

Surname	Centre Number	Candidate Number
First name(s)		0



GCSE

3310U50-1



A21-3310U50-1

TUESDAY, 2 NOVEMBER 2021 – MORNING

**MATHEMATICS – NUMERACY
UNIT 1: NON-CALCULATOR
HIGHER TIER**

1 hour 35 minutes

ADDITIONAL MATERIALS

The use of a calculator is not permitted in this examination.
A ruler, a protractor and a pair of compasses may be required.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen. Do not use gel pen or correction fluid.

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 additional page at the back of the booklet. Question numbers must be given for the work written on the additional page.

Take π as 3.14.

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.

In question 3, the assessment will take into account the quality of your linguistic and mathematical organisation, communication and accuracy in writing.

For Examiner's use only		
Question	Maximum Mark	Mark Awarded
1.	2	
2.	9	
3.	8	
4.	4	
5.	12	
6.	10	
7.	6	
8.	12	
9.	7	
Total	70	

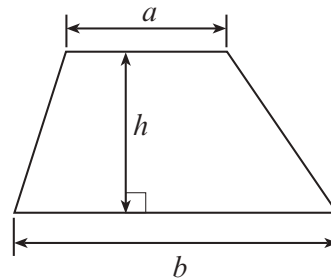
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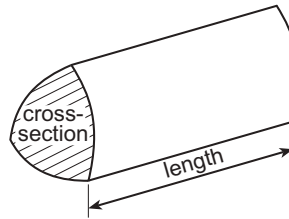
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Formula List – Higher Tier

Area of trapezium = $\frac{1}{2}(a + b)h$

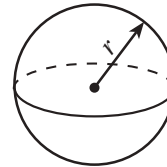


Volume of prism = area of cross-section \times length



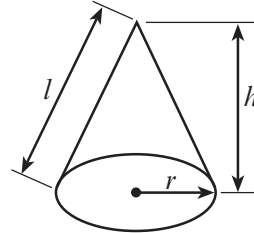
Volume of sphere = $\frac{4}{3}\pi r^3$

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



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

Curved surface area of cone = $\pi r l$

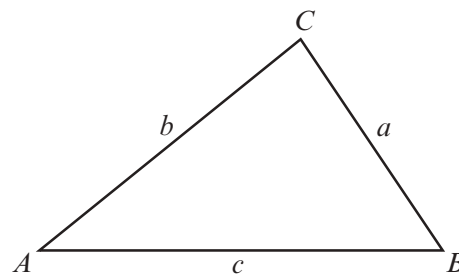


In any triangle ABC

Sine rule $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

Cosine rule $a^2 = b^2 + c^2 - 2bc \cos A$

Area of triangle = $\frac{1}{2}ab \sin C$



The Quadratic Equation

The solutions of $ax^2 + bx + c = 0$ where $a \neq 0$ are given by $x = \frac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$

Annual Equivalent Rate (AER)

AER, as a decimal, is calculated using the formula $\left(1 + \frac{i}{n}\right)^n - 1$, where i is the nominal interest rate per annum as a decimal and n is the number of compounding periods per annum.



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1.



The skeleton of a dinosaur was found in Wyoming, USA, in 2008. This skeleton is now on display in a shopping mall in Dubai.

Here are some facts about this skeleton.

- It was transported 7500 miles from Wyoming to Dubai.
- It is over 155 million years old.
- It is 80 feet (ft) long and 25 feet tall.

(a)



Assume:

- the skeleton had been transported complete in one crate,
- the crate was in the shape of a cuboid.

Which of the following would be the best estimate of the volume of the crate?
Circle your answer.

[1]

20 000 ft³

20 000 ft²

2 000 ft²

200 000 ft³

2 000 ft³

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- (b) Which of the following is 155 million written in standard form?
Circle your answer.

[1]

15.5×10^7

1.55×10^4

1.55×10^6

155×10^6

1.55×10^8

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2. (a) Penystrad is a mountain village.
The daily rainfall for April 2021 is given in the table below.

Daily rainfall, r (mm)	Number of days
$0 \leq r < 6$	15
$6 \leq r < 12$	11
$12 \leq r < 18$	3
$18 \leq r < 24$	1

- (i) Wesley asks,

During April 2021, on how many days did it **not** rain in Penystrad?

Explain why it is not possible to answer Wesley's question using the table shown above. [1]

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- (ii) Calculate an estimate for the mean daily rainfall for the 30 days of April. [4]

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(b) Glanwen is a different village.

During the first 25 days of April in Glanwen, the mean daily rainfall was 4.4 mm.
It did not rain in Glanwen during the last 5 days of April.
Calculate the mean daily rainfall in Glanwen for April.
Give your answer correct to 3 significant figures.

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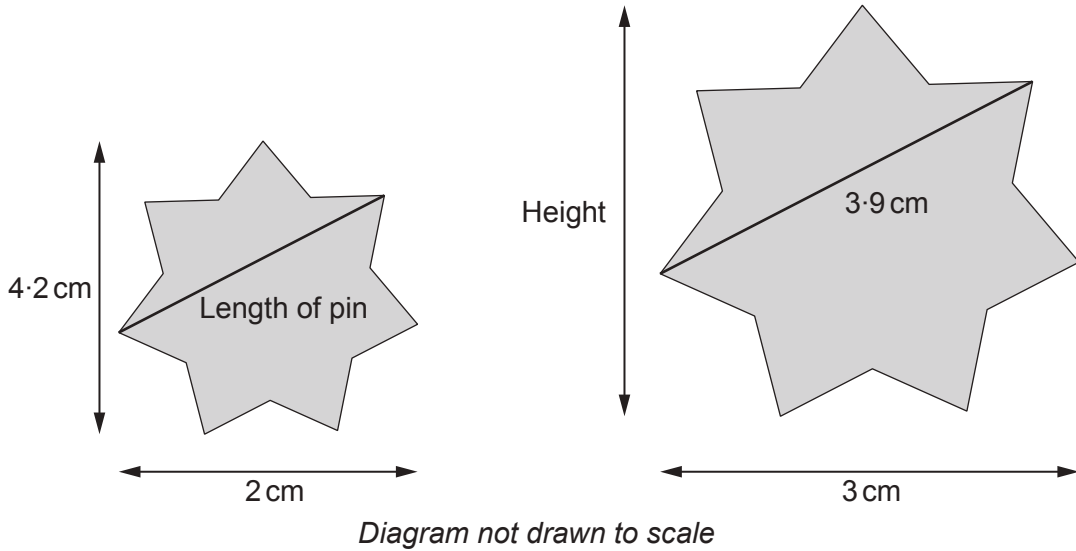
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4. A fast food restaurant has staff name badges in the shape of a star. Each badge has a pin across the back, as shown in the diagram. Members of staff choose the size of badge they want to wear. The badges are mathematically similar.



The length of the pin on the larger badge is 3.9 cm.

Calculate the height of the larger badge and the length of the pin on the smaller badge. [4]

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Height of the larger badge cm
 Length of the pin on the smaller badge cm



5. Bethan works as an office manager at a medical centre.

Last Monday, 60 patients each had an appointment with a doctor. Bethan recorded how long each patient's appointment lasted. Her results are given in the table below.

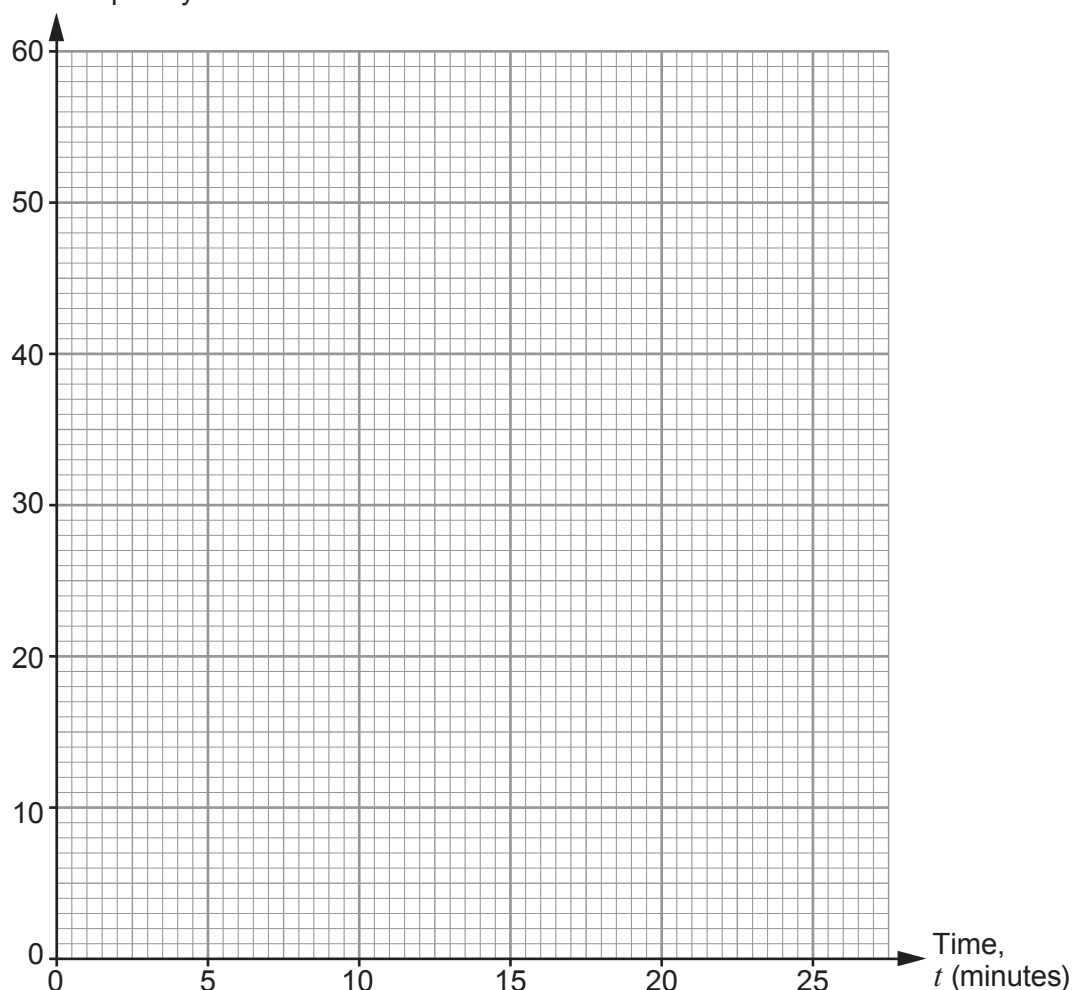
Length of time, t (minutes)	$0 < t \leq 4$	$4 < t \leq 8$	$8 < t \leq 12$	$12 < t \leq 16$	$16 < t \leq 20$	$20 < t \leq 24$
Number of patients	4	24	18	6	2	6

(a) Complete the following cumulative frequency table. [1]

Time, t (minutes)	$t \leq 0$	$t \leq 4$	$t \leq 8$	$t \leq 12$	$t \leq 16$	$t \leq 20$	$t \leq 24$
Cumulative frequency	0	4	28				60

(b) On the graph paper below, draw a cumulative frequency diagram to show this information. [2]

Cumulative frequency



(c) Each patient is given 10 minutes for their appointment.
Use your graph to give the best estimate for the number of appointments that lasted longer than 10 minutes.
Give your answer correct to the nearest whole number of appointments. [2]

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(d) Of the patients seen last Monday, what percentage spent longer than 20 minutes with the doctor? [2]

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(e) The median length of the appointments last Tuesday was 11.5 minutes.
How much shorter was the median length of the appointments on Monday?
Give your answer correct to the nearest minute. [2]

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(f) Bethan is considering changing the time given for each patient's appointment to 12 minutes.
She would set a target of 80% of patient appointments taking less than or equal to 12 minutes.
Would this target have been met last Monday?
You must show all your working. [3]

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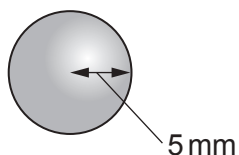
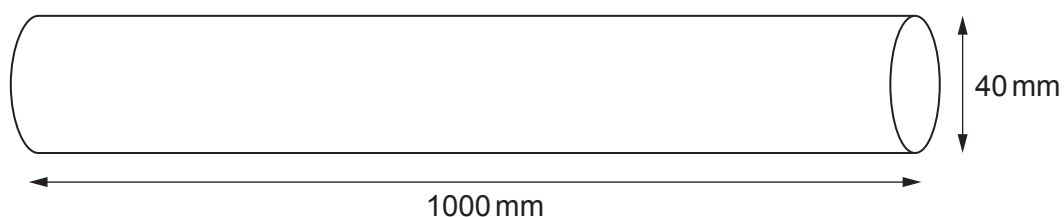
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6. *Bearing-Up* is a company that makes steel spheres to be used in bearings.



- (a) *Bearing-Up* melts a steel cylinder of diameter 40 mm and length 1000 mm. It recasts all the steel to make spheres of radius 5 mm.



Diagrams not drawn to scale

Calculate how many spheres can be made from the cylinder.

[5]

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- (b) *Bearing-Up* also makes spheres with a different radius.
Each of these spheres has a surface area of 320π mm².
Calculate the radius of one of these spheres.

Give your answer in the form $a\sqrt{b}$, where a is an integer and b is a prime number. [5]

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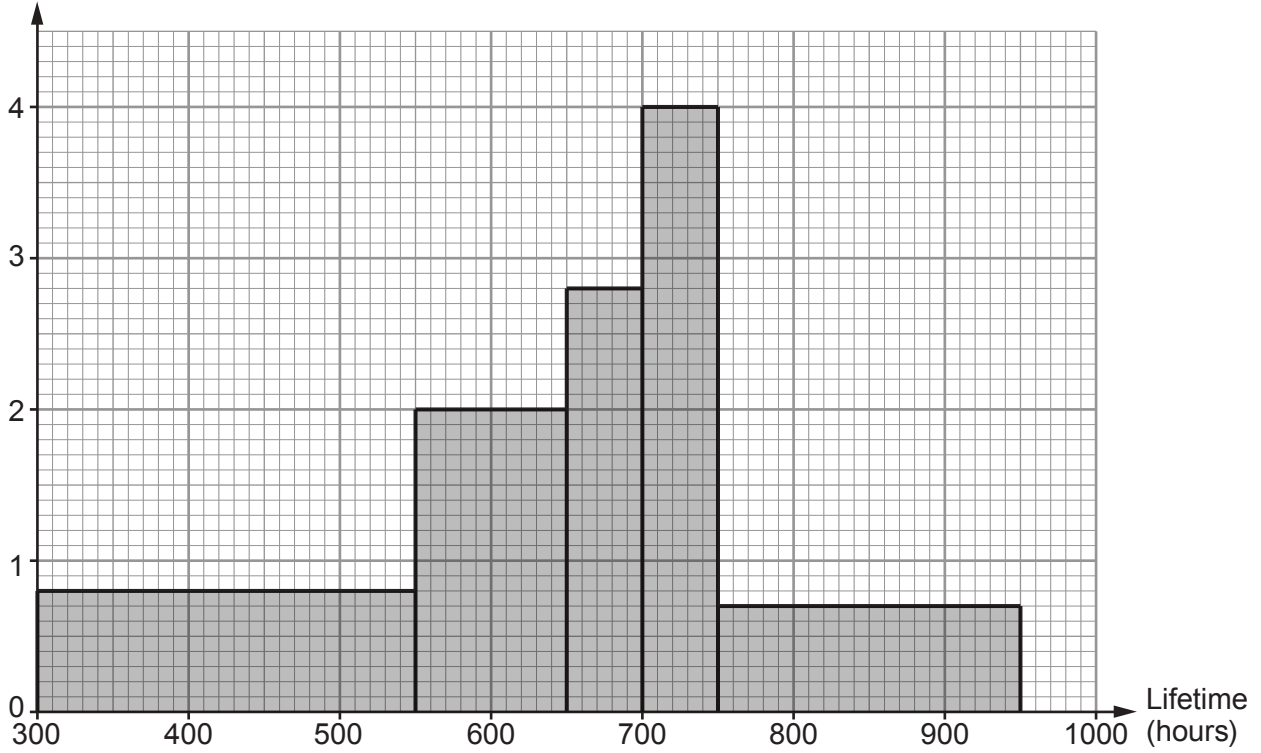
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7. *PowerUp* is a company that makes a certain type of battery. To find out how long these batteries last, it tests a sample of new batteries. The lifetime of each battery in the sample is recorded. The results are shown in the histogram below.

Frequency density



Use the histogram to answer the following questions:

- (a) Calculate the total number of batteries that were in the sample. [2]

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(b) *PowrUp* can advertise the lifetime of these batteries based on the results of these tests. 75% of the sample must **exceed** this lifetime.

Calculate an estimate of the lifetime of these batteries that *PowrUp* should use in its adverts.

You must show all your working.

[4]

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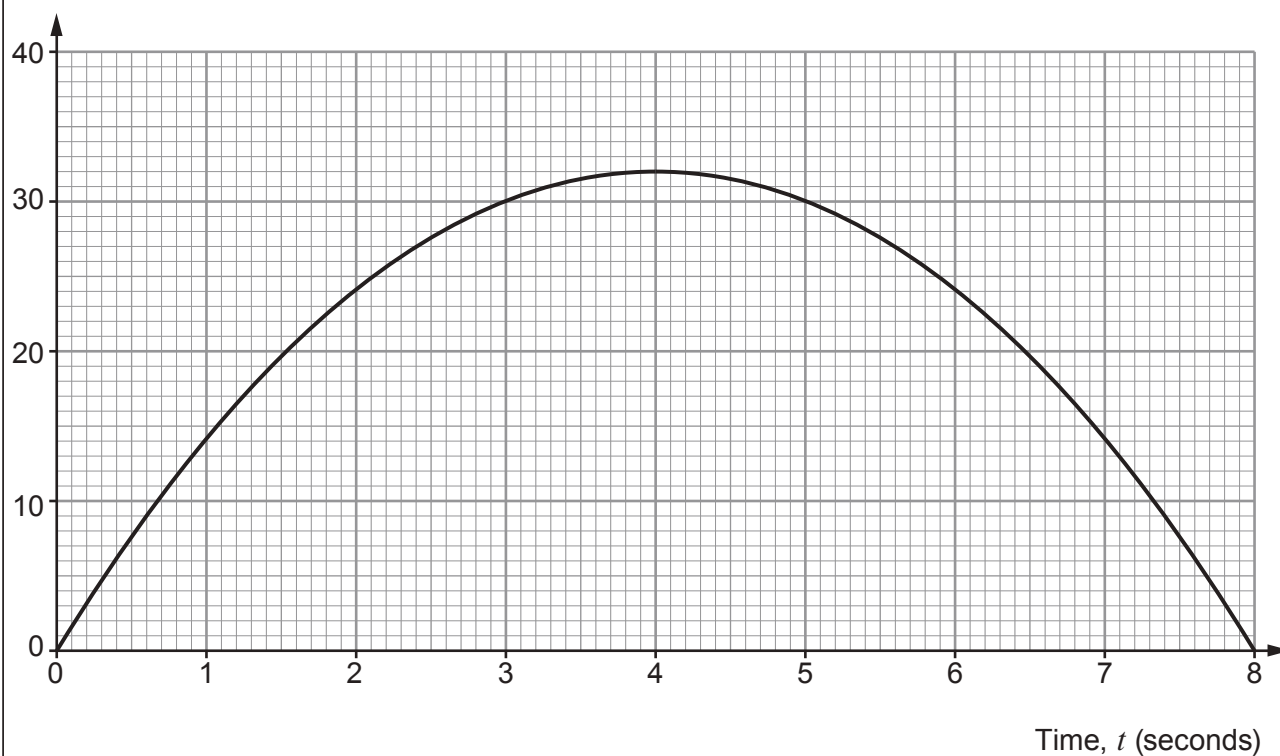
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8. The graph below shows the velocity, v , in m/s, of a particle at time t seconds, for the first 8 seconds of its journey.

Velocity, v (m/s)



- (a) At time $t = 2$ seconds, estimate the acceleration of the particle.
Simplify your answer as far as possible.
State the units of your answer.

[4]

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- (b) (i) Use the trapezium rule with 8 strips of equal width to estimate the distance travelled by the particle in the first 8 seconds. [3]

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- (ii) The actual distance travelled during the first **6 seconds** is exactly 144 m. Use this to calculate the average velocity of the particle over the first **6 seconds**.
Give your answer in **miles per hour** (mph). [5]

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9. A bridge in Pontrhydyfen, located in the Afan Valley, was built in the 19th century.



From 2016 to 2017, restoration work was carried out on most of the surfaces of the bridge.

The diagram below shows a simplified version of the bridge.

The semi-circular arches each have a diameter of 20 m.

The entire length of the bridge has a uniform width of 4 m.

All the pillars are identical cuboids.

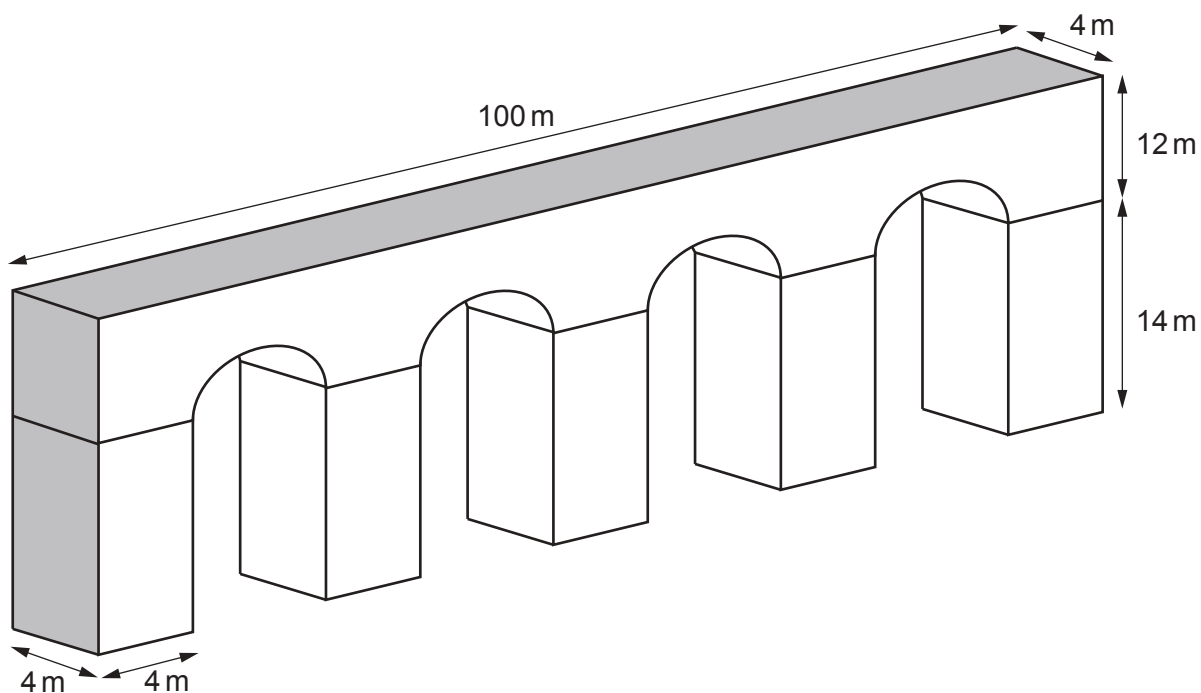


Diagram not drawn to scale

All of the surfaces were restored **except** the shaded areas at the top and at both ends of the bridge.

(Note, in the diagram, only one of the ends can be seen.)

Calculate the total surface area that was restored.

Give your answer, in terms of π , in its simplest form.

[7]



