| Surname | Centre Number | Candidate Number |
|---|---|---|
| Other Names | | 0 |

# GCSE

C300UB0-1

A18-C300UB0-1

# MATHEMATICS – Component 2
## Calculator-Allowed Mathematics
## HIGHER TIER

THURSDAY, 8 NOVEMBER 2018

– MORNING

2 hours 15 minutes

| For Examiner's use only | | |
|---|---|---|
| **Question** | **Maximum Mark** | **Mark Awarded** |
| **1.** | **2** | |
| **2.** | **4** | |
| **3.** | **2** | |
| **4.*(a)*** | **8** | |
| **4.*(b)*** | **5** | |
| **5.** | **2** | |
| **6.** | **5** | |
| **7.** | **5** | |
| **8.** | **2** | |
| **9.*(a)(b)(c)(d)*** | **5** | |
| **9.*(e)*** | **1** | |
| **10.** | **5** | |
| **11.*(a)*** | **3** | |
| **11.*(b)*** | **4** | |
| **12.** | **4** | |
| **13.** | **7** | |
| **14.** | **9** | |
| **15.** | **6** | |
| **16.** | **10** | |
| **17.** | **9** | |
| **18.** | **6** | |
| **19.** | **6** | |
| **20.** | **6** | |
| **21.** | **4** | |
| **Total** | **120** | |

### ADDITIONAL MATERIALS

A calculator will be required for this examination.

A ruler, protractor and a pair of compasses may be required.

### INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

You may use a pencil for graphs and diagrams only.

Write your name, centre number and candidate number in the spaces at the top of this page.

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

If you run out of space, use the continuation page at the back of the booklet, taking care to number the question(s) correctly.

Take $\pi$ as 3·14 or use the $\pi$ button on your calculator.

### INFORMATION FOR CANDIDATES

You should give details of your method of solution when appropriate.

Unless stated, diagrams are not drawn to scale.

Scale drawing solutions will not be acceptable where you are asked to calculate.

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

You are reminded of the need for good English and orderly, clear presentation in your answers.

C300UB01
01

## Formula list

*Area and volume formulae*

Where $r$ is the radius of the sphere or cone, $l$ is the slant height of a cone and $h$ is the perpendicular height of a cone:

Curved surface area of a cone = $\pi rl$

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

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

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

*Kinematics formulae*

Where $a$ is constant acceleration, $u$ is initial velocity, $v$ is final velocity, $s$ is displacement from the position when $t = 0$ and $t$ is time taken:

$$v = u + at$$

$$s = ut + \frac{1}{2}at^2$$

$$v^2 = u^2 + 2as$$

Examiner only

**1.** A length of wire is cut into 3 pieces.
The 2 shortest pieces are the same length.
The longest piece is 3 times the length of each of the shortest pieces.

*(a)* Write down the ratio of the lengths of the 3 pieces of wire. [1]

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*(b)* What fraction of the original length of wire is the longest piece? [1]

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**2.** Rearrange each of the following to make $w$ the subject of the formula.

*(a)* $\frac{7}{w} = e$ [1]

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*(b)* $3(w + 5) - f = g$ [3]

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**3.** A road track measures 2·2 cm on a map with a scale of 1 : 25 000.

What is the actual length of the road track?
Give your answer in km. [2]

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Actual length ..... km

Examiner only

**4.** Gregor owns a restaurant.

*(a)* The diagram shows a circular place mat and a square place mat.

*Diagram not drawn to scale*

The radius of the circular place mat is 14 cm.

(i) Calculate the circumference of the circular place mat. [2]

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(ii) The **area** of the square place mat is 25% more than the **area** of the circular place mat.

Calculate the **perimeter** of the square place mat.
Comment on the accuracy of your answer. [6]

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Comment:

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Examiner only

*(b)* Gregor plans to buy some spoons and forks.

A bag of 24 spoons costs £19.95.
A box of 18 forks costs £15.55.
Bags and boxes cannot be split.

Gregor decides to buy the same number of spoons as forks.
He places an order to buy the smallest number of each that he can.

Complete the details on the order form shown at the bottom of the page.
You must show all your working. [5]

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| Order form | Cost (For the required numbers ordered) |
|---|---|
| ..... bags of spoons | ..... |
| ..... boxes of forks | ..... |
| Total cost of the complete order £ ..... | |

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Examiner only

**5.** Gary measures the depth of a river in 6 places between two bridges.
The depths are as follows:

48·8 cm  55·1 cm  34·6 cm  75·2 cm  85·7 cm  96·1 cm

Gary decides to write each of the 6 depths correct to the nearest 10 cm.
He states that the median depth of the river between the two bridges is 70 cm.

Give two reasons why the method Gary used to obtain this median depth leads to an inaccurate result. [2]

Reason 1:

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Reason 2:

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**6.**

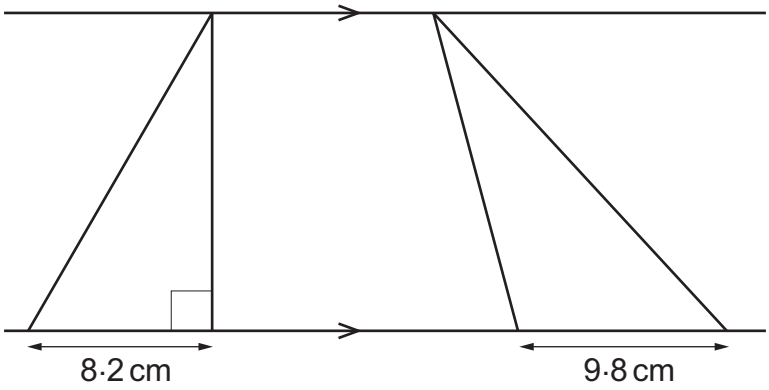


*Diagram not drawn to scale*

The area of the right-angled triangle is 41·82 $cm^2$.

Calculate the area of the obtuse-angled triangle. [5]

Examiner only

**7.** *(a)* A straight line passes through the points (0, 7) and (3, 19).

Find the equation of the straight line.
Give your answer in the form $y = mx + c$. [3]

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Examiner only

*(b)* Which two of the following equations represent a straight line that is parallel to $y = 8x - 3$?
Circle your answers. [2]

$y = -3x + 3$ $\quad$ $y = 8x + 3$ $\quad$ $y = -8x + 3$

$y = -8x - 8$ $\quad$ $8x + y + 3 = 0$ $\quad$ $y - 8x - 8 = 0$

**8.** A brand of toothpaste is available in two different sizes.

87·5 ml tube costs 49p.
125 ml tube costs 72p.

Which size of toothpaste offers the better value for money?
You must show all your working. [2]

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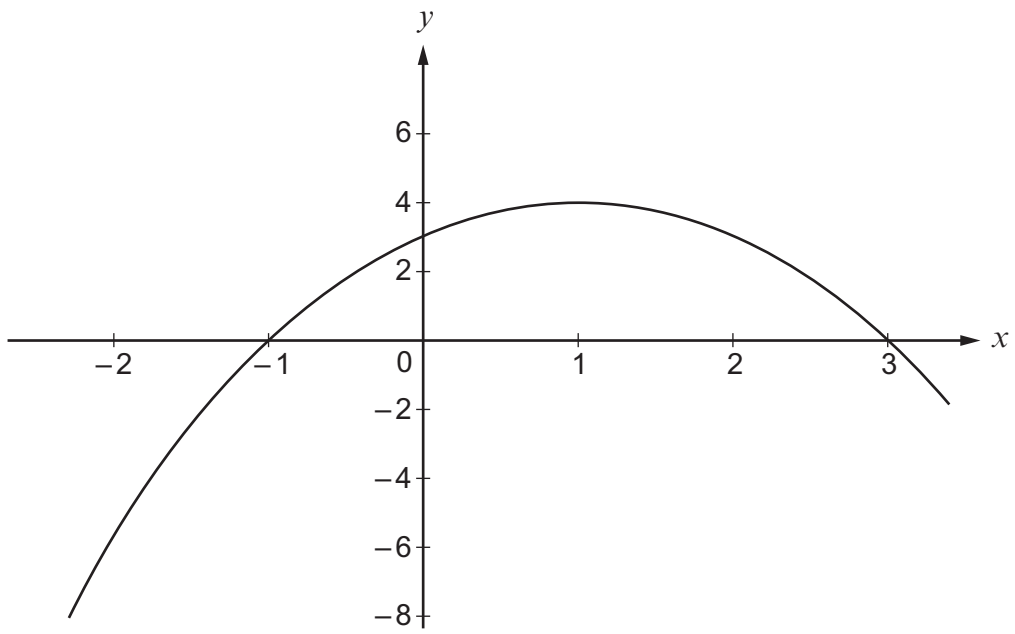
**9.** A sketch of a graph representing the equation $y = 3 + 2x - x^2$ is shown below.




*(a)* Find the $y$-coordinate when $x = 0$. [1]

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*(b)* Find the $y$-coordinate when $x = -3$. [1]

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*(c)* Give the coordinates of the point where the sketch shows a gradient of zero. [1]

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( ..... , ..... )

*(d)* Find the coordinates of all points for which $3 + 2x - x^2 = 0$. [2]

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Examiner only

*(e)* Does the point with coordinates (8·2, –47·84) lie on $y = 3 + 2x - x^2$?

Yes ☐ No ☐

You must show all your working to support your answer. [1]

**10.** The **perimeter** of the rectangle shown below is 232·8 cm.

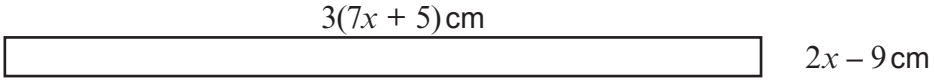


*Diagram not drawn to scale*

Form an equation in terms of $x$ and solve it.
Hence find the dimensions of the rectangle. [5]

Length of the rectangle is ..... cm

Width of the rectangle is ..... cm

Examiner only

**11.** Ms Leighton arranged a £15 000 loan for 22 years to buy a canal boat.
After 22 years the loan is to be paid back in full together with compound interest at 3·4% per annum.

*(a)* Ms Leighton did not plan to make any payments during the 22 years.

How much would Ms Leighton need to pay back after 22 years? [3]

*(b)* In fact, Ms Leighton paid off £10 000 of the loan in a single payment at the end of 10 years. For each of the next 12 years compound interest continues to be charged at rate of 3·4% per annum on the amount owed.

How much would Ms Leighton pay back **in total** during the full period of the loan?
Give your answer to the nearest £. [4]

Examiner only

**12.** Jenny is setting up a stall offering prizes in a community hall.
She has a bag of white, red, green and black balls.
All the balls in the bag are the same size.

A player pays £1 to select a ball at random.
The probability that a player selects:

- a white ball is 0·4,
- a red ball is 0·2,
- a green ball is 3 times the probability of selecting a black ball.

When either a black ball or a red ball is selected the player will win a prize.
The prizes are:

- £2.50 for selecting a black ball,
- £1.50 for selecting a red ball.

Any ball selected is to be placed back into the bag before the next player has a go.

If 300 players select a ball, show that Jenny can expect to make a profit in excess of £125. [4]

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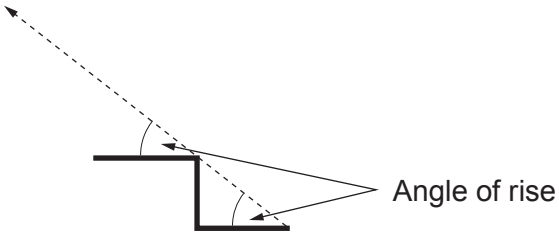
Examiner only

**13.** Eleri goes on holiday to visit historic gardens in Italy.
In many of the gardens she notices irregular staircases.
Each staircase has horizontal steps and vertical rises.

The angle of rise is measured from the horizontal upwards.




*(a)* The bottom step on a staircase is 26·4 cm wide with a vertical rise of 24 cm.
The second step in this staircase is 39·5 cm wide and has the same angle of rise.

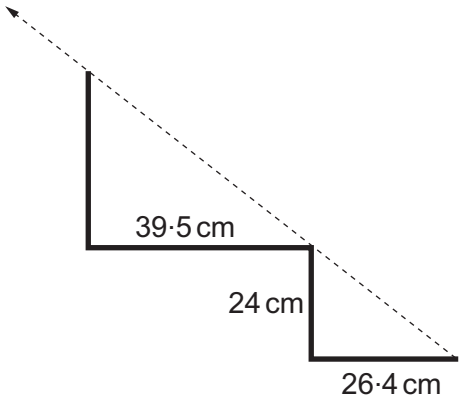



*Diagram not drawn to scale*

(i) Calculate the angle of rise. [2]

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(ii) Hence **use trigonometry** to calculate the vertical rise of the second step in centimetres.
Give your answer correct to 2 significant figures.
You must show all your working. [2]

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Examiner only

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*(b)* Look again at the diagram and your method of using trigonometry, in part *(a)*.

- Show how the vertical rise of the second step could be calculated **without** the use of trigonometry.
  You must show all your working.
  *(A scale drawing is not acceptable, as you are asked to calculate.)*

- Evaluate which was the most efficient method of calculating the vertical rise of the second step. [3]

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Evaluation:

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Examiner only

**14.** *(a)* Albert sells bird food in 28·8 kg sacks.
The bird food is a mix of millet, peanuts and sunflower seeds.
It contains, by mass, the millet, peanuts and sunflower seeds in the ratio 4 : 5 : 7.

To make the bird food mix, Albert pays
- 95p per kg for millet,
- £1.04 per kg for peanuts, and
- 75p per kg for sunflower seeds.

On Friday, Albert sold twelve 28·8 kg sacks of bird food for £29.99 each.

How much profit did Albert make from selling the bird food on Friday? [5]

Examiner only

*(b)* Nicole and Arthur share a house with a garden.

The probability that Nicole feeds the birds on a Saturday is 0·65.
When Nicole does not feed the birds, the probability that Arthur feeds the birds is 0·72.

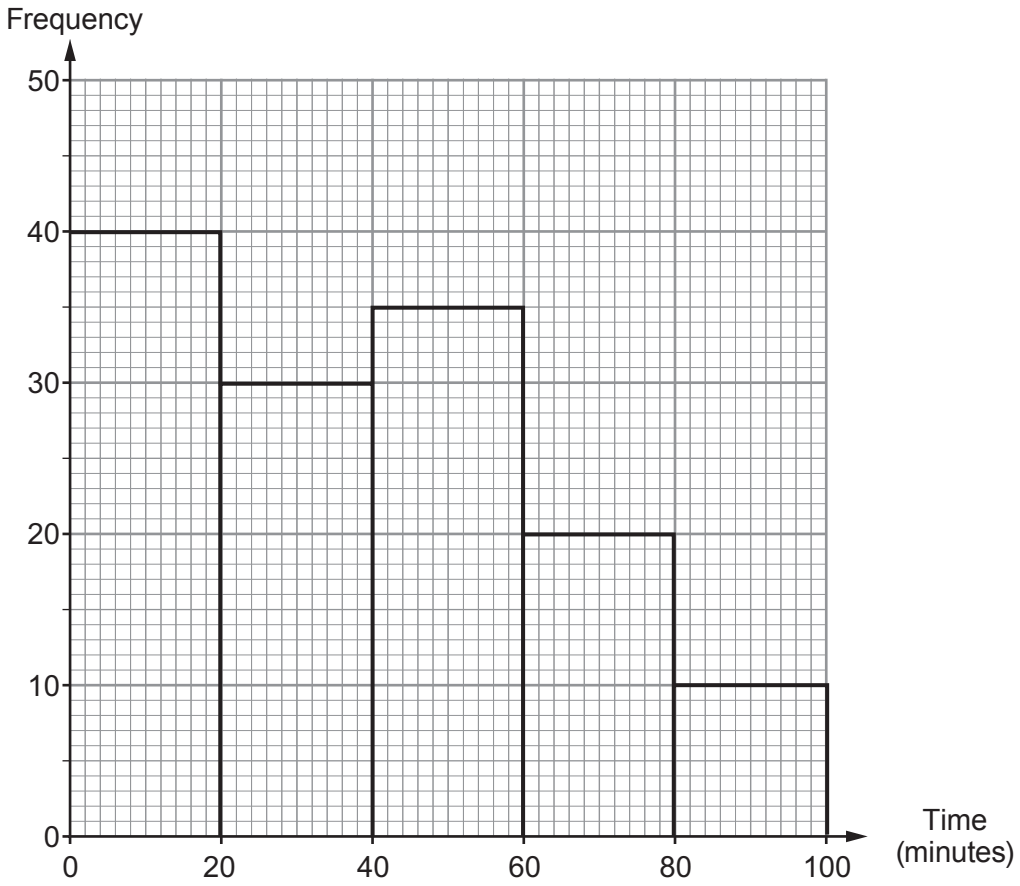
Arthur says to Nicole,

'The probability that the birds are **not** fed in our garden on a Saturday is less than 10%.'

Show that Arthur is correct.
You must show all your working. [4]

Examiner only

**15.** Graham has recorded the time taken to score the first goal in each match for his favourite team, *The Whisper Wanderers*.
For a number of seasons he collected grouped data in a frequency table.
He then displayed this grouped data in a frequency diagram, as shown below.




*(a)* How many matches are represented in the frequency diagram? [1]

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Examiner only

*(b)* (i) Calculate an estimate of the mean time taken for *The Whisper Wanderers* to score their first goal in these matches. [4]

(ii) How has any assumption you made in calculating your estimate of the mean time affected your answer? [1]

Examiner only

**16.** *(a)*

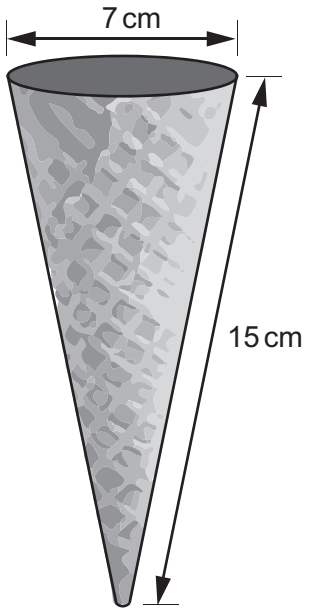


*Diagram not drawn to scale*

Megan buys ice cream in a 2 litre pack.

(i) How many cones could Megan fill?
You may assume that each cone is completely filled, level to the top, with ice cream.
[7]

Examiner only

(ii) What **impact** does the assumption have on your answer in *(a)*(i)? [1]

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*(b)* Two mathematically similar ice cream cones are shown below.

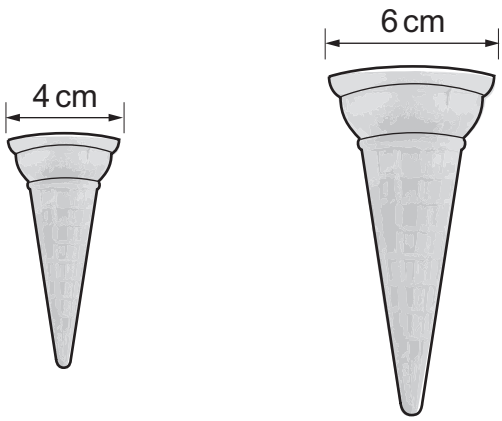


*Diagram not drawn to scale*

The smaller cone has a volume of 40 $cm^3$.

Calculate the volume of the larger cone. [2]

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Examiner only

**17.** *(a)* Factorise and hence solve the following equation. [3]

$$6x^2 - x - 2 = 0$$

*(b)* Find the $n$th term of the following sequence. [2]

4, 7, 12, 19, 28, 39, .....

*(c)* Calculate the 105th term of a sequence with an $n$th term of $3n^2 - n$. [1]

*(d)* The expression $x^2 + 14x + 25$ has a minimum value.

By **completing the square**, complete the statements below.
You must show all your working. [3]

'The minimum value of $x^2 + 14x + 25$ occurs when $x$ = .....'

'The minimum value of $x^2 + 14x + 25$ is .....'

Examiner only

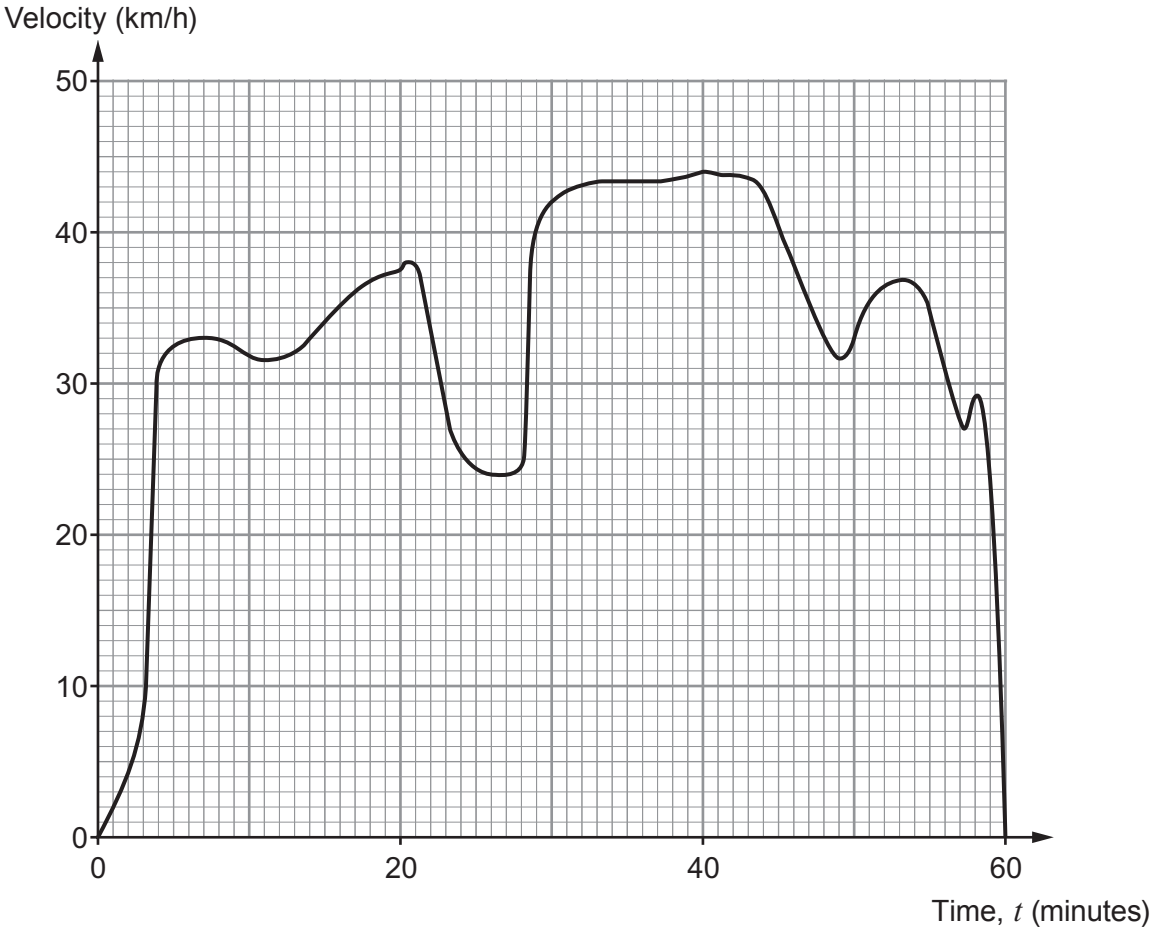
**18.** Solve the following simultaneous equations.

$$y = 4x^2 + 5x - 7$$
$$y = 3x + 2$$

Use an algebraic method and give your answers correct to 2 decimal places. [6]

Examiner only

**19.** The graph shows the velocity of a car during the first hour of a journey.




*(a)* At $t = 4$, find the velocity of the car in **km/min**. [1]

Examiner only

*(b)* Calculate the acceleration of the car when $t = 17$.
Give your answer in **km/min$^2$**. [3]

*(c)* Calculate the average acceleration of the car between $t = 40$ and $t = 50$.
Give your answer in **km/h$^2$**. [2]

Examiner only

**20.** Quadrilateral *EFGH* is shown below.

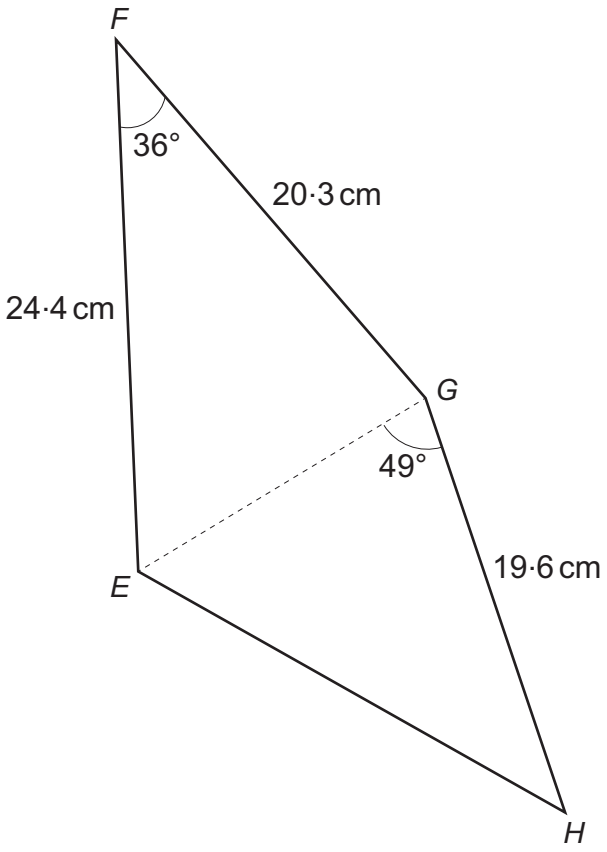



*Diagram not drawn to scale*

Calculate the area of *EFGH*. [6]

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Examiner only

**21.** The density of a piece of stainless steel is 7750 kg/m$^3$, correct to the nearest 5 kg/m$^3$.
A block of this stainless steel is in the shape of a cuboid.
The dimensions of the cuboid are 0·33 m, 0·22 m and 0·11 m, all given correct to the nearest 1 cm.

Calculate the least possible mass of the block.
Give your answer in kg, correct to 1 decimal place.
You must show all your working. [4]

Least possible mass is ..... kg

**END OF PAPER**

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**For continuation only.**

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