

# June 2014

## Predicted Paper 1 (Non Calc)

### Solutions

#### Information

- The total mark for this paper is 100.
- The marks for **each** question are shown in brackets  
– *use this as a guide as to how much time to spend on each question.*
- Questions labelled with an **asterisk** (\*) are ones where the quality of your written communication will be assessed  
– *you should take particular care on these questions with your spelling, punctuation and grammar, as well as the clarity of expression.*

#### Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

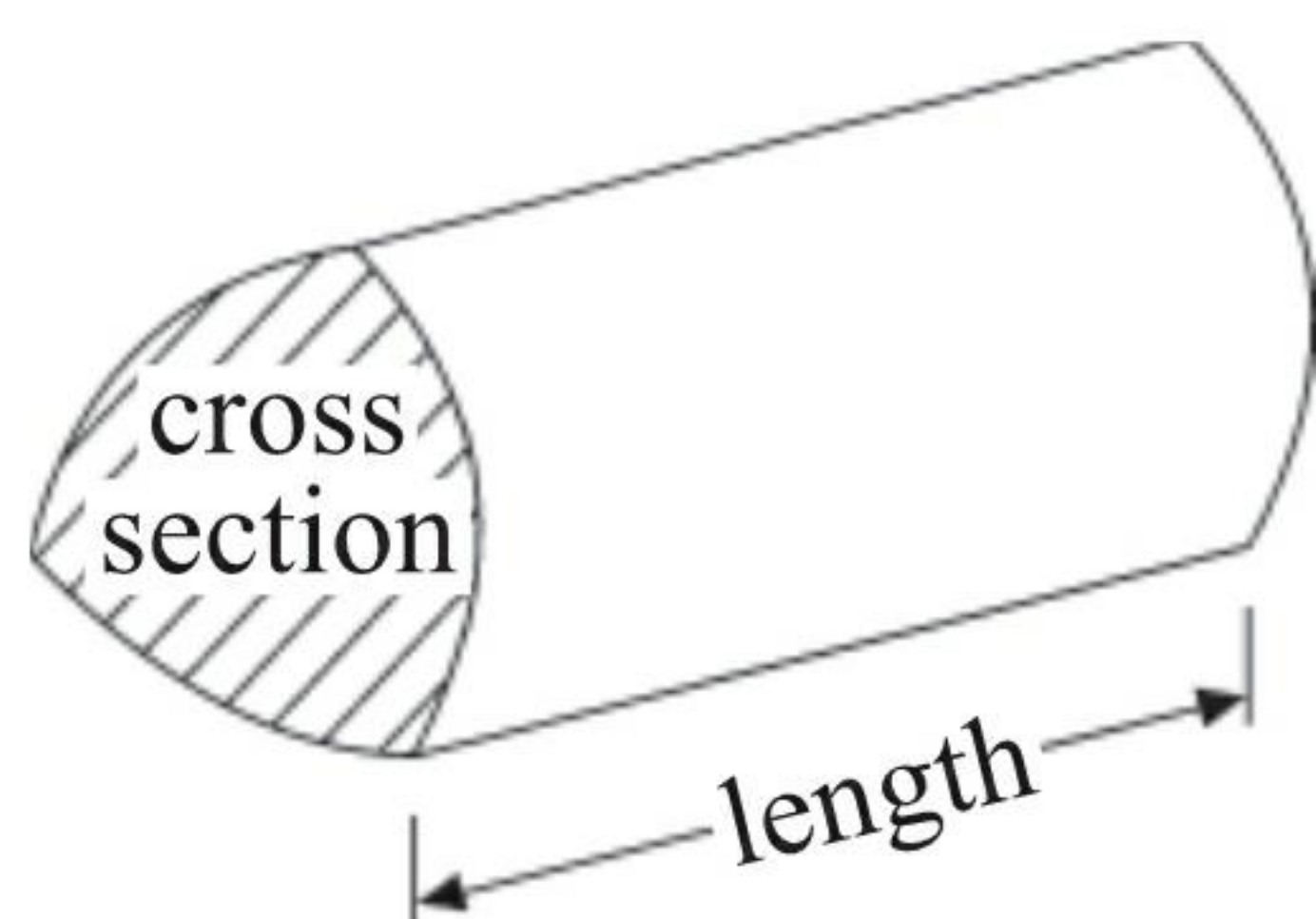


## GCSE Mathematics 1MA0

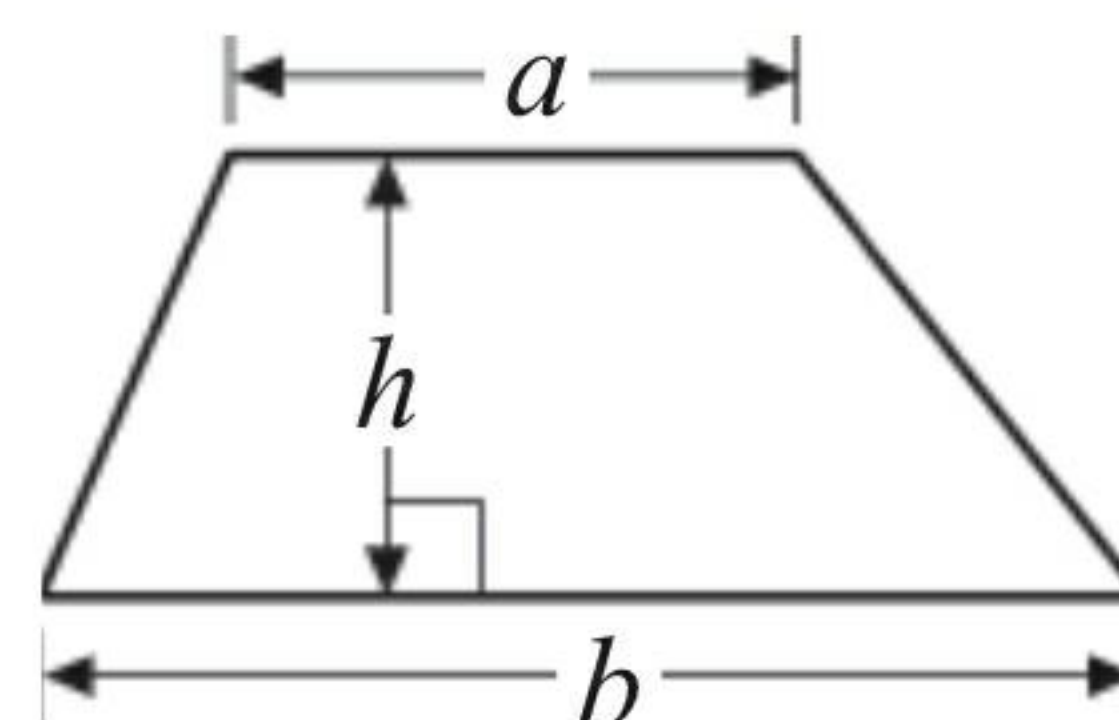
### Formulae – Higher Tier

**You must not write on this formulae page.**  
**Anything you write on this formulae page will gain NO credit.**

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

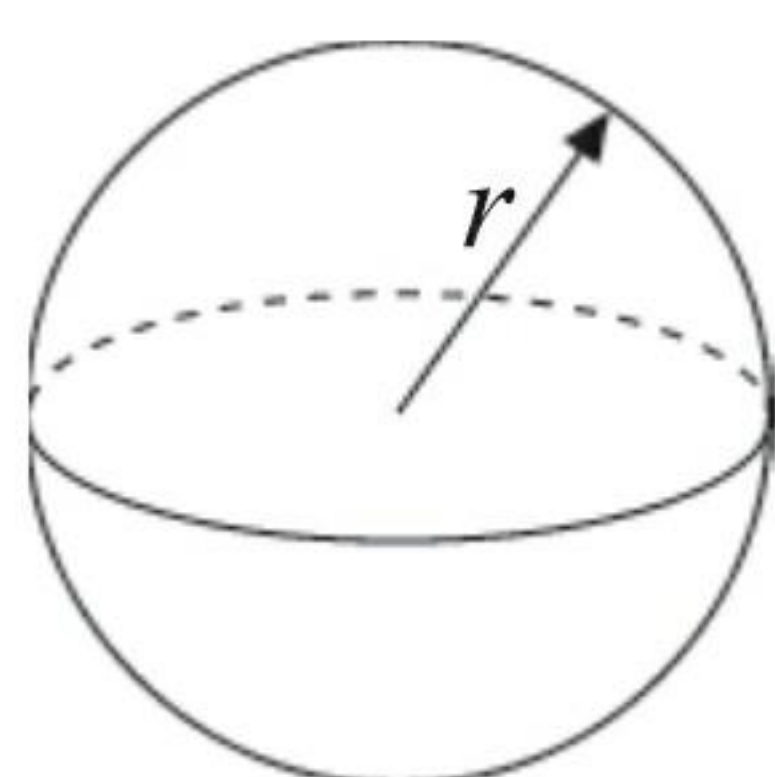


**Area of trapezium** =  $\frac{1}{2}(a + b)h$



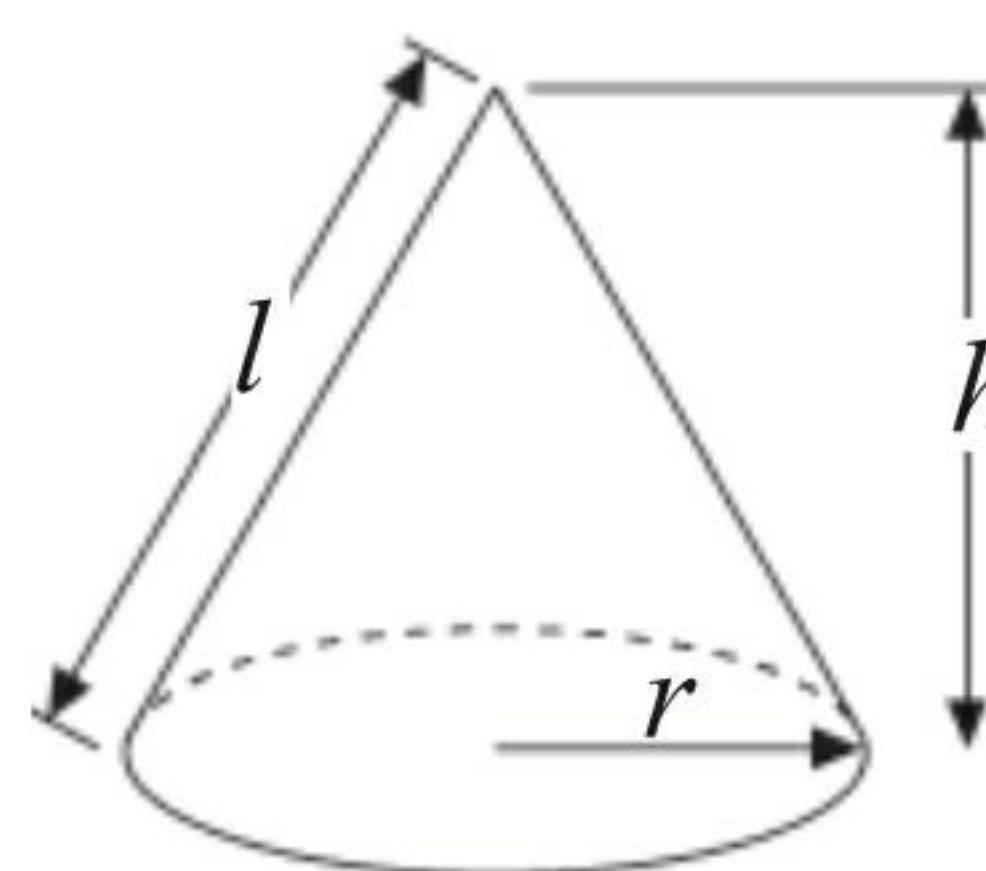
**Volume of sphere** =  $\frac{4}{3}\pi r^3$

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

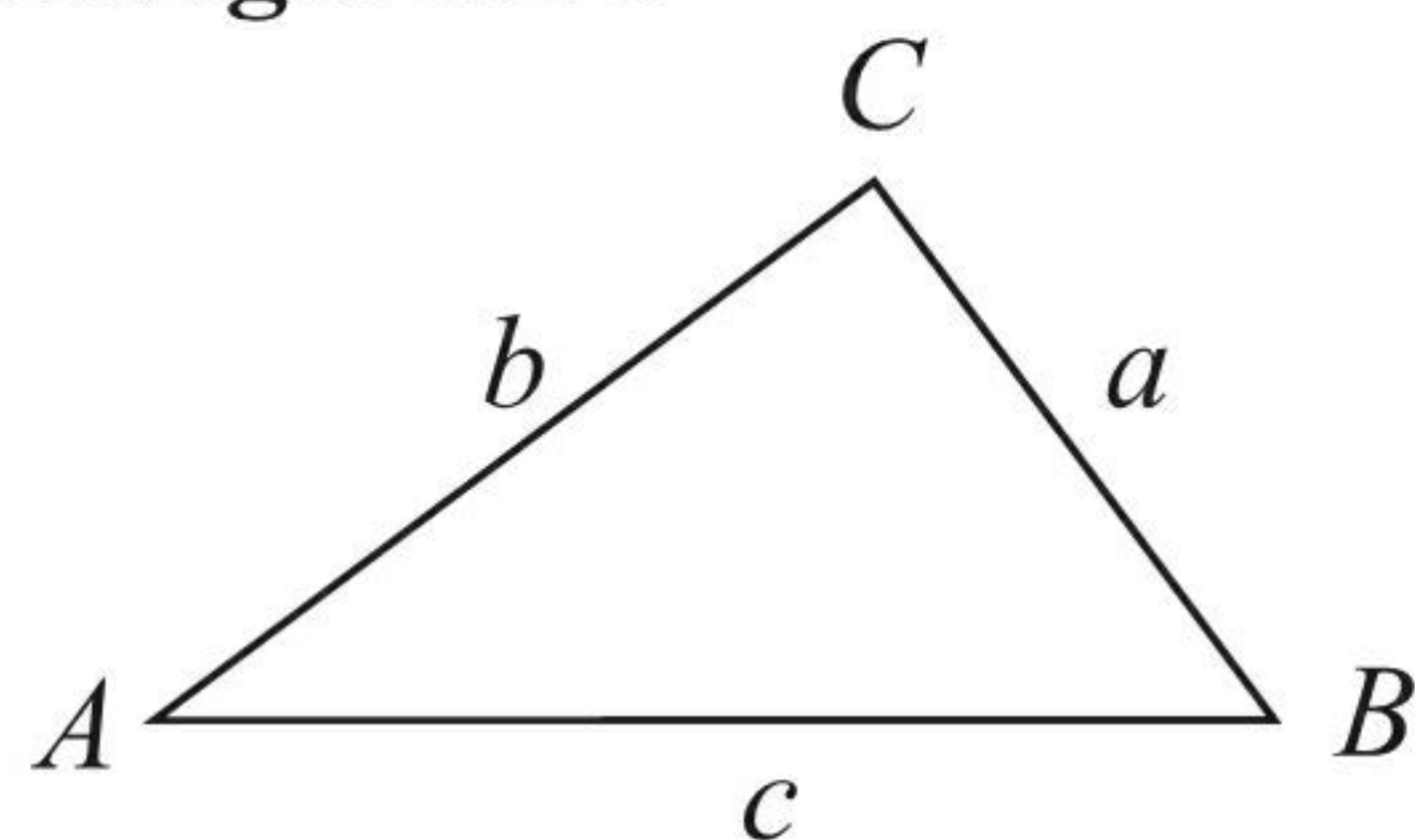


**Volume of cone** =  $\frac{1}{3}\pi r^2 h$

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



**In any triangle ABC**



**The Quadratic Equation**

The solutions of  $ax^2 + bx + c = 0$

where  $a \neq 0$ , are given by

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

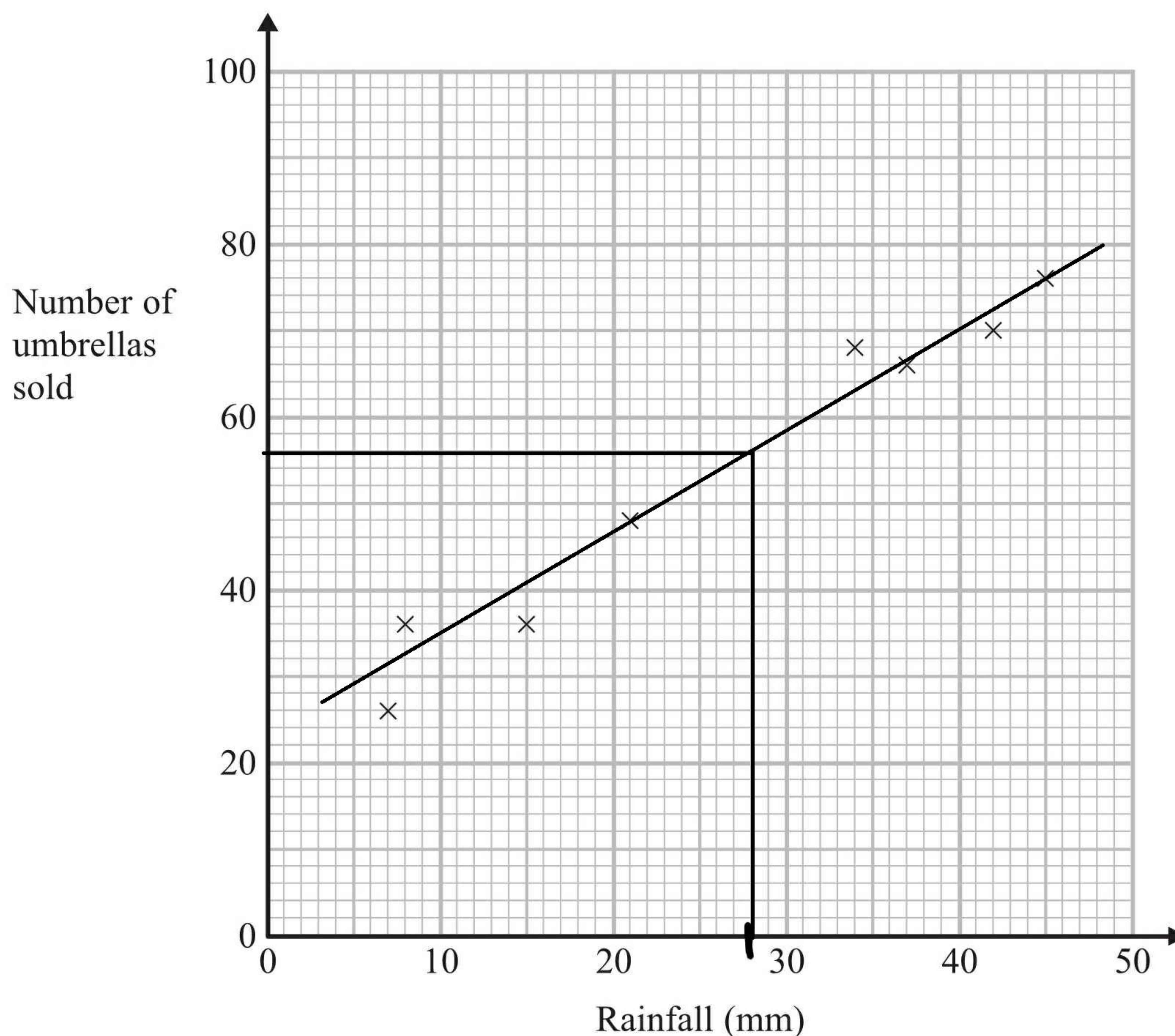
**Sine Rule**  $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

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

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



1. The scatter graph gives information about the rainfall (mm) and the number of umbrellas sold in a shop for each of eight months last year.



- (a) Describe the relationship between the rainfall and the number of umbrellas sold.

as the rainfall increases the number of umbrellas sold increase (positive correlation)

(1)

In a different month, the rainfall was 28 mm.

- (b) Estimate the number of umbrellas sold in the shop that month.

using your line of best fit:

56

(2)

(Total for Question 1 is 3 marks)



2.

Bill gives away £20000 to help animals.

He gives 20% of the £20000 to a donkey sanctuary.

He shares the rest of the £20000 between a dogs' home and a cats' home in the ratio 3 : 2

How much money does Bill give to the cats' home?

5 parts

£20000 in total

$$10\% = £2000$$

$$20\% = £4000$$

£4000 to the Donkeys

$$£20000 - £4000 = £16000 \quad \text{to be split } 3:2$$

$$5 \text{ parts} \quad \therefore \frac{£16000}{5} = £3200 \quad (1 \text{ part})$$


$$\text{Cats home } 2 \text{ parts} \quad £3200 \times 2 = £6400$$

£ 6400

(Total for Question 2 is 4 marks)



3. Here is part of Jo's electricity bill.

Electricity Bill		May 2012
J. Evans 3 Hillside Ave London		
		CP Energy Connecting people Connecting places
<b>2012</b>		
Reading 1st Jan		02792 units
Reading 1st April		03307 units
Number of units used		<u>515 units</u>
Cost: <u>35p per unit</u>		

Work out how much Jo has to pay for the units she has used.

515 units at 35p each

$$\begin{array}{r}
 515 \\
 \times 35 \\
 \hline
 2575 \\
 15450 \\
 \hline
 18025
 \end{array}$$

6/2

	500	10	5
30	15000	300	150
5	2500	50	25

$$\begin{array}{r}
 15000 \\
 2500 \\
 300 \\
 150 \\
 25 \\
 \hline
 18025
 \end{array}$$

£ 180.25

(Total for Question 3 is 4 marks)

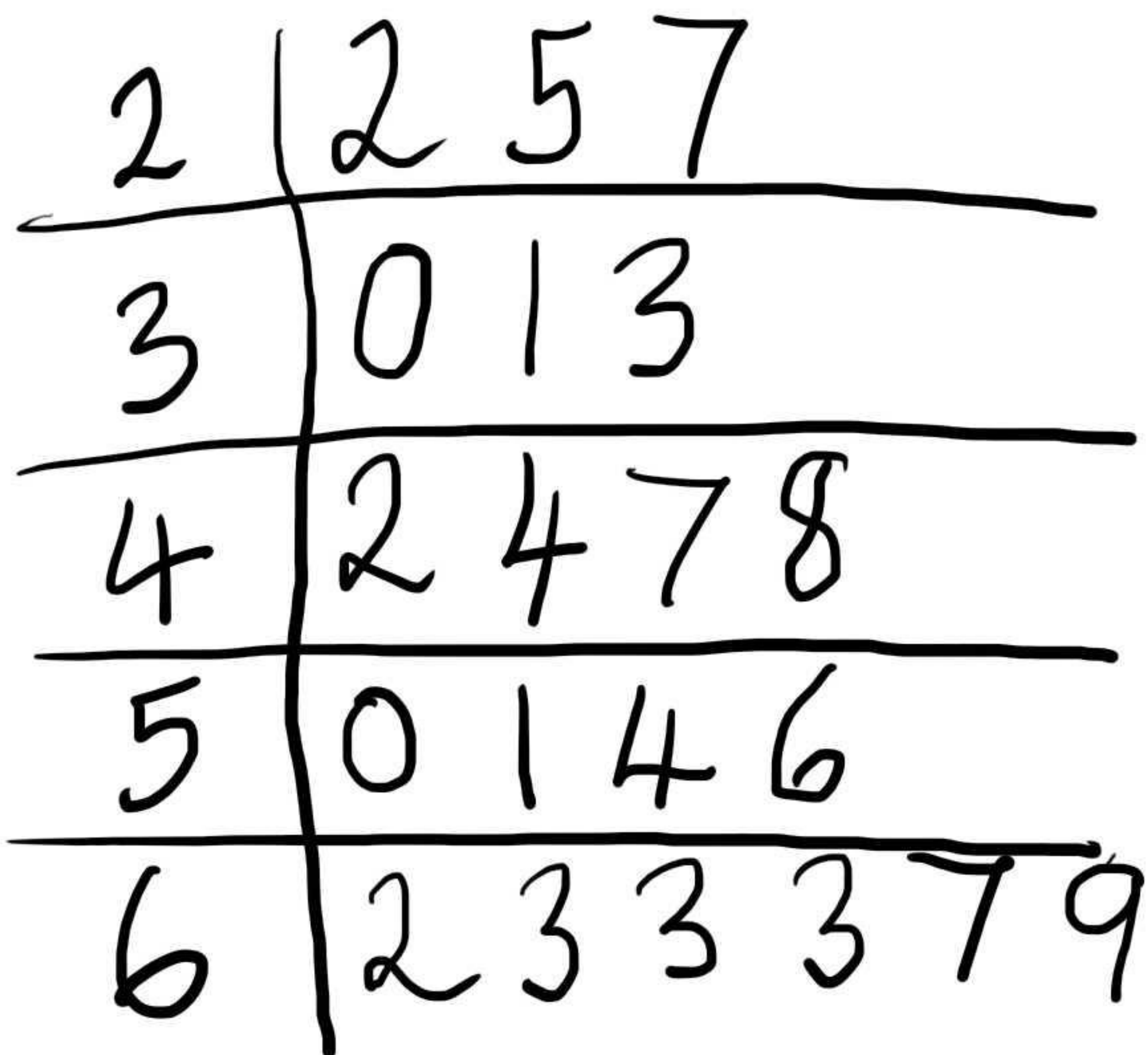


4.

Here are some people's ages in years.

~~62~~ ~~27~~ ~~35~~ ~~44~~ ~~47~~  
~~30~~ ~~27~~ ~~63~~ ~~67~~ ~~54~~  
~~69~~ ~~56~~ ~~63~~ ~~50~~ ~~25~~  
~~31~~ ~~63~~ ~~42~~ ~~48~~ ~~51~~

In the space below, draw an ordered stem and leaf diagram to show these ages.



key: 2|2 = 22

(Total for Question 4 = 3 marks)



5.

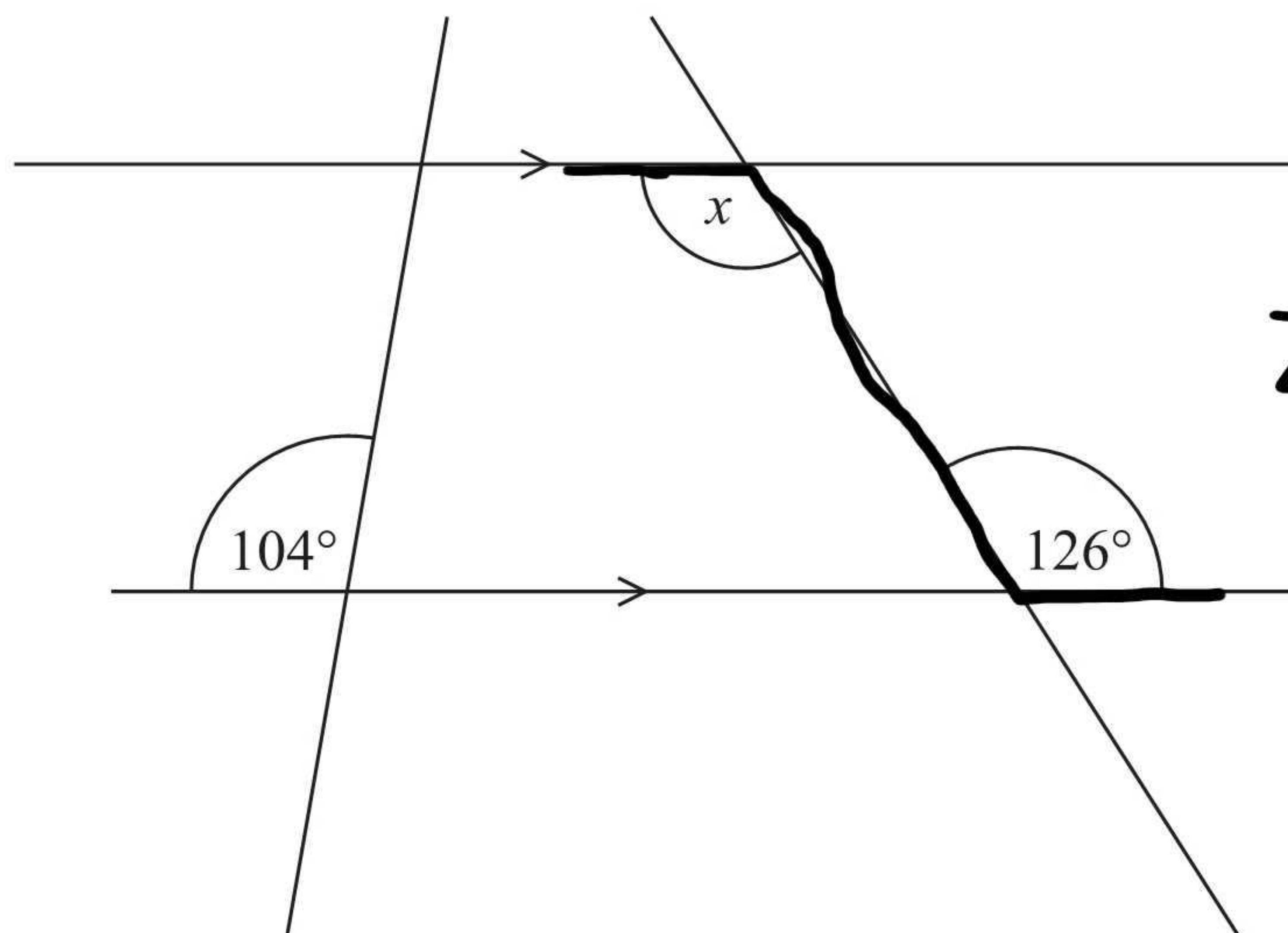


Diagram NOT accurately drawn

Z angles are called alternate angles

(i) Find the size of the angle marked  $x$ .

126 °

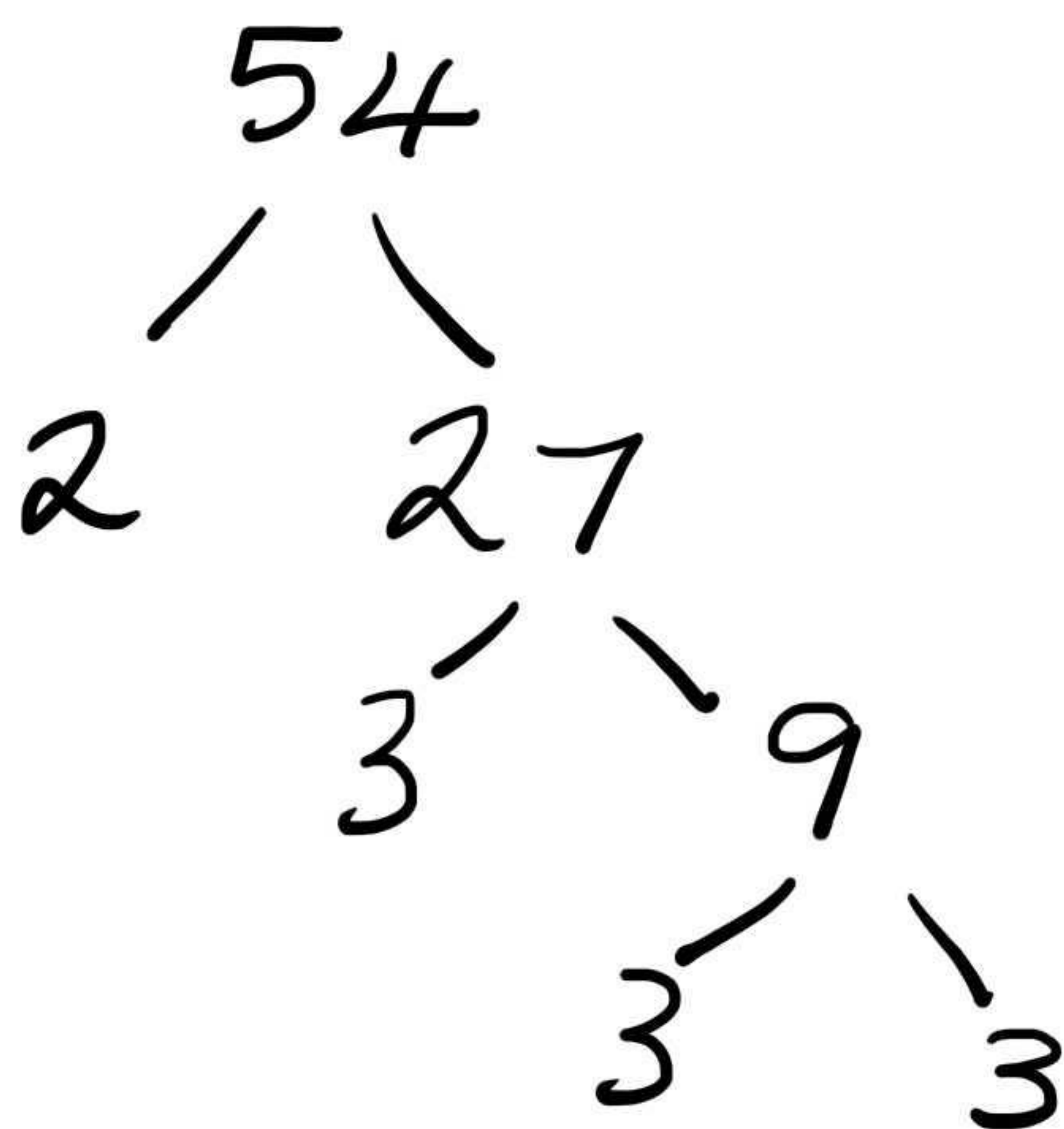
(ii) Give a reason for your answer.

alternate angles are equal

(Total for Question 5 is 2 marks)



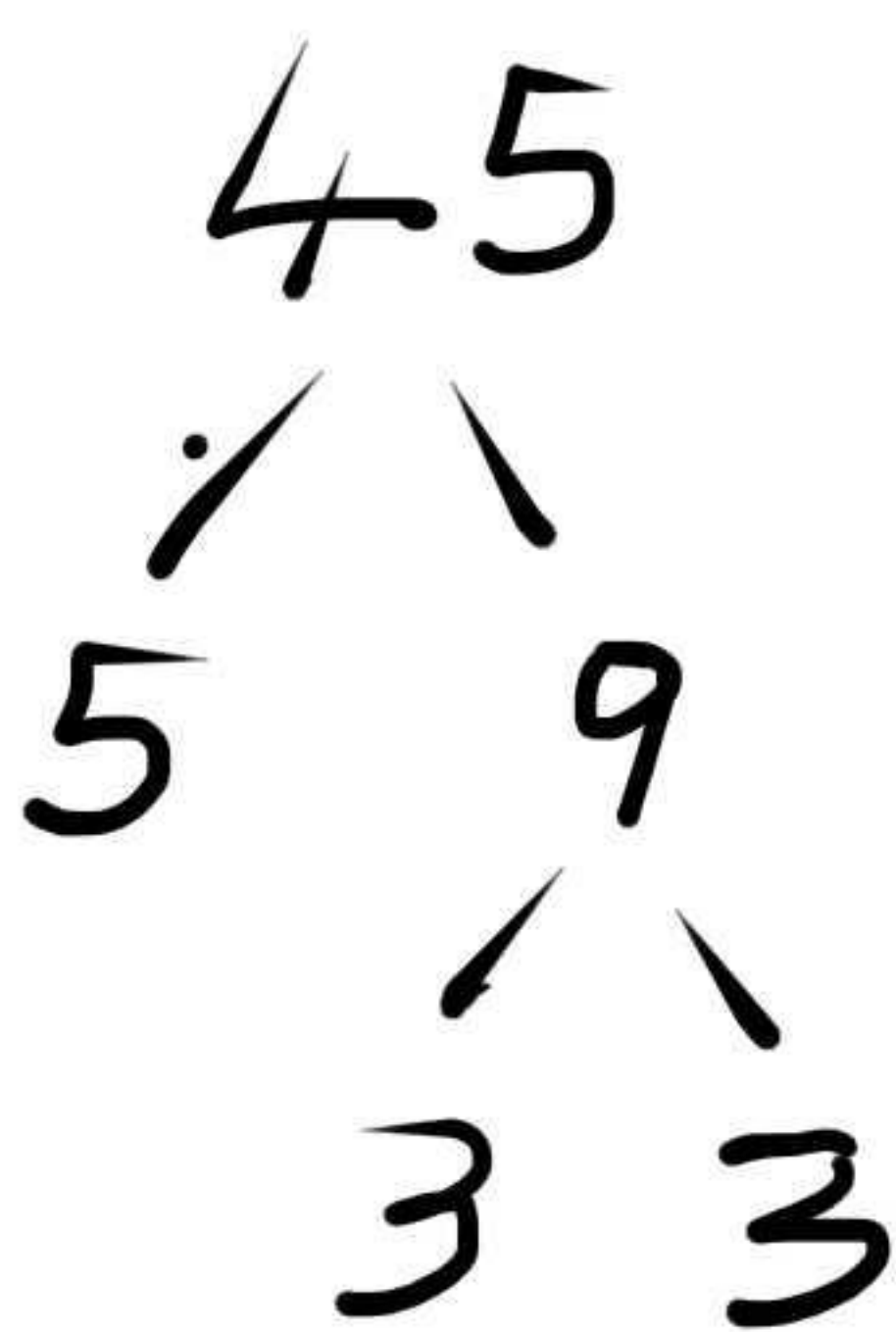
6. (a) Express 54 as a product of its prime factors.



$$2 \times 3^3$$

(2)

- (b) Find the Lowest Common Multiple (LCM) of 45 and 54



$$54 = 2 \times 3 \times 3 \times 3$$

$$45 = 5 \times 3 \times 3$$

$$\text{HCF} = 3 \times 3 = 9$$

(HCF) (The other numbers)

$$\text{LCM} = 9 \times 2 \times 3 \times 5$$

$$= 270$$

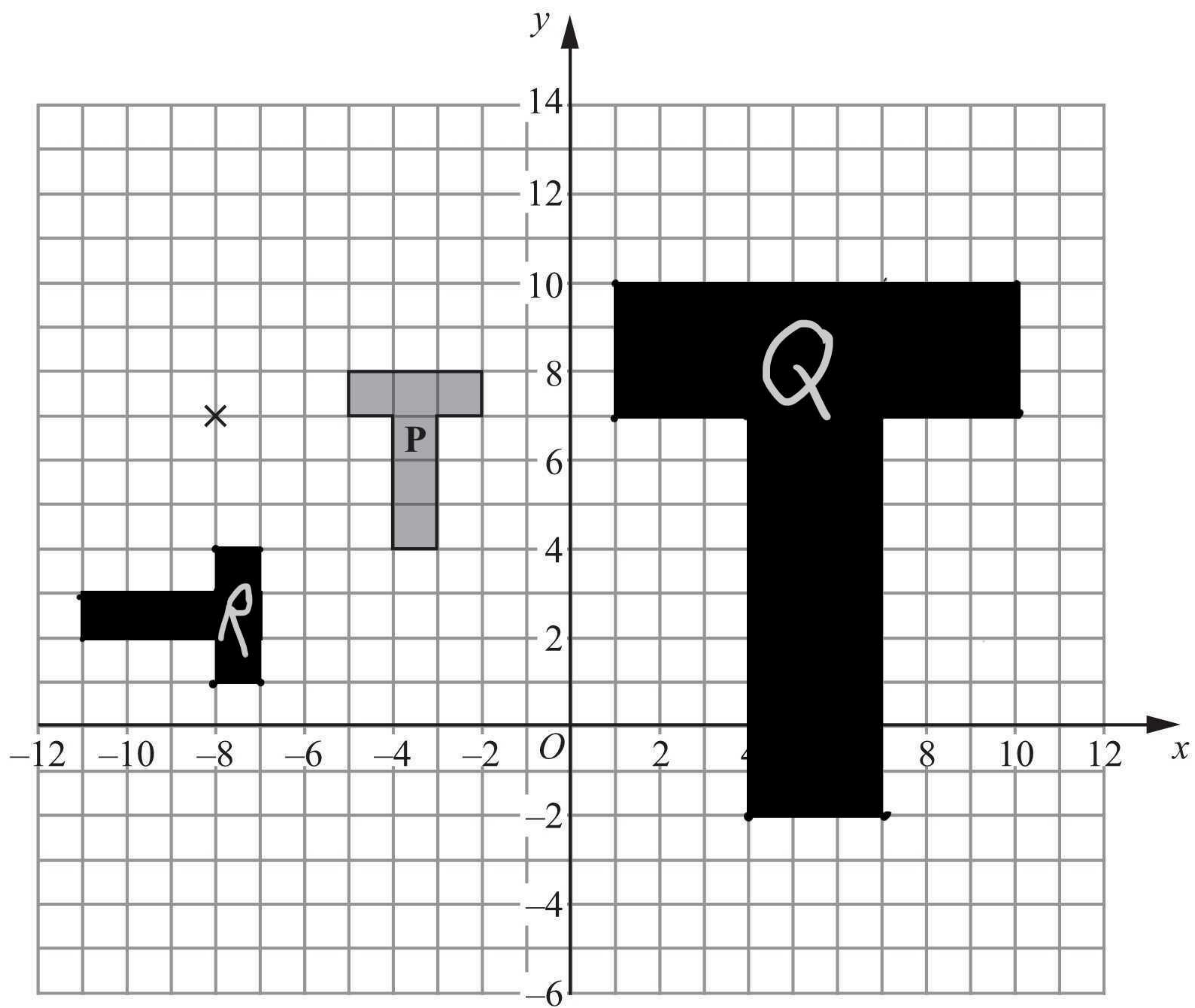
$$270$$

(2)

(Total for Question 6 is 4 marks)



7.



(a) On the grid, enlarge shape **P** with scale factor 3 and centre  $(-8, 7)$ .

Label the new shape **Q**.

(3)

(b) On the grid, rotate shape **P** through  $90^\circ$  clockwise about the point  $(-8, 7)$ .

Label the new shape **R**.

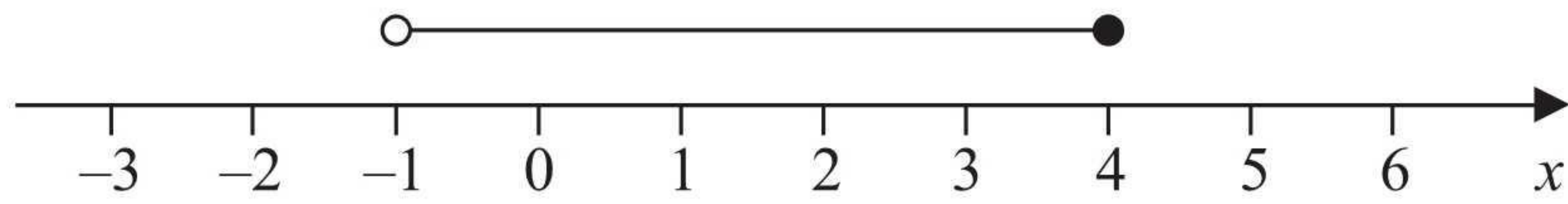
(2)

(Total for Question 7 is 5 marks)



8.

(a)



An inequality is shown on the number line.

Write down this inequality.

$$\underline{-1 < x \leq 4}$$

(2)

(b) (i) Solve the inequality  $2(y - 3) \geq 1$

$$\begin{aligned} 2y - 6 &\geq 1 \\ 2y &\geq 7 \\ y &\geq 3.5 \end{aligned}$$

$$\underline{y \geq 3.5}$$

(ii) Write down the lowest **integer** which satisfies this inequality.

$$\underline{4}$$

(4)

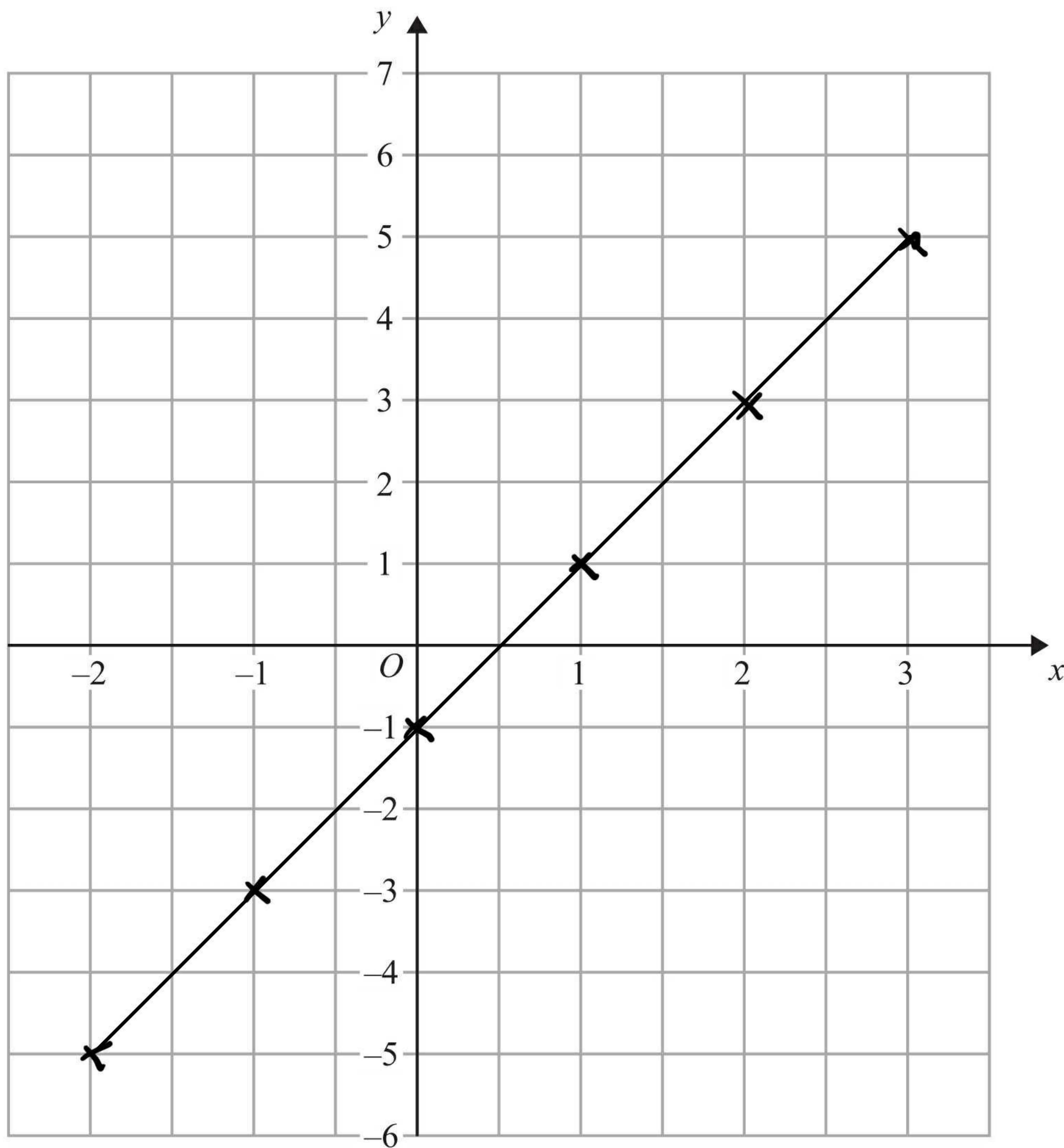
(Total for Question 8 is 6 marks)

Do NOT write in this space.



9. On the grid, draw the graph of  $y = 2x - 1$  for values of  $x$  from  $-2$  to  $3$

$x$	$-2$	$-1$	$0$	$1$	$2$	$3$
$y$	$-5$	$-3$	$-1$	$1$	$3$	$5$



(Total for Question 9 is 3 marks)



10.

The diagram shows an accurate scale drawing of part of the boundary of a field.  
The complete boundary of the field is in the shape of a quadrilateral  $ABCD$ .

$AB = 300$  metres.

$BC = 230$  metres.

Point  $B$  is due north of point  $C$ .

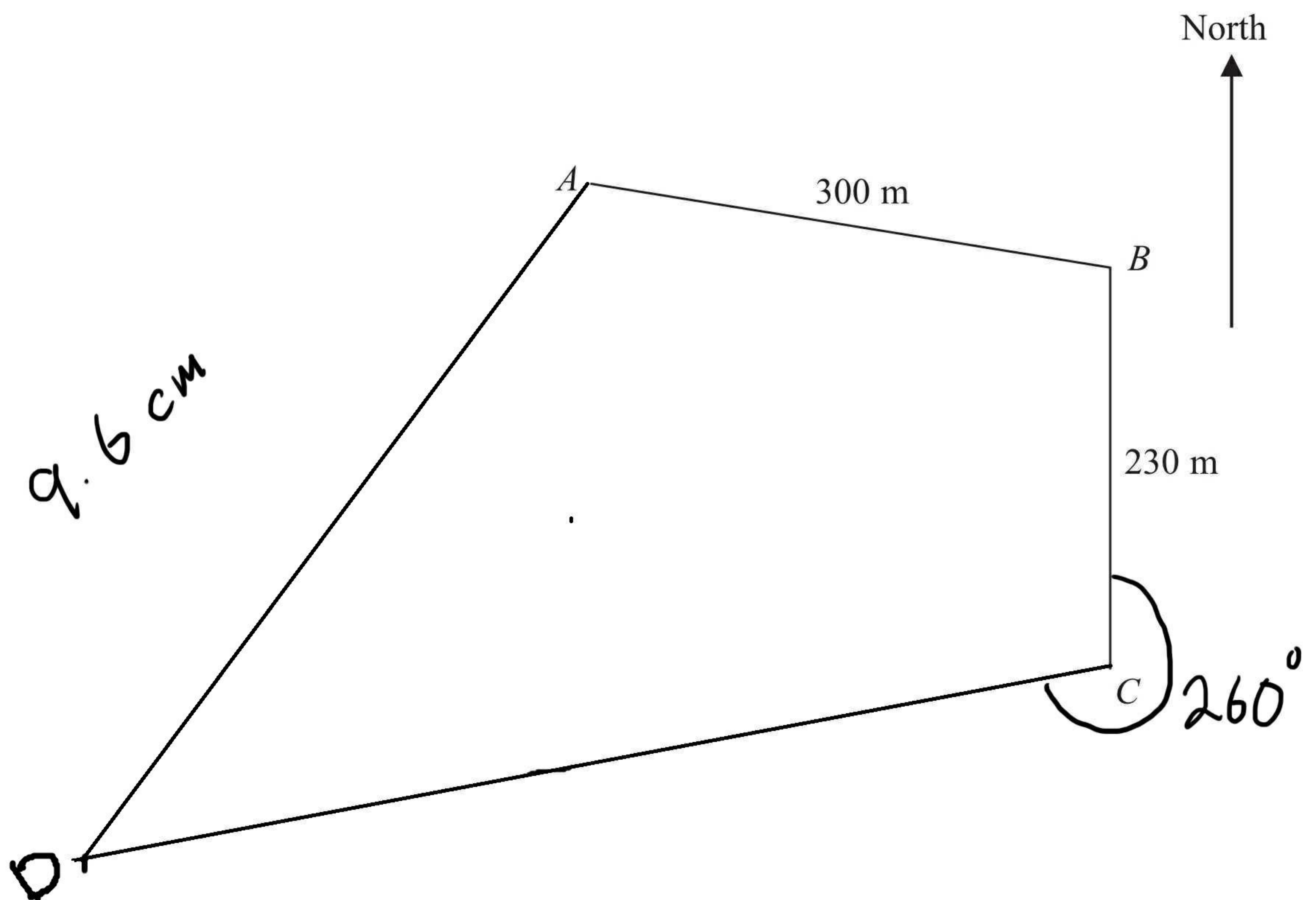
The scale of the diagram is 1 cm to 50 metres.

The bearing of  $D$  from  $C$  is  $260^\circ$

$AD = 480$  metres.

$$\frac{480}{50} = 9\frac{30}{50} = 9.6 \text{ cm}$$

Complete the scale drawing of the boundary of the field.  
Mark the position of  $D$ .



(Total for Question 10 is 2 marks)



11

Work out an estimate for the value of  $\frac{89.3 \times 0.51}{4.8}$

Round to 1st:  $\frac{90 \times 0.5}{5} = \frac{45}{5}$

9

(Total for Question 11 is 2 marks)

12.

(a) Write 152 million in standard form.

152 000 000

$1.52 \times 10^8$   
(2)

(b) Write  $2.4 \times 10^{-3}$  as an ordinary number.

0.0024  
(1)

(Total for Question 12 is 3 marks)



\*13.

You can use the graph opposite to find out how much Lethna has to pay for the units of electricity she has used.

Lethna pays at one rate for the first 100 units of electricity she uses.  
She pays at a different rate for all the other units of electricity she uses.

Lethna uses a total of 900 units of electricity.

Work out how much she must pay.

Price for first 100 units:

£25

She needs to buy a further  
800 units at a price of  
£10 per 100 units

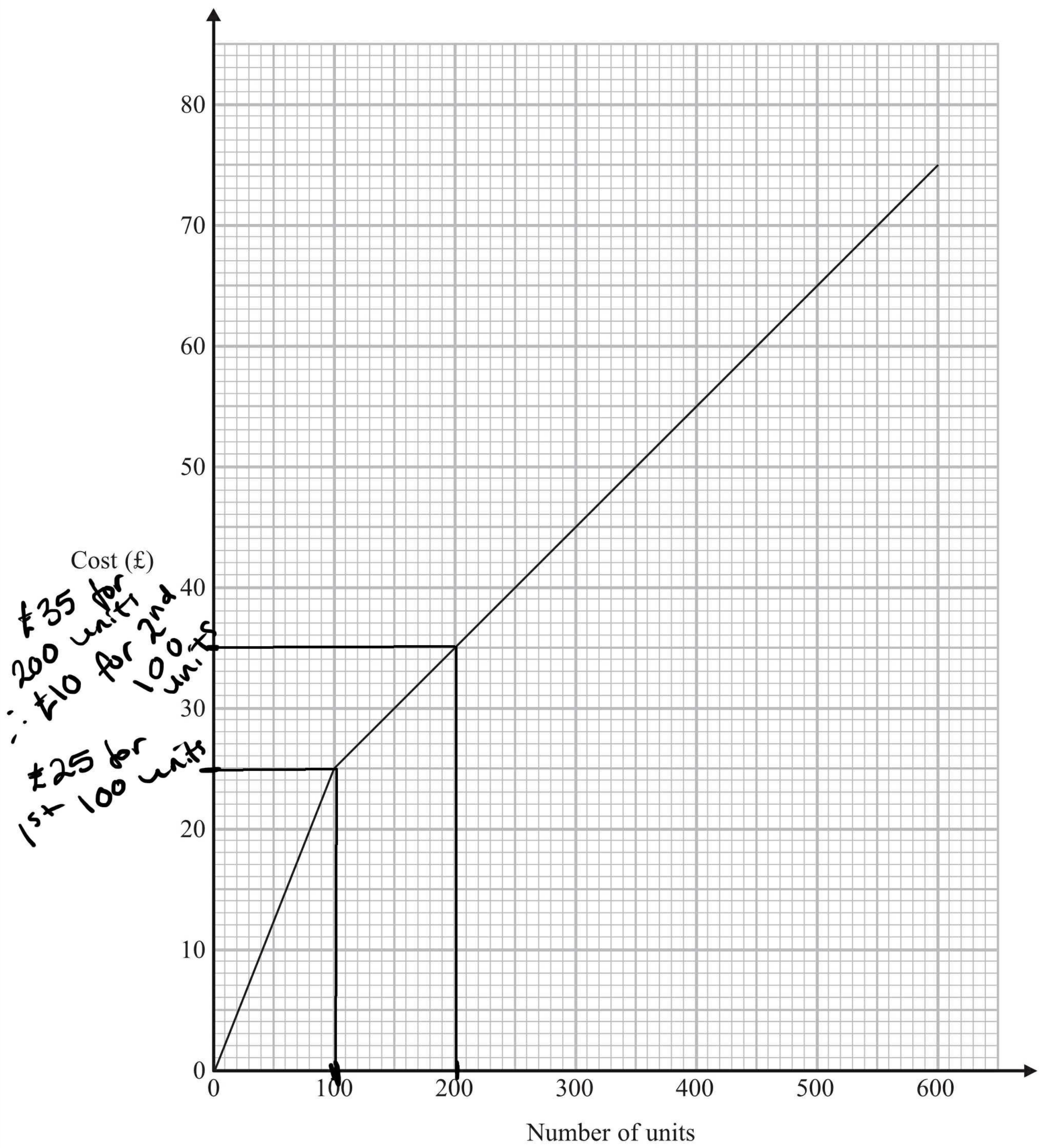
∴ 800 units cost  $8 \times £10 = £80$

£25 + £80 = £105

Lethna must pay £105

£ 105





(Total for Question 13 is 3 marks)



14.

Rectangle **A** has a width of  $x$  metres and a height of  $(x + 2)$  metres.  
Rectangle **B** has a width of  $2x$  metres and a height of  $4x$  metres.

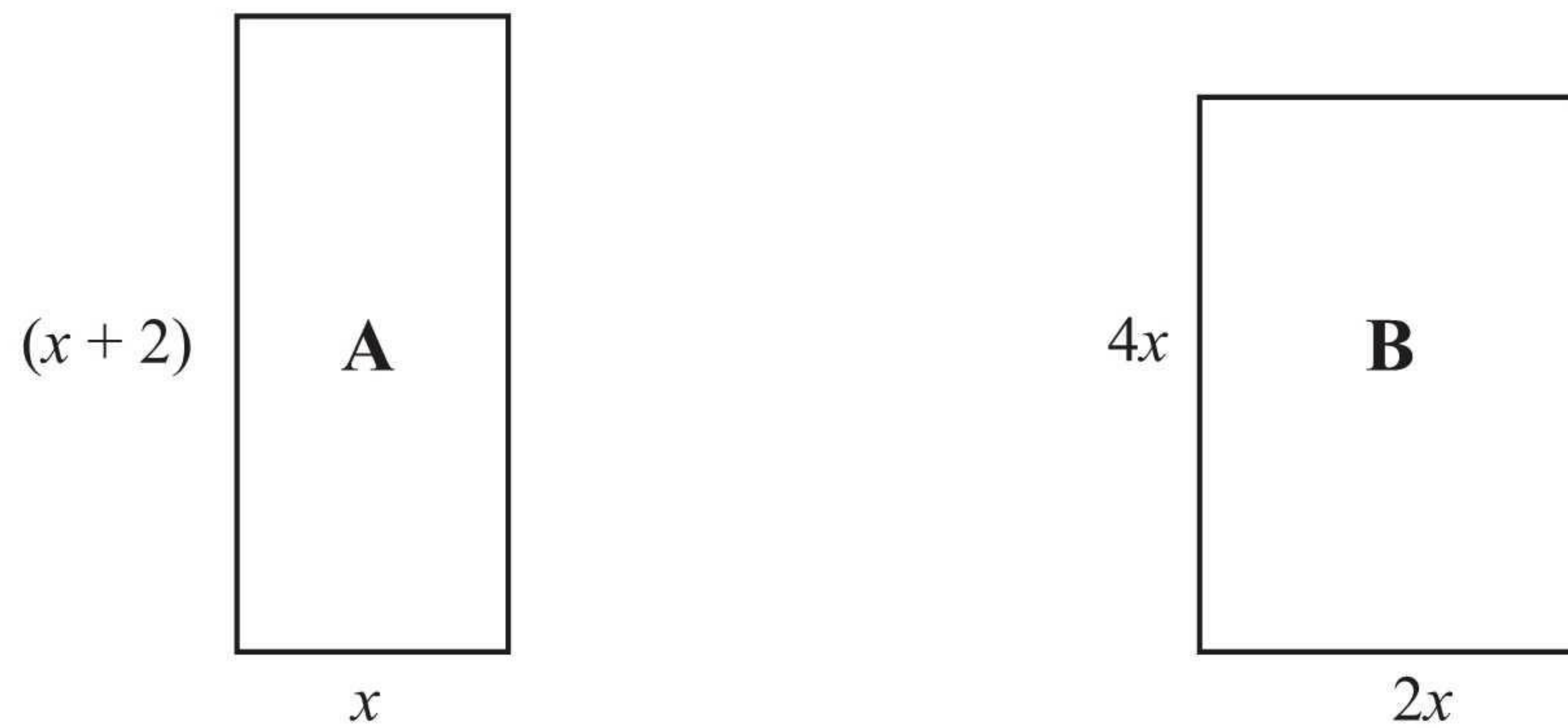


Diagram **NOT**  
accurately drawn

The perimeter of rectangle **A** is equal to the perimeter of rectangle **B**.

(i) Use this information to write down an equation in  $x$ .

$$\begin{aligned} \text{Perimeter for A} &= \text{Perimeter for B} \\ x+2+x+x+2+x &= 4x+2x+4x+2x \\ 4x+4 &= 12x \end{aligned}$$

$$\underline{4x + 4 = 12x}$$

(ii) Find the value of  $x$ .

$$4x + 4 = 12x$$

$$4 = 8x$$

$$x = \frac{4}{8} = \frac{1}{2}$$

$$x = \underline{\underline{\frac{1}{2}}}$$

(Total for Question 14 is 4 marks)



15. The diagram represents a shed.

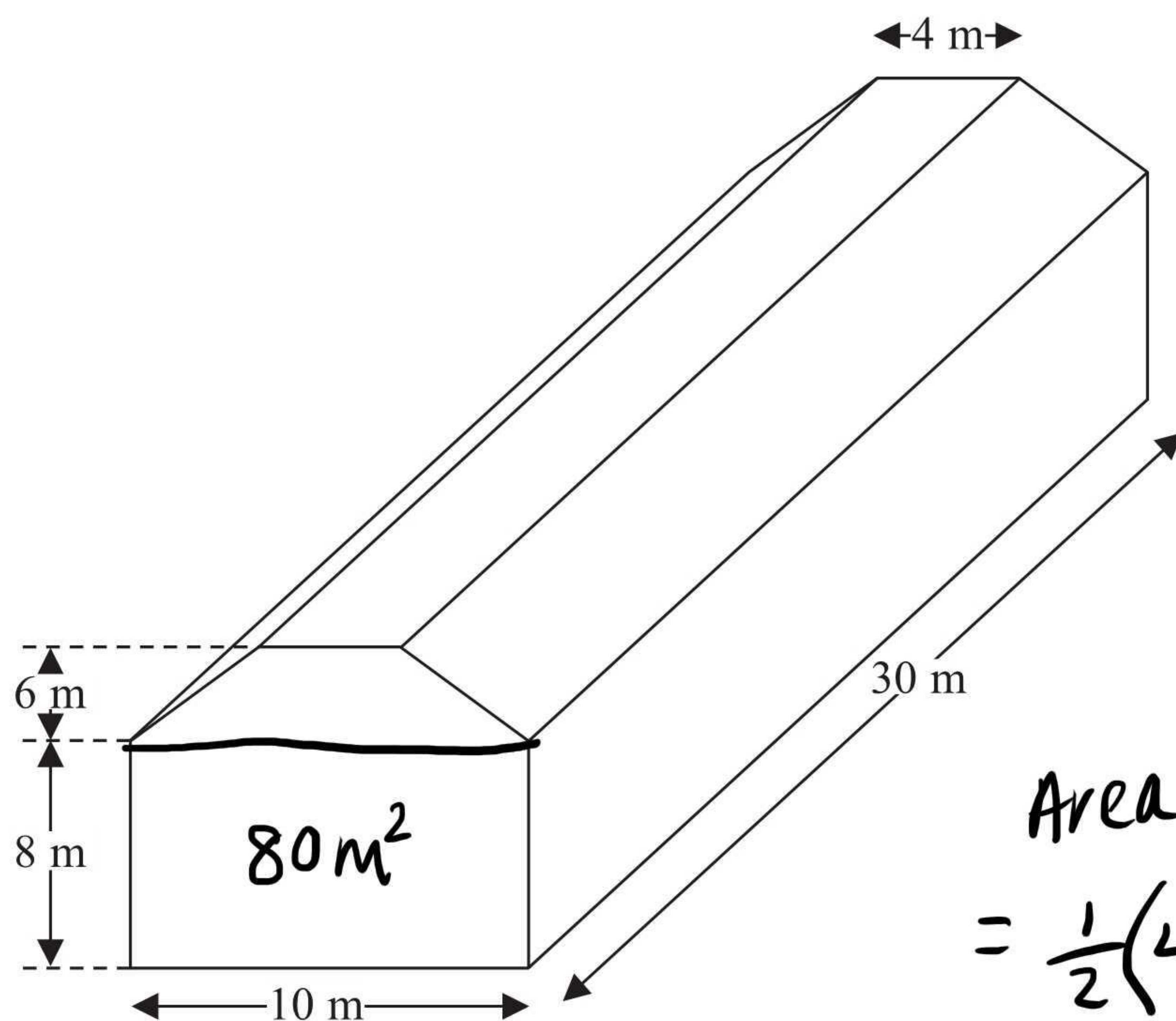


Diagram NOT accurately drawn

$$\begin{aligned}
 &\text{Area of trapezium} \\
 &= \frac{1}{2}(4+10) \times 6 \\
 &= 7 \times 6 \\
 &= 42 \text{ m}^2
 \end{aligned}$$

The shed is in the shape of a prism.  
 The cross section of the prism is a hexagon.  
 The hexagon has one line of symmetry.  
 The walls of the shed are vertical.

Calculate the volume of the shed.

$$\begin{aligned}
 \text{Volume} &= \text{area front} \times \text{how far back it goes} \\
 &= (80 + 42) \times 30 \\
 &= 122 \times 30 \\
 &= 122 \times 3 \times 10 \\
 &= 366 \times 10
 \end{aligned}$$

$$\underline{\quad\quad\quad 3660 \quad\quad\quad} \text{ m}^3$$

(Total for Question 15 is 4 marks)



16.

The grouped frequency table gives information about the lengths of 160 pythons.

Length ( $x$ metres)	Frequency
$0 < x \leq 1$	4
$1 < x \leq 2$	8
$2 < x \leq 3$	16
$3 < x \leq 4$	32
$4 < x \leq 5$	72
$5 < x \leq 6$	28

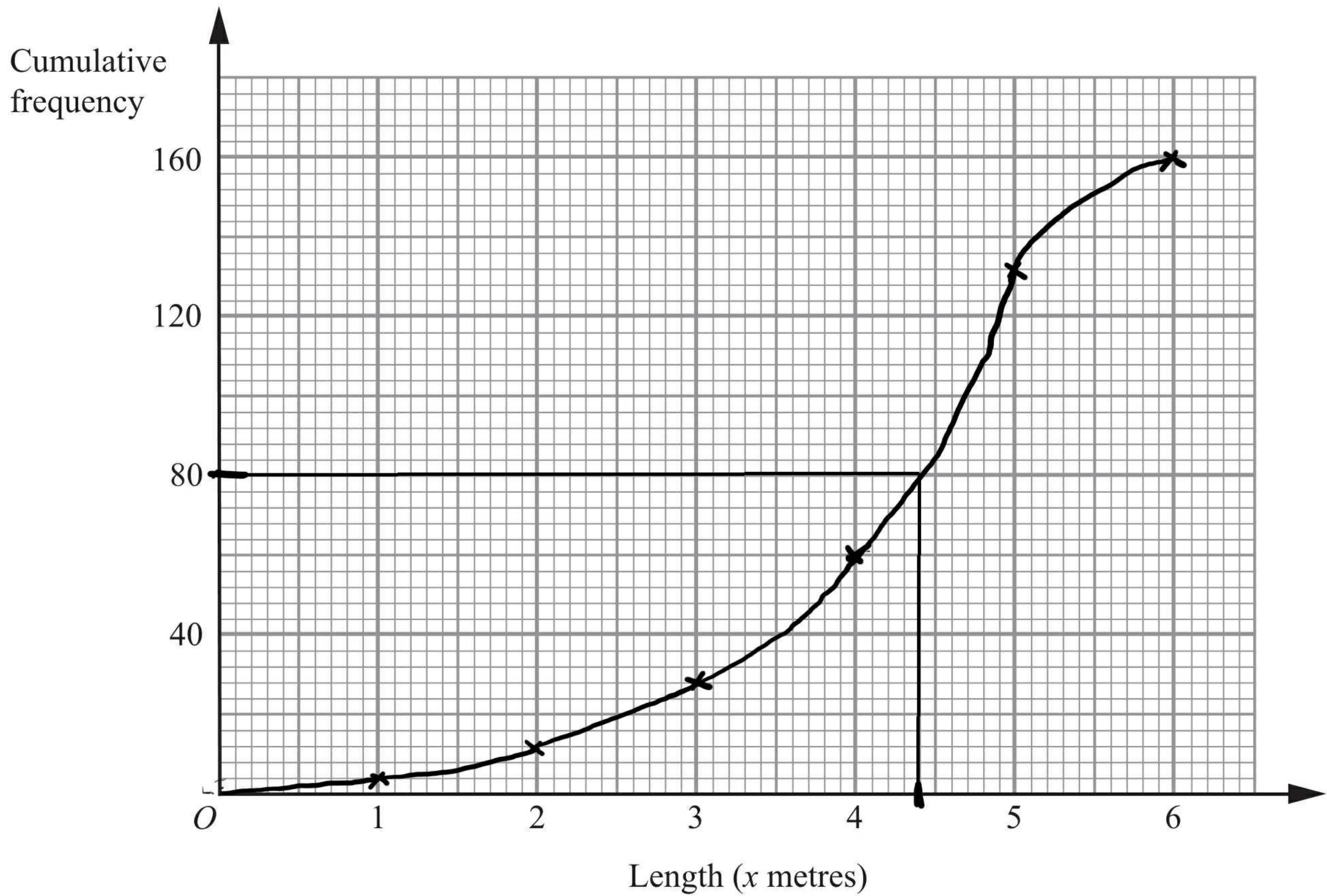
(a) Complete the cumulative frequency table.

Length ( $x$ metres)	Cumulative frequency
$0 < x \leq 1$	4
$0 < x \leq 2$	12
$0 < x \leq 3$	28
$0 < x \leq 4$	60
$0 < x \leq 5$	132
$0 < x \leq 6$	160

(1)



(b) On the grid, draw a cumulative frequency graph for your table.



(2)

(c) Use your graph to find an estimate for the median length of the pythons.

..... 4.4 ..... metres  
(2)

(Total for Question 16 is 5 marks)

**Do NOT write in this space.**



\*  
17.

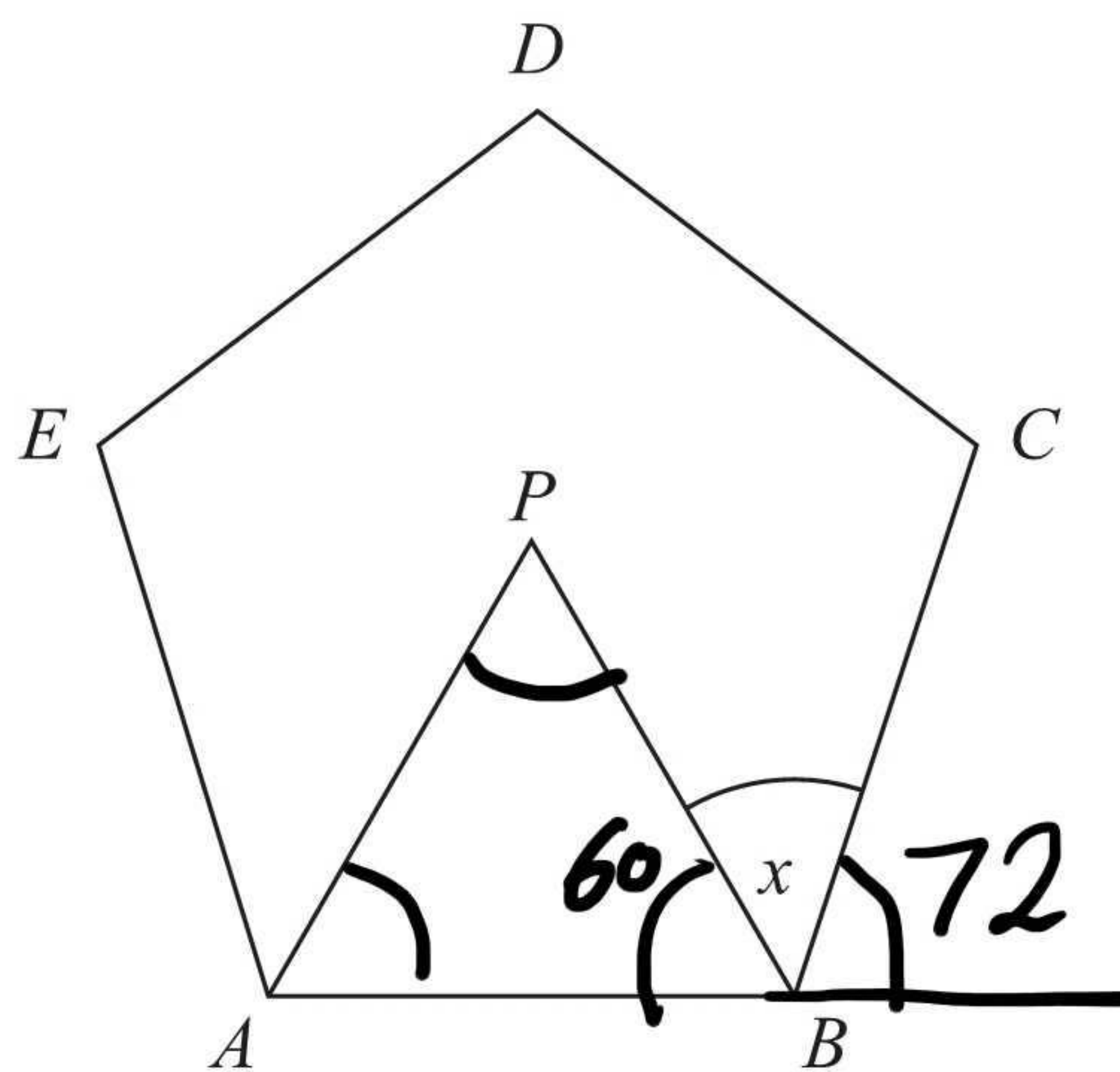


Diagram NOT  
accurately drawn

*ABCDE* is a regular pentagon.  
*ABP* is an equilateral triangle.

Work out the size of angle  $x$ .

All angles in equilateral  
triangle =  $60^\circ$

$$\text{Exterior angle in regular pentagon} = \frac{360}{5} = 72^\circ$$

$$x = 180 - 60 - 72 = 48^\circ$$

Because angles on a straight  
line add up to  $180^\circ$

.....  
48 °

(Total for Question 17 is 4 marks)



18.

Solve the simultaneous equations

$$5x - 2y = 13 \quad \times 2$$

$$\begin{array}{r} 7x + 4y = 8 \\ + \quad + \quad + \\ 10x - 4y = 26 \end{array}$$

$$17x = 34$$

$$x = 2$$

substituting  $x=2$  into original equation:

$$5(2) - 2y = 13$$

$$10 - 2y = 13$$

$$-2y = 3$$

$$y = \frac{3}{-2} = -1.5$$

$$x = \dots\dots\dots -1.5$$

$$y = \dots\dots\dots 2$$

(Total for Question 18 = 4 marks)



19.

(a) Factorise  $3t + 12$

$$\underline{3(t+4)}$$

(1)

(b) (i) Expand and simplify  $7(2x+1) + 6(x+3)$

$$14x + 7 + 6x + 18$$

$$\underline{20x + 25}$$

(ii) Show that when  $x$  is a whole number

$$7(2x+1) + 6(x+3)$$

is always a multiple of 5

$$20x + 25 = 5(4x + 5)$$

the number in the brackets will  
be multiplied by 5  $\therefore$  it will  
be a multiple of 5

(3)

(Total for Question 19 is 4 marks)







21.

(a) Write down the value of  $10^{-1}$

$$\frac{1}{10}$$

(1)

(b) Find the value of  $27^{\frac{2}{3}}$

← square  
← cube root

$$3^2$$

$$9$$

(2)

(c) Write  $\sqrt{75}$  in the form  $k\sqrt{3}$ , where  $k$  is an integer.

$$\sqrt{25} \sqrt{3}$$
$$5\sqrt{3}$$

$$5\sqrt{3}$$

(2)

(Total for Question 21 is 5 marks)

22.

Simplify fully

$$\frac{2x^2 + 6x}{x^2 - 2x - 15}$$

$$\frac{2x(x+3)}{(x-5)(x+3)}$$

$$\frac{2x}{x-5}$$

(Total for Question 22 is 3 marks)



23.

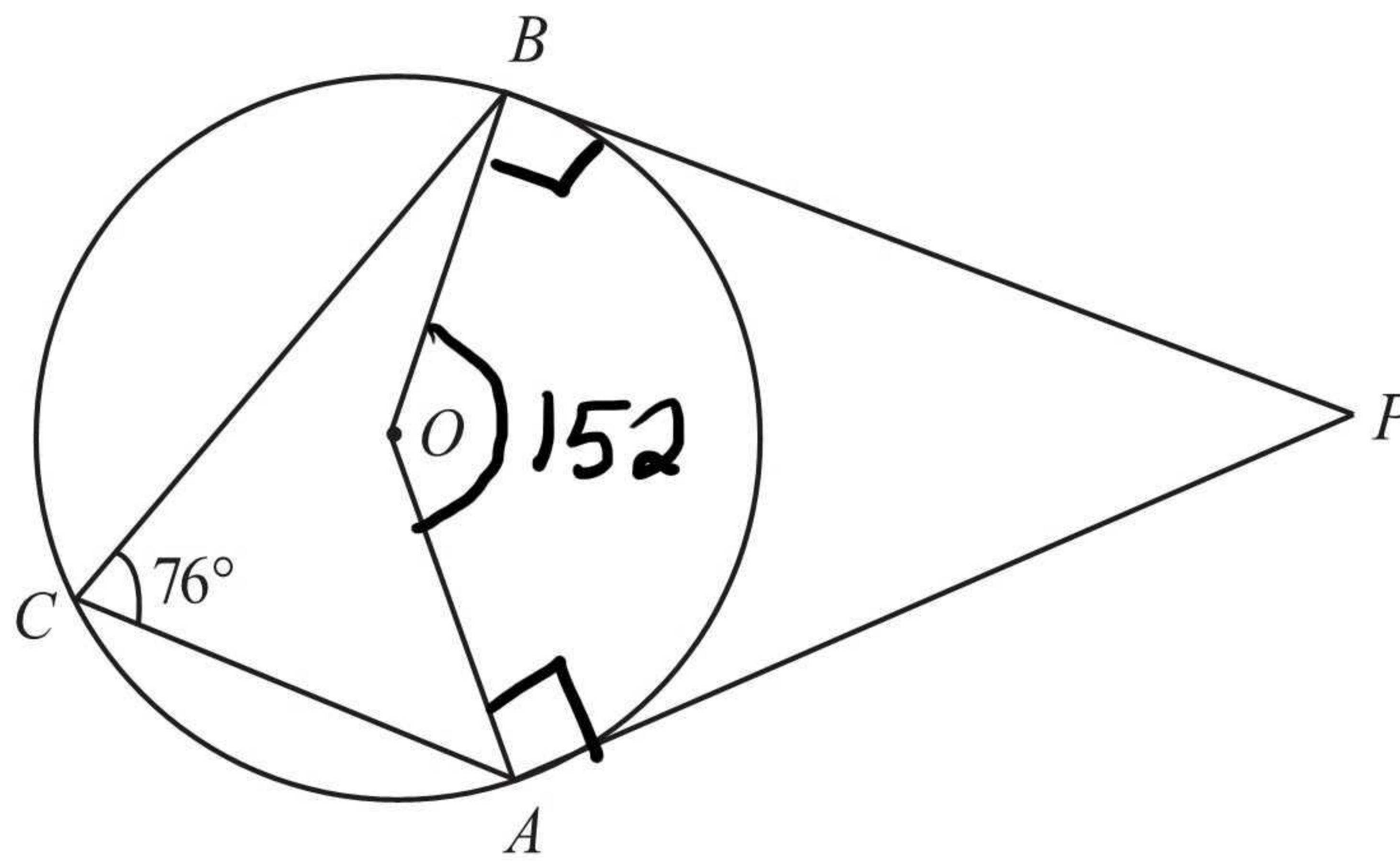


Diagram NOT accurately drawn

$A$ ,  $B$  and  $C$  are points on a circle, centre  $O$ .

Angle  $ACB = 76^\circ$

$PA$  and  $PB$  are tangents to the circle.

Calculate the size of angle  $APB$ .

$$\text{Angle } \hat{AOB} = 152^\circ \text{ (Double } \hat{ACB}\text{)}$$

$$\text{Angles } \hat{OAP} \text{ and } \hat{OBP} = 90^\circ$$

$$\hat{APB} = 360 - 90 - 90 - 152$$

(Angles in quadrilateral)  
add up to  $360^\circ$ )

28

(Total for Question 23 is 4 marks)

Do NOT write in this space.



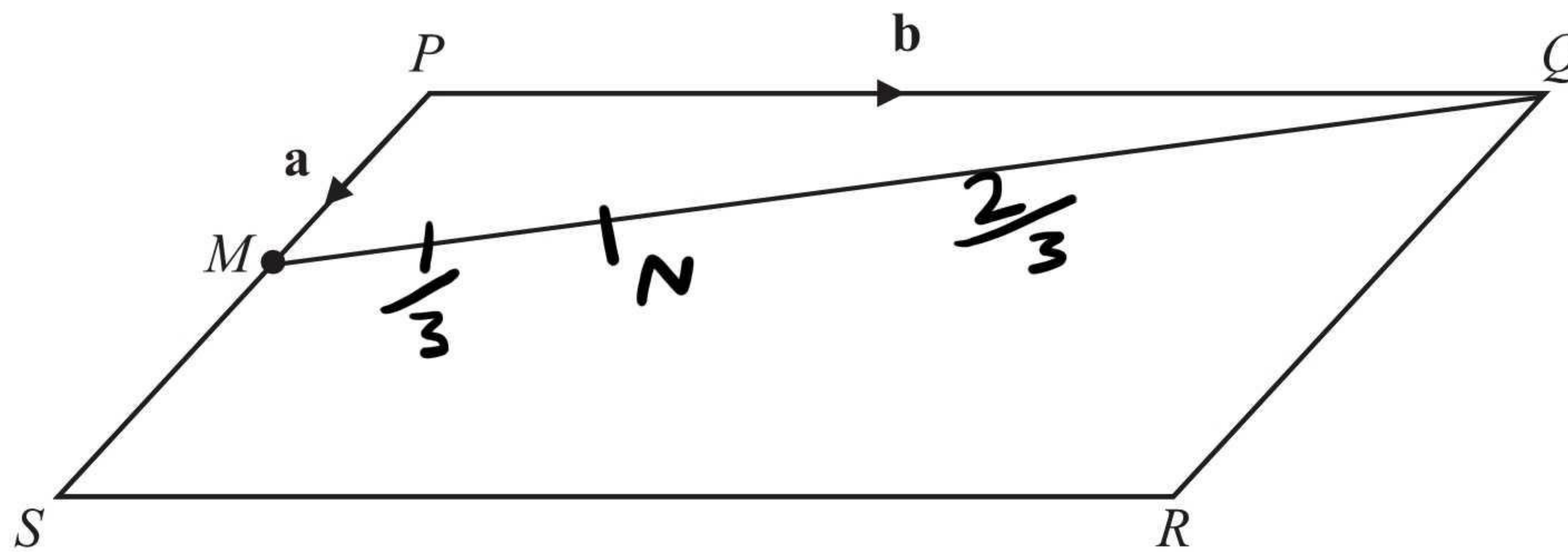
24.

The diagram shows a parallelogram,  $PQRS$ .

$M$  is the midpoint of  $PS$ .

$$\vec{PM} = \mathbf{a} \quad \vec{PQ} = \mathbf{b}$$

Diagram **NOT** accurately drawn



(a) Find, in terms of  $\mathbf{a}$  and/or  $\mathbf{b}$ ,

(i)  $\vec{PS}$

2a

(ii)  $\vec{PR}$

2a + b

(iii)  $\vec{MQ}$

-a + b

(3)

$N$  is the point on  $MQ$  such that  $MN = \frac{1}{3}MQ$

(b) Use a vector method to prove that  $PNR$  is a straight line.

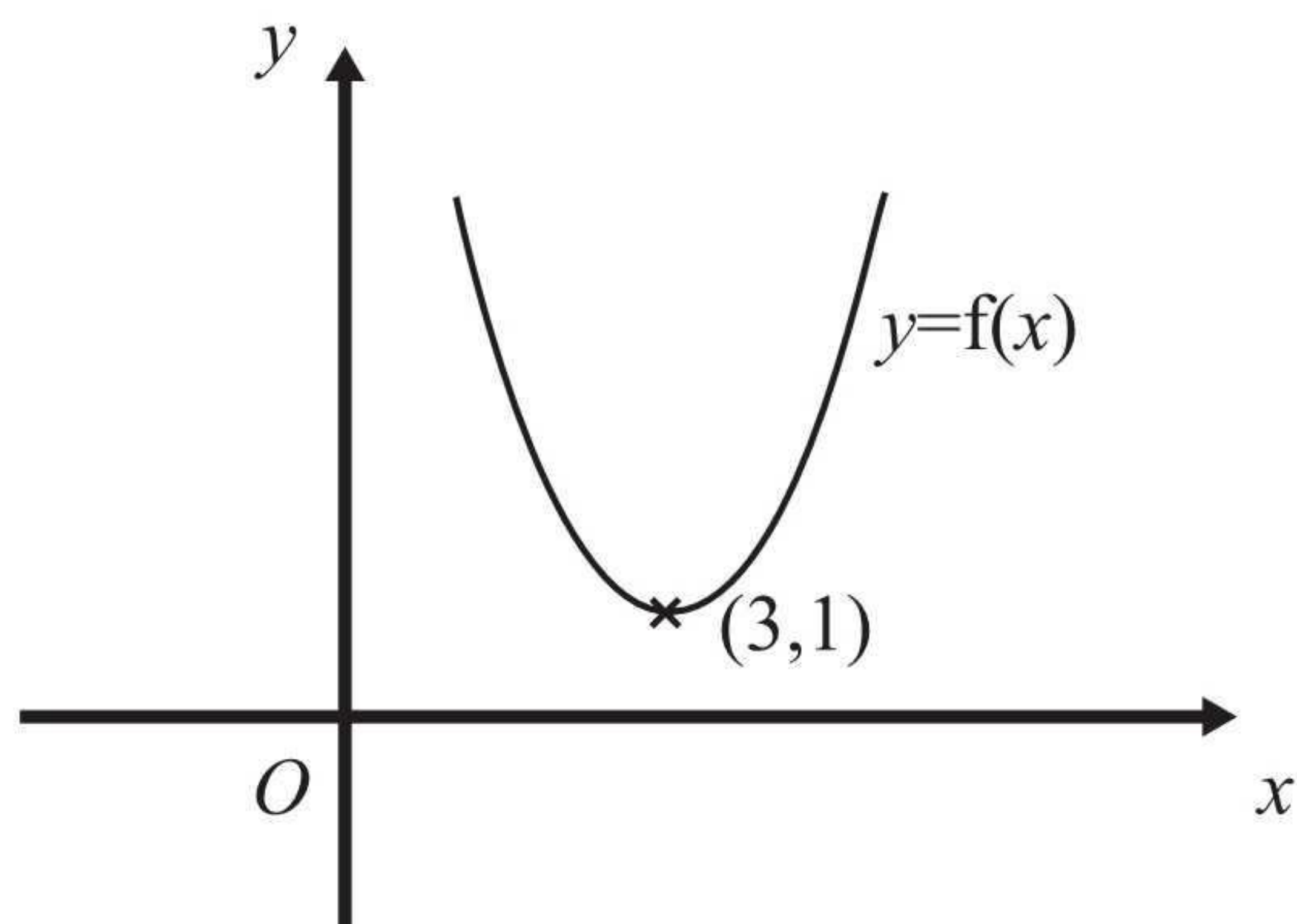
$$\begin{aligned} \vec{PN} &= \mathbf{a} + \frac{1}{3}(-\mathbf{a} + \mathbf{b}) \\ &= \mathbf{a} - \frac{1}{3}\mathbf{a} + \frac{1}{3}\mathbf{b} \\ &= \frac{2}{3}\mathbf{a} + \frac{1}{3}\mathbf{b} \end{aligned}$$

$\vec{PR}$  is a multiple of  $\vec{PN}$  and they both go through  $P \therefore$  straight line (2)

(Total for Question 24 is 5 marks)



25.



The diagram shows part of the curve with equation  $y = f(x)$ .  
The coordinates of the minimum point of this curve are  $(3,1)$ .

Write down the coordinates of the minimum point of the curve with equation

(a)  $y = f(x) + 3$  (1)  
*outside brackets changes y*  
( 3 4 )

(b)  $y = f(x - 2)$  (1)  
*inside changes x*  
( 5 1 )

(c)  $y = f\left(\frac{1}{2}x\right)$  (1)  
( 6 1 )

(Total for Question 25) = 3 marks



\*26 Solve  $\frac{3}{x-2} + \frac{8}{x+3} = 2$

To add fractions we must make the denominators the same.

$$\frac{3(x+3)}{(x-2)(x+3)} + \frac{8(x-2)}{(x-2)(x+3)} = 2$$

$$\frac{3(x+3) + 8(x-2)}{(x-2)(x+3)} = 2$$

$$3x+9 + 8x-16 = 2(x-2)(x+3)$$

$$11x-7 = 2(x^2+3x-2x-6)$$

$$11x-7 = 2(x^2+x-6)$$

$$11x-7 = 2x^2+2x-12$$

$$0 = 2x^2-9x-5$$

$$0 = (2x+1)(x-5)$$

$$\underline{x = -\frac{1}{2}} \quad \underline{x = 5}$$