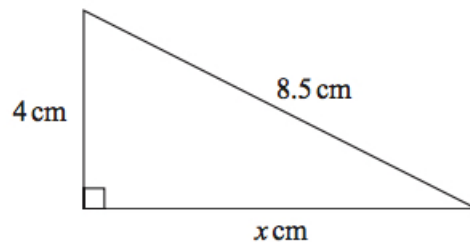


**Dr Oliver Mathematics**  
**GCSE Mathematics**  
**2022 June Paper 3H: Calculator**  
**1 hour 30 minutes**

The total number of marks available is 80.  
You must write down all the stages in your working.

1. Here is a right-angled triangle. (2)



Work out the value of  $x$ .

- 2.

$$T = 4m^2 - 11.$$

- (a) Work out the value of  $T$  when  $m = -3$ . (2)
- (b) Make  $p$  the subject of the formula (2)

$$d = 3p + 4.$$

3. Rick, Selma and Tony are playing a game with counters. (5)

- Rick has some counters.
- Selma has twice as many counters as Rick.
- Tony has 6 counters less than Selma.

In total they have 54 counters.

The number of counters Rick has : the number of counters Tony has =  $1 : p$ .

Work out the value of  $p$ .

4. Jo is going to buy 15 rolls of wallpaper. (4)

Here is some information about the cost of rolls of wallpaper from each of two shops.

<b>Chic Decor</b>  3 rolls for £36	<b>Style Papers</b>  Pack of 5 rolls normal price £70  12% off the normal price
--	--

Jo wants to buy the 15 rolls of wallpaper as cheaply as possible.

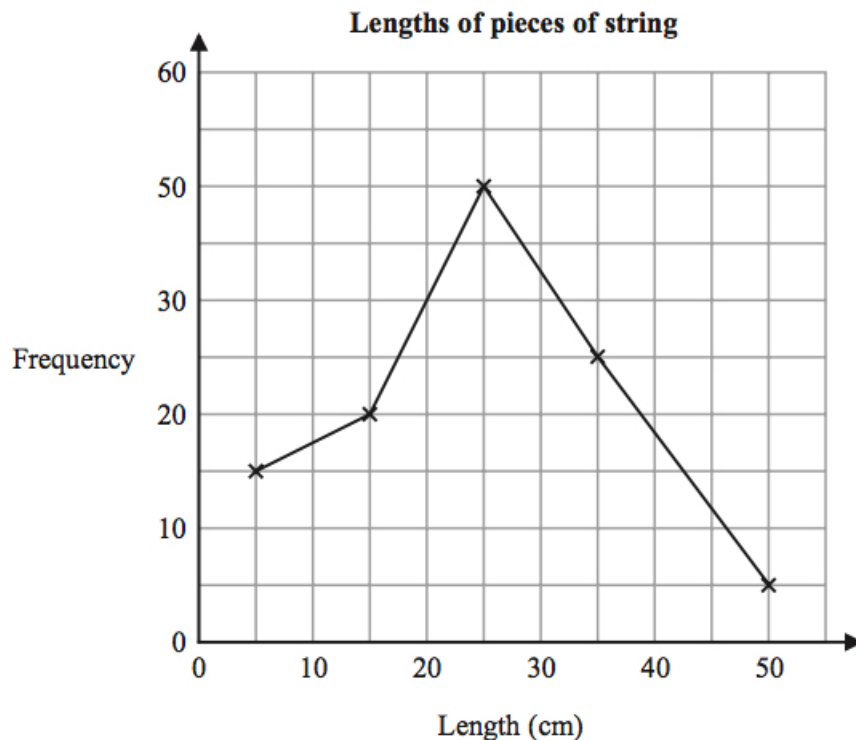
Should Jo buy the wallpaper from Chic Decor or from Style Papers?

You must show how you get your answer.

5. The table gives information about the lengths, in cm, of some pieces of string. (2)

Length ( $t$ cm)	Frequency
$0 < t \leq 10$	15
$10 < t \leq 20$	20
$20 < t \leq 30$	50
$30 < t \leq 40$	25
$40 < t \leq 50$	5

Amos draws a frequency polygon for the information in the table.



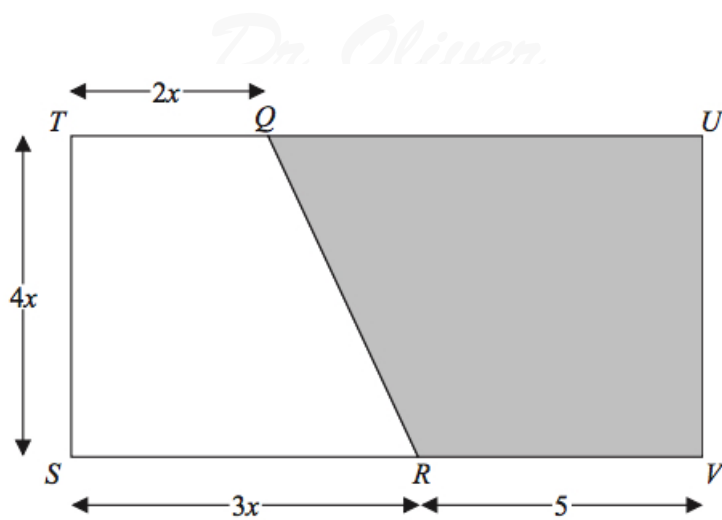
Write down **two** mistakes that Amos has made.

6. Jessica runs for 15 minutes at an average speed of 6 miles per hour. (4)  
She then runs for 40 minutes at an average speed of 9 miles per hour.

It takes Amy 45 minutes to run the same total distance that Jessica runs.

Work out Amy's average speed.  
Give your answer in miles per hour.

7. The diagram shows rectangle  $STUV$ . (3)  
 $TQU$  and  $SRV$  are straight lines.  
All measurements are in cm.



The area of trapezium  $QUVR$  is  $A \text{ cm}^2$ .

Show that

$$A = 2x^2 + 20x.$$

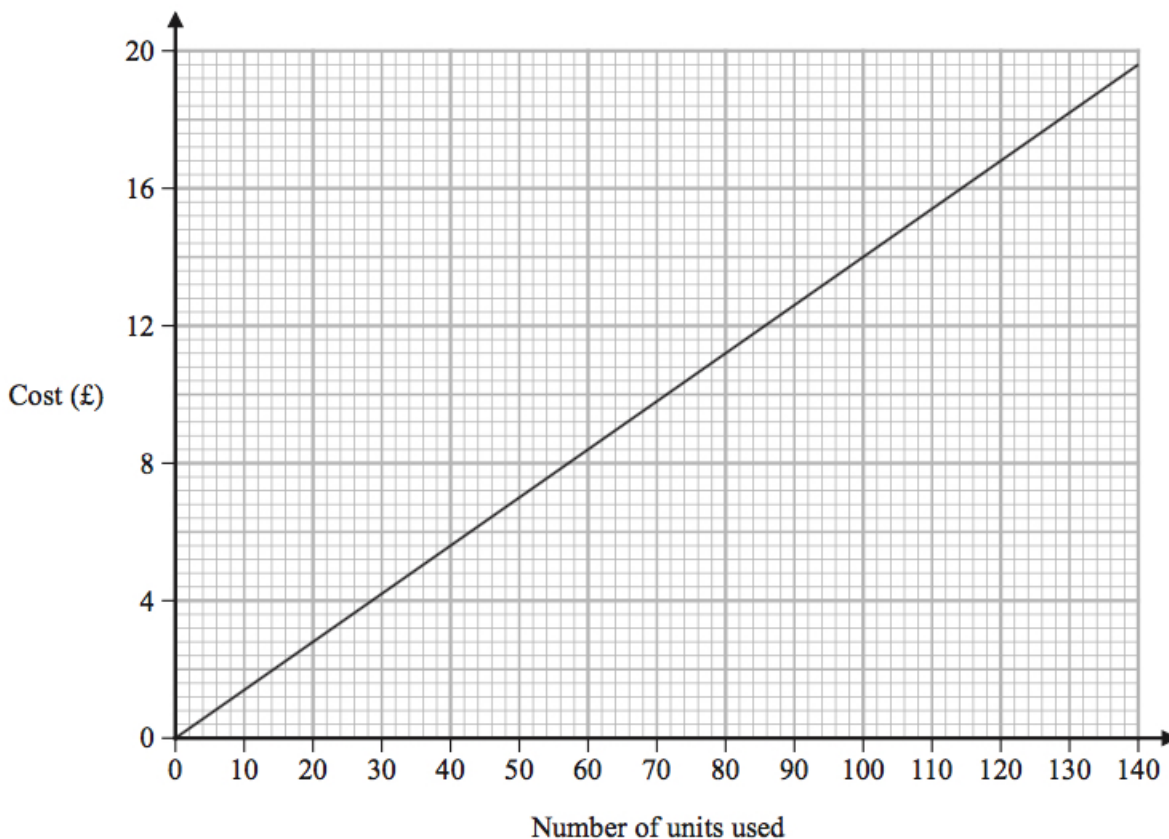
8. An electricity company charges the same fixed amount for each unit of electricity used.

David uses this graph to work out the total cost of the electricity he has used.

*Dr Oliver*  
*Mathematics*

*Dr Oliver*  
*Mathematics*

*Dr Oliver*  
*Mathematics*



- (a) Work out the gradient of the straight line. (2)
- (b) What does the gradient of this line represent? (1)
9. (a) Express (3)

$$\sqrt{\frac{10^{360}}{10^{150} \times 10^{90}}}$$

as a power of 10.

Liam was asked to express  $(12^{50})^2$  as a power of 12.

Liam wrote

$$(12^{50})^2 = 12^{50^2} = 12^{2500}.$$

Liam's method is wrong.

- (b) Explain why. (1)
10. Jane bought a new car three years ago. (3)

At the end of the first year the value of the car had decreased by 12.5%.

The value of the car then decreased by 10% each year for the next two years.

At the end of the three years, the value of the car was £17 010.

Work out the value of the car when Jane bought it three years ago.

11. Rayheem has (2)

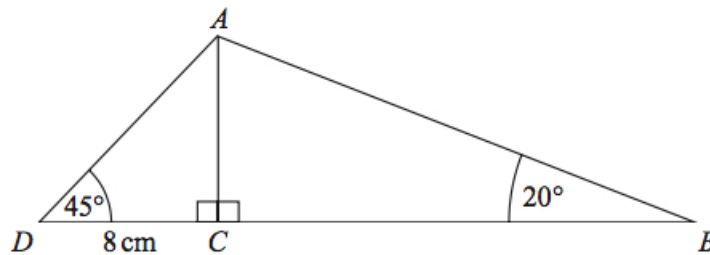
- 16 shirts,
- 5 pairs of jeans, and
- 3 jackets.

Rayheem chooses an outfit to wear.

An outfit is 1 shirt, 1 pair of jeans, and 1 jacket.

Work out how many different outfits Rayheem can choose.

12. ABC and ACD are right-angled triangles. (3)



- $DC = 8$  cm.
- Angle  $ADC = 45^\circ$ .
- Angle  $ABC = 20^\circ$ .

Work out the length of  $AB$ .

Give your answer correct to 3 significant figures.

13.  $\mathbf{a}$  and  $\mathbf{b}$  are vectors such that (3)

$$\mathbf{a} = \begin{pmatrix} 2 \\ -3 \end{pmatrix} \text{ and } 3\mathbf{a} - 2\mathbf{b} = \begin{pmatrix} 8 \\ -17 \end{pmatrix}.$$

Find  $\mathbf{b}$  as a column vector.

14. (a) Factorise fully (2)

$$4p^2 - 36.$$

(b) Show that

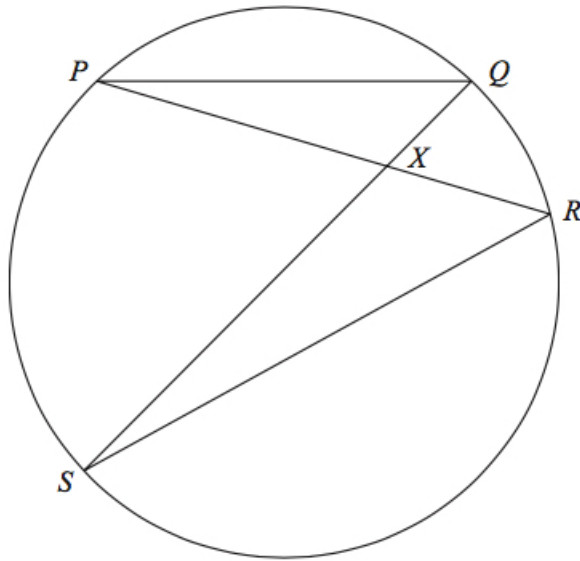
$$(m + 4)(2m - 5)(3m + 1)$$

can be written in the form

$$am^3 + bm^2 + cm + d,$$

where  $a$ ,  $b$ ,  $c$ , and  $d$  are integers.

15.  $P$ ,  $Q$ ,  $R$ , and  $S$  are four points on a circle.



$PXR$  and  $SXQ$  are straight lines.

Prove that triangle  $PQX$  and triangle  $SRX$  are similar.

16.

$$p = \sqrt{\frac{2e}{f}}$$

$e = 6.8$ , correct to 1 decimal place.

$f = 0.05$ , correct to 1 significant figure.

Work out the upper bound for the value of  $p$ .

Give your answer correct to 3 significant figures.

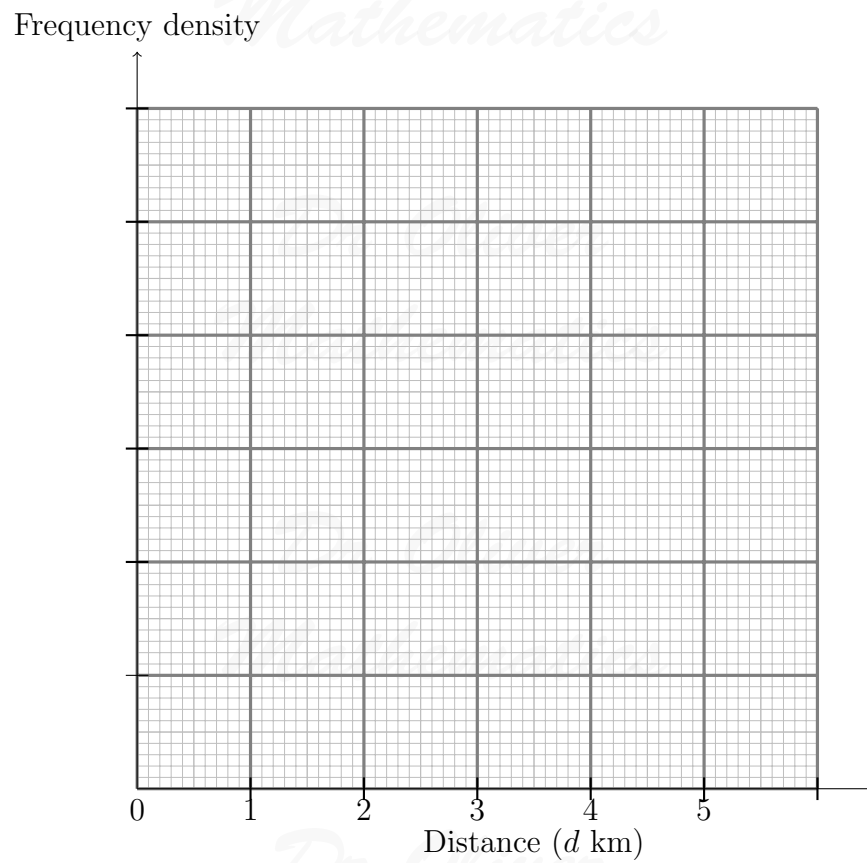
You must show all your working.

17. The table gives information about the distances, in miles, that some Year 10 students live from school.

Distance ( $d$ miles)	Frequency
$0 < d \leq 1.0$	90
$1.0 < d \leq 1.5$	48
$1.5 < d \leq 2.0$	22
$2.0 < d \leq 3.0$	8
$3.0 < d \leq 5.0$	12

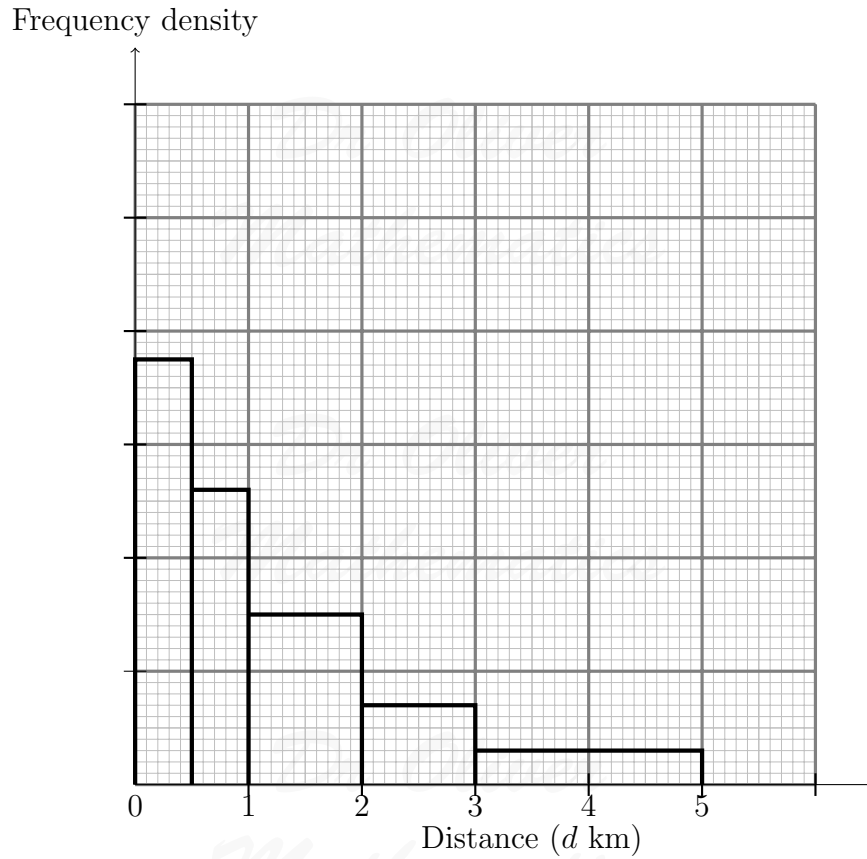
(a) On the grid, draw a histogram for this information.

(3)





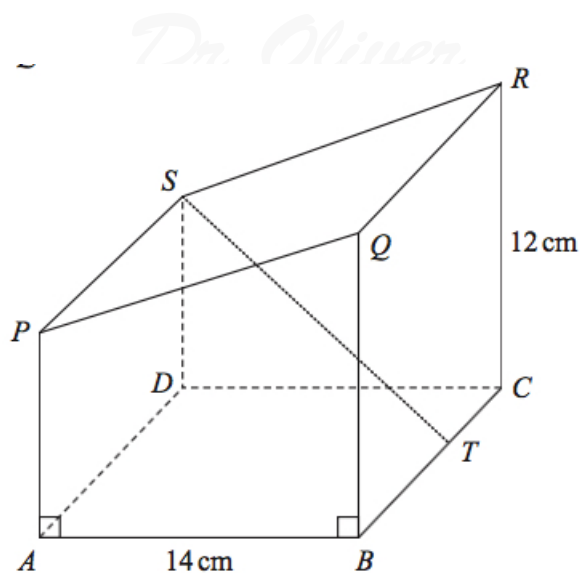
The histogram below shows information about the distances, in miles, that some Year 11 students live from school.



The number of Year 11 students who live between 1 and 2 miles from school is  $n$ .

- (b) Find an expression, in terms of  $n$ , for the number of Year 11 students who live between 3 and 5 miles from school. (2)

18. Here is a prism  $ABCDS PQR$ . (5)



The base  $ABCD$  of the prism is a square of side 14 cm.

$T$  is the point on  $BC$  such that  $BT : TC = 4 : 3$ .

The cross-section of the prism is in the shape of a trapezium of area  $147 \text{ cm}^2$ .  
 $CR = 12 \text{ cm}$ .

Find the size of the angle between the line  $ST$  and the base  $ABCD$ .  
 Give your answer correct to 1 decimal place.

19. Show that

$$\frac{3x}{x+2} - \frac{2x+1}{x-2} - 1$$

(4)

can be written in the form

$$\frac{ax+b}{x^2-4},$$

where  $a$  and  $b$  are integers.

20. The profit made by a shop increases each year.

(4)

The profit made by the shop in year  $n$  is  $\text{£}P_n$ .

Given that the profit made by the shop in the next year is  $\text{£}P_{n+1}$  then

$$P_{n+1} = aP_n + 800,$$

where  $a$  is a constant.

The table shows the profit made by the shop in 2018 and in 2019.

Year	2018	2019
Profit	£24 000	£29 600

Work out the profit predicted to be made by the shop in 2021.

21. Ray has nine cards numbered 1 to 9.

(4)



Ray takes at random three of these cards.

He works out the sum of the numbers on the three cards and records the result.

Work out the probability that the result is an even number.

22. **L** is the straight line with equation

(5)

$$y = 2x - 5.$$

**C** is a graph with equation

$$y^2 = 6x^2 - 25x - 8.$$

Using algebra, find the coordinates of the points of intersection of **L** and **C**.  
You must show all your working.