Cambridge Assessment International Education

# Cambridge IGCSE™

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*8300176659*

**MATHEMATICS** **0580/31**

Paper 3 (Core) **October/November 2021**

**2 hours**

You must answer on the question paper.

You will need: Geometrical instruments

**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 calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For $\pi$, use either your calculator value or 3.142.

**INFORMATION**

- The total mark for this paper is 104.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **20** pages. Any blank pages are indicated.


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**1** **(a)** 14 17 25 27 30 36 48

From the list, write down

**(i)** the square root of 289,

..... [1]

**(ii)** a factor of 81,

..... [1]

**(iii)** a common multiple of 3 and 5.

..... [1]

**(b)** A, B and C are three **consecutive** whole numbers.

- A is a prime number.
- B is a cube number.
- C is a square number.
- A + B + C is less than 40.

Find A, B and C.

A = .....

B = .....

C = ..... [2]

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**(c)** Put **one** pair of brackets into each of these calculations to make them correct.

**(i)** $4 \times 3 + 7 \div 2 = 20$

[1]

**(ii)** $51 - 12 \div 3 + 6 = 19$

[1]

**(d)** Write down

**(i)** the reciprocal of 8,

..... [1]

**(ii)** the value of $14^0$.

..... [1]

**(e)** Calculate.

**(i)** $5^4$

..... [1]

**(ii)** $\sqrt[3]{6859}$

..... [1]

**(iii)** $16^{-\frac{1}{2}}$

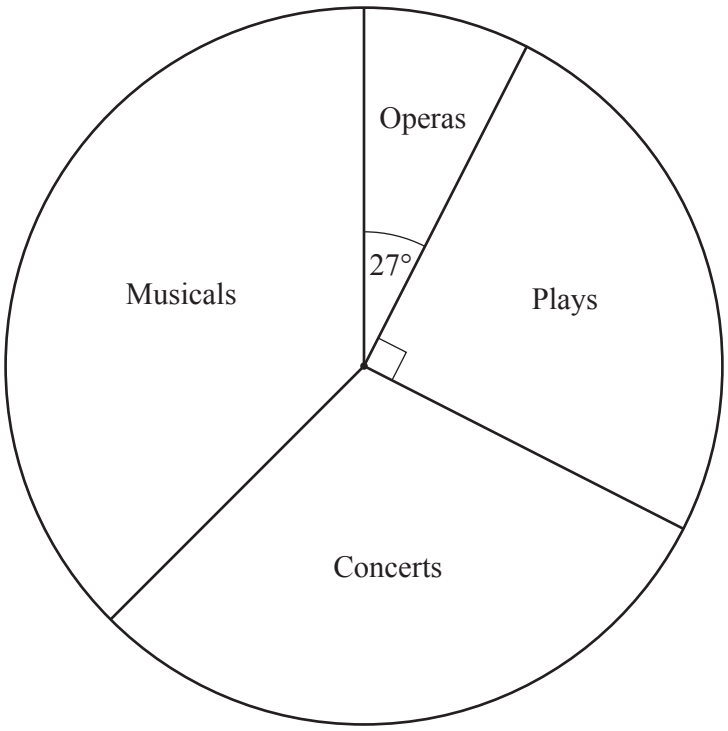
..... [1]

**2** **(a)** In one year, a theatre sells four hundred and ninety-six thousand and fifty tickets.

Write this number in figures.

..... [1]

**(b)** The theatre is used for performances of operas, plays, concerts and musicals.
The pie chart shows information about the number of each type of performance.




**(i)** Complete these statements.

The type of performance shown the most is ..... .

The sector angle for this type of performance is ..... degrees. [2]

**(ii)** Write down the percentage of performances that are plays.

..... % [1]

**(iii)** The theatre is used for 320 performances in the year.

Calculate the number of opera performances.

..... [2]

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**(iv)** The number of concert performances is in the ratio classical music : popular music = 7 : 5.
There are 56 classical music concerts.

Find the number of popular music concerts.

..... [2]

**(c)** The table shows the prices of a child ticket and a senior ticket for a play.

| Adult | Child | Senior |
|---|---|---|
| $ ..... | $15.50 | $35 |

Alex buys tickets for 2 adults, 3 children and 1 senior.
He pays a total of $159.50 .

Complete the table.

[2]

**(d)** Last week the cost of a ticket for a musical was $65.
This week the same ticket costs $55.90 .

Find the percentage reduction in the cost of this ticket.

..... % [2]

**3** 360 people go on a school trip to one of four places.
Some of the information is shown in the table.

| | Adventure park | Botanic gardens | Wildlife centre | Red castle | Total |
|---|---|---|---|---|---|
| Boys | 65 | 12 | | 36 | |
| Girls | | 9 | 62 | | 163 |
| Staff | 15 | 3 | | | 37 |
| Total | 144 | 24 | 121 | 71 | 360 |

**(a)** Complete the table.

[3]

**(b)** Find the probability that

**(i)** a girl, picked at random, visits the Wildlife centre,

..... [1]

**(ii)** a person, picked at random from those visiting the Botanic gardens, is a girl,

..... [1]

**(iii)** a person, picked at random, visits the Adventure park or the Botanic gardens.

..... [1]

**(c)** The people who visit the Adventure park travel by coach.
Each coach has 52 seats for passengers.

Complete this statement.

The least number of coaches needed for the trip to the Adventure park is ..... and there will be a total of ..... empty seats.

[2]

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**(d)** The school hires one coach from each of two different companies for the trip to Red castle.

A coach from Fast Track coaches costs \$600 plus \$0.72 per kilometre travelled.
The total cost, in dollars, for travelling $x$ kilometres is $600 + 0.72x$.

**(i)** A coach from Rapid coaches costs \$550 plus \$1.12 per kilometre travelled.

Write an expression for the total cost, in dollars, for travelling $x$ kilometres.

..... [1]

**(ii)** Both companies charge the same amount for the trip.

Write down an equation and solve it to find the distance travelled.

..... km [3]

**(e)** The length, $l$ km, of the journey to the Wildlife centre is 53 km, correct to the nearest kilometre.

Complete this statement about the value of $l$.

..... $\leqslant l <$ ..... [2]

**(f)** Samira takes \$31.50 to spend in the Botanic gardens.

**(i)** She spends $\frac{2}{7}$ of this money on food.

Work out how much Samira spends on food.

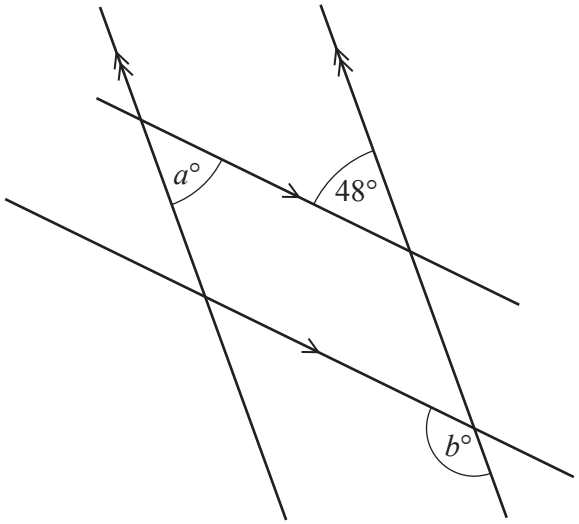
\$ ..... [1]

**(ii)** At the end of the visit to the Botanic gardens, Samira has \$4.50 left.

What fraction of her money does Samira spend?
Give your answer in its simplest form.

..... [2]

**4 (a)**




NOT TO SCALE

The diagram shows two pairs of parallel lines.

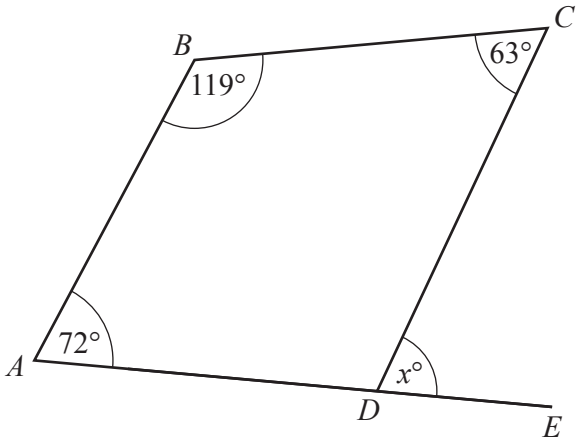
**(i)** Find the value of $a$.

$a =$ ..... [1]

**(ii)** Find the value of $b$.

$b =$ ..... [1]

**(b)**



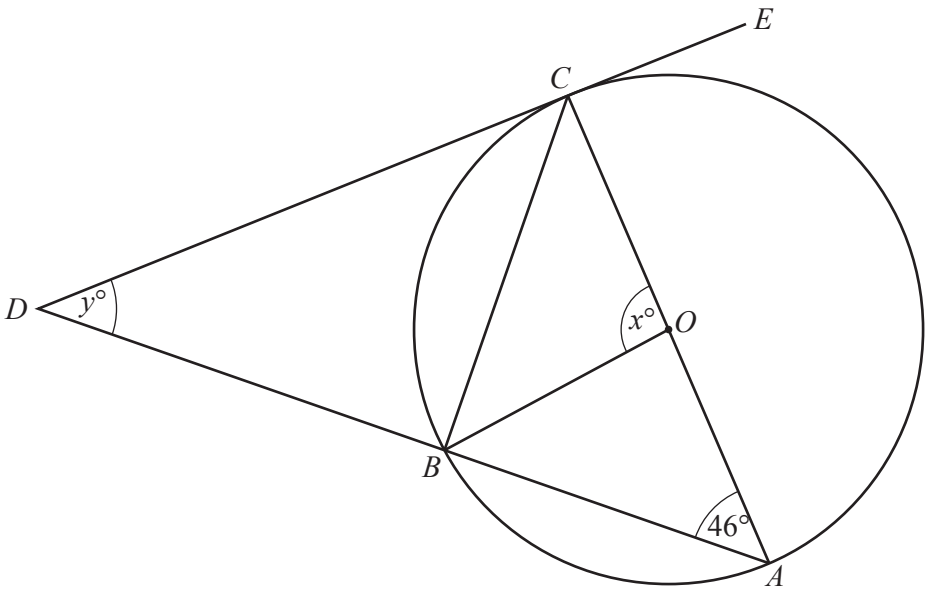

NOT TO SCALE

The diagram shows a quadrilateral $ABCD$ and a straight line $ADE$.

Work out the value of $x$.

$x =$ ..... [2]

**(c)**




NOT TO SCALE

$A$, $B$ and $C$ are points on the circle, centre $O$.
$AC$ is a diameter of the circle and $ABD$ is a straight line.
$DCE$ is a tangent to the circle at $C$.

**(i)** Write down the mathematical name for the line $BC$.

..... [1]

**(ii)** Explain why angle $ABC$ is 90°.

..... [1]

**(iii)** Find the value of $x$.

$x =$ ..... [2]

**(iv)** Find the value of $y$.

$y =$ ..... [2]

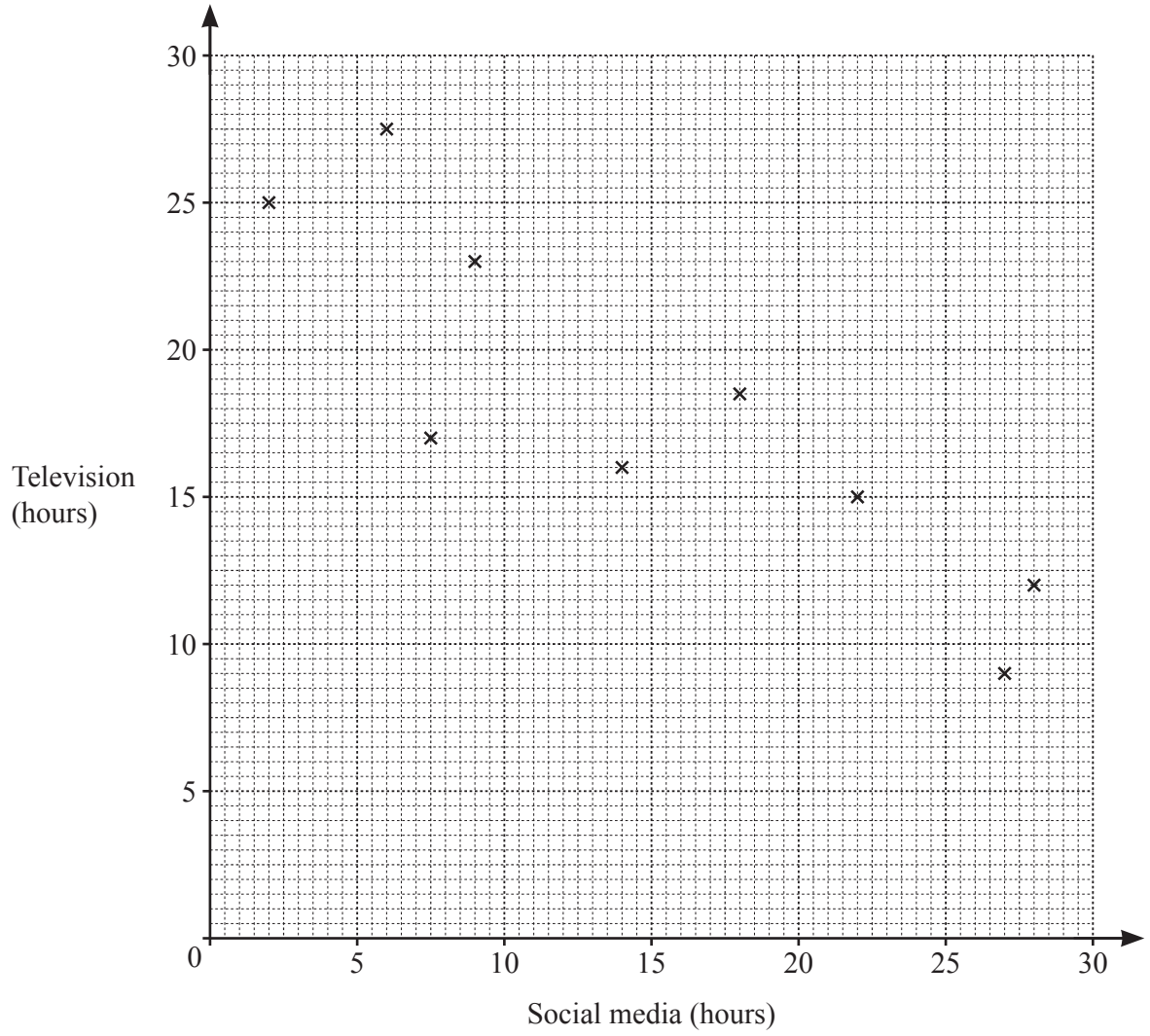
**5** 11 students record the time they spent on social media and watching television during one week. The table shows the time, in hours, for each student.

| Social media (hours) | 2 | 9 | 18 | 6 | 28 | 14 | 7.5 | 27 | 22 | 19.5 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Television (hours) | 25 | 23 | 18.5 | 27.5 | 12 | 16 | 17 | 9 | 15 | 11 | 20 |

**(a)** Find the range of the times spent on social media.

..... hours [1]

**(b)** **(i)** Complete the scatter diagram.
The first nine points have been plotted for you.




[1]

**(ii)** What type of correlation is shown on the scatter diagram?

..... [1]

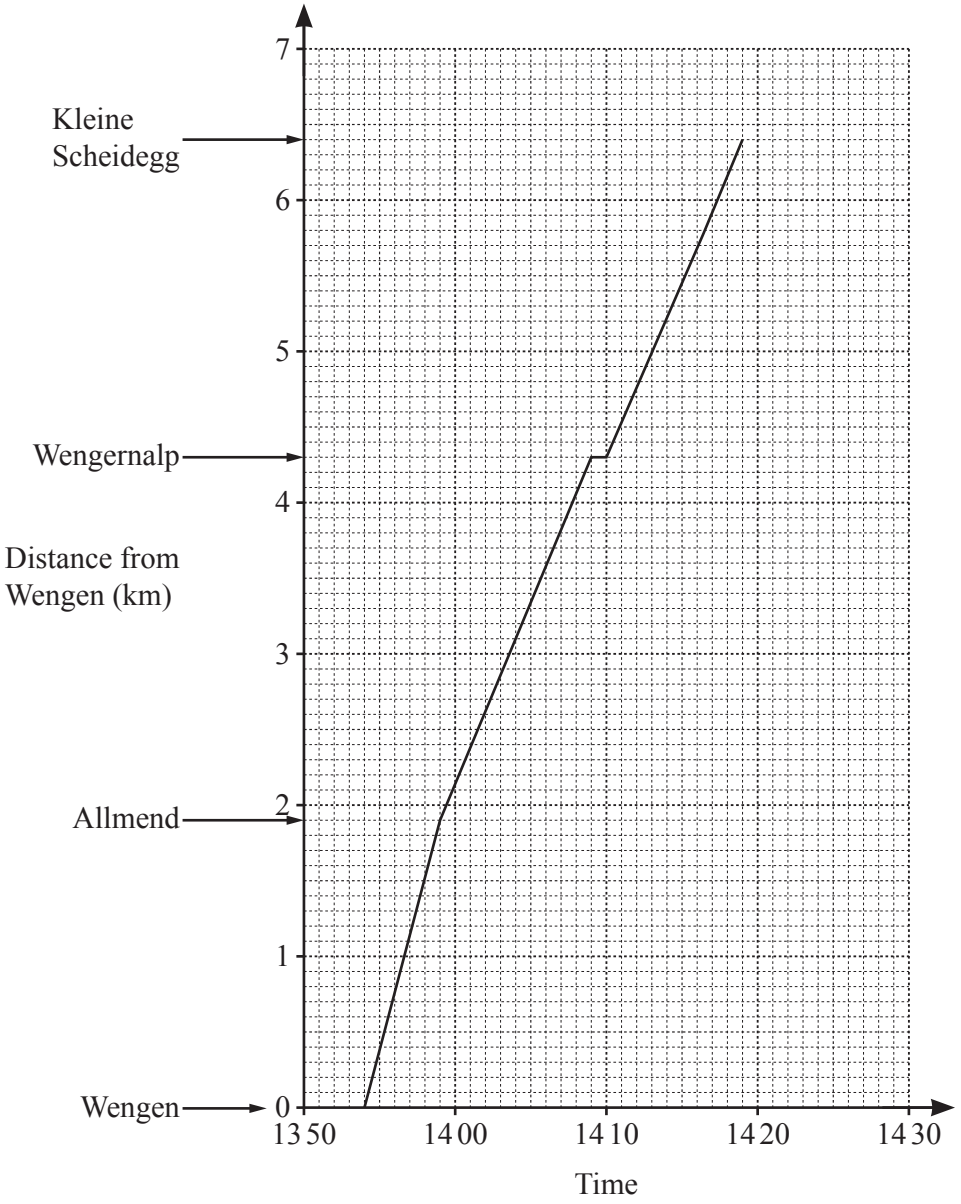
**(iii)** Draw a line of best fit on the scatter diagram. [1]

**(iv)** Another student spent 21 hours watching television.

Use your line of best fit to estimate the number of hours this student spent on social media.

..... hours [1]

**6** **(a)** The diagram shows the travel graph of a train journey from Wengen to Kleine Scheidegg.




**(i)** Explain what happens between 14 09 and 14 10.

..... [1]

**(ii)** Find the journey time from Allmend to Wengernalp in minutes.

..... min [1]

**(iii)** Calculate the average speed for the train journey from Wengen to Kleine Scheidegg.
Give your answer in km/h.

..... km/h [3]

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**(iv)** Another train travels from Kleine Scheidegg to Wengen.
The table gives information about its journey.

| Station | Arrival time | Departure time |
|---|---|---|
| Kleine Scheidegg | | 1401 |
| Wengernalp | Train does not stop | |
| Allmend | 1418 | 1420 |
| Wengen | 1430 | |

On the travel graph, draw the journey for this train. [3]

**(v)** Write down the time when the two trains pass each other.

..... [1]

**(b)** The temperature in Wengen at 5 am was $-3\,°C$.
At 4 pm the temperature has increased by $10\,°C$.

Work out the temperature at 4 pm.

..... °C [1]

**(c)** A formula to work out the temperature at different heights above Wengen is

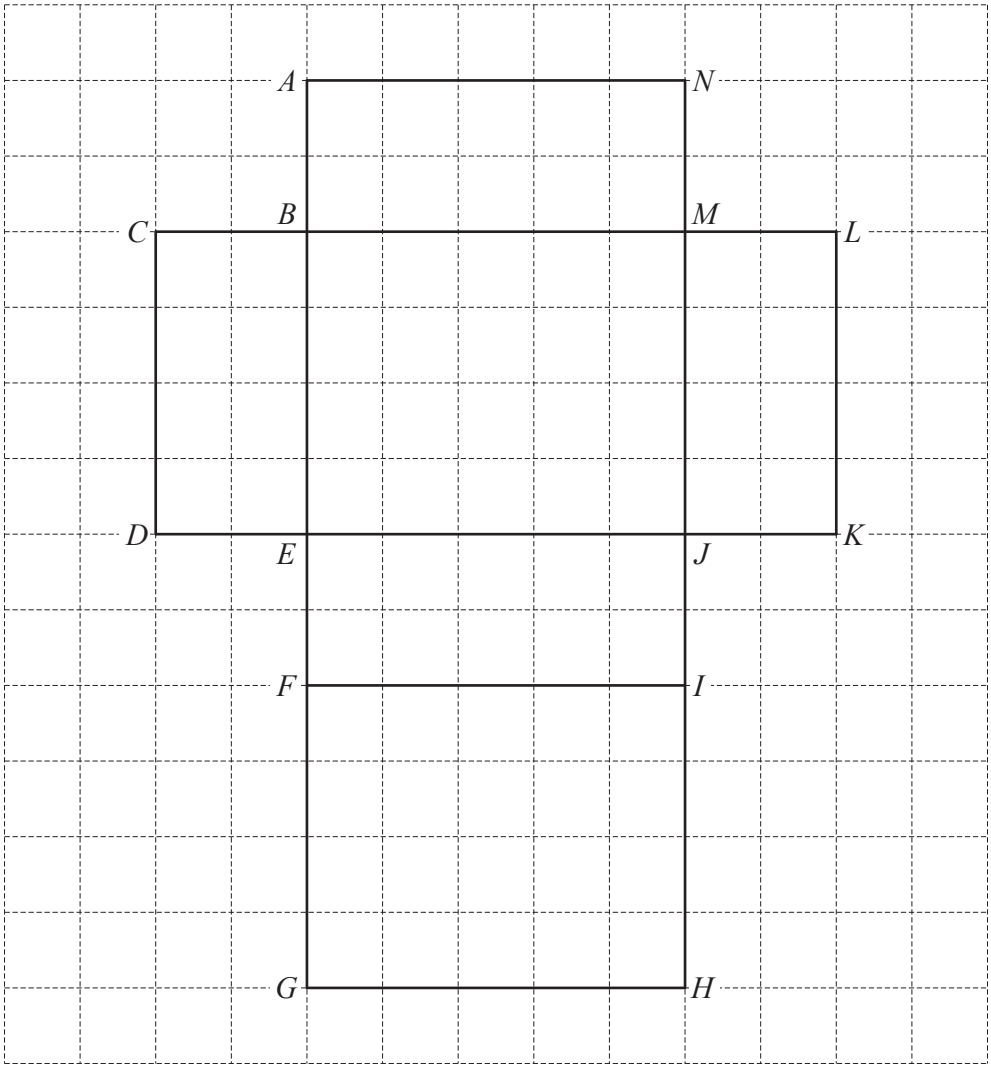
$$T = 2 - \frac{h}{130}$$

where $T$ is the temperature in °C and $h$ is the height, in metres, above Wengen.
Kleine Scheidegg is 780 m above Wengen.

Work out the temperature at Kleine Scheidegg.

..... °C [1]

**7** **(a)** The diagram shows the net of a cuboid on a 1 $cm^2$ grid.




**(i)** The net is folded to form the cuboid.

**(a)** Write down which two corners join to corner *A*.

..... [1]

**(b)** Write down the edge which joins with *KL*.

..... [1]

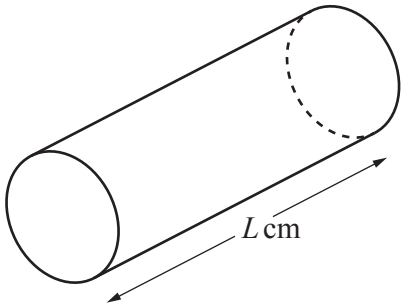
**(ii)** Find the total surface area of the cuboid.

..... $cm^2$ [2]

**(iii)** Find the volume of the cuboid.

..... $cm^3$ [2]

**(b)** The diagram shows a cylinder with length $L$ cm.
The radius of the cylinder is 3.2 cm and the volume is 775 $cm^3$.




NOT TO SCALE

**(i)** Calculate the value of $L$.

$L =$ ..... [3]

**(ii)** Calculate the volume of a solid sphere with radius 3 cm.
[The volume, $V$, of a sphere with radius $r$ is $V = \frac{4}{3}\pi r^3$.]

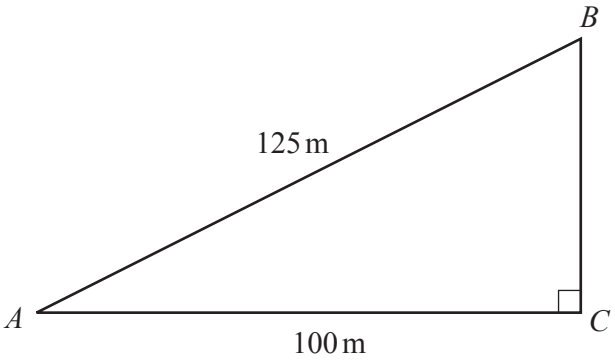
..... $cm^3$ [2]

**(iii)** Four of these spheres are placed inside the cylinder.

Calculate the percentage of the cylinder that is empty.

..... % [3]

**8 (a)**




NOT TO SCALE

The diagram shows a right-angled triangle, $ABC$.

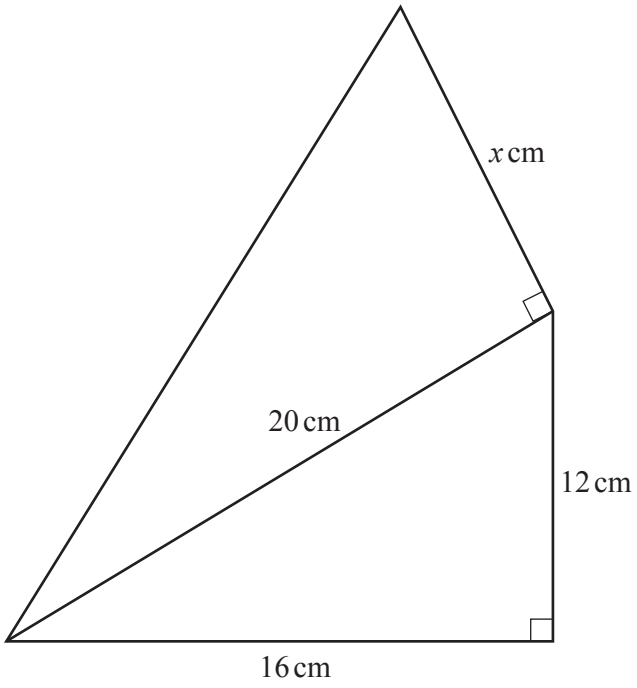
**(i)** Show that $BC = 75\,\text{m}$.

[2]

**(ii)** Calculate angle $BAC$.

Angle $BAC =$ ..... [2]

**(b)**



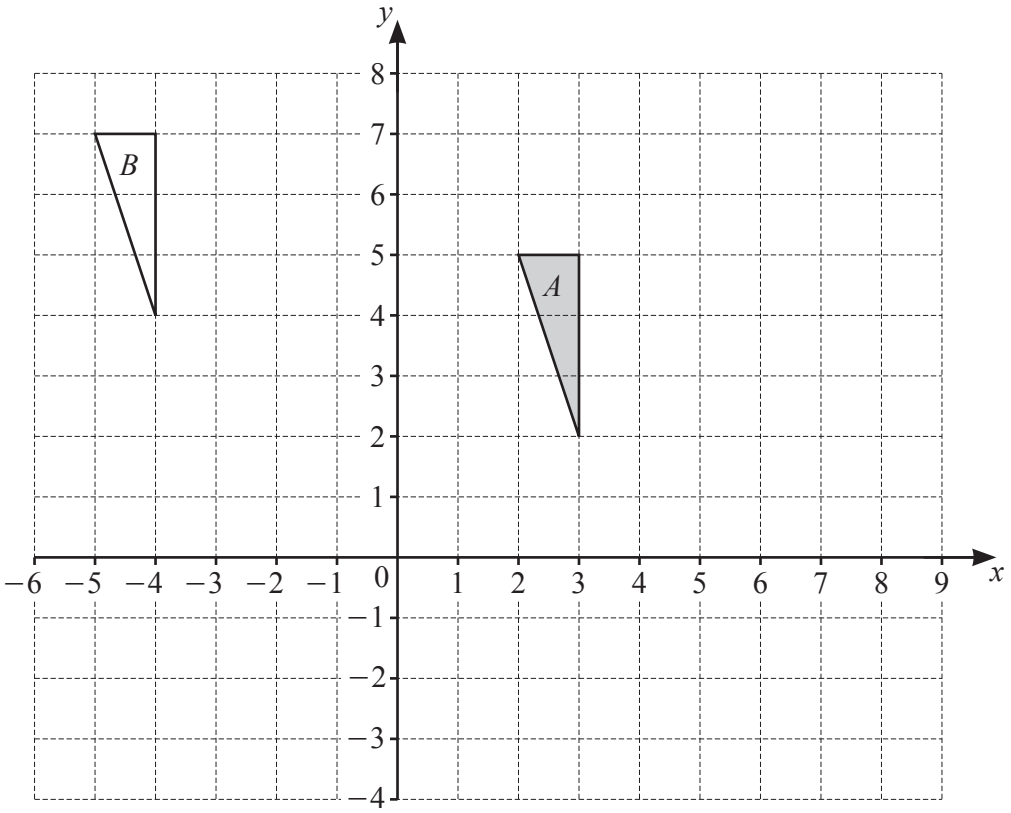

NOT TO SCALE

The diagram shows a shape made from two right-angled triangles.
The total area of this shape is $246\,cm^2$.

Work out the value of $x$.

$x =$ ..... [3]

**9**




**(a)** On the grid, draw the image of

**(i)** triangle $A$ after a rotation of 90° clockwise about the origin, [2]

**(ii)** triangle $A$ after a reflection in the line $x = 5$, [2]

**(iii)** triangle $A$ after an enlargement, scale factor 2, centre (7, 7). [2]

**(b)** Describe fully the **single** transformation that maps triangle $A$ onto triangle $B$.

.....

..... [2]

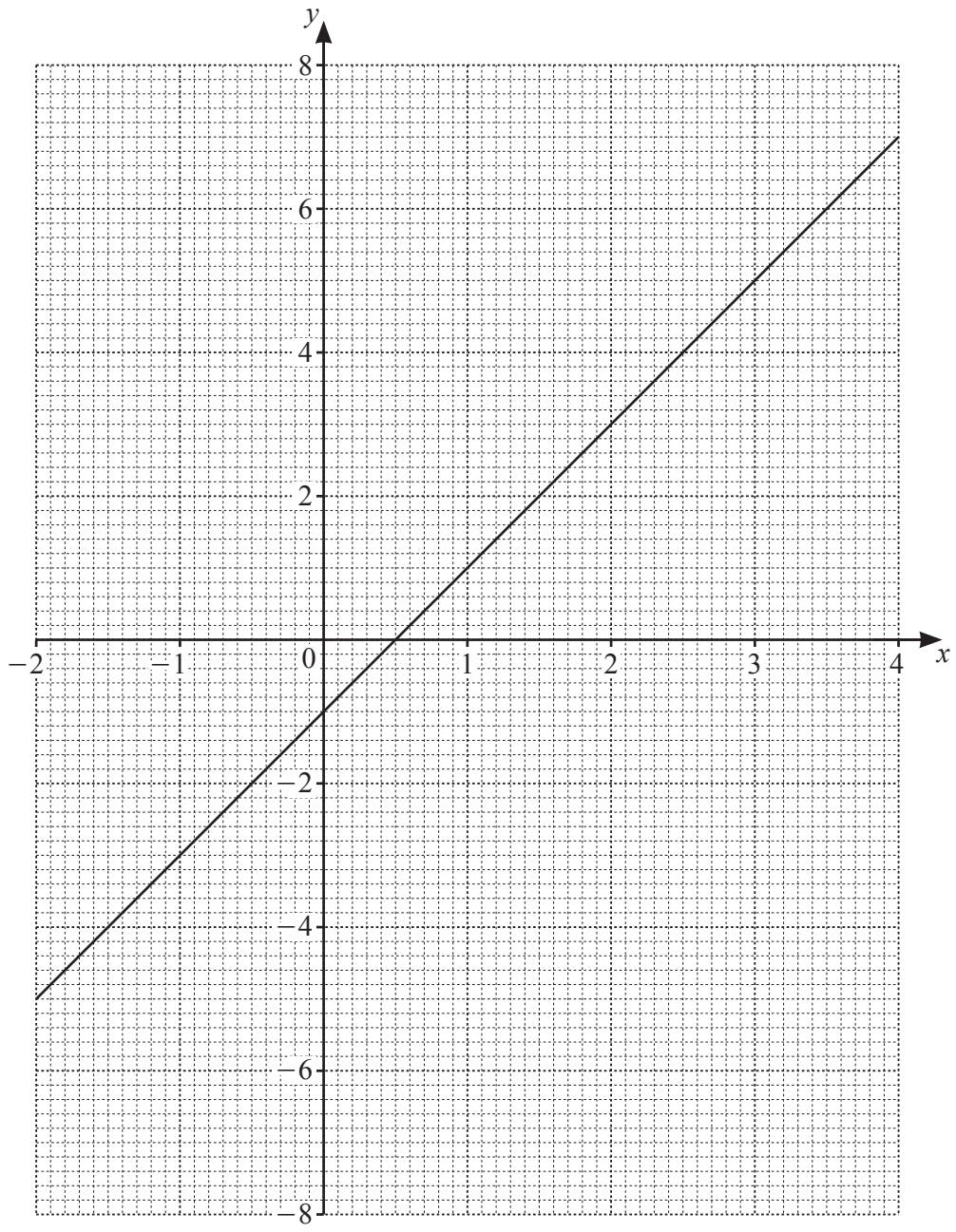
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**10** **(a)** Complete the table of values for $y = 4 + 3x - x^2$.

| $x$ | $-2$ | $-1$ | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|---|---|
| $y$ | | 0 | 4 | | 6 | | 0 |

[2]

**(b)** On the grid, draw the graph of $y = 4 + 3x - x^2$ for $-2 \leqslant x \leqslant 4$.




[4]

**(c)** The line $y = 2x - 1$ is drawn on the grid.

Use your graph to solve the equation $4 + 3x - x^2 = 2x - 1$.

$x =$ ..... or $x =$ ..... [2]

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