

Surname	Centre Number	Candidate Number
First name(s)		0



**GCSE**

3310U40-1



**THURSDAY, 9 NOVEMBER 2023 – MORNING**

**MATHEMATICS – NUMERACY  
UNIT 2: CALCULATOR-ALLOWED  
INTERMEDIATE TIER**

1 hour 45 minutes

**ADDITIONAL MATERIALS**

A calculator will be required for 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** questions.

Write your answers in the spaces provided in this booklet. If you run out of space, use the additional page(s) 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.

For Examiner's use only		
Question	Maximum Mark	Mark Awarded
1.	7	
2.	5	
3.	6	
4.	8	
5.	13	
6.	8	
7.	14	
8.	15	
9.	4	
<b>Total</b>	<b>80</b>	

**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.

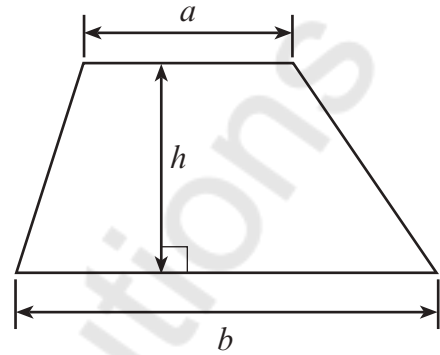
In question 3, the assessment will take into account the quality of your linguistic and mathematical organisation, communication and accuracy in writing.



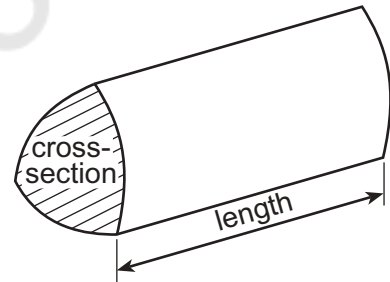
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## Formula List – Intermediate Tier

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



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



1. Miss Jardon's electricity bill is shown below.  
Complete the bill to find the total amount that Miss Jardon owes.

[7]

Miss Jardon  
34 Heol Ysbyty

Period	Previous meter reading	Present meter reading	Number of units of electricity used
July, August and September 2023	68 928	69 658	730

<b>Charge for electricity:</b> $730 \times 0.19$ units at £0.19 per unit	£ 138.7
<b>Standing charge:</b> 3 months at £6.50 per month	£ 19.5
<b>Total charges:</b>	£ 138.2

<b>VAT at 5%:</b>	£ 7.91
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**Amount due to pay** £ 166.11

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2. A report from a Saturday newspaper is shown below.

### Mean rainfall for the last 5 days is 42 mm

Mid Wales had significant rainfall over the last 5 days.  
40 mm of rain fell on Monday, 37 mm on Tuesday and 39 mm on Wednesday.  
Thursday was the wettest day, when 48 mm of rain fell.  
Rain fell again on Friday.  
The mean rainfall per day for these 5 days was 42 mm.

- (a) Calculate the rainfall for Friday.  
You must show all your working.

[3]

$$\frac{40 + 37 + 39 + 48 + x}{5} = 42$$

$$\frac{164 + x}{5} \neq 42$$

$$164 + x = 210$$

$$x = 210 - 164$$

$$x = 46 \text{ mm}$$

Rainfall on Friday was 46 mm

- (b) It did not rain on Saturday or Sunday in this week.  
Calculate the mean rainfall per day for the week.

[2]

$$\frac{40 + 37 + 39 + 48 + 46 + 0 + 0}{7} = x$$

$$= \frac{210}{7} = 30$$

Mean rainfall per day for the week is 30 mm



3. In this question, you will be assessed on the quality of your organisation, communication and accuracy in writing.

Elwyn ordered a solid garden ornament.

The ornament arrives in a box in the shape of a cuboid.  
The box has length 15 cm, width 15 cm and height 30 cm.

The box only contains the ornament and packing.  
The packing fits around the ornament and fills **all** the other space in the box.

When Elwyn opens the box, he is surprised at the volume of the packing in the box.

He says,

" $\frac{2}{3}$  of this box is filled with packing."

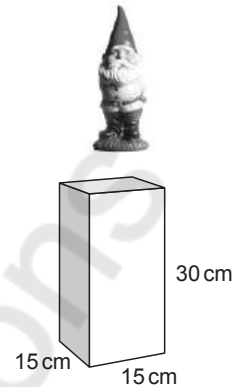


Diagram not drawn to scale

Use this information to calculate the volume of the garden ornament.  
You must show all your working.

[4 + 2 OCW]

$$\frac{1}{3} \times l \times w \times h$$

$$\frac{1}{3} \times 15 \times 15 \times 30$$

$$\therefore 15 \times 15 \times 10$$

$$= 2250 \text{ cm}^3$$



4. (a) Maggie sees a Bluetooth speaker in a sale.

The price of the speaker is reduced by 18% in the sale.  
The original price of the speaker was £45.



Maggie's mum says she will share the cost of buying this speaker.  
The ratio of the amount Maggie's mum pays to the amount Maggie pays is 8 : 1.

Calculate the amount Maggie's mum will pay towards buying this speaker in the sale.  
You must show all your working. [4]

$$\begin{aligned} \text{Original price "S"} &= \text{£45} \\ \text{New price of "S"} &= 45 \times \frac{18}{100} \\ &= 8.1 \\ &= 45 - 8.1 = 36.9 \\ \text{maggie mum: maggie} &= 8/9 \\ 8:1 \\ \frac{8}{9} \times 36.9 &= \text{£32.8} \end{aligned}$$



- (b) The diagram below shows a flowerbed at Maggie's house.  
Maggie's mum will pay her £2.50 per  $\text{m}^2$  to weed the flowerbed.

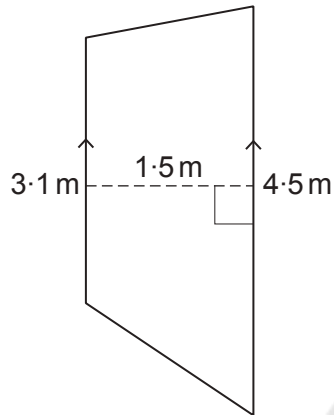


Diagram not drawn to scale

Calculate how much Maggie will get paid for the weeding.

[4]

$$\text{area of land} = \frac{1}{2} \times (a+b) \times h$$

$$= \frac{1}{2} \times (4.5 + 3.1) \times 1.5$$

$$= \frac{1}{2} \times 7.6 \times 1.5$$

$$= 0.5 \times 7.6 \times 1.5 = 5.7$$

$$\therefore 5.7 \times 2.5 = \pounds 14.25$$



5. Treviso is a company that designs and builds bicycles.

- (a) Treviso has designed this new bike frame. The missing angles need to be calculated.

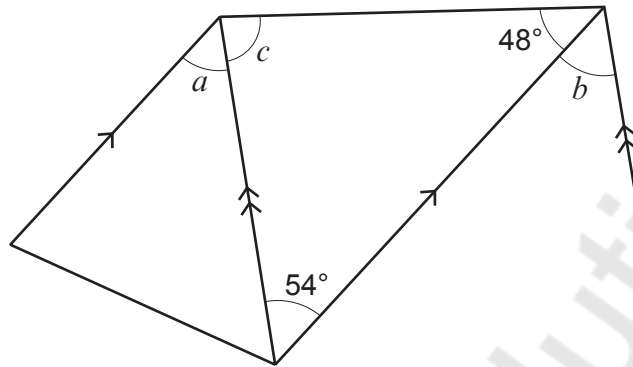


Diagram not drawn to scale

Find the size of each of the angles  $a$ ,  $b$  and  $c$ .

$$\text{For } c; 180 - (48 + 54) = 180 - 92 \quad [3]$$

$$= 78^\circ$$

$$a = 54^\circ \quad b = 54^\circ \quad c = 78^\circ$$



(b) Each wheel on Treviso's new bike has a diameter of 29 inches.

(i)

Remember: 1 foot = 12 inches

Ollie tests Treviso's new bike over a distance of 1000 feet.  
How many times will a wheel rotate during the test?

[4]

$$1 \text{ Treviso bike} = 29 \text{ inch}; \quad 1 \text{ foot} = 12 \text{ inch}$$

$$1000 \text{ ft} = x$$

$$x = 12,000 \text{ inch}$$

$$\text{No rev} = \frac{D}{d\pi} = \frac{12000 \text{ inch}}{29 \times \pi}$$

$$= 131.71 \approx 132$$

(ii)

Remember: 12 inches  $\approx$  30 cm

What is the diameter of each wheel in **millimetres**?

[3]

$$\text{If } 12 = 30$$

$$29 = x$$

$$; \quad x = \frac{29 \times 30}{12}$$

$$x = 72.5 \text{ cm}$$

$$x = 72.5 \text{ cm} \times 10$$

$$= 725 \text{ mm}$$

Diameter is 725 mm

(c) Ollie uses the new bike in a 48 km race.  
He completes the race in a time of 1 hour 30 minutes.  
Calculate his average speed for the race.  
Give your answer in km/h.

[3]

$$\text{Formula } S = \frac{\text{Dist}}{\text{Time}}$$

$$= \frac{48 \text{ km}}{1 \frac{1}{2} \text{ hr}} = \frac{48}{1.5}$$

$$1 \text{ hr } 30 \text{ min} = 1 \frac{1}{2} \text{ hr}$$

$$= 32 \text{ km/h}$$

Average speed is 32 km/h



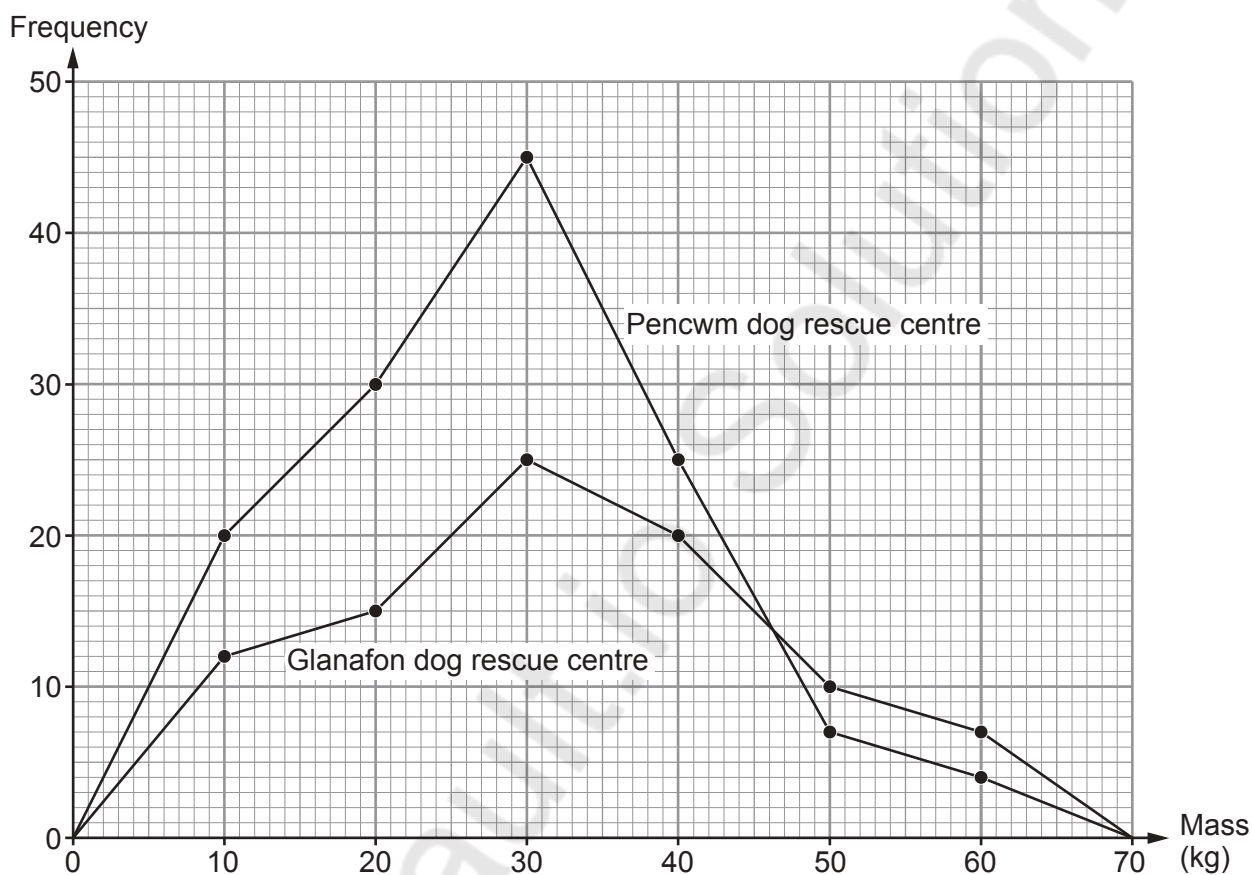
6. Glanafon and Pencwm dog rescue centres take in unwanted dogs.  
The mass of each dog in the two dog rescue centres was recorded.



Groups of width 10 kg were used:

$$5 \text{ kg} \leq \text{mass} < 15 \text{ kg}, \quad 15 \text{ kg} \leq \text{mass} < 25 \text{ kg}, \quad \dots, \quad 55 \text{ kg} \leq \text{mass} < 65 \text{ kg}$$

The results are shown in the frequency polygons below.



- (a) Doreen, Rory and Muzhir look at these frequency polygons.

- (i) Doreen says,

"The modal group of the masses of dogs in each dog rescue centre is the same."

Is Doreen correct?

Yes

No

Can't tell

You must give a reason for your answer.

[1]

Both have same mass at 30kg class interval, i.e. highest frequency bar, both groups



- (ii) Rory says,  
"28 of the dogs in Pencwm each have a mass of 18 kg."

Is Rory correct?

Yes  No  Can't tell

You must give a reason for your answer.

[1]

actual mass of each dog not given; data is grouped

- (iii) Muzhir says,  
"There is a higher proportion of dogs that are heavier than 35 kg in Glanafon than in Pencwm."

Without doing any calculations, decide if Muzhir is correct.

Correct  Incorrect  Can't tell

You must give a reason for your answer.

[1]

PENC Wm polygon shows greater drop for greater masses than Glanafon

- (b) The estimate of the mean mass of the dogs in Glanafon was 32.5 kg.  
How much less was the estimate of the mean mass of the dogs in Pencwm?  
You must show all your working.

[5]

$$\begin{aligned}
 &20 + 30 + 45 + 25 + 7 + 4 = 131 \\
 &(10 \times 20) + (20 \times 30) + (30 \times 45) + (40 \times 25) \\
 &+ (50 \times 7) + (60 \times 4) \\
 &= 200 + 600 + 1350 + 1000 + 350 + 240 \\
 &= 3740 \\
 &= 3740 / 131 = 28.55 \\
 &32.5 - 28.55 \\
 &3.95
 \end{aligned}$$

Estimate of the mean mass of the dogs in Pencwm is 3.95 kg less than in Glanafon.



7. Jac is planning to visit the Empire State Building in New York.

- (a) According to the internet, the Empire State Building has a total of 1172 miles of elevator cable.

Complete the following statement.

[2]

There is a total of 1875.2 km of elevator cable in the Empire State Building.

$$1 \text{ mile} = 1.6 \text{ km};$$

$$1172 \text{ miles} = x; \quad x = 1172 \times 1.6$$

$$x = 1875.2 \text{ km}$$



- (b) The elevators in the Empire State Building were designed to move at a rate of 0.366 kilometres per minute.

Complete the following statement.

[2]

The elevators in the Empire State Building were designed to move at 6.1 m/s metres per second.

$$0.366 \text{ km/min}; \quad 1 \text{ km} = 1000 \text{ m}$$

$$1 \text{ min} = 60 \text{ sec}$$

$$x = \frac{0.366 \times 1000}{60 \text{ sec}}$$

$$= 6.1 \text{ m/s}$$

- (c) Planners had an original budget of \$60 million to construct the Empire State Building. It actually cost \$41 000 000 to construct.

Complete the following statement.

Give your answer correct to 2 decimal places.

[3]

Constructing the Empire State Building cost ..... % less than the original budget.

$$\$60 \text{ mil} - \$41 \text{ mil} = \$19 \text{ mil}$$

$$\frac{19}{60} \times 100 = 31.67$$

$$\text{or } \frac{41}{60} \times 100 = 68.33$$

$$100 - 68.33$$

$$= 31.67$$



- (d) More than 4 million people visit the Empire State Building each year.  
What is 4 million written in standard form?  
Circle your answer.

[1]

$4 \times 10^{-5}$      $0.4 \times 10^5$      $4 \times 10^5$      $4 \times 10^6$      $4 \times 10^7$

$4 \times 10^6$

- (e) The conversion rate at the exchange shop is £1 = \$1.25.  
The exchange shop only has \$10 notes and \$50 notes.

Jac has exactly £350.

He wants to exchange as close to £350 as possible for US dollars (\$).

He asks for as few notes as possible.

Calculate:

- how many \$10 notes and how many \$50 notes Jac gets
- how much he pays for his currency.

You must show all your working.

[6]

$$£1 = \$1.25$$

$$£350 = x \quad ; \quad x = 350 \times 1.25$$

$$x = 437.5$$

$$x = \underline{\underline{430}}$$

$$430 = 400 + 30$$

$$= \frac{400}{50} = 8 \text{ (\$50 notes)}$$

$$\text{while } \frac{30}{10} = 3 \text{ (\$10 notes)}$$



8. (a) (i) A single tree can absorb 48 **pounds** of carbon dioxide per year. Calculate the carbon dioxide absorbed per year by a forest of 440 of these trees. Give your answer in **kilograms**. [2]

$$1 = 48$$

$$440 = x \quad ; \quad x = 440 \times 48 =$$

$$x = 21120 \quad 1 \text{ kg} = 2.2 \text{ pound} \therefore$$

$$x = \frac{21120}{2.2} = 9600 \text{ kg}$$

Carbon dioxide absorbed per year is 9600 kg kg

- (ii) A forest of trees absorbs  $2.3 \times 10^{11}$  grams of carbon dioxide per year. Which of the following is  $2.3 \times 10^{11}$ ? Circle your answer. [1]

230000000000

23000000000

230000000000

0.0000000000023

0.000000000023

(b)

Remember:  $10000 \text{ m}^2 \approx 2.47 \text{ acres}$

A report states that a fire in a forest has a high risk of spreading when there are more than 60 trees per acre.

There are 615 trees in Grancwm Forest.  
The forest covers an area of  $40000 \text{ m}^2$ .

Would a fire in Grancwm Forest have a high risk of spreading?

Yes  No

You must show all your working to support your answer. [4]

$$10000 \text{ m}^2 = 2.47 \text{ acres}$$

$$40000 \text{ m}^2 = x \quad ; \quad x = \frac{40000 \times 2.47}{10000}$$

$$x = 9.88 \text{ acres}$$

$$= \frac{615 \text{ trees}}{9.88 \text{ acres}} \approx 62.2 \text{ trees/acre}$$



- (c) A vertical pine tree stands on horizontal ground.  
From a point on the ground 21 metres from its base, the angle of elevation of the top of the pine tree is  $39^\circ$ .

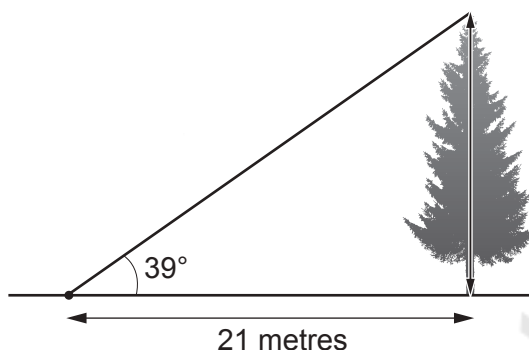


Diagram not drawn to scale

- (i) Show that the pine tree has a vertical height of 17 metres. [3]

$$\tan 39^\circ = \frac{x}{21}$$

$$x = \tan 39^\circ \times 21$$

$$x = 17.0005 \approx \underline{\underline{17}}$$

- (ii) A cylindrical log is cut from this pine tree.  
The **circumference** of the cross-section of the log is 1.75 m.  
The length of the log is half the height of the tree.

Calculate the volume of the log.

Give your answer in  $\text{m}^3$ .

You must show all your working. [5]

$$C = \pi d$$

$$1.75 = \pi d ; d = \frac{1.75}{\pi}$$

$$r = \frac{1.75}{\pi} \times \frac{1}{2} = \frac{1.75}{2\pi}$$

$$\begin{aligned} \text{Area} &= \pi r^2 L \\ &= \pi \left( \frac{1.75}{2\pi} \right)^2 \times \frac{17}{2} \end{aligned}$$

$$= 2.07 \text{m}^3$$

Volume of the log is 2.07  $\text{m}^3$



9. A car was bought in 1973 for £2500.

In the first year, this car depreciated by 23% of its value.

In each of the following 39 years, it depreciated by 4% of its value the previous year.

The car then started to increase in value.

In each of the next 10 years, it increased by 14% of its value the previous year.

Calculate the value of the car after these 50 years.

You must show all your working.

$$\begin{aligned}
 & 2500 \times (1 - 0.23)^1 \times (1 - 0.04)^{39} \quad [4] \\
 & \times (1 + 0.14)^{10} \\
 & = 2500 \times 0.77 \times 0.96^{39} \times 1.14^{10} \\
 & \approx \text{£} 1452.30 \\
 & \approx \underline{\underline{\text{£} 1450}}
 \end{aligned}$$

The value of the car after 50 years is £ .....

**END OF PAPER**



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