12x + 36$ (1)

$(x+6)(x+6)$

$= (x+6)^2$ (1)

Do not write outside the box

22 Liam is trying to remember a 3-digit code.

He knows the rule that

the first digit is a cube number

the second digit is a factor of 16

the third digit is an odd number.

Liam tries at random a code that matches the rule.

Work out the probability that this is the correct code.

[4 marks]

From 1 to 9 :

1st : 1, 8

2nd : 1, 2, 4, 8 (1)

3rd : 1, 3, 5, 7, 9 (1)

$\frac{1}{2} \times \frac{1}{4} \times \frac{1}{5} = \frac{1}{40}$ (1) (1)

Answer $\frac{1}{40}$

8

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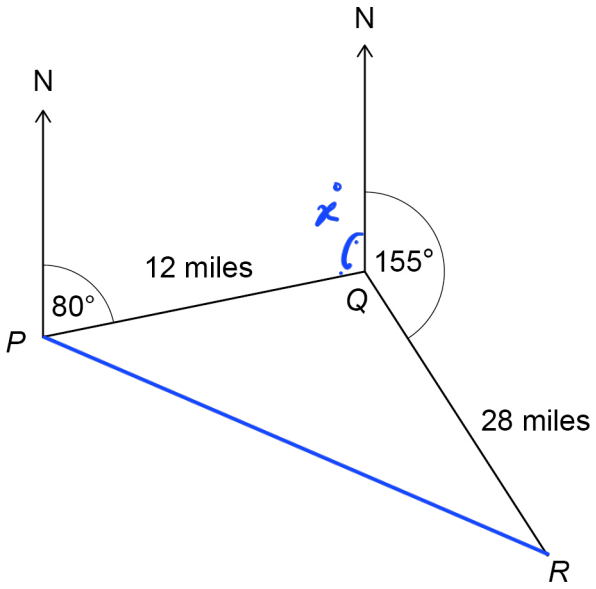
23 A ship sails from *P* to *Q* and then from *Q* to *R*.

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

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



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Work out the direct distance from *P* to *R*.

[4 marks]

$x^\circ = 180^\circ - 80^\circ = 100^\circ$

$PQR = 360^\circ - 155^\circ - 100^\circ$

$= 105^\circ$ (1)

$PR^2 = 12^2 + 28^2 - 2(12)(28)\cos 105^\circ$

$= 1101$ (1)

$PR = \sqrt{1101}$ (1)

$= 33.19$ (1)

Answer 33.19 miles

Do not write outside the box

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]

$\frac{731}{x} + \frac{287}{x-24} = 2$ (1)

$731(x-24) + 287x = 2(x)(x-24)$ (1)

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

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

$x^2 - 533x + 8772 = 0$ (1)

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

$= \frac{533 \pm \sqrt{284089 - 35088}}{2}$

$= \frac{533 \pm 499}{2}$ time cannot be negative

$= \frac{34}{2}$ or $\frac{1032}{2}$ $= 17$ or 516

Answer 516 (1)

9

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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]

$y = (x+7)^2 - 49 + 52$ (1)

$y = (x+7)^2 + 3$ (1)

Answer (-7 , 3 (1))

END OF QUESTIONS

3

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ANSWER IN THE SPACES PROVIDED

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