

|                                      |               |                  |
|--------------------------------------|---------------|------------------|
| Surname <i>StemUp Model Solution</i> | Centre Number | Candidate Number |
| First name(s)                        |               | 0                |



**GCSE**

3310U40-1



A23-3310U40-1

**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.

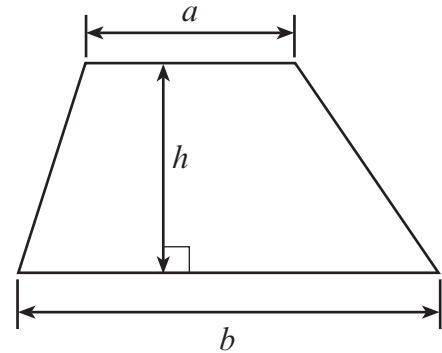
In question 3, the assessment will take into account the quality of your linguistic and mathematical organisation, communication and accuracy in writing.



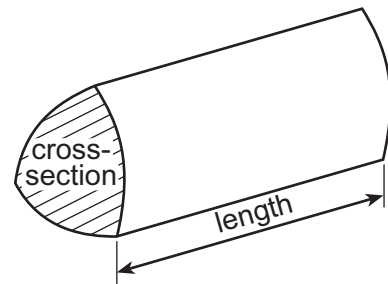
NOV233310U40101

### 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                | <u>730</u>                          |

|                                                                             |                 |
|-----------------------------------------------------------------------------|-----------------|
| <b>Charge for electricity:</b><br><u>730</u> units at <b>£0.19 per unit</b> | £ <u>138.70</u> |
| <b>Standing charge:</b><br>3 months at <b>£6.50 per month</b>               | £ <u>19.50</u>  |
| <b>Total charges:</b>                                                       | £ <u>158.20</u> |

|                   |               |
|-------------------|---------------|
| <b>VAT at 5%:</b> | £ <u>7.91</u> |
|-------------------|---------------|

**Amount due to pay** £ 166.11

$$\text{Units used} = 69\,658 - 68\,928 = 730 \text{ units}$$

$$\text{Charge for electricity} = 730 \times \text{£}0.19 = \text{£}138.70$$

$$\text{Standing charge} = 3 \times \text{£}6.50 = \text{£}19.50, \quad \text{Total} = \text{£}138.70 + \text{£}19.50 = \text{£}158.20$$

$$\text{VAT} = 5\% \text{ of } \text{£}158.20 = 0.05 \times \text{£}158.20 = \text{£}7.91$$

$$\text{Amount due} = \text{£}158.20 + \text{£}7.91 = \text{£}166.11$$



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]

$$\text{Total rainfall for 5 days} = 5 \times 42 = 210 \text{ mm}$$

$$\text{Monday to Thursday} = 40 + 37 + 39 + 48 = 164 \text{ mm}$$

$$\text{Rainfall on Friday} = 210 - 164 = 46 \text{ mm}$$

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]

$$\text{Total for the week} = 210 \text{ mm (0 mm on Saturday and Sunday)}$$

$$\text{Mean per day} = 210 \div 7 = 30 \text{ mm}$$

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."

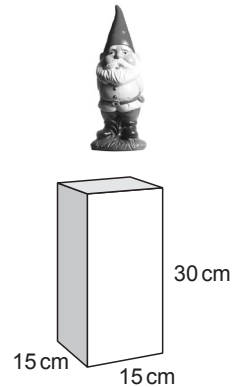


Diagram not drawn to scale

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

[4 + 2 OCW]

$$\text{Volume of box} = \text{length} \times \text{width} \times \text{height}$$

$$= 15 \times 15 \times 30 = 6750 \text{ cm}^3$$

$$\text{Volume of packing} = \frac{2}{3} \text{ of } 6750 = 6750 \div 3 \times 2 = 4500 \text{ cm}^3$$

$$\text{Volume of ornament} = \text{volume of box} - \text{volume of packing}$$

$$= 6750 - 4500 = 2250 \text{ cm}^3$$

$$(\text{Check: the ornament fills } \frac{1}{3} \text{ of the box, } 6750 \div 3 = 2250 \text{ cm}^3)$$

$$\text{The volume of the garden ornament is } 2250 \text{ cm}^3.$$



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]

$$\text{Sale price} = £45 \times (1 - 0.18) = £45 \times 0.82 = £36.90$$

$$\text{Ratio } 8 : 1 \text{ gives } 8 + 1 = 9 \text{ parts}$$

$$\text{One part} = £36.90 \div 9 = £4.10$$

$$\text{Mum pays 8 parts} = 8 \times £4.10 = £32.80$$

Maggie's mum will pay £32.80 towards the speaker.



- (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.

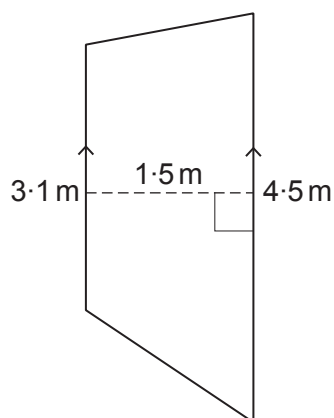


*Diagram not drawn to scale*

Calculate how much Maggie will get paid for the weeding.

[4]

*The flowerbed is a trapezium.*

$$\text{Area} = \frac{1}{2} \times (3.1 + 4.5) \times 1.5 = \frac{1}{2} \times 7.6 \times 1.5 = 5.7 \text{ m}^2$$

$$\text{Pay} = 5.7 \times \text{£}2.50 = \text{£}14.25$$

*Maggie will get paid £14.25 for the weeding.*



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.

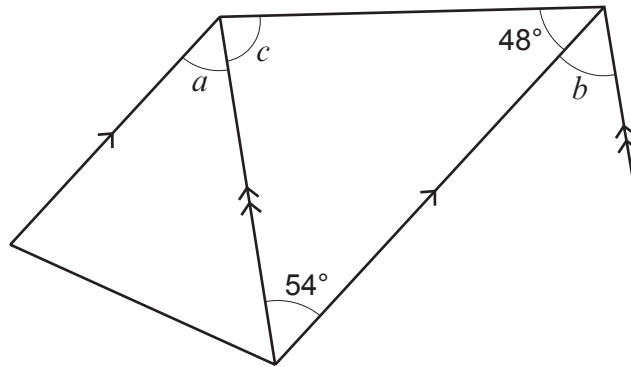


Diagram not drawn to scale

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

[3]

$a = 54^\circ$  (alternate angles),  $b = 54^\circ$  (alternate angles)

$c = 180^\circ - 48^\circ - 54^\circ = 78^\circ$  (angles in a triangle add up to  $180^\circ$ )

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



- (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]

$$\text{Circumference of wheel} = \pi \times 29 = 91.106... \text{ inches}$$

$$91.106... \div 12 = 7.592... \text{ feet}$$

$$\text{Number of rotations} = 1000 \div 7.592... = 131.71...$$

The wheel rotates about 132 times.

(ii)

Remember: 12 inches  $\approx$  30 cm

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

[3]

$$1 \text{ inch} \approx 30 \div 12 = 2.5 \text{ cm}$$

$$\text{Diameter} = 29 \times 2.5 = 72.5 \text{ cm}$$

$$72.5 \text{ cm} = 72.5 \times 10 = 725 \text{ mm}$$

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]

$$\text{Time} = 1 \text{ hour } 30 \text{ minutes} = 1.5 \text{ hours}$$

$$\text{Average speed} = \text{distance} \div \text{time} = 48 \div 1.5 = 32 \text{ km/h}$$

Average speed is 32 km/h



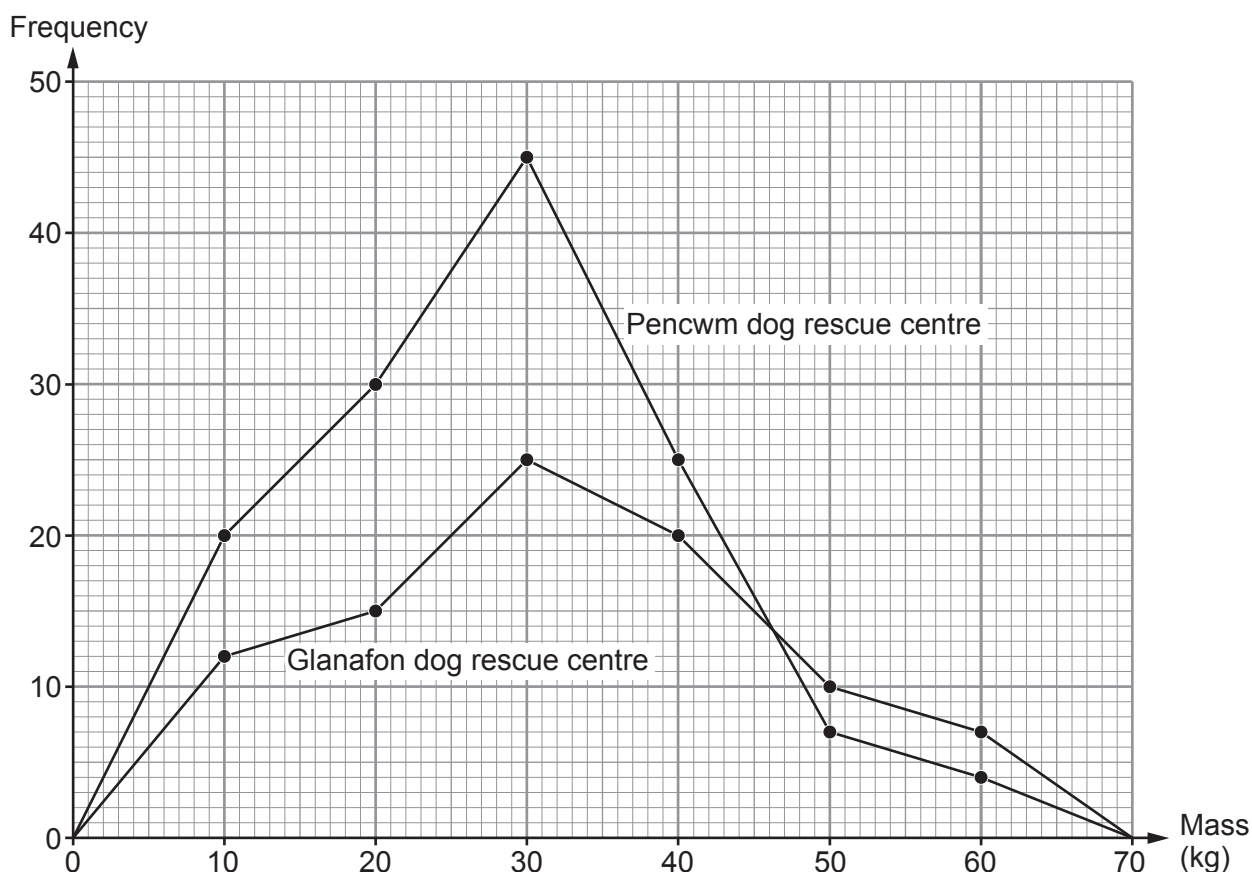
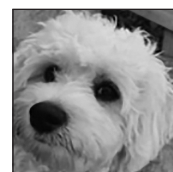
6. Glanafon and Pencwm dog rescue centres take in unwanted dogs.

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]

*Yes. Both polygons have their highest point at 30 kg, so the modal group is  $25 \text{ kg} \leq \text{mass} < 35 \text{ kg}$  for both centres.*



- (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]

*Can't tell. The data is grouped, so we only know that 30 dogs  
in Pencwm have a mass from 15 kg to 25 kg. The actual  
mass of each dog is not given.*

- (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]

*Correct. Both centres have about the same number of dogs  
over 35 kg, but Glanafon has far fewer dogs altogether, and  
the Pencwm polygon drops much more steeply after 30 kg.*

- (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]

$$\text{Number of dogs in Pencwm} = 20 + 30 + 45 + 25 + 7 + 4 = 131$$

$$\Sigma fx = 10 \times 20 + 20 \times 30 + 30 \times 45 + 40 \times 25 + 50 \times 7 + 60 \times 4$$

$$= 200 + 600 + 1350 + 1000 + 350 + 240 = 3740$$

$$\text{Estimate of mean for Pencwm} = 3740 \div 131 = 28.549... \text{ kg}$$

$$\text{Difference} = 32.5 - 28.549... = 3.950... \text{ kg}$$

$$= 3.95 \text{ kg (to 2 d.p.)}$$

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.

$$5 \text{ miles} \approx 8 \text{ km, so } 1 \text{ mile} \approx 8 \div 5 = 1.6 \text{ km}$$

$$1172 \times 1.6 = 1875.2 \text{ km}$$



- (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 metres per second.

$$0.366 \text{ km per minute} = 0.366 \times 1000 = 366 \text{ m per minute}$$

$$366 \div 60 = 6.1 \text{ m per second}$$

- (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 31.67 % less than the original budget.

$$\text{Amount under budget} = \$60\,000\,000 - \$41\,000\,000 = \$19\,000\,000$$

$$\text{Percentage less} = 19\,000\,000 \div 60\,000\,000 \times 100$$

$$= 31.666\ldots\% = 31.67\% \text{ (to 2 d.p.)}$$



- (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]

$4 \times 10^{-5}$

$0.4 \times 10^5$

$4 \times 10^5$

$4 \times 10^6$

$4 \times 10^7$

- (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]

$$\text{Dollars for } \pounds 350 = 350 \times 1.25 = \$437.50$$

Only \$10 and \$50 notes, so he can only get a multiple of \$10.

Closest amount without going over £350 is \$430.

$$\text{Fewest notes for } \$430: 430 \div 50 = 8 \text{ remainder } 30$$

$$8 \times \$50 = \$400 \text{ and } 3 \times \$10 = \$30, \text{ total } \$400 + \$30 = \$430$$

$$\text{Cost of } \$430 = 430 \div 1.25 = \pounds 344$$

Jac gets eight \$50 notes and three \$10 notes.

He pays £344 for his currency (he keeps £6).



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]

$$\text{Total} = 440 \times 48 = 21\,120 \text{ pounds}$$

$$1 \text{ kg} \approx 2.2 \text{ pounds, so } 21\,120 \div 2.2 = 9600 \text{ kg}$$

Carbon dioxide absorbed per year is 9600 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]

230 000 000 000

23 000 000 000

2 300 000 000 000

0.000 000 000 002 3

0.000 000 000 023

(b)

Remember:  $10\,000 \text{ m}^2 \approx 2.47 \text{ acres}$

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  $40\,000 \text{ m}^2$ .

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]

$$\text{Area in acres} = 40\,000 \div 10\,000 \times 2.47 = 4 \times 2.47 = 9.88 \text{ acres}$$

$$\text{Trees per acre} = 615 \div 9.88 = 62.246... \text{ trees per acre}$$

$$62.2 \text{ trees per acre} > 60 \text{ trees per acre}$$

Yes, a fire in Grancwm Forest would have a high risk of spreading.



- (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  $39^\circ$ .

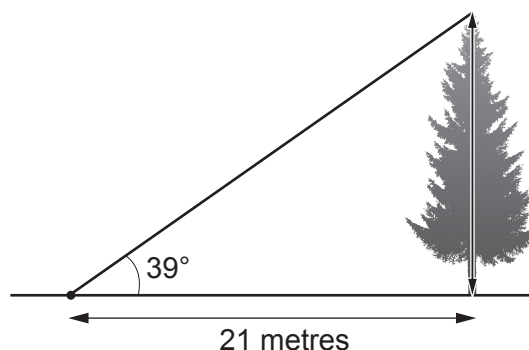


Diagram not drawn to scale

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

$$\tan 39^\circ = \text{opposite} \div \text{adjacent} = h \div 21$$

$$h = 21 \times \tan 39^\circ = 21 \times 0.8097... = 17.005... \text{ m}$$

Height of the pine tree = 17 metres (to the nearest metre)

- (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]

$$\text{Circumference} = 2\pi r, \text{ so } 1.75 = 2 \times \pi \times r$$

$$r = 1.75 \div (2\pi) = 0.27852... \text{ m}$$

$$\text{Area of cross-section} = \pi r^2 = \pi \times 0.27852...^2 = 0.24370... \text{ m}^2$$

$$\text{Length of log} = 17 \div 2 = 8.5 \text{ m}$$

$$\text{Volume} = \text{area} \times \text{length} = 0.24370... \times 8.5$$

$$= 2.0715... \text{ m}^3 = 2.07 \text{ m}^3 \text{ (to 2 d.p.)}$$

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.

[4]

$$\text{After the 1st year: } £2500 \times (1 - 0.23) = £2500 \times 0.77 = £1925$$

$$\text{After the next 39 years: } £1925 \times 0.96^{39} = £391.749...$$

$$\text{After the next 10 years: } £391.749... \times 1.14^{10} = £1452.303...$$

$$\text{Value} = 2500 \times 0.77 \times 0.96^{39} \times 1.14^{10} = £1452.30$$

The value of the car after 50 years is £ 1452.30

**END OF PAPER**



[illegible]

**BLANK PAGE**

**PLEASE DO NOT WRITE  
ON THIS PAGE**



**BLANK PAGE**

**PLEASE DO NOT WRITE  
ON THIS PAGE**



**BLANK PAGE**

**PLEASE DO NOT WRITE  
ON THIS PAGE**

