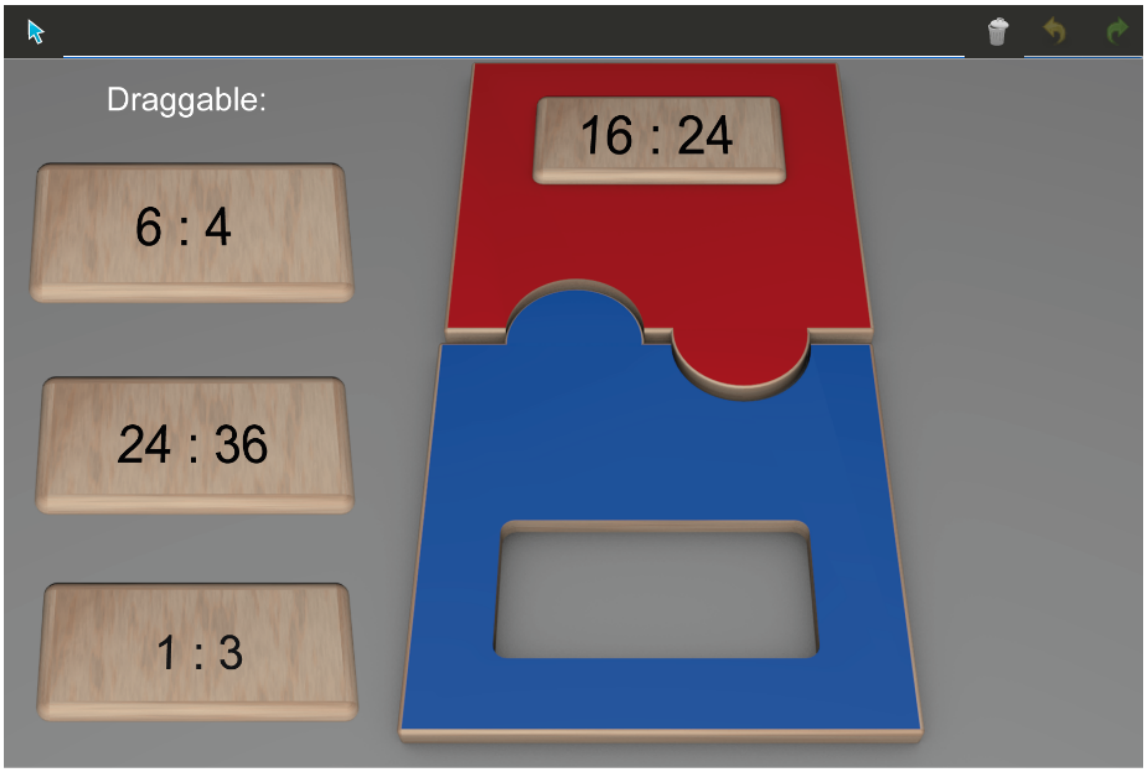
2020 November Maths eAssessment

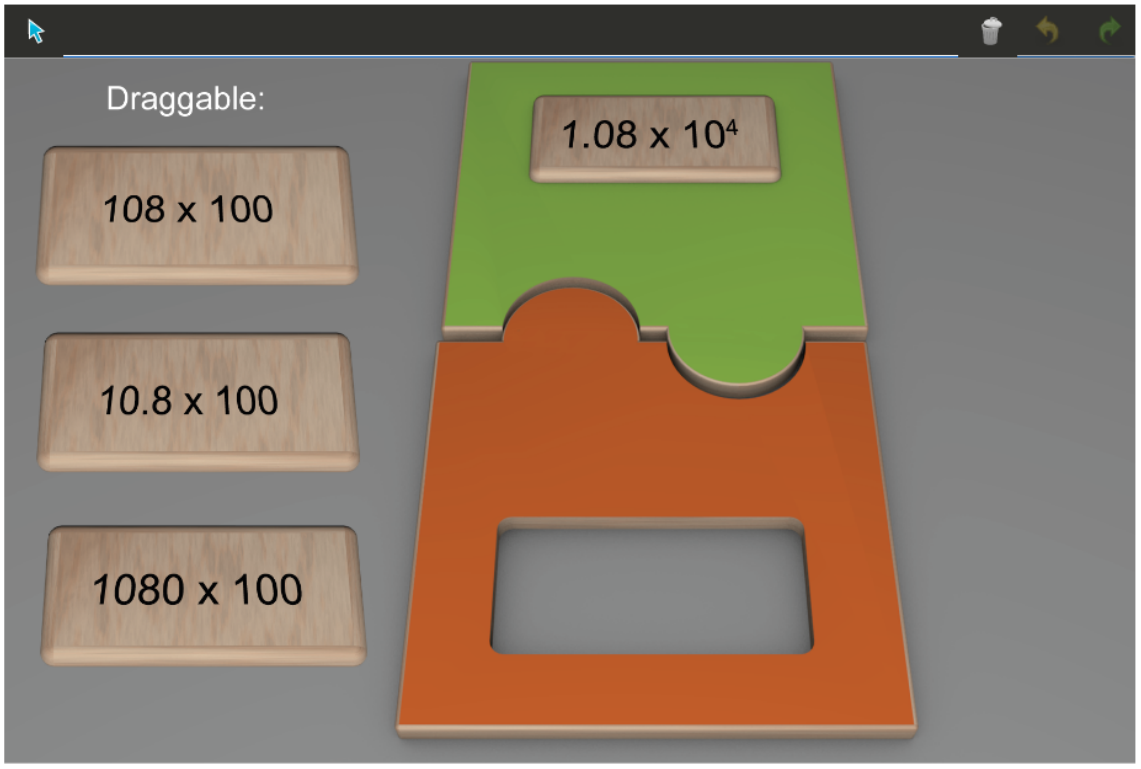
Question 1 (7 marks)

Below are seven puzzles, each with a missing section. From the draggable items, **select** the correct equivalent option to complete each puzzle.

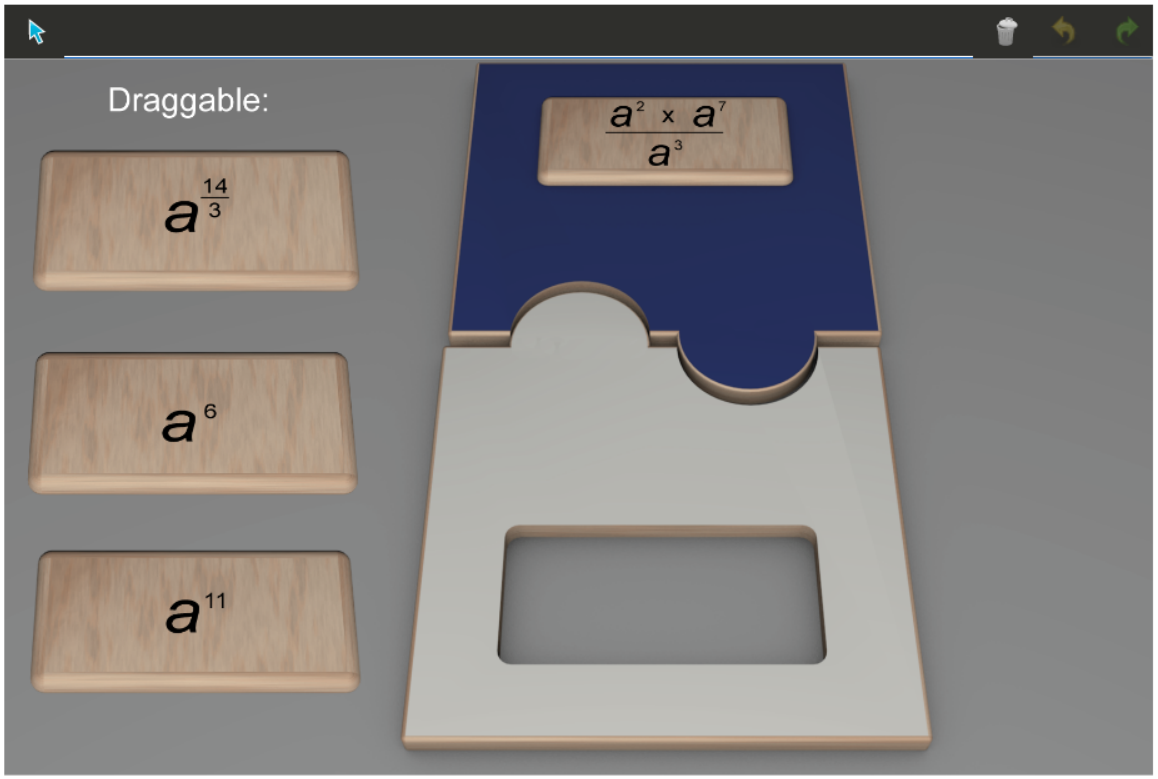
Question 1a (1 mark)



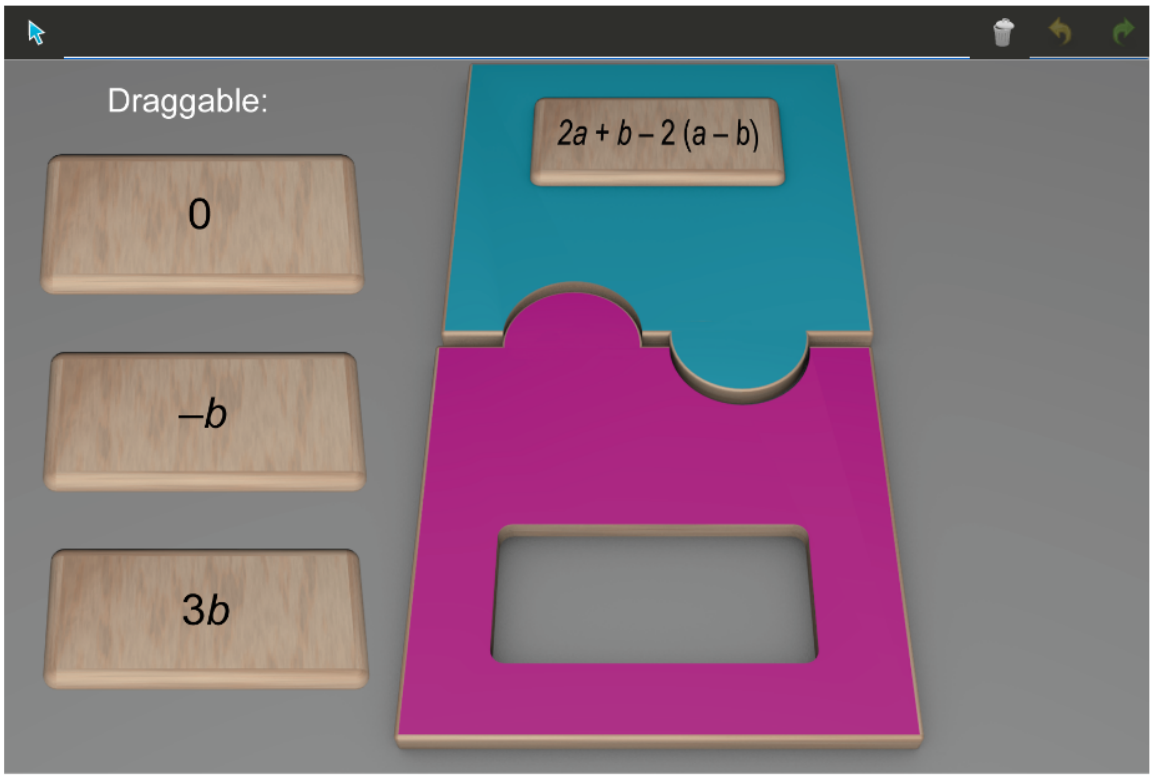
Question 1b (1 mark)



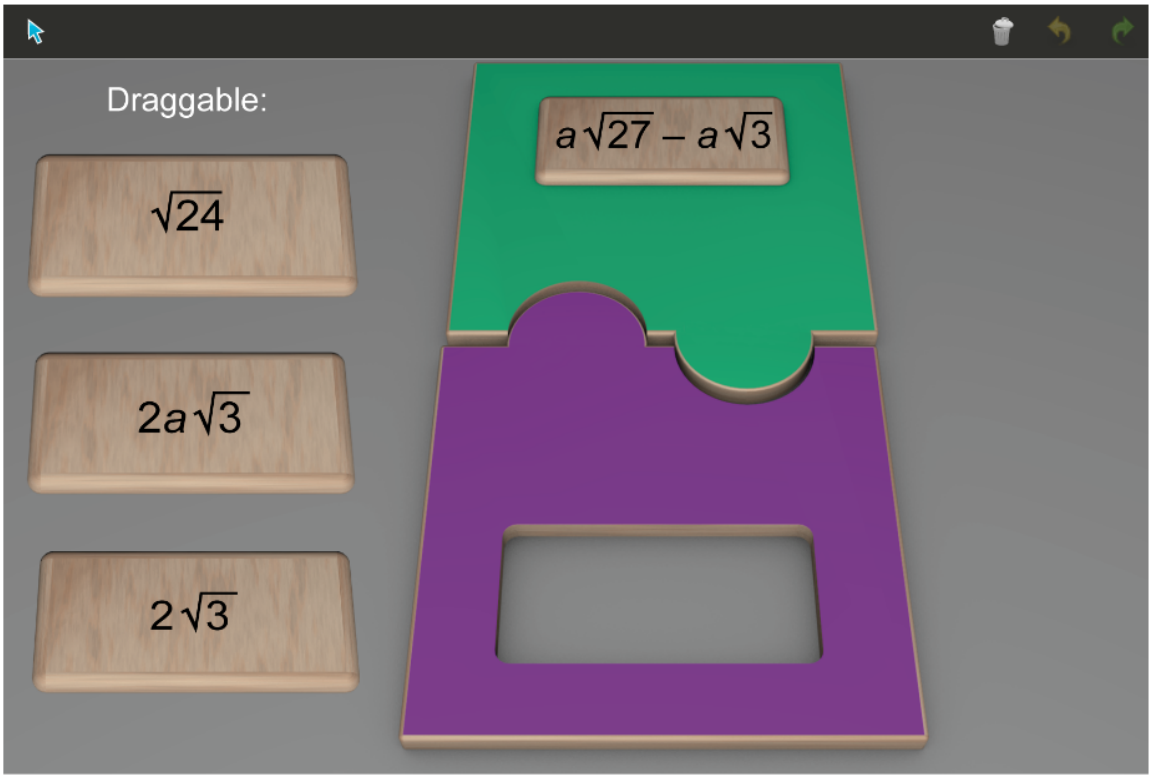
Question 1c (1 mark)



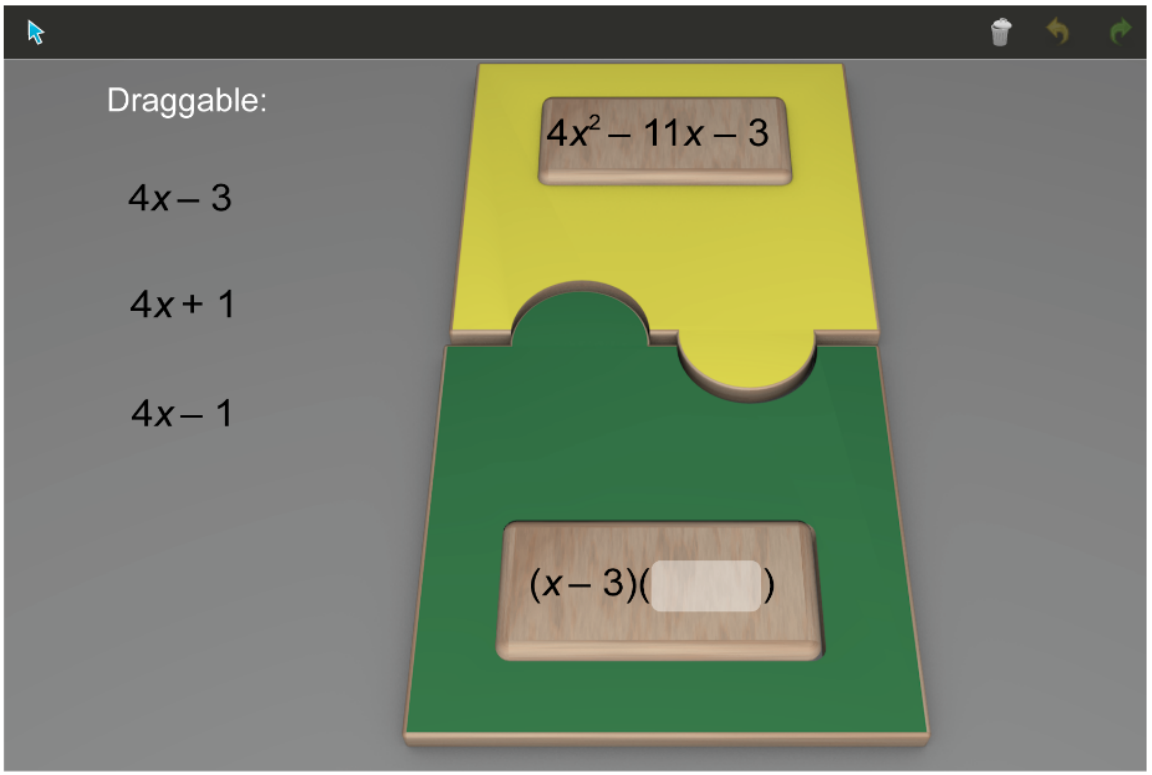
Question 1d (1 mark)



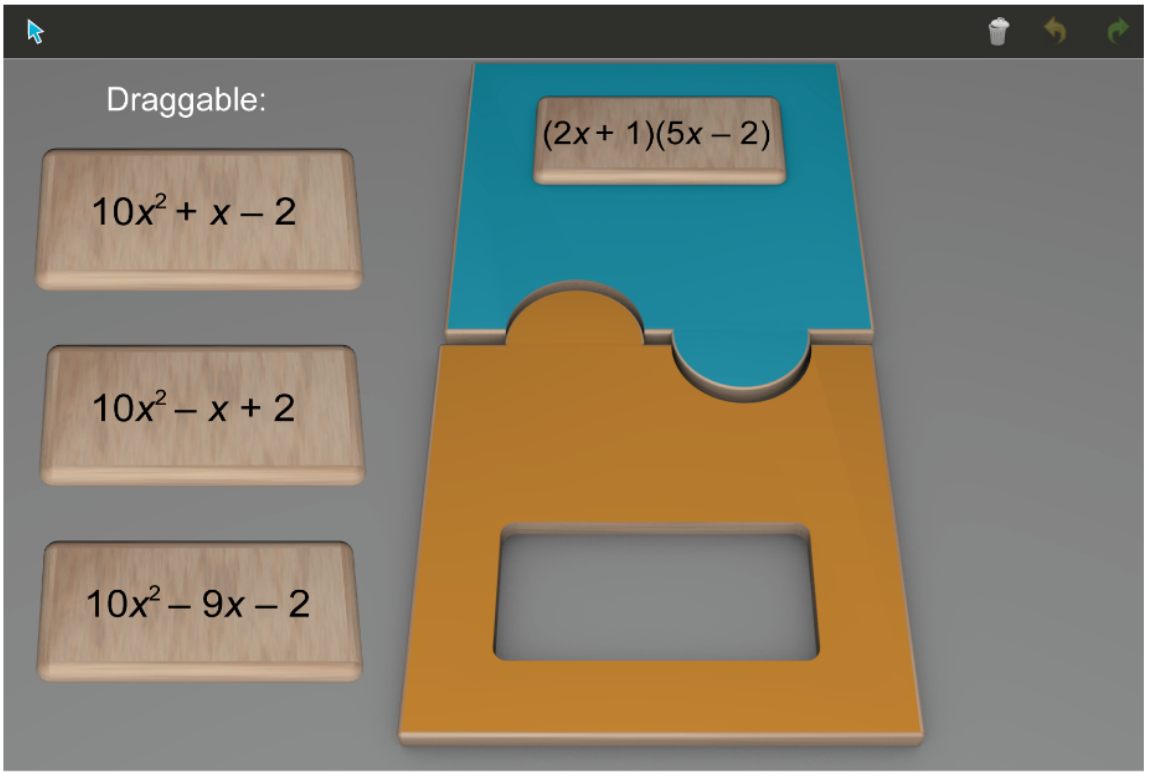
Question 1e (1 mark)



Question 1f (1 mark)



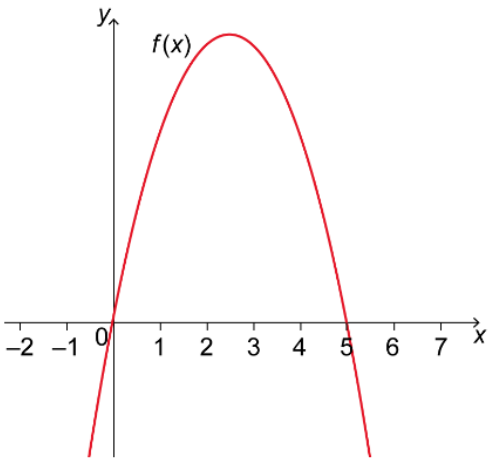
Question 1g (1 mark)



Question 2 (8 marks)

Question 2a (3 marks)

The function $f(x) = -x(x - 5)$ is shown below.

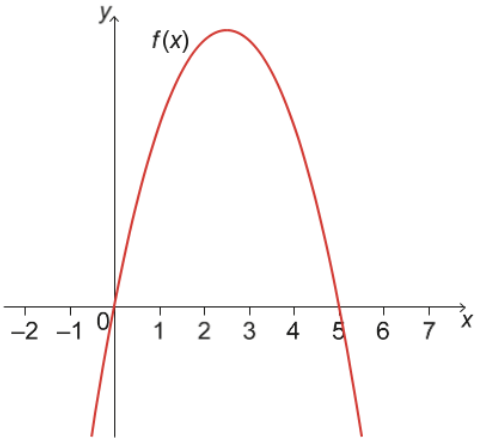


Calculate the maximum value of $f(x)$.

Styles

The function $f(x)$ is transformed to $g(x)$ by a translation of L units to the right. Press 'Next' to illustrate below.

This media is interactive



Next

Question 2b (1 mark)

Write down the value of L.

$L =$

Question 2c (2 marks)

Hence, **determine** the equation for $g(x)$.

Styles

Question 2d (1 mark)

The function $g(x)$ is transformed to $h(x)$ by a reflection in the x-axis. **Write down** the equation for $h(x)$.

Question 2e (1 mark)

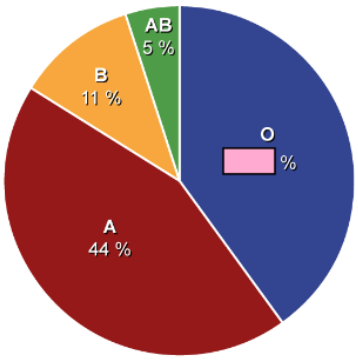
Write down the minimum value of $h(x)$.

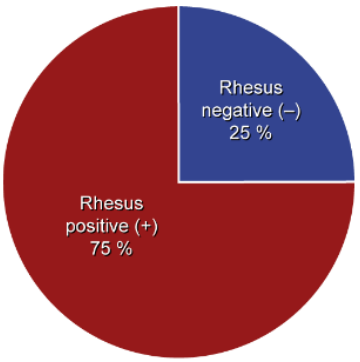
Question 3 (9 marks)

Question 3a (2 marks)

One of four main blood types can be found in a human body. They are known as **A**, **B**, **AB** and **O**. Each blood type can be further classified as either a Rhesus positive (+) or Rhesus negative (–).
For example, a possible combination is blood type **O** and Rhesus negative which is written as **O–**.

The pie charts below shows the distribution of the blood types and Rhesus types for a blood donor centre recorded in 2019.





Question 3a (2 marks)

People with blood type **O–** are known as universal donors. They can donate their blood to patients with any blood type.

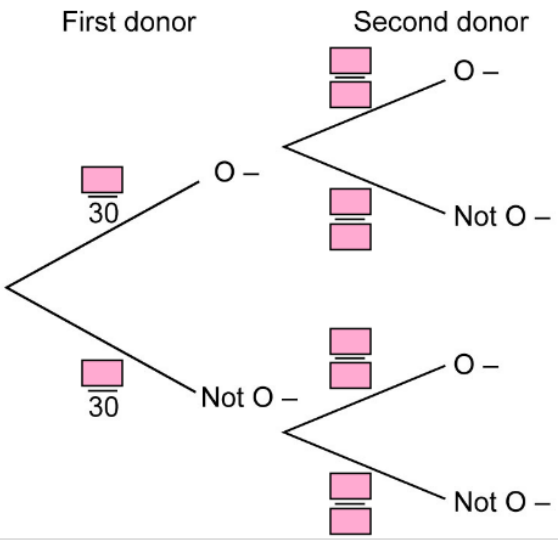
Show that the probability that a randomly selected person has blood type **O–** is 0.1.

Question 3b (1 mark)

Thirty people donate blood one morning. **Determine** the expected number of people that have blood type **O–**.

Question 3c (3 marks)

Two of the thirty donors are selected at random. **Write down** the missing values in the tree diagram below.



Question 3d (3 marks)

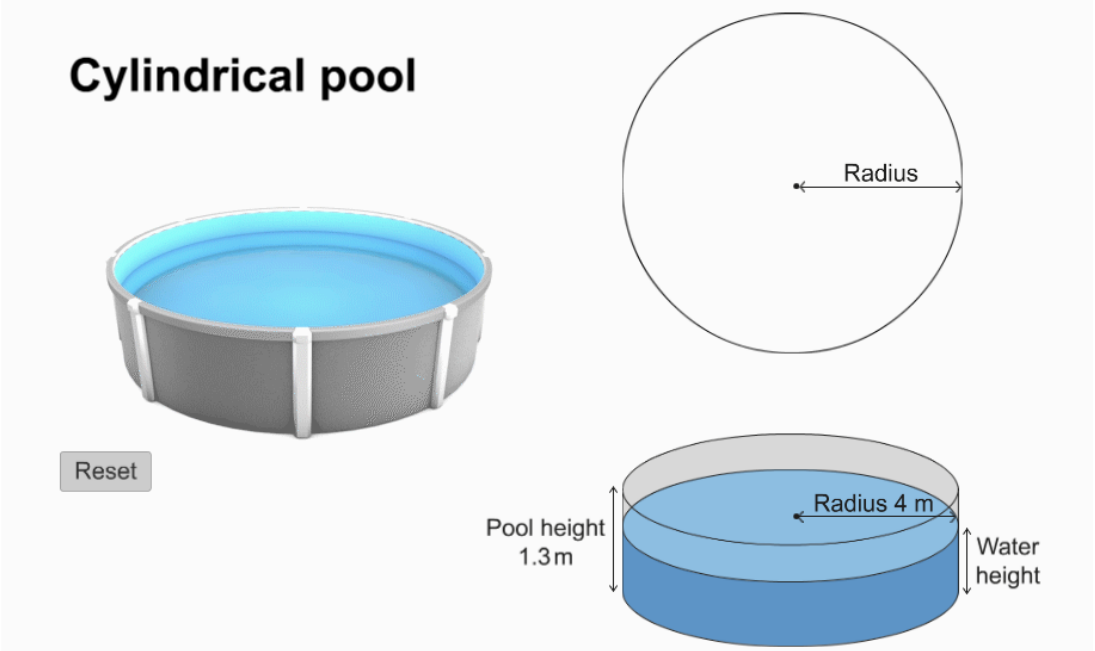
Find the probability that only one of the two donors has blood type **O–**.

Question 4 (12 marks)

An above-ground pool can be represented as a cylinder filled with water. If we look at the pool from above, we can see a circle.

This media is interactive

Diagram not to scale



The pool height is 1.3 metres (m) and the radius of the pool is 4 m.

Question 4a (3 marks)

To avoid overflow, the pool is filled with water to 90 % capacity. **Show that** 90 % of the capacity is 58.8 m^3, correct to three significant figures.

Question 4b (3 marks)

A pump is used to remove water from the pool. The pump removes water at a rate of 11 200 litres (L) per hour.

$$1000\ \text{L} = 1\ \text{m}^3$$

Find the time it takes for the pump to remove the 58.8 m^3 of water. Write your answer in hours and minutes, to the nearest minute.

B I U x_2 x^2 Ω Σ Styles

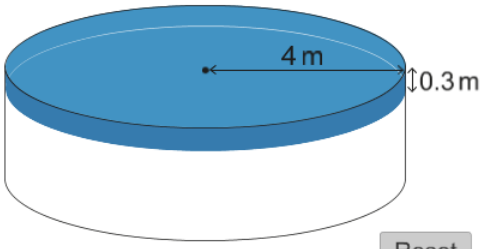
[ ] hours and [ ] minutes

Question 4c (5 marks)

A cylindrical pool cover is placed over the pool. The pool cover has a radius of 4 m and a depth of 0.3 m.

This media is interactive

Diagram not to scale



Reset

Find the outer surface area of the pool cover, to the nearest square metre.

B I U x_2 x^2 Ω Σ Styles

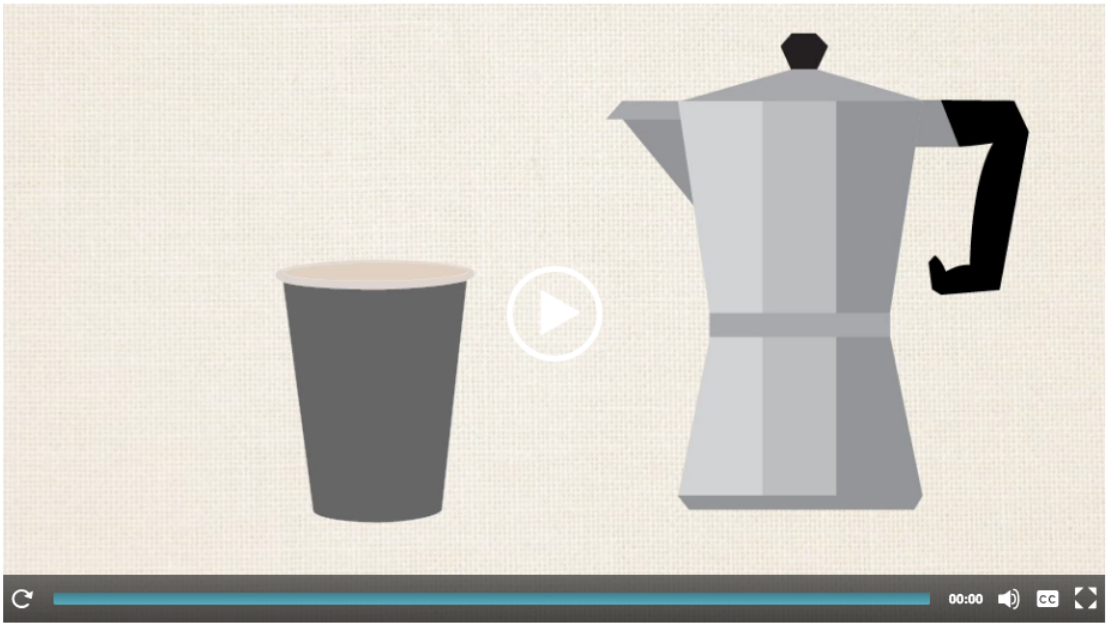
Question 4d (1 mark)

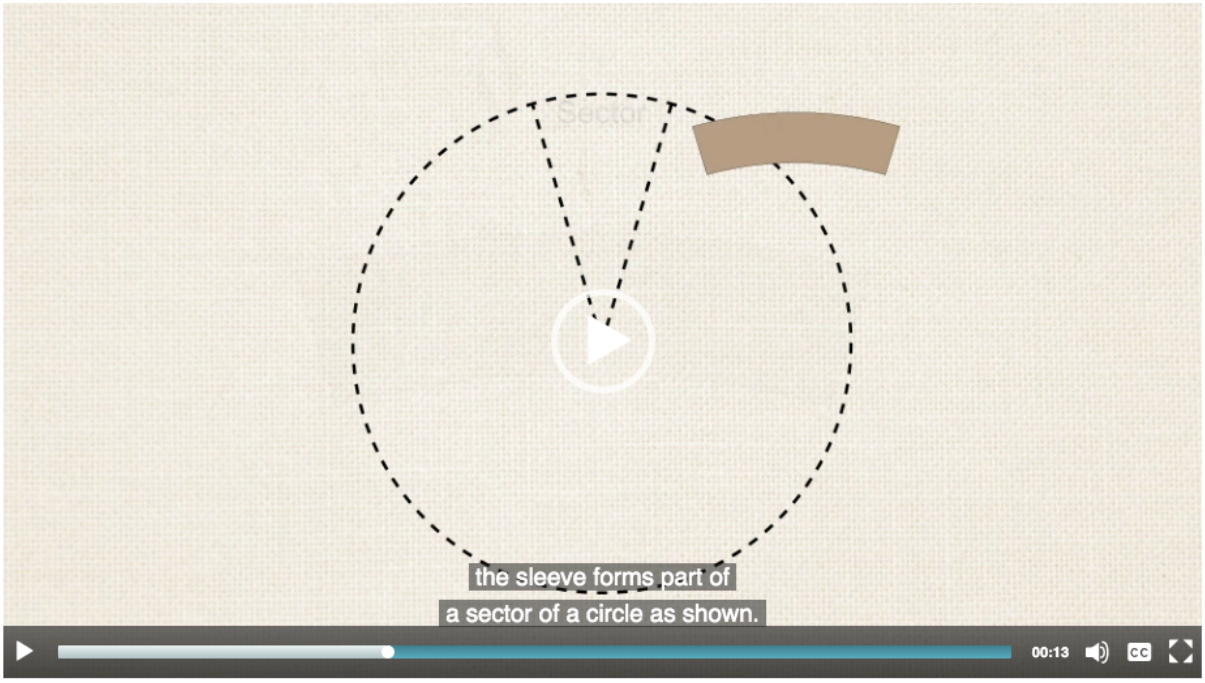
Material for the pool cover costs $3.40 per square metre. **Determine** the cost of the pool cover.

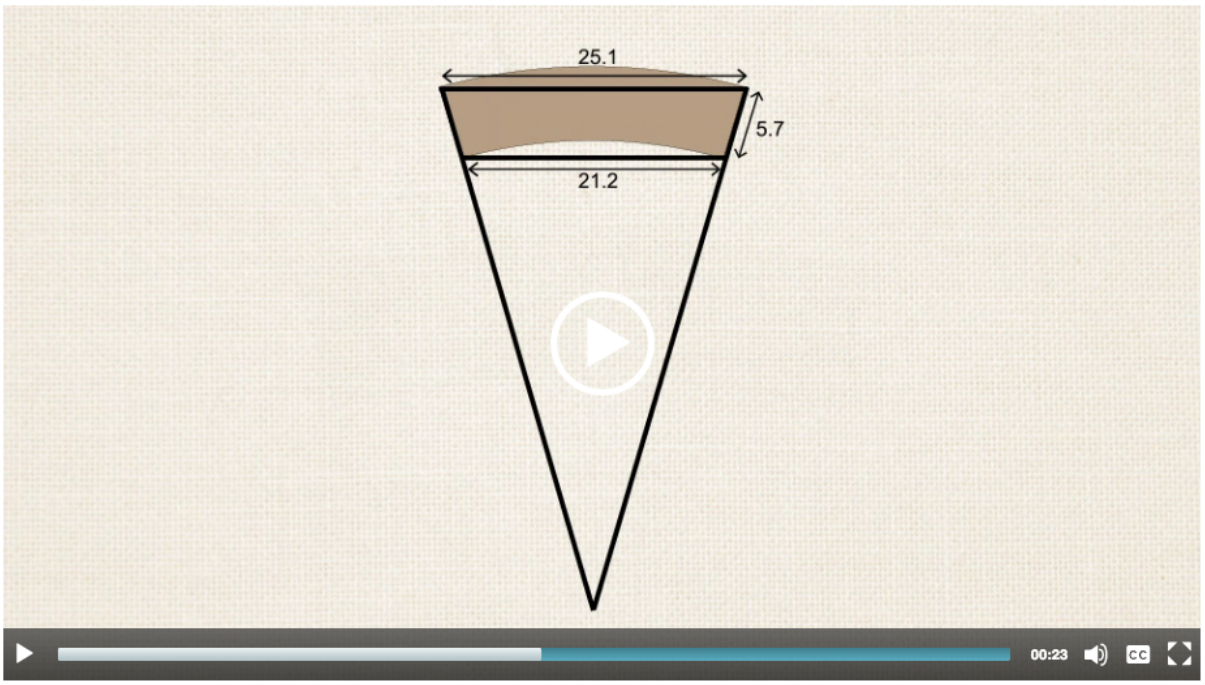
Question 5 (15 marks)

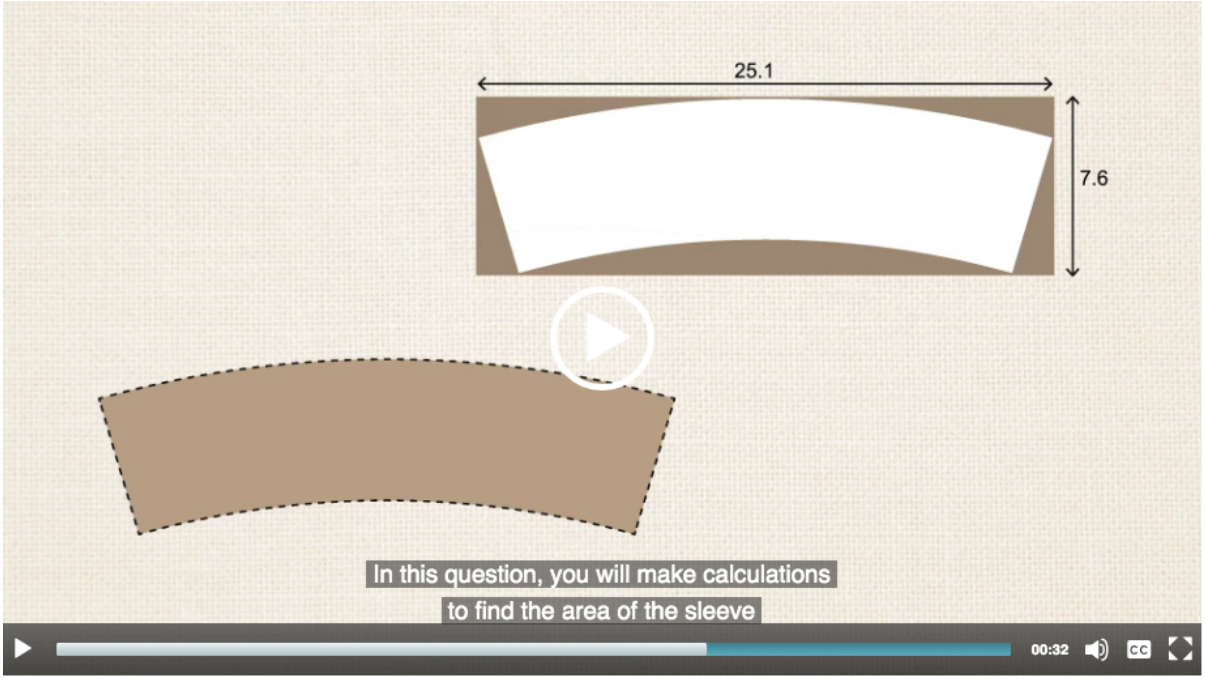
The following video explains the use of sleeves for paper cups.

Video Script




the sleeve forms part of
a sector of a circle as shown.
00:13

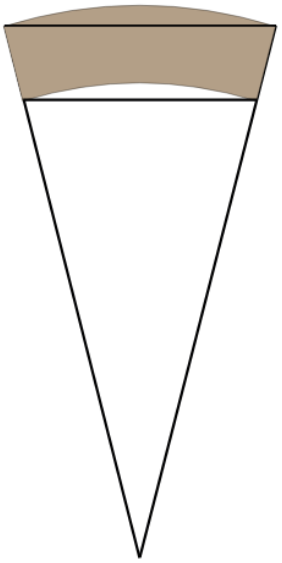

25.1
5.7
21.2
00:23



The dimensions of the sleeve are provided on the diagram, in centimetres (cm).

This media is interactive

Stage 2



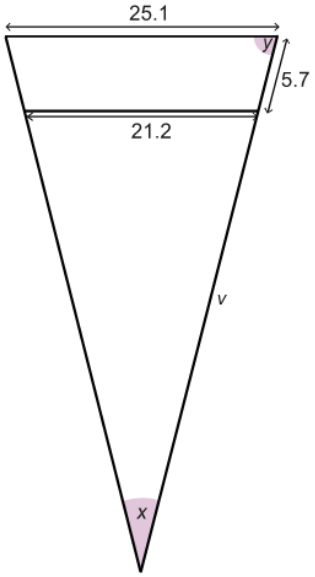
Stage control

Stage: 2

The dimensions of the sleeve are provided on the diagram, in centimetres (cm).

This media is interactive

Stage 3



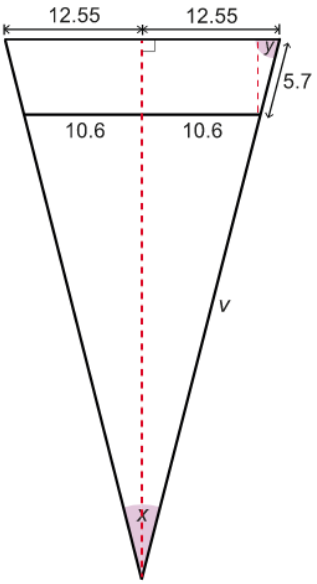
Stage control

Stage: 3

The dimensions of the sleeve are provided on the diagram, in centimetres (cm).

This media is interactive

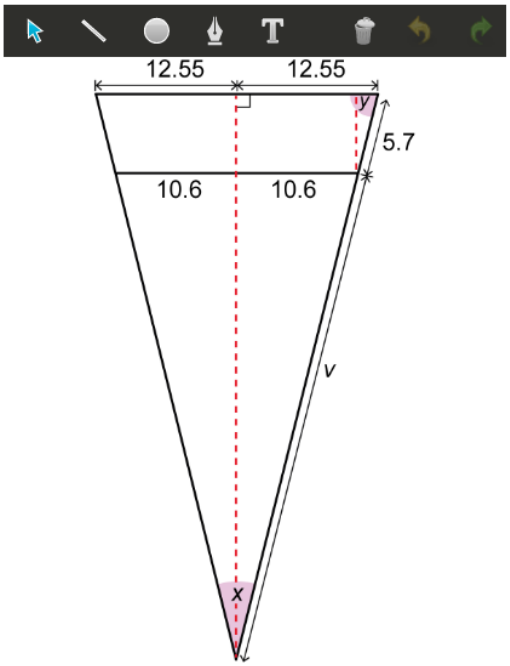
Stage 4



Stage control

Stage: 4

Question 5a (3 marks)



Show that the value of angle y is 70°, to the nearest degree.

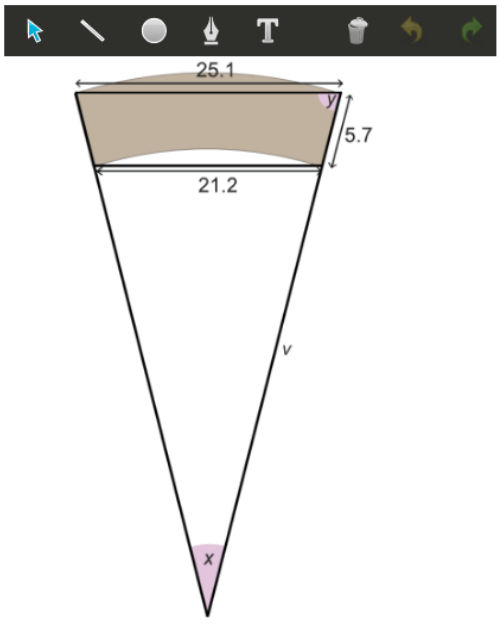
Question 5b (2 marks)

Hence, **determine** the value of angle x, to the nearest degree.

Question 5c (3 marks)

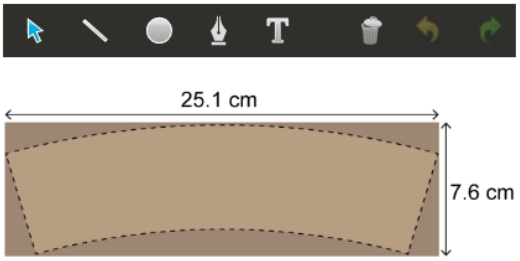
Calculate the value of v.

Question 5d (4 marks)



Find the area of the sleeve.

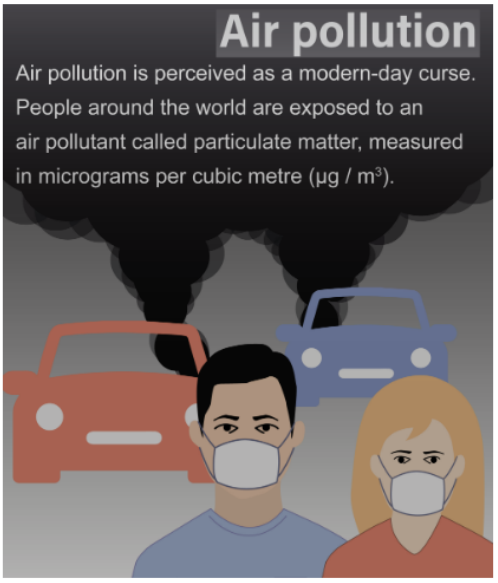
Question 5e (3 marks)



The sleeve is cut out from a 25.1 cm by 7.6 cm rectangle. **Calculate** the percentage of material wasted.

Question 6 (19 marks)

Many efforts have been made through the years to put into action solutions to resolve the problem of exposure to particulate matter in order to reach a globally agreed goal. In this question, you will make calculations and analyse exposure to particulate matter over a period of time.



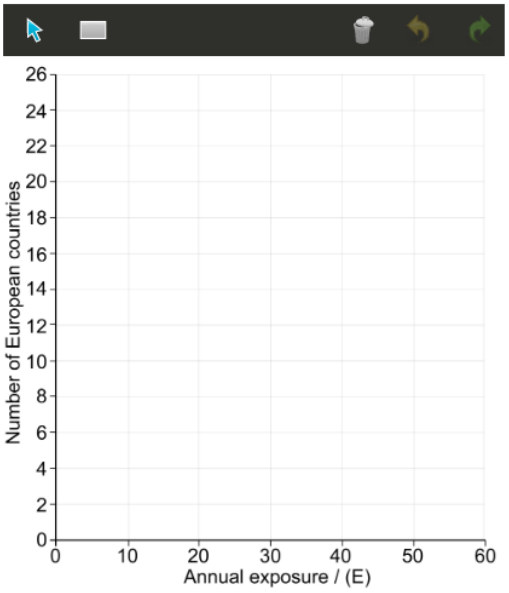
Question 6a (2 marks)

Annual exposure to particulate matter across Europe in 1990.

Annual exposure (E) to particulate matter in µg / m^3	$0 \leq E < 10$	$10 \leq E < 20$	$20 \leq E < 30$	$30 \leq E < 40$	$40 \leq E < 50$	$50 \leq E < 60$
Number of European countries	3	17	6	9	3	1

To visualize the level of exposure across Europe in 1990, use the table to **construct** a histogram.

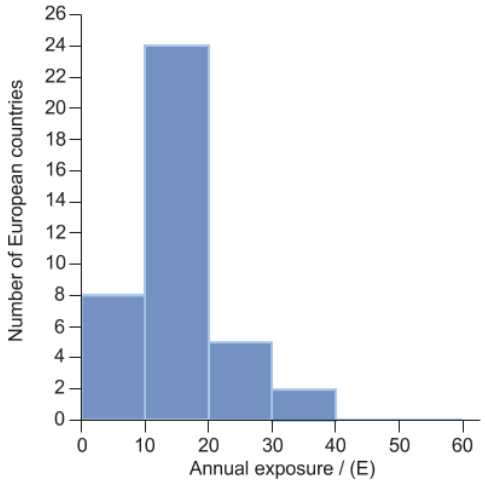
Particulate matter for 1990



Below is the histogram for the annual exposure to particulate matter across Europe in 2016.

Particulate matter for 2016

This media is interactive



Question 6b (1 mark)

In comparison with your histogram in part (a), **state** one difference between annual exposure to particulate matter in 1990 and 2016.

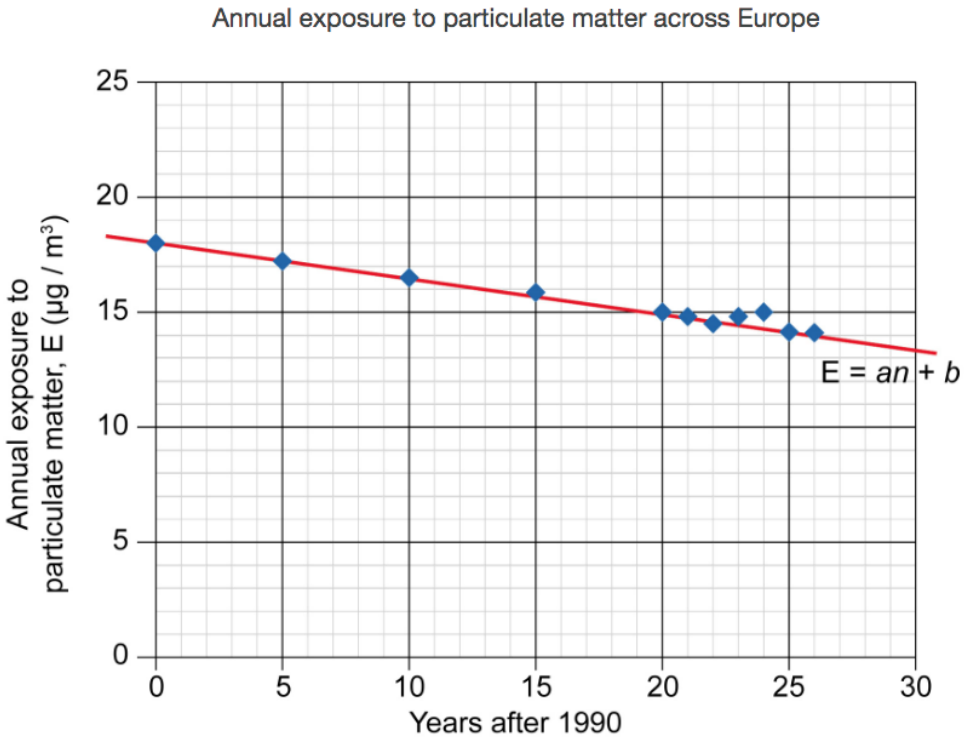
Question 6c (4 marks)

Using the histogram for 2016, **show that** an estimate for the mean of E in 2016 is 15.3 μg / m^3 to the nearest one decimal place.

Question 6d (2 marks)

The data from 1990 to 2016 can be modelled by a line of best fit as shown in Graph 1.

Graph 1



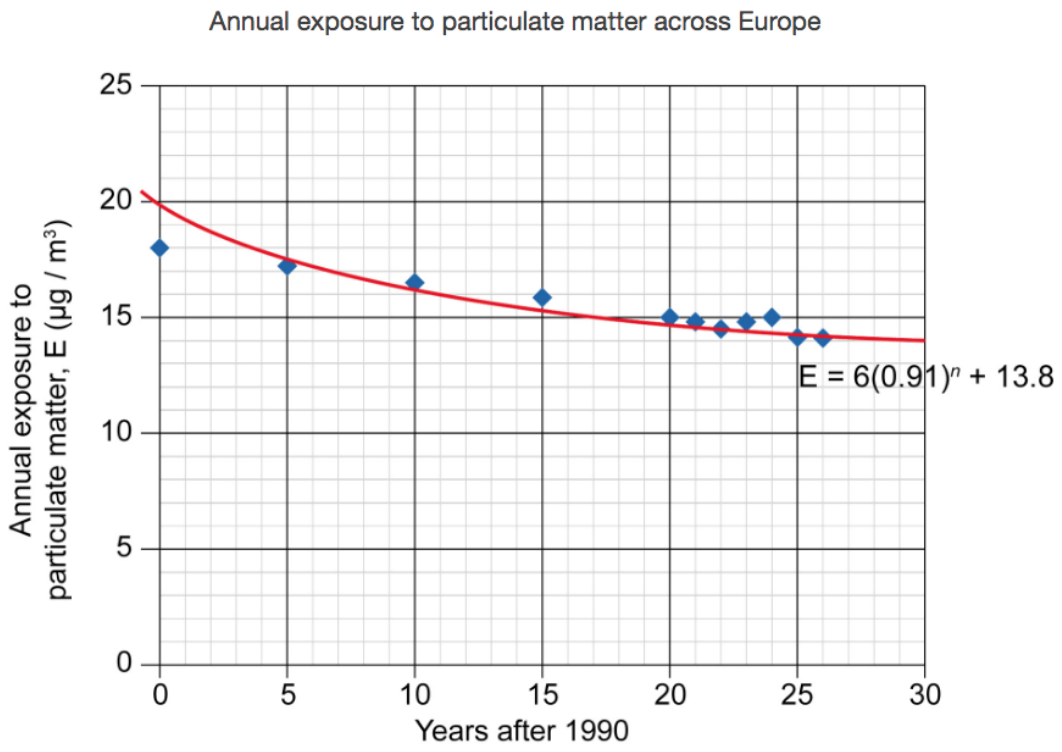
The equation of the line of best fit can be written as E = $an + b$, where E is the annual exposure to particulate matter and n is the number of years after 1990.

Determine the values of a and b.

Question 6e (10 marks)

The data from 1990 to 2016 can also be modelled by $E = 6(0.91)^n + 13.8$ as shown in Graph 2.

Graph 2



You are a statistical adviser on a government panel that wants to reduce annual exposure to particulate matter in Europe to a level below 13 µg / m^3 by 2030. **Analyse** the two models to make a prediction of annual exposure to particulate matter in 2030. In your answer, you should:

- identify a factor from the data to be considered when making your prediction
- predict the level of annual exposure to particulate matter in 2030 using models from both graphs
- comment on the accuracy of your predictions
- advise the government which is a better model to make predictions and justify your answer.

Question 7 (30 marks)

In this task you will investigate perimeter and area of squares.

Question 7a (1 mark)

The square below has a side length of 3 units.

©

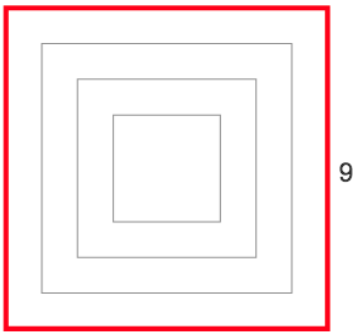
Show that the perimeter of the square is 12 units.

B I U x_2 x^2 Ω Σ Styles

Drag the slider to see how the square is enlarged in different stages.

This media is interactive

Stage 4



Stage control

Stage: 4

Question 7b (2 marks)

Write down the missing values in the table up to row 6.

Stage number (n)	Perimeter of square (P)
1	12
2	20
3	28
4	36
5	
6	

Question 7c (2 marks)

Describe in words two patterns in the table for the perimeter of square (P).

B I U x_2 x^2 Ω Σ Styles

Question 7d (2 marks)

Write down a general rule for P in terms of n.

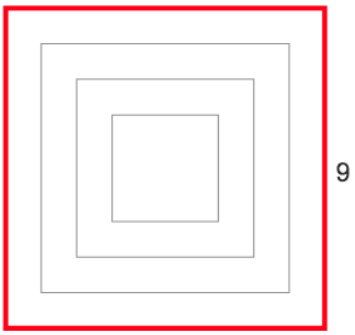
Question 7e (3 marks)

Verify your general rule for P.

Question 7f (20 marks)

This media is interactive

Stage 4



Stage control

Stage: 4

Stage number (n)	Area of square (A)	
1	9	
2	25	
3	49	
4	81	
5		
6		

Reset

Investigate the values in the table to find a relationship for the area of each square (A) in terms of n. In your answer, you should:

- predict more values and record these in the table
- describe in words a pattern in the table for area of square (A)
- write down a general rule for A in terms of n
- test your general rule for A
- verify and justify your general rule for A in relation to the squares
- ensure that you communicate all your working appropriately.