Surname	Centre Number	Candidate Number
First name(s)		0

wjec cbac

GCSE

3310U50-1

A20-3310U50-1

TUESDAY, 3 NOVEMBER 2020 – MORNING

MATHEMATICS – NUMERACY
UNIT 1: NON-CALCULATOR
HIGHER TIER

1 hour 45 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 **2***(b)*, 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.	4	
2.	13	
3.	3	
4.	3	
5.	6	
6.	6	
7.	5	
8.	5	
9.	8	
10.	10	
11.	9	
12.	8	
Total	80	

3310U501
01

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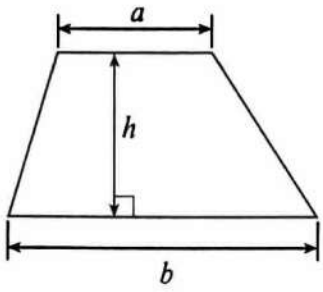
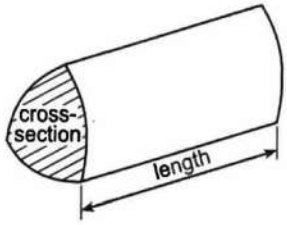
Formula List - Higher Tier

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

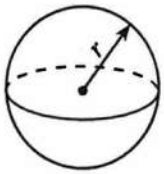


Volume of prism = area of cross-section × length



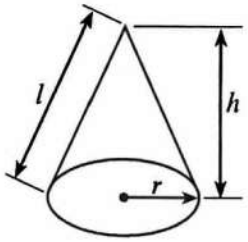
Volume of sphere = $\frac{4}{3}\pi r^3$

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



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

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

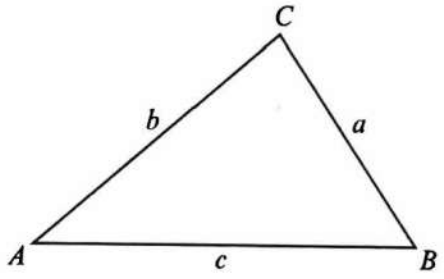


In any triangle ABC

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

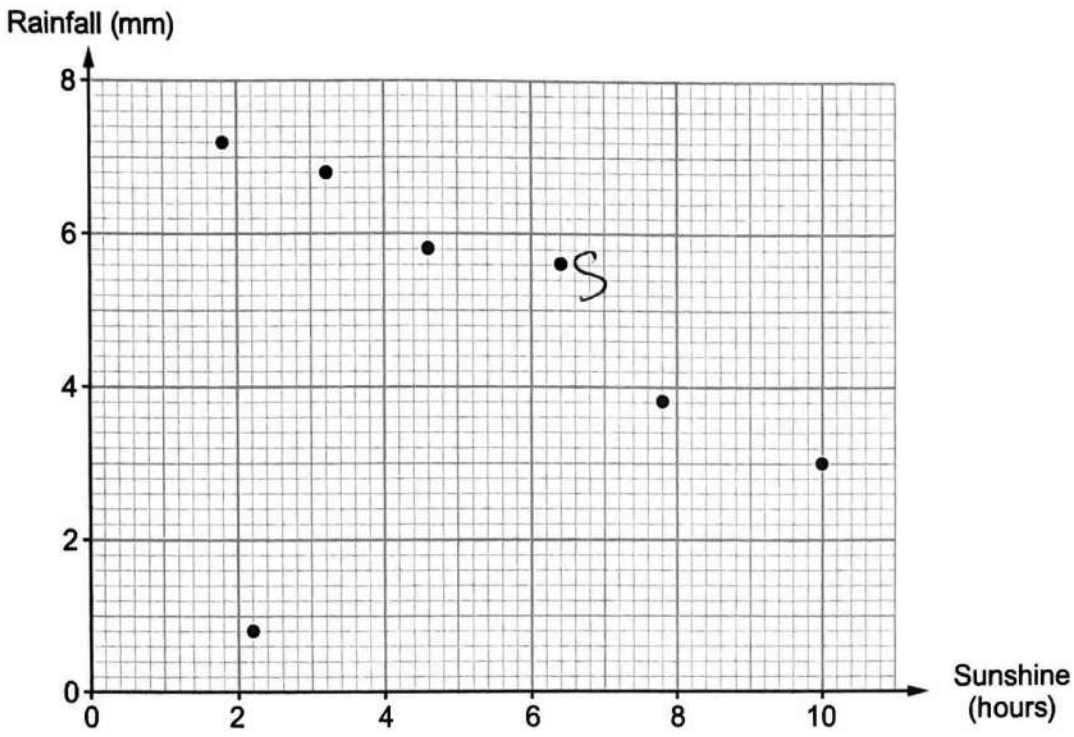
The solutions of $ax^2 + bx + c = 0$ where $a \neq 0$ are given by $x = \frac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$

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.

Examiner only

1. *(a)* Rosie recorded the rainfall and the number of hours of sunshine each day last week.



(i) The number of hours of sunshine on Sunday was double the number of hours of sunshine on Monday.
Mark, with the letter S, the point on the scatter diagram that shows Sunday's data. [1]

(ii) Rosie says,

> There will be a positive correlation between rainfall and the number of hours of sunshine next week.

Is Rosie correct?

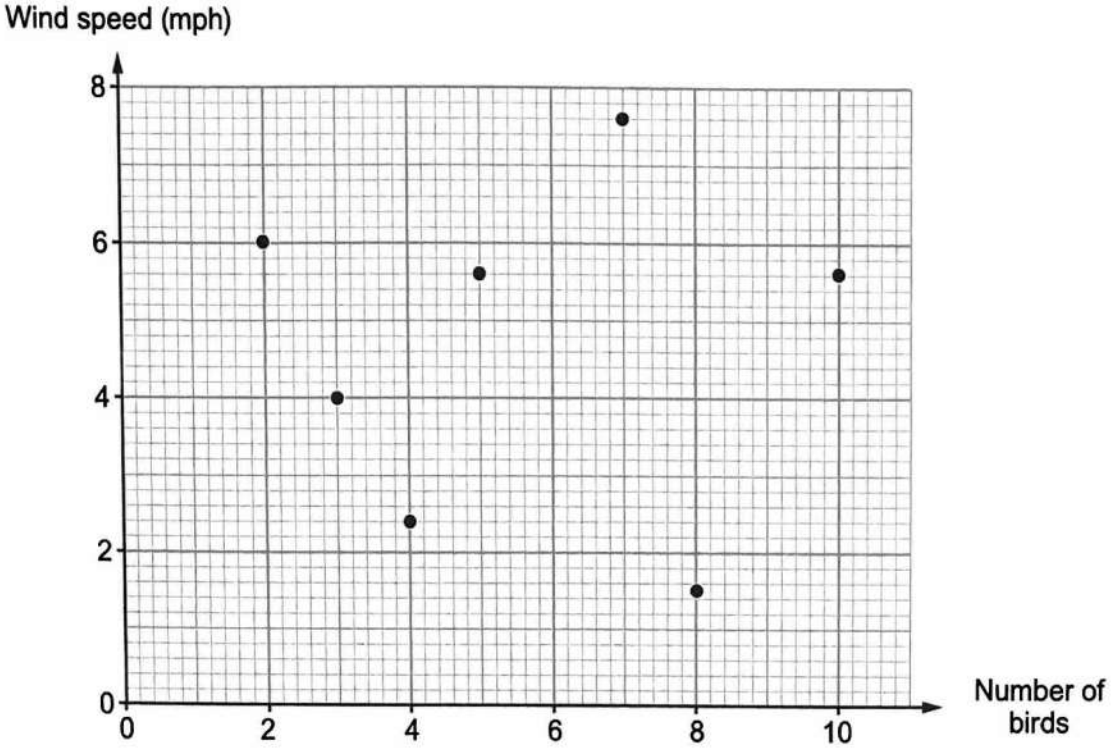
Yes ☐ No ☑

You must give a reason for your answer. [1]

shows a negative correlation this week

Examiner only

(b) At 3 p.m. each day last week, Rosie recorded the wind speed and the number of birds feeding in her garden.



On Wednesday last week, the wind speed at 3 p.m. was a quarter of that on Friday.
Complete the following table. [2]

Day	Wind speed (mph)
Wednesday	1.5
Friday	6.0

3310U501
05

Examiner only

2. Albert, Terri and Gareth are going camping.

(a) Albert, Terri and Gareth paid for a tent between them.
The amount they each paid for the tent was in the ratio 1 : 4 : 6 respectively.
Gareth paid £66.36 towards the tent.

Calculate the cost of the tent. [3]

1 : 4 : 6 → 11 parts

(£66.36 ÷ 6) × 11 = £121.66

(b) *In this part of the question, you will be assessed on the quality of your organisation, communication and accuracy in writing.*

The charge to stay at a campsite has increased by 5% each year for the last two years.
Two years ago, the charge was £24 per night for a large tent and three people.

Calculate the current charge per night for a large tent and three people.
You must show all your working. [4 + 2 OCW]

2 yrs ago = £24

1 yr ago = £24 × 1.05 = £25.2

This year = £25.2 × 1.05 = £26.46

= £26.46

Examiner only

(c) The diagram shows the groundsheet of a tent.

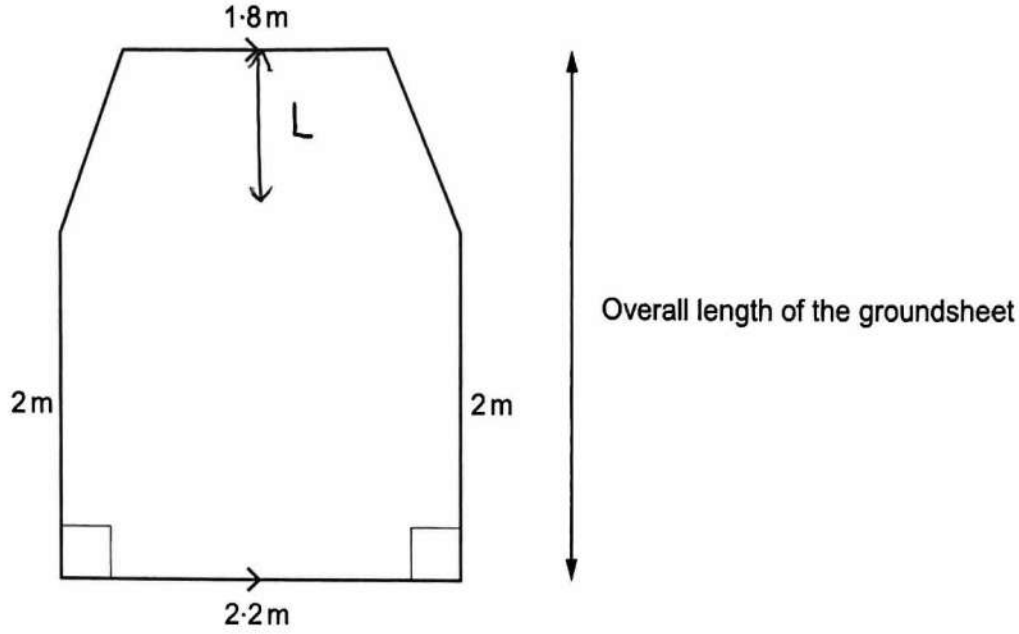


Diagram not drawn to scale

The area of the groundsheet is 6·8 m².
The width of the groundsheet is 2·2 m.
Calculate the overall length of the groundsheet. [4]

$L \rightarrow \frac{1}{2}(1.8 + 2.2) \times L + 2(2.2) = 6.8$

$2L + 4.4 = 6.8$

$2L = 2.4$

$L = 1.2$

overall length $= 2 + 1.2$

$= 3.2\text{m}$

3310U501 07

Examiner only

3. The scale diagram below shows Haydn's garden.

His garden is 27 metres long and 18 metres wide.
The scale used is **1 cm represents 3 metres**.

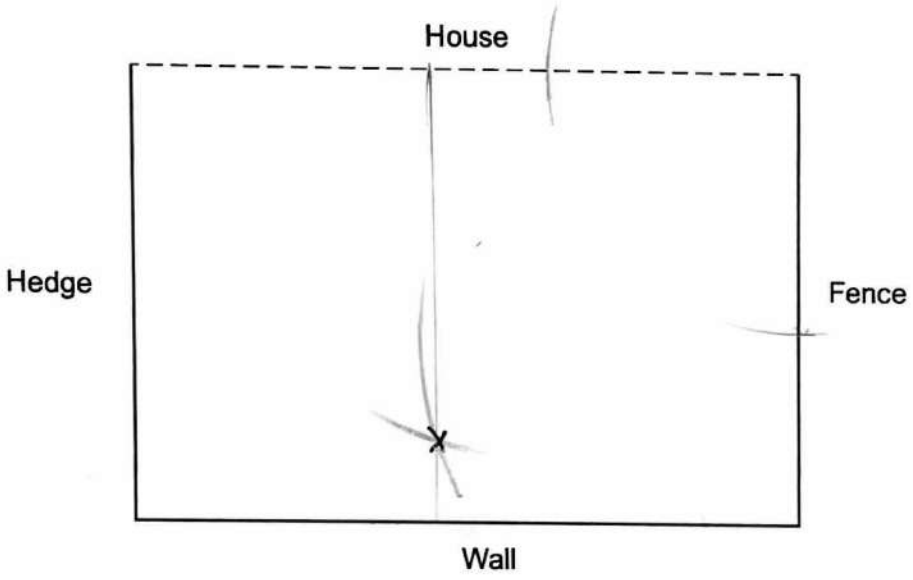
Haydn is planting a tree in his garden.

He decides that the tree must be planted:

- 15 metres from the fence,
- equidistant from the house and the fence.

Draw suitable lines on the diagram and show where Haydn should plant the tree. [3]

1 cm represents 3 metres



15m = 5cm

Examiner only

4. There are 600 pupils in a school.
8 of these pupils are to be selected to discuss changes to the school uniform.

The headteacher has a spreadsheet of the names of all 600 pupils.
There are 600 rows of pupil names in the spreadsheet, starting at row 1.
There is one pupil name on each row.

The headteacher uses a systematic sampling method.

(a) The first pupil selected on the headteacher's list is a boy whose name is in the 25th row.

Give the row numbers in the spreadsheet of the other 7 pupils who would be selected.
Complete the table below. [2]

600 ÷ 8 = 75

Pupil	1st	2nd	3rd	4th	5th	6th	7th	8th
Row in the spreadsheet	25th	100	175	250	325	400	475	550

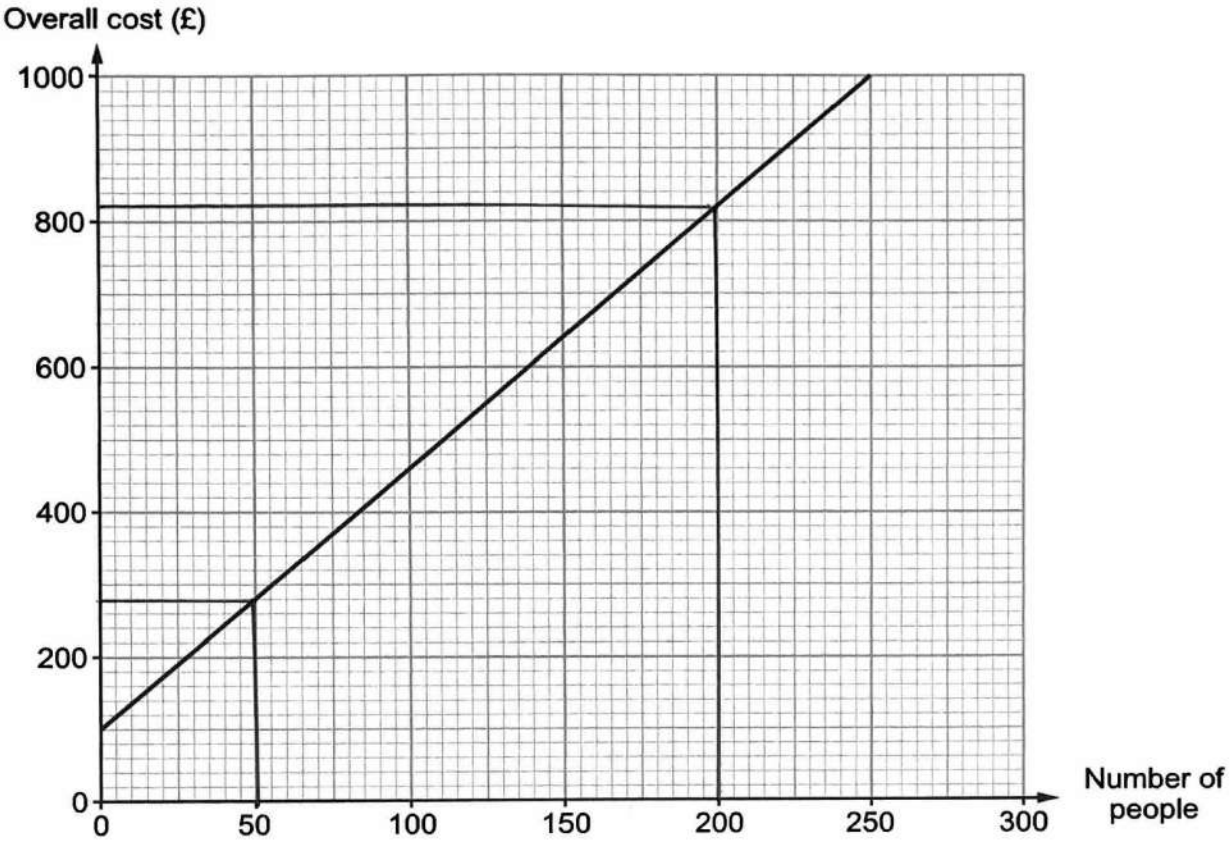
(b) Explain how the headteacher selected the first pupil. [1]

Random selection from first 75 pupils

3310U501
09

5. Meinir is planning a charity event to be held at a hotel.

A section of a straight line graph showing the hotel charges for this event is shown below. These charges include a single payment for the room hire and the cost of one drink for each person attending.



Meinir decides to pay the room hire cost herself.
She decides to price the tickets so that she will be able to make £500 to give to charity.

Examiner only

(a) Calculate the selling price of each ticket if Meinir plans the event for 50 people. [3]

pays £100 for room hire

Remaining cost: £180

+ £500 for charity

£680

£680 ÷ 50 = £13.60

(b) Calculate the selling price of each ticket if Meinir plans the event for 400 people. [3]

base off 200 people: £820

- £100 room hire

£720

cost per person = £720 ÷ 200

= £3.60

each person contribution to charity: £500 ÷ 400

= £1.25

Total price = £3.60 + £1.25 = £24.85

3310U501
11

Examiner only

6. *(a)* A square piece of card measures 1 m by 1 m.

Calculate the area of this piece of card.
Give your answer in **standard form** in mm^2. [2]

1m x 1m

= 1000 mm x 1000 mm

= 1000000 mm^2

1×10^6 mm^2

(b) Some fabric shrinks when it is washed.

A piece of fabric is washed twice.

After the first wash, the area of the fabric is 75% of the area of the original piece of fabric.
After the second wash, the area of the fabric is 90% of the area of the fabric after the first wash.

After these two washes, the area of the fabric is 2700 cm^2.

Calculate the area of the original piece of fabric. [4]

2 washes = 2700 cm^2

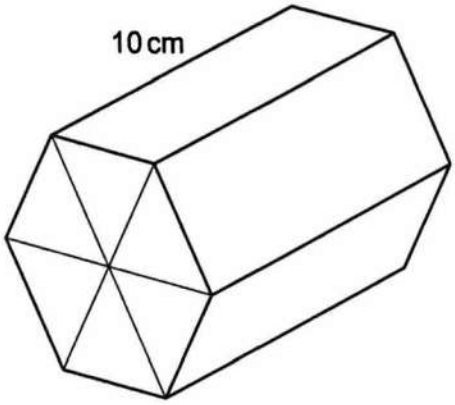
1 wash = 2700 ÷ 0.9 = 3000 cm^2

0 wash = 3000 ÷ 0.75 = 4000 cm^2

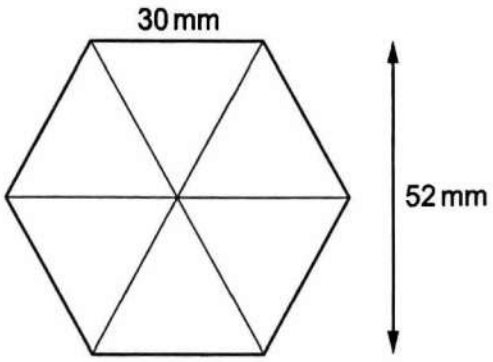
Examiner only

7. A box for mints is to be made in the shape of a hexagonal prism.
The cross-section of the box is a regular hexagon.
The volume of the box must be greater than 230 000 mm^3.

Box for mints



Cross-section



Diagrams not drawn to scale

Using the measurements above, show that this would make a suitable box for the mints.
You must show all your working. [5]

Cross section area =

area per triangle = $\frac{1}{2}(30 \times \frac{52}{2}) = 390$

per 6 triangles = $390 \times 6 = 2340 mm^2$

volume = $2340 \times 1000 = 2340000 mm^3$

Examiner only

8. On a building site, 4 bricklayers were able to lay 2000 bricks in 8 hours.

To complete the work on time, bricklayers will need to lay 9000 bricks in 10 hours.

(a) Calculate how many bricklayers would be needed to lay 9000 bricks in 10 hours. You must show all your working. [4]

(hours)

$4 \times \frac{8}{10} \times \frac{9000}{2000} =$

$4 \times 0.8 \times 4.5 =$

14.4

= 15 bricklayers needed

(b) Give one assumption that you made in answering part *(a)*. [1]

All bricklayers work at the same rate

Examiner only

9. Carwyn owns a car and a motorcycle.

(a) After owning the car for a year, Carwyn had the car valued.
He calculated that the car had lost $0\dot{1}3\dot{8}$ of its value at the start of the year.

Express $0\dot{1}3\dot{8}$ as a fraction in its lowest terms. [3]

② $100x = 13.888\ldots$

① $1000x = 138.88\ldots$

① − ② $= 900x = 125$

$$x = \frac{125}{900}$$

(b) Carwyn bought the motorcycle for £9600.
At the end of each year of owning the motorcycle, Carwyn had the motorcycle valued.

Each year the motorcycle lost $\frac{1}{5}$ of its value at the start of the year.

(i) Carwyn used the method $9600 \times \frac{1}{5} \times \frac{1}{5}$ to calculate the value of the motorcycle after 2 years.

Explain why Carwyn's method is incorrect. [1]

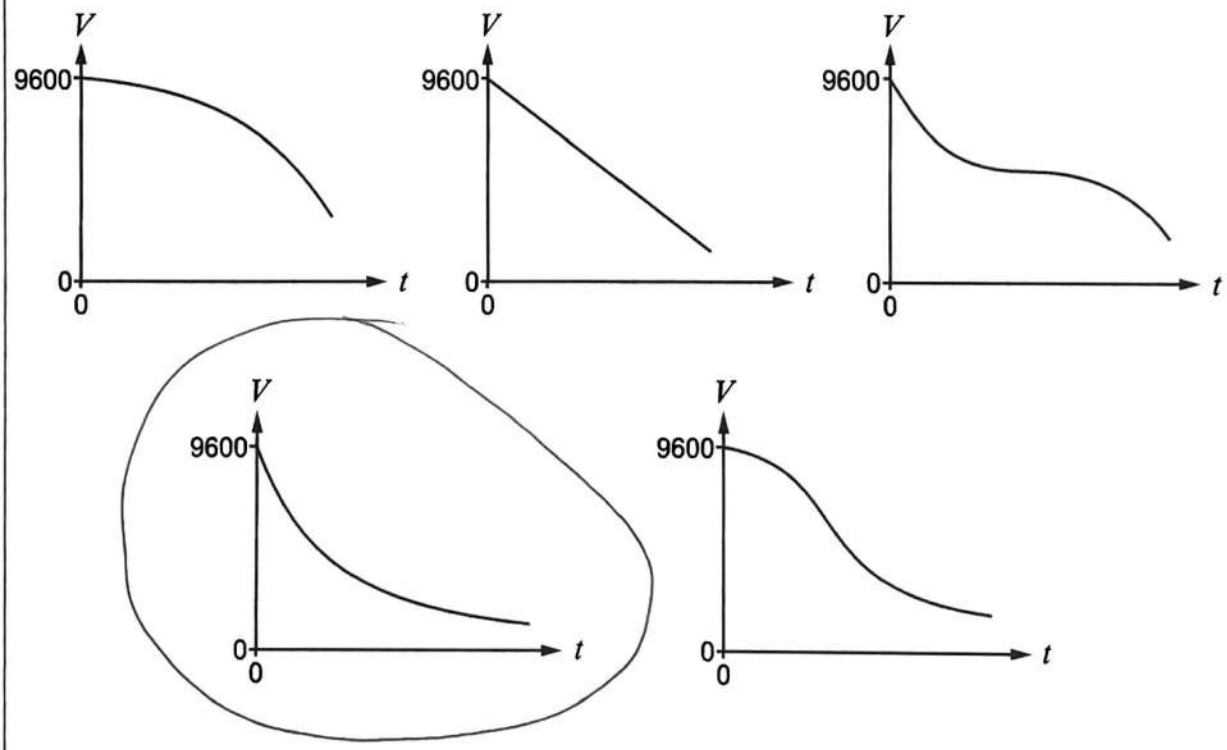
he should have multiplied by $\frac{4}{5} \times \frac{4}{5}$ not $\frac{1}{5} \times \frac{1}{5}$

Examiner only

(ii) Write down a **formula** for the value V, in pounds, of Carwyn's motorcycle after he has owned the motorcycle for t years. [3]

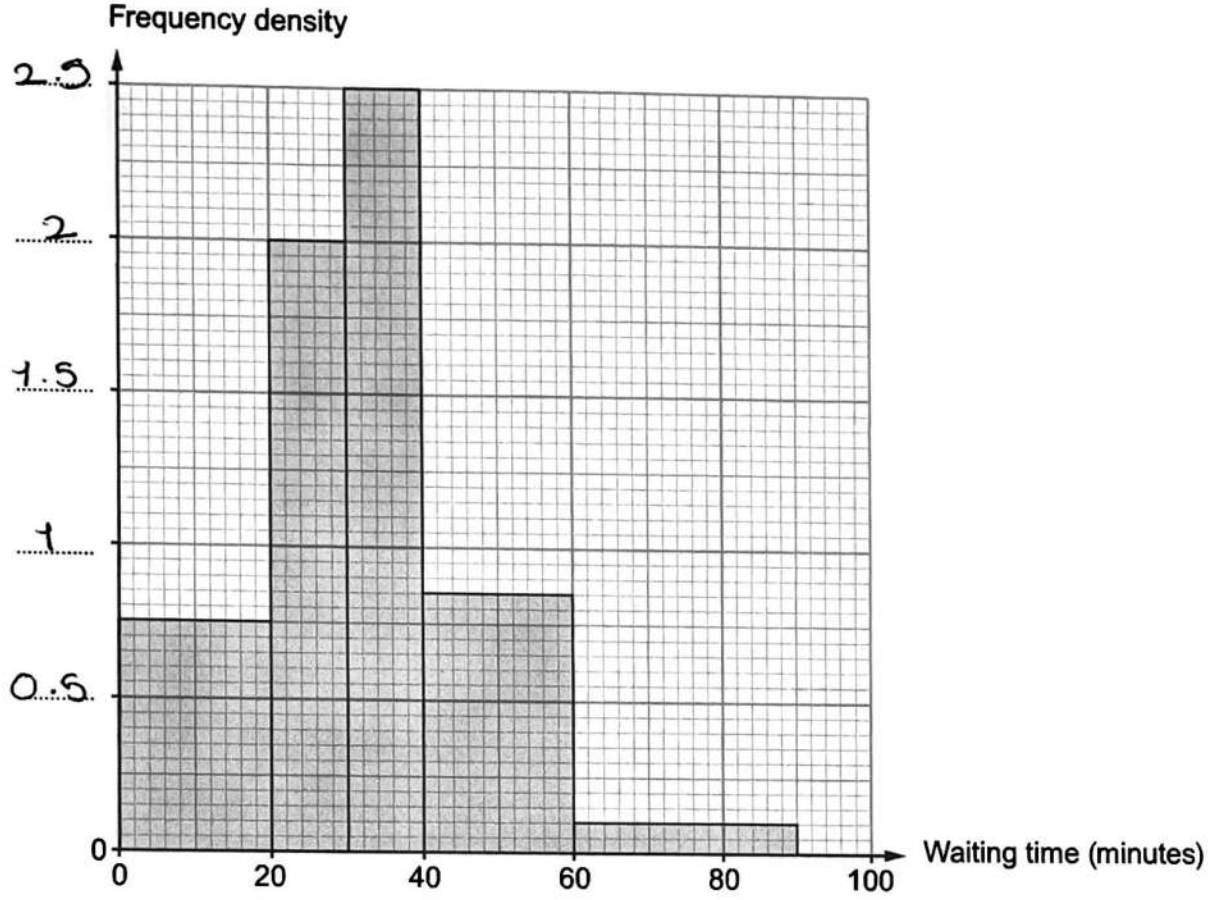
$V = 9600 \times \frac{4}{5}^{t}$

(iii) Which one of the following best represents the graph of V against t? Circle your answer. [1]



Examiner only

10. The management of a hospital wants to reduce the waiting time in its Accident and Emergency Unit.
After arriving at the unit, patients have to wait to see a doctor.
One Tuesday, the waiting time for each patient was recorded.
The results are displayed in the following histogram.



(a) 15 patients had to wait up to 20 minutes.
Complete the scale on the frequency density axis. [2]

15 ÷ 20 = 0.75

(b) Show that there were 80 patients in total who waited to see a doctor on this Tuesday. [2]

15 + (2 × 10) + (2.5 × 10) + (0.8 × 20) + (0.1 × 30)

= 80

Examiner only

(c) Calculate an estimate of the inter-quartile range of the waiting times recorded.
You must show all your working. [5]

80 patients

upper quartile = 60 patients
= 40 mins

lower quartile = 20 patients
$= 20 + \frac{1}{4}(10)$
= 22.5 mins

interquartile range = 40 - 22.5
= 17.5 mins

Estimate of the inter-quartile range = 17.5 minutes

(d) One Saturday, the waiting time for each patient was recorded.
The inter-quartile range of the waiting times for this Saturday was smaller than the inter-quartile range for the Tuesday.

The management used this fact to conclude that waiting times were shorter on Saturdays than on Tuesdays.
Was the management correct to come to this conclusion?

Yes ☐ No ☑

Explain your answer. [1]

No - interquartile range tells us that saturday had wait times that were more closely grouped but says nothing about the actual wait times

Examiner only

11. *Môr-Dda* is a company that makes buoys for use at sea.

(a) *Môr-Dda* makes 4 types of buoy.
Each week, they make the following numbers of each type of buoy.

Type of buoy	Deep sea	Harbour	Navigation	Shoreline
Number made each week	18	27	23	4

This week, *Môr-Dda* plans to take a sample of the buoys it makes to check on the quality of their production.
It plans to take a stratified sample of 12 buoys, based on the type of buoy.

Calculate the number of each type of buoy that should be included in the sample.
You must show all your working. [4]

Total = 18 + 27 + 23 + 4 = 72

Deep sea harbour navigation Shoreline

$\frac{12 \times 18}{72}$ $\frac{12 \times 27}{72}$ $\frac{12 \times 23}{72}$ $\frac{12 \times 4}{72}$

= 3 = 4 = 4 = 1

Type of buoy	Deep sea	Harbour	Navigation	Shoreline
Number in the sample	3	4	4	4

Examiner only

(b) The design for a new buoy is shown below.
It is made up of a cone attached to a hemisphere.

The base radius of the cone and the radius of the hemisphere are both 2 m.

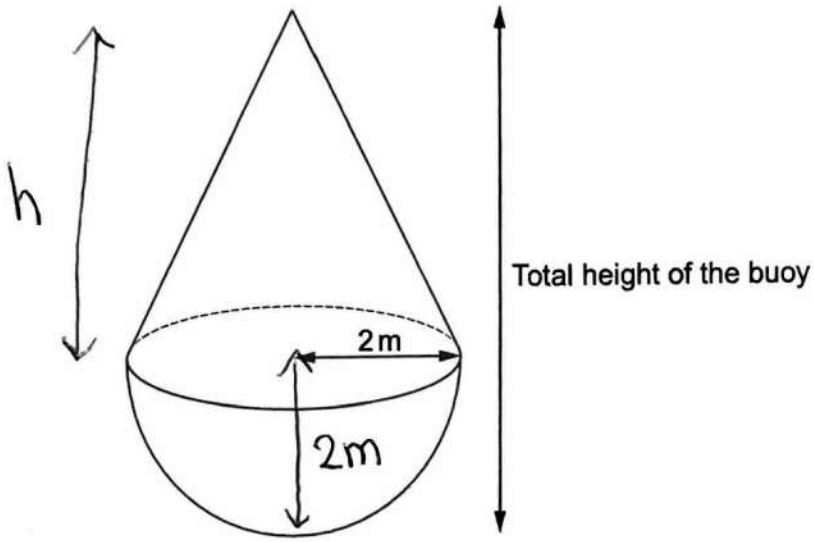


Diagram not drawn to scale

The **total** volume of this new buoy is 10π m^3.
Calculate the total height of the buoy. [5]

hemisphere $= \frac{2}{3}\pi 2^3$

cone $= \frac{1}{3}\pi 2^2 (h)$

$\frac{1}{3}\pi 2^3 + \frac{1}{3}\pi 2^2 h = 10\pi$

$\frac{16}{3}\pi + \frac{4}{3}\pi h = 10\pi$

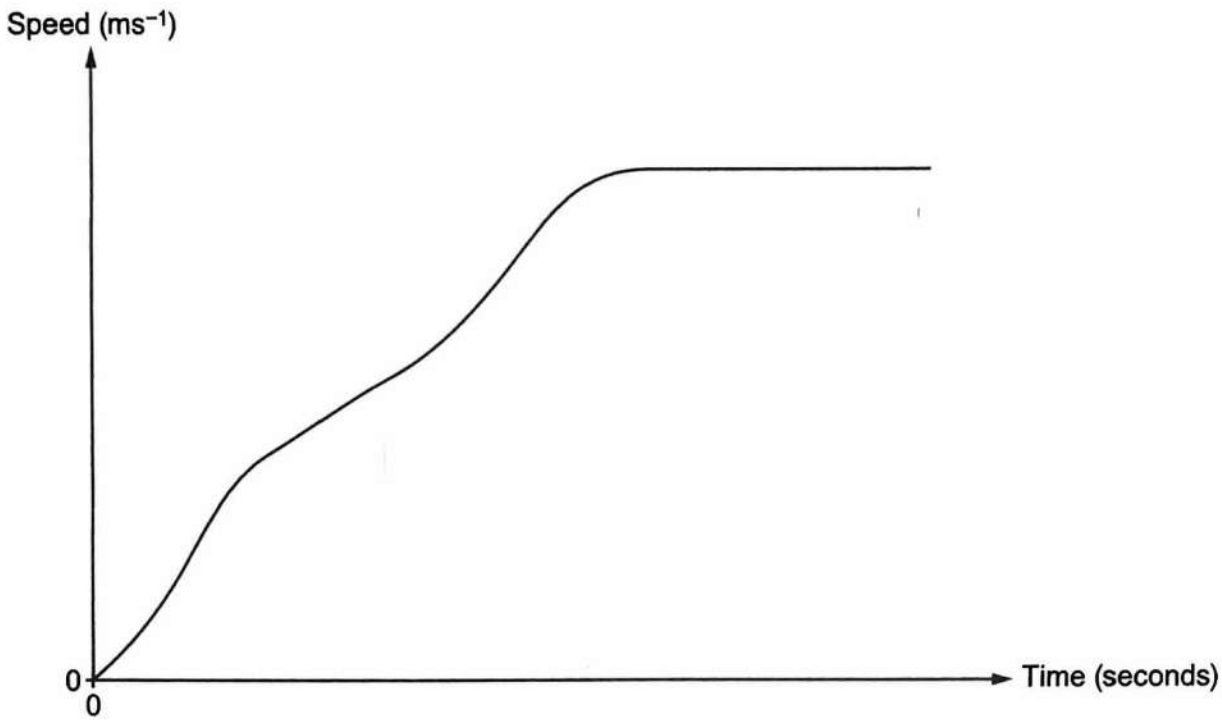
$h = \frac{7}{2}$

overall $= \frac{7}{2} + 2 = \frac{11}{2}$

Total height of the buoy = 5.5 m

Examiner only

12. Eleri's cycle computer shows a speed-time graph for the first 60 seconds of her cycle ride.



The cycle computer has also generated the following table, showing Eleri's speed after every 10 seconds, for the first 40 seconds of her ride.

Time (seconds)	0	10	20	30	40
Speed (ms⁻¹)	0	3	4·6	6·4	8

(a) Calculate an estimate of the distance travelled in the first 40 seconds of Eleri's cycle ride. You must use 4 strips of equal width. [3]

Area = trapezium

① ② ③

$\frac{(0+3)\times 10}{2} + \frac{(3+4.6)\times 10}{2} + \frac{(4.6+6.4)\times 10}{2}$

④

$+ \frac{(8+6.4)}{2} \times 10$

$= 180\text{m}$

Examiner only

(b) After 40 seconds, Eleri's speed remained constant.

Calculate an estimate of Eleri's average speed over the first **60 seconds** of her ride.
Give your answer in ms^{-1}, correct to 2 significant figures.
You must show all your working. [5]

Total distance = 180 + 20(8) = 340m

Average speed = 340 ÷ 60 = 5.7 ms^{-1}

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