

MATHEMATICS –
COMPONENT 1
NON – CALCULATOR
MATHEMATICS
HIGHER TIER

THURSDAY,
25 MAY 2017 – MORNING

2 hours 15 minutes
(plus your additional
time allowance)

THE USE OF A
CALCULATOR IS NOT
PERMITTED IN THIS
EXAMINATION

For Examiner's use only		
Question	Maximum Mark	Mark Awarded
1.	4	
2.	8	
3.	4	
4.	5	
5.	4	
6.	5	
7.	3	
8.	3	
9.	9	
10.	5	
11.	4	
12.	8	
13.	5	
14.	8	
15.	9	
16.	7	
17.	4	
18.	4	
19.	7	
20.	5	
21.	9	
Total	120	

Surname:	
Other Names:	
Centre Number:	
Candidate Number:	0

ADDITIONAL MATERIALS

A ruler, a protractor and a pair of compasses may be required.

ITEMS INCLUDED WITH QUESTION PAPER

A separate Formula List.

A separate Diagram Booklet.

A spare Diagram Booklet.

Model for Question 9 (a).

INSTRUCTIONS TO CANDIDATES

Use black ink, black ball – point pen, black felt tip or your usual method.

Write your name, centre number and candidate number in the spaces on the front cover.

Answer ALL questions.

Write your answers in the spaces provided.

If you run out of space, use the continuation pages at the back of the booklet, taking care to number the question(s) correctly.

Take π as 3.14

(Turn over)

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.

You are reminded of the need for good English and orderly, clear presentation in your answers.

- 1. Look at the information for Question 1 in the separate Diagram Booklet.**

Sasha is carrying out a survey into the amount of chocolate teenagers eat in a day.

- (a) The information shows a question from her survey:**

- (i) Explain why this is a biased question.**

[1 mark]

- (ii) State ONE other criticism of the question.**

(Turn over)

[1 mark]

1. (b) Sasha stands outside a supermarket on a Monday morning and surveys 10 people as they go in.

Are her results likely to be reliable?

Yes

☐

No

☐

Give TWO reasons to support your answer.

Reason 1: _____

Reason 2: _____

[2 marks]

(Turn over)

2. (a) Solve $7x + 2 = 3x + 4$

[2 marks]

continued on the next page . . .

(Turn over)

Question 2 continued

2. (b) Solve $3 - 2(x - 9) = 5x$

[3 marks]

continued on the next page . . .

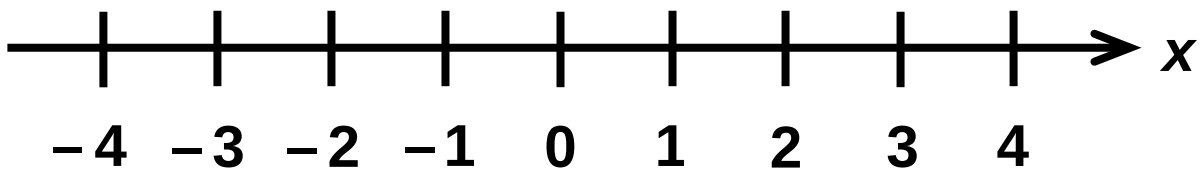
(Turn over)

Question 2 continued

2. (c) (i) Solve $7 - 3x < 1$

[2 marks]

(ii) Represent your answer to part (c) (i) on the number line below.



[1 mark]

(Turn over)

3. Look at the diagram for Question 3 in the separate Diagram Booklet.

The diagram shows a scale drawing of a lake. There are two small islands in the lake at **A** and **B**.

The lifeguard station is marked at **C**.

Swimming is only allowed in the area of the lake that is,

- nearer to **A** than it is to **B** and
- less than **120** metres from **C**.

Using a ruler and a pair of compasses, show accurately on the diagram the area where swimming is allowed.

Shade the area where swimming is allowed.

Use the scale **1 cm** represents **10 m**.

[4 marks]

(Turn over)

4. $\mathbf{p} = \begin{pmatrix} 6 \\ -1 \end{pmatrix}$ and $\mathbf{q} = \begin{pmatrix} -4 \\ 7 \end{pmatrix}$

(a) Work out the column vector $\mathbf{p} + 3\mathbf{q}$

[2 marks]

(b) When $\mathbf{p} + m\mathbf{q} = \begin{pmatrix} 10 \\ n \end{pmatrix}$

find the value of m and the value of n .

(Turn over)

$m =$ _____

$n =$ _____

[3 marks]

(Turn over)

5. Look at the table for Question 5 in the separate Diagram Booklet.

The table shows the cost of sending items using a delivery service.

Riley is planning to send TWO laptops to James using this delivery service.

The laptops are to be sent with full insurance against being lost.

Each laptop is worth £700 and has a mass of 1250 g, CORRECT TO THE NEAREST 50 g.

Riley says,

The delivery charge is MORE than £20
--

James says,

You can send these for LESS than £20
--

Explain how Riley and James could have come to their conclusions.

Show all your working and state any assumption that you make.

(Turn over)

(Turn over)

6. Look at the diagram for Question 6 in the separate Diagram Booklet.
The diagram is a Venn diagram.

Twenty people go on a trip to the seaside.

Of these 20 people

- 13 swim in the sea
- 17 go to the funfair
- 2 do not swim in the sea or go to the funfair.

- (a) Complete the Venn diagram to show this information.

[2 marks]

(Turn over)

Question 6 continued

- 6. (b) One person is chosen at random.**

Find the probability that this person swims in the sea and goes to the funfair.

[1 mark]

- (c) One person is chosen at random from those who swim in the sea.**

Find the probability that this person does not go to the funfair.

[2 marks]

(Turn over)

7. Make y the subject of this formula.

$$9x = p(8 + y) + 5$$

[3 marks]

(Turn over)

8. A shop sells BRAND *X* trainers
in three colours only.

The proportion of gold trainers sold is **0.04**

The proportion of black trainers sold
is **5** times the proportion of lime trainers.

Find the proportion of black trainers sold.

Colour	Gold	Lime	Black
Proportion	0.04		

[3 marks]

(Turn over)

9. (a) Ask for the model for Question 9 (a).

The model is NOT made to scale.

The model represents a large shipping container, with length **10 m**, width **4 m** and height **3 m**.

The shipping container is at rest on horizontal ground.

The weight of the container is **32 000 N**.

Work out the pressure exerted on the ground by the shipping container.

Give your answer in N/m^2

[2 marks]

(Turn over)

Question 9 continued

9. (b) A table is at rest on horizontal ground.

The table has 4 legs.

Each leg has a height of 50 cm.

**The volume of material in one leg
is 450 cm³**

The table weighs 54 N.

**By considering the base of the table legs,
work out the pressure exerted on the
ground by the table.**

Give your answer in N/cm²

You must show all your working.

(Turn over)

[5 marks]

continued on the next page . . .

(Turn over)

Question 9 continued

- 9. (c) (i) State ONE assumption you have made in your answer to part (b).**

[1 mark]

- (ii) How would your answer to part (b) change if you had not made this assumption?**

[1 mark]

(Turn over)

10 Look at the diagram for Question 10 in the separate Diagram Booklet.

The diagram is NOT drawn to scale.

(a) Show that the interior angle of a regular octagon is 135°

[2 marks]

(b) The shaded shape is formed by cutting a kite from a regular octagon as shown in the diagram.

Prove that $y = 2x - 135$

You must give reasons to support your statements.

(Turn over)

[3 marks]

(Turn over)

- 11. Look at the diagram for Question 11 in the separate Diagram Booklet.**

The diagram is NOT drawn to scale.

Gabby buys a chest of drawers and a computer desk to fit side by side between two walls in her bedroom.

The width of the chest of drawers is 45 cm, correct to the nearest cm.

The width of the computer desk is 60 cm, correct to the nearest cm.

The two walls are 1.2 m apart, correct to the nearest 10 cm.

Calculate the least possible width of the gap remaining when Gabby's furniture is in place.

(Turn over)

[4 marks]

(Turn over)

- 12. Look at the table for Question 12 in the separate Diagram Booklet.**

The table shows information about the length (in minutes) of phone calls made between two college friends during March.

- (a) Complete the frequency density column in the table.**

[1 mark]

- (b) On the diagram provided for Question 12 (b) in the separate Diagram Booklet, draw a histogram to illustrate the data in the table.**

[2 marks]

continued on the next page . . .

(Turn over)

Question 12 continued

- 12. (c) Estimate the fraction of calls that lasted for more than 35 minutes.**

[2 marks]

- (d) Look at the diagram for Question 12 (d) in the separate Diagram Booklet.**

This histogram shows the length of calls made between the same two college friends during April.

How many phone calls were made during April?

[2 marks]

(Turn over)

Question 12 continued

- 12. (e) During one of the months, the college friends had examinations.**

Compare the two histograms and explain which month this is likely to be.

[1 mark]

(Turn over)

13. (a) Evaluate each of the following.

$$\left(\frac{49}{4}\right)^{\frac{1}{2}} =$$

$$125^0 =$$

$$8^{\frac{2}{3}} =$$

$$0.75^{-1} =$$

[3 marks]

(Turn over)

Question 13 continued

13. (b) $\sqrt[4]{100}$ lies between two consecutive whole numbers.

Complete the following statement:

$\sqrt[4]{100}$ lies between the two consecutive whole numbers _____ and _____

Space for working:

[2 marks]
(Turn over)

14. Look at the diagram for Question 14 in the separate Diagram Booklet.

The diagram is NOT drawn to scale.

The diagram shows the points $P(1, -4)$ and $Q(7, q)$, joined by a straight line.

The gradient of PQ is $\frac{5}{3}$

- (a) Find the value of q .

[3 marks]

continued on the next page . . .

(Turn over)

Question 14 continued

14. (b) The line L_1 is parallel to the line PQ and passes through the point $(3, 0)$

Where does the line L_1 cross the y – axis?

[2 marks]

continued on the next page . . .

(Turn over)

Question 14 continued

14. (c) The line L_2 is perpendicular to the line PQ and passes through the point $(-5, 1)$
Find the equation of L_2

[3 marks]

(Turn over)

15. (a) Look at the diagram for Question 15 (a) in the separate Diagram Booklet.

The diagram is NOT drawn to scale.

PQRS is a cyclic quadrilateral of a circle, centre ***O***.

Angle ***SPQ*** = 54°

The ratio of angle ***OSR*** to angle ***OQR*** is **2 : 1**

- (i) Find angle ***SOQ***.

Give a reason for your answer.

[2 marks]

continued on the next page . . .

(Turn over)

Question 15 (a) continued

15. (a) (ii) Find angle *SRQ*.

[1 mark]

continued on the next page . . .

(Turn over)

Question 15 (a) continued

15. (a) (iii) Calculate the size of angle *OSR*.

[3 marks]

continued on the next page . . .

(Turn over)

Question 15 continued

15. (b) Look at the diagram for Question 15 (b) in the separate Diagram Booklet.

The diagram is NOT drawn to scale.

The diagram shows points A , B , C and D on the circumference of a circle.

AC and BD intersect at the point E .

Show clearly that triangle AEB is similar to triangle DEC .

Give a reason for each step of your answer.

[3 marks]

16. (a) Simplify each of the following.

(i) $\frac{15}{\sqrt{5}}$

[2 marks]

(ii) $\sqrt{300} - \sqrt{27}$

[2 marks]

continued on the next page . . .

(Turn over)

Question 16 continued

16. (b) Tom says:

“Expanding and simplifying

$(c + \sqrt{2})(d - \sqrt{2})$ where c and d

are integers, can never have an integer answer.”

Show that Tom’s statement is incorrect.

Give the reasons to support your decision.

[3 marks]
(Turn over)

17. Look at the diagram for Question 17 in the separate Diagram Booklet.

The diagram is NOT drawn to scale.

In this question all dimensions are in centimetres.

The diagram shows a sketch of two circles, both with centre O .

The line AB is a chord of the outer circle and a tangent to the inner circle.

The length of AB is 24

The equation of the outer circle is

$$x^2 + y^2 = 13^2$$

Find the equation of the inner circle.

(Turn over)

[4 marks]

(Turn over)

- 18. Look at the diagram for Question 18 in the separate Diagram Booklet.**

The diagram shows a sketch of the graph of $y = f(x)$.

The point A has coordinates $(1, 0)$ and the point B has coordinates $(0, 2)$

- (a) On the diagram provided for Question 18 (a) in the separate Diagram Booklet, sketch the graph of $y = -f(x)$ on the axes.**

You must indicate the coordinates of the new positions of the points A and B .

[2 marks]

- (b) On the diagram provided for Question 18 (b) in the separate Diagram Booklet, sketch the graph of $y = f(x) - 3$ on the axes.**

You must indicate the coordinates of the new positions of the points A and B .

[2 marks]

(Turn over)

19. Water in a tank is X cm deep.

The tank has a tap which is slightly open.

The rate, $R \text{ cm}^3$ per minute, at which the volume of water decreases is proportional to the square root of X .

When the water is 81 cm deep, the volume of water decreases at the rate of 900 cm^3 per minute.

(a) Find the rate at which the volume of water decreases when the depth of the water is 9 cm.

(Turn over)

[5 marks]

19. (b) Find the depth of the water when the rate at which the volume of water decreases is 400 cm^3 per minute.

[2 marks]

(Turn over)

20. The functions $g(x)$ and $h(x)$ are defined, for $x > 2$, by

$$g(x) = x^2 - 1$$

$$h(x) = 3x$$

- (a) Find the value of $hg(9)$

[2 marks]

- (b) Find and simplify an expression for $gh(2x)$

(Turn over)

[3 marks]

- 21. A manufacturer wants to test the performance of a new fuel.**

In the test, a total of 20 litres of the fuel is shared between a car and a motorbike.

- (a) The car uses X litres of fuel in the test.**

Write an expression in terms of X for the number of litres used by the motorbike.

[1 mark]

continued on the next page . . .

(Turn over)

Question 21 continued

- 21. (b) Look at the table for Question 21 (b) in the separate Diagram Booklet.**

The vehicles are driven and the distance travelled is recorded.

The table shows some of the test results.

The motorbike averaged 2 miles per litre more than the car in the test.

- (i) Show that X satisfies the equation**

$$x^2 + 84x - 1600 = 0$$

(Turn over)

continued on the next page . . .

(Turn over)

Question 21 (b) continued

21. (b) (ii) Using an algebraic method, find the number of litres of fuel used by the motorbike.

[illegible]

(Turn over)

[3 marks]

END OF PAPER
TOTAL 120 MARKS

(Turn over)

Question number	Additional Pages, if required. Write the question number in the left - hand margin.

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GCSE – NEW
C300UA0-1



MATHEMATICS – COMPONENT 1
NON – CALCULATOR MATHEMATICS
HIGHER TIER

THURSDAY, 25 MAY 2017 – MORNING

Diagram Booklet

Surname:	
Other Names:	
Centre Number:	
Candidate Number:	0

Question 1

Information

Too much chocolate is bad for your health.

How many pieces of chocolate did you eat yesterday?

Tick (✓) one box.

1 – 2

☐

3 – 4

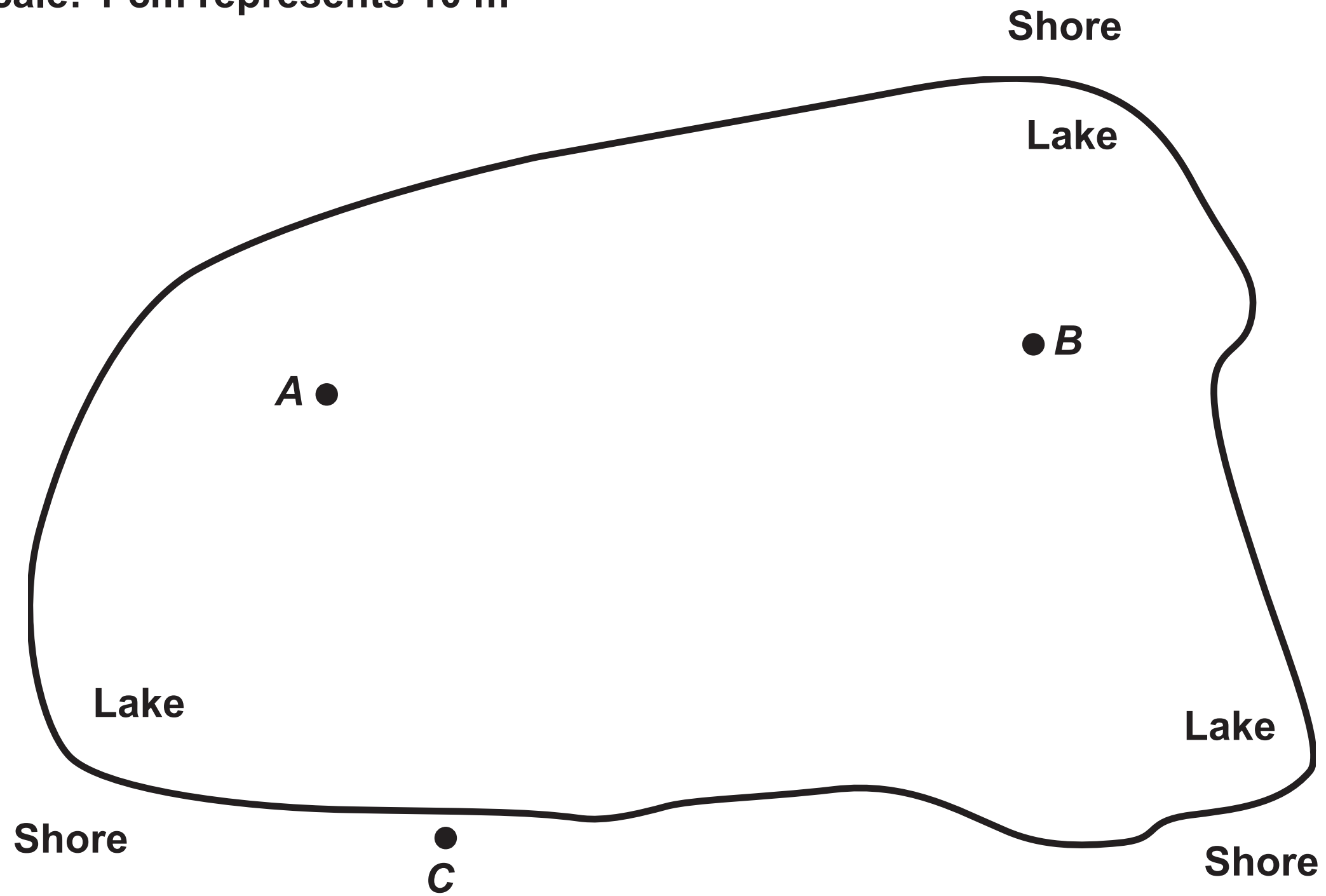
☐

5 – 6

☐

Question 3

Scale: 1 cm represents 10 m

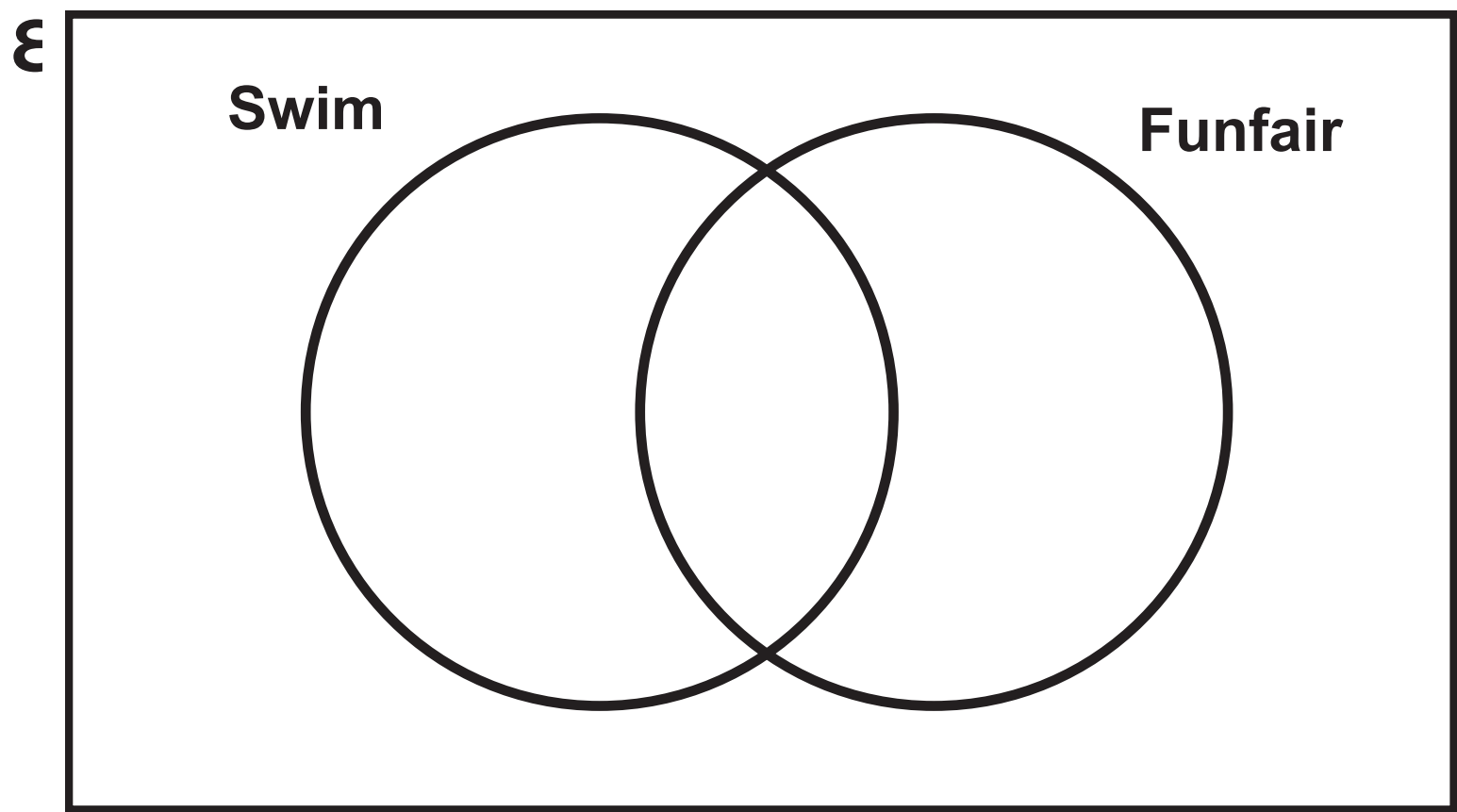


Question 5

Table

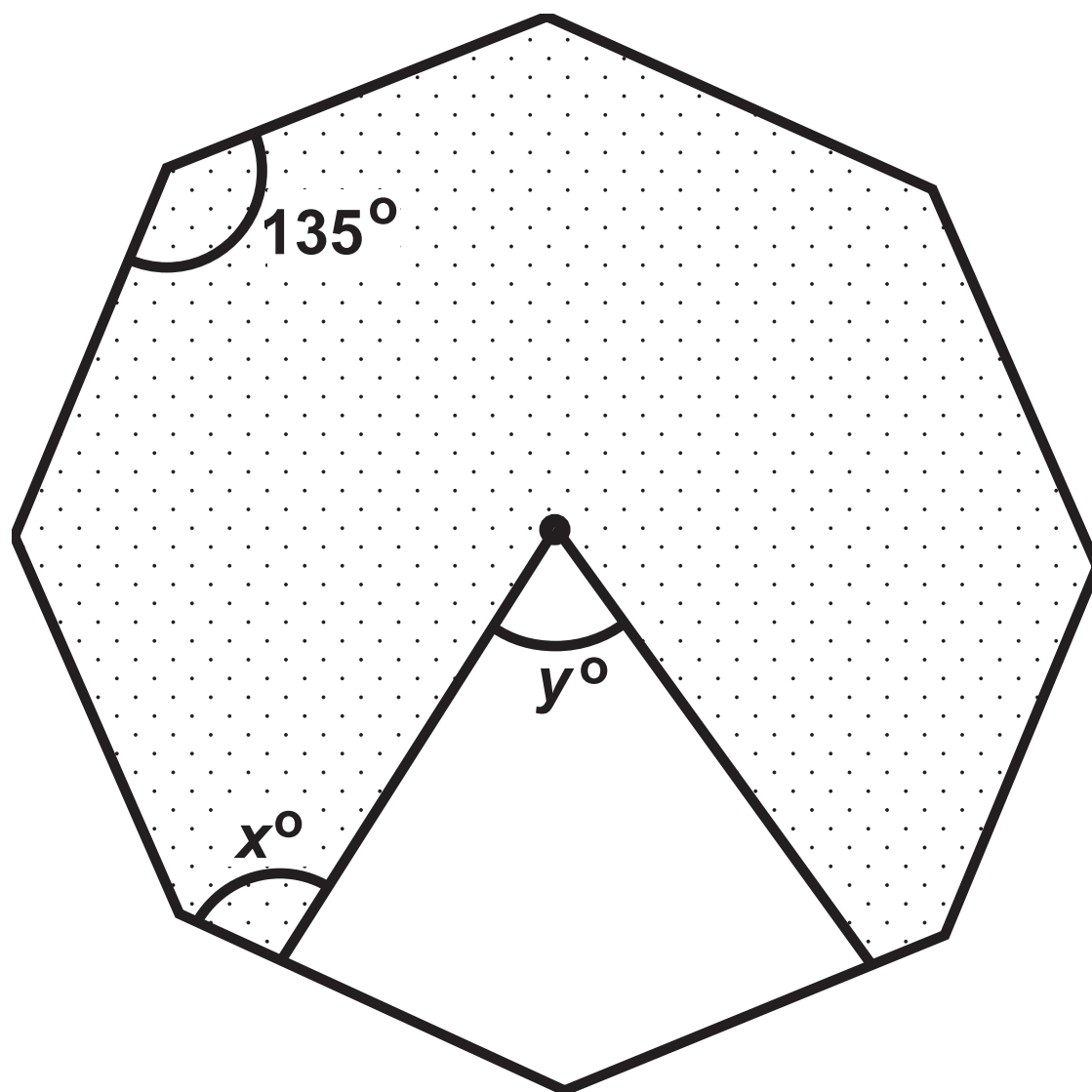
MASS LESS THAN	FULL INSURANCE AGAINST BEING LOST:		
	£250	£750	£1500
100 g	£5	£7	£9
250 g	£7.50	£9.50	£11.50
1000 g	£9.25	£11.25	£13.25
1750 g	£11	£13	£15
2500 g	£13.50	£15.50	£17.50
5000 g	£18	£20	£22

Question 6



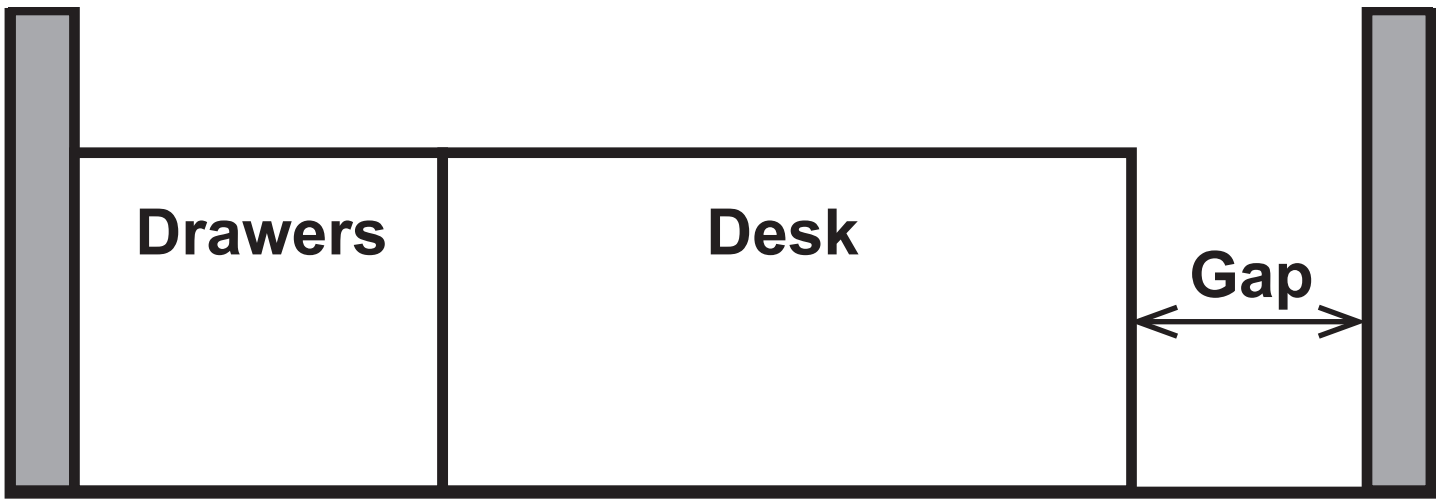
Question 10

Diagram NOT drawn to scale



Question 11

Diagram NOT drawn to scale

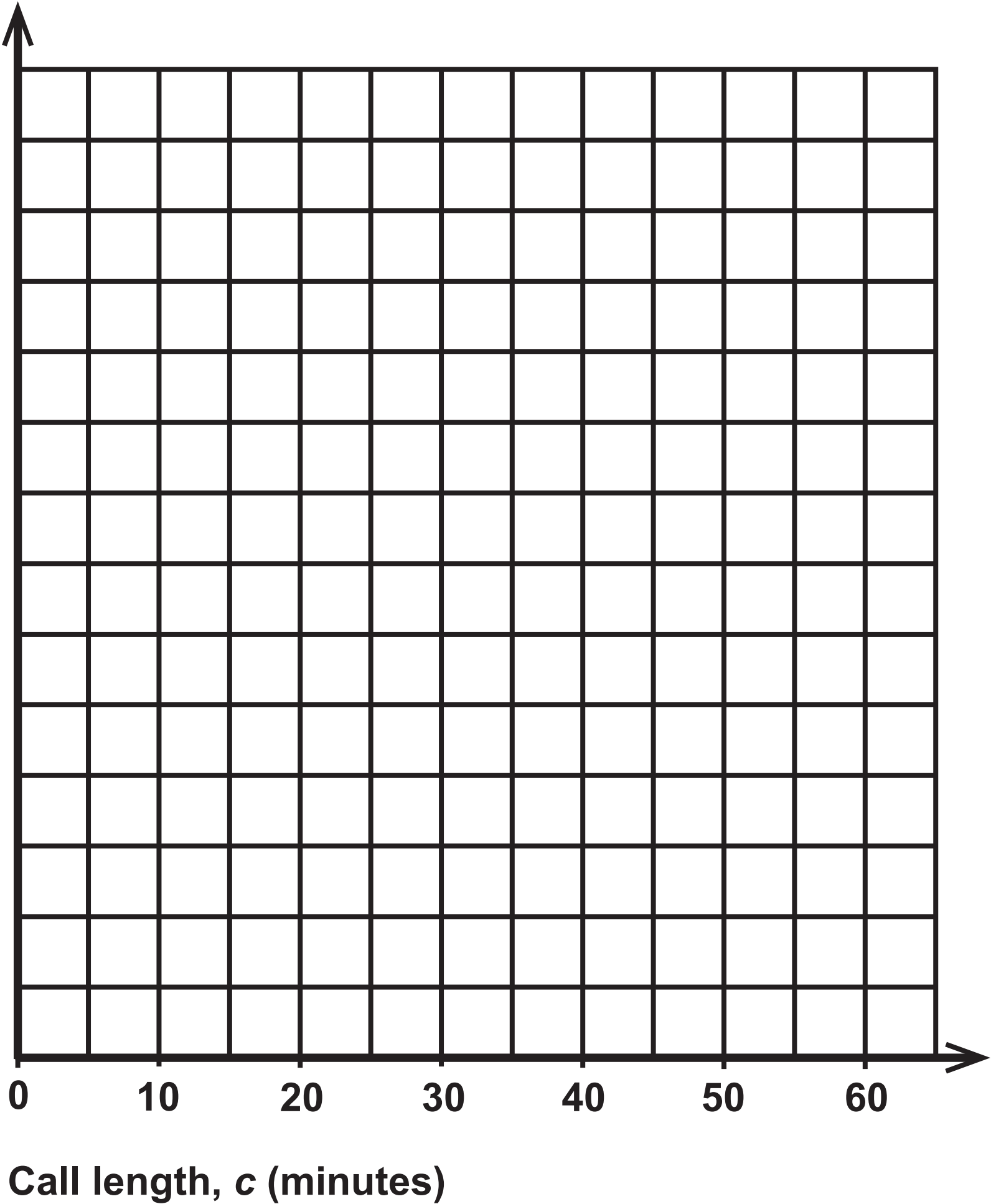


Question 12

Table

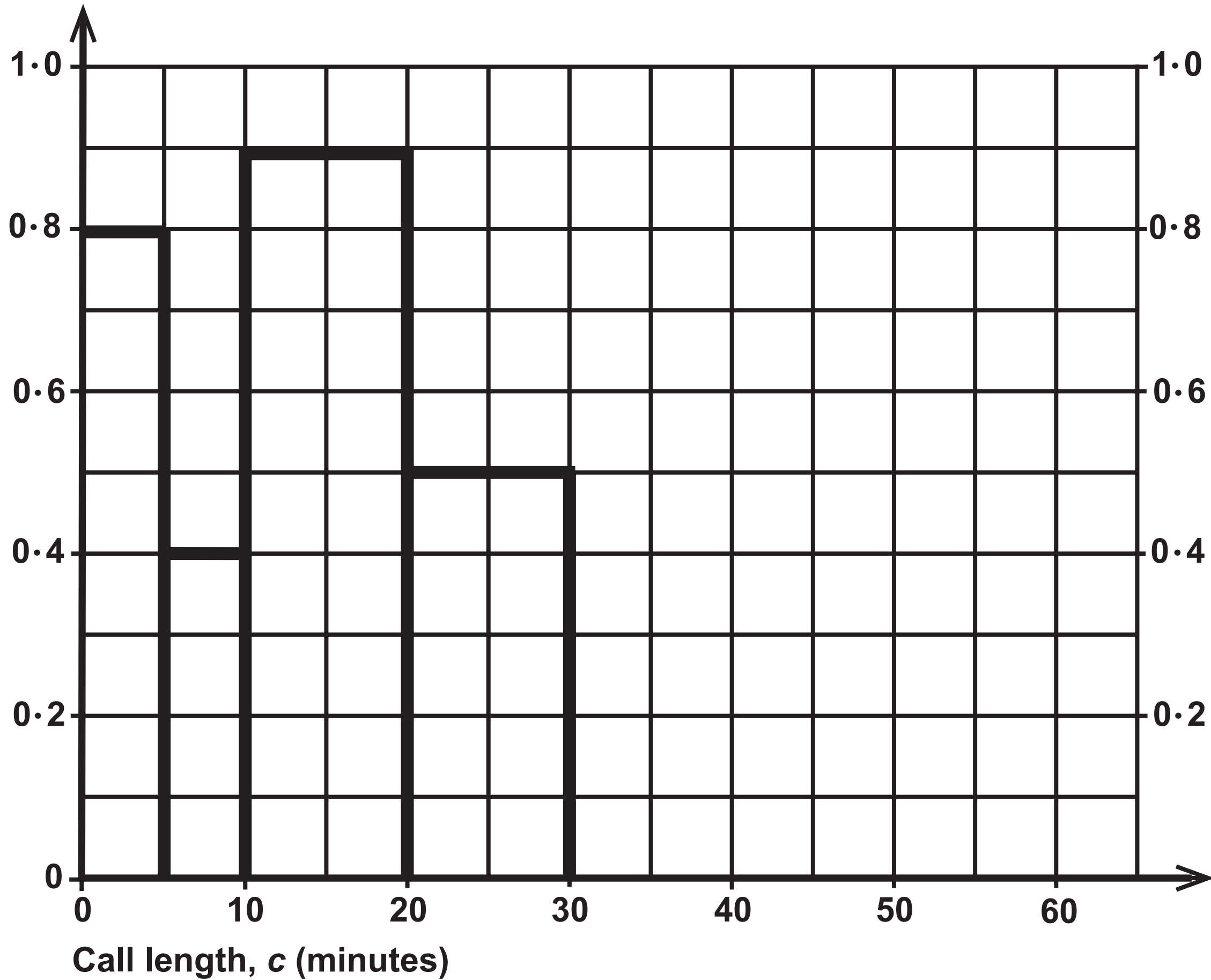
Call length, c (minutes)	Frequency	Frequency density
$0 < c \leq 5$	3	
$5 < c \leq 10$	4	
$10 < c \leq 20$	7	
$20 < c \leq 30$	12	
$30 < c \leq 60$	6	

Question 12 (b)



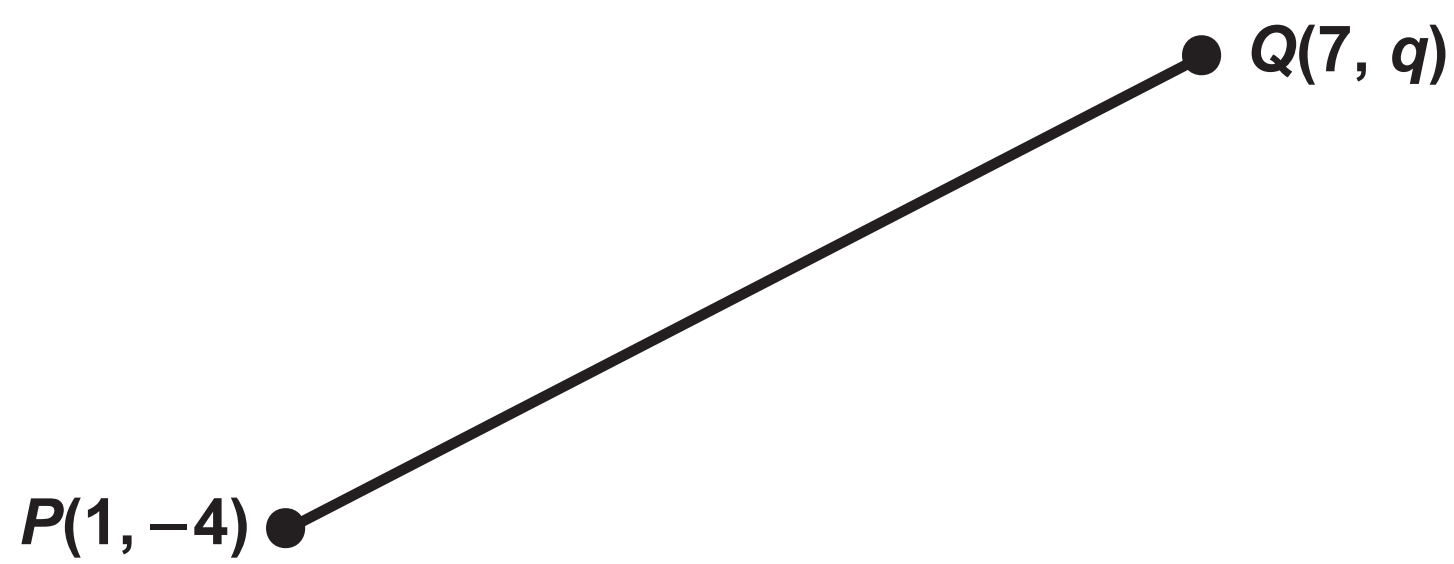
Question 12 (d)

Frequency density



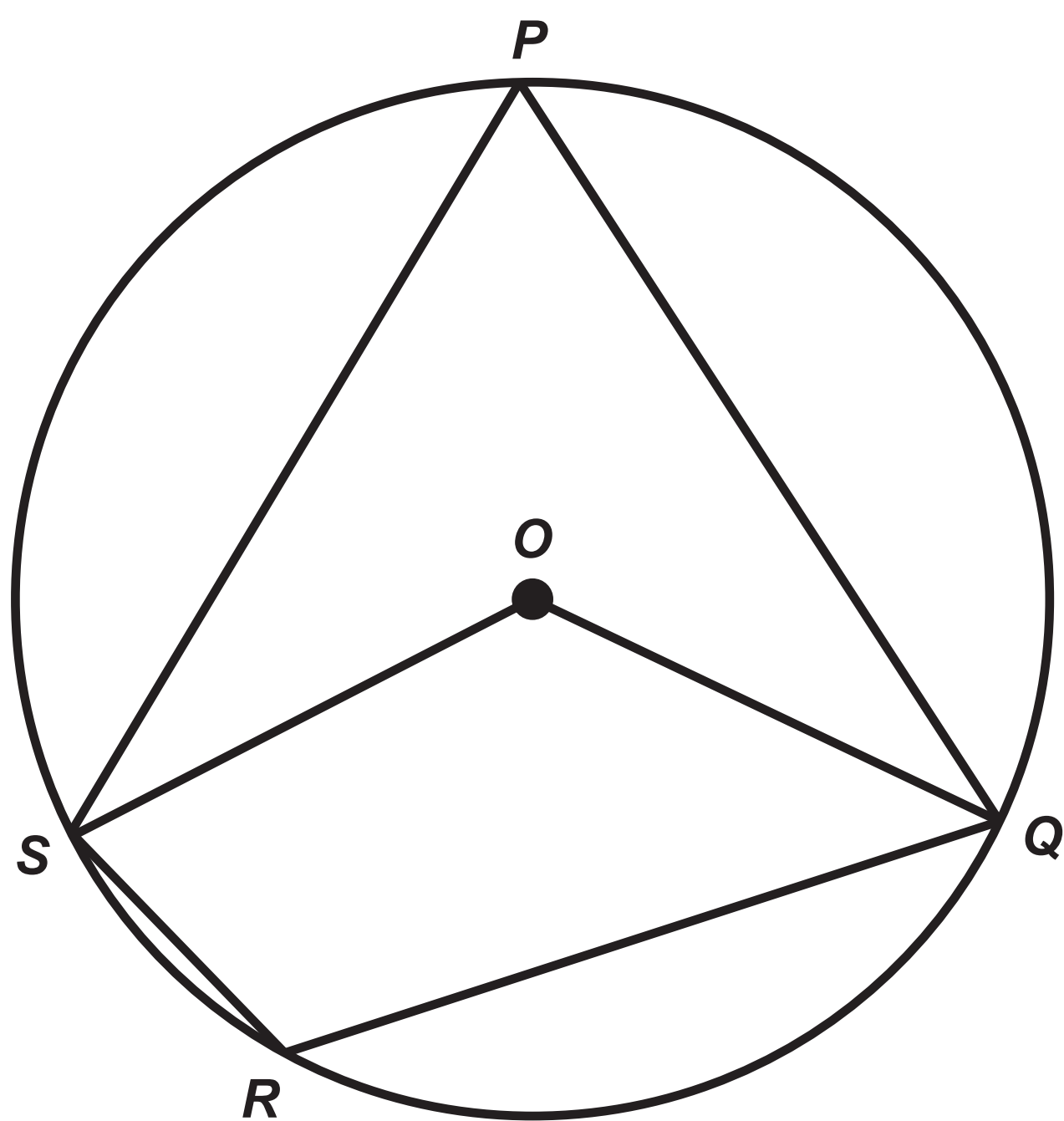
Question 14

Diagram NOT drawn to scale



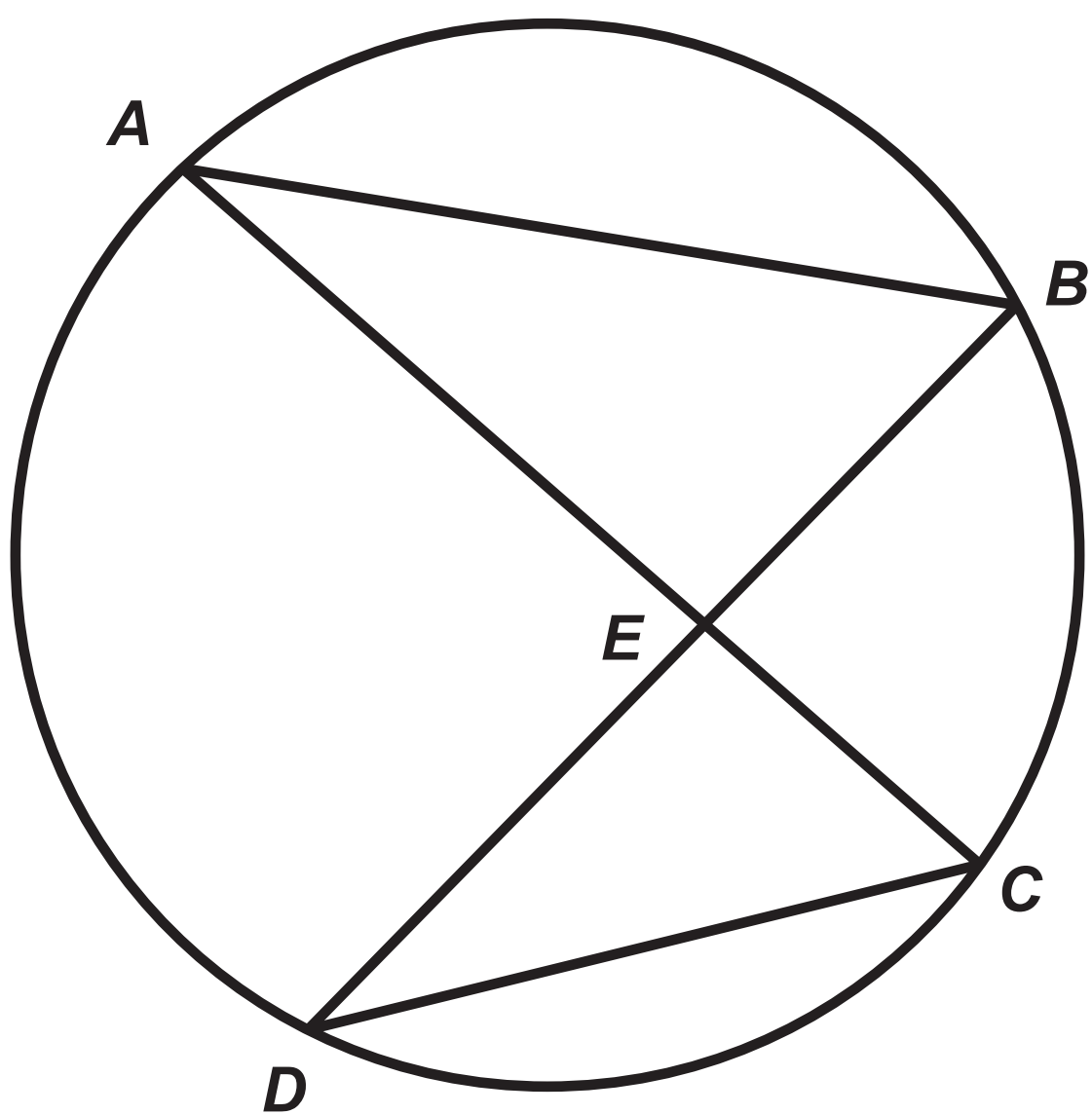
Question 15 (a)

Diagram NOT drawn to scale



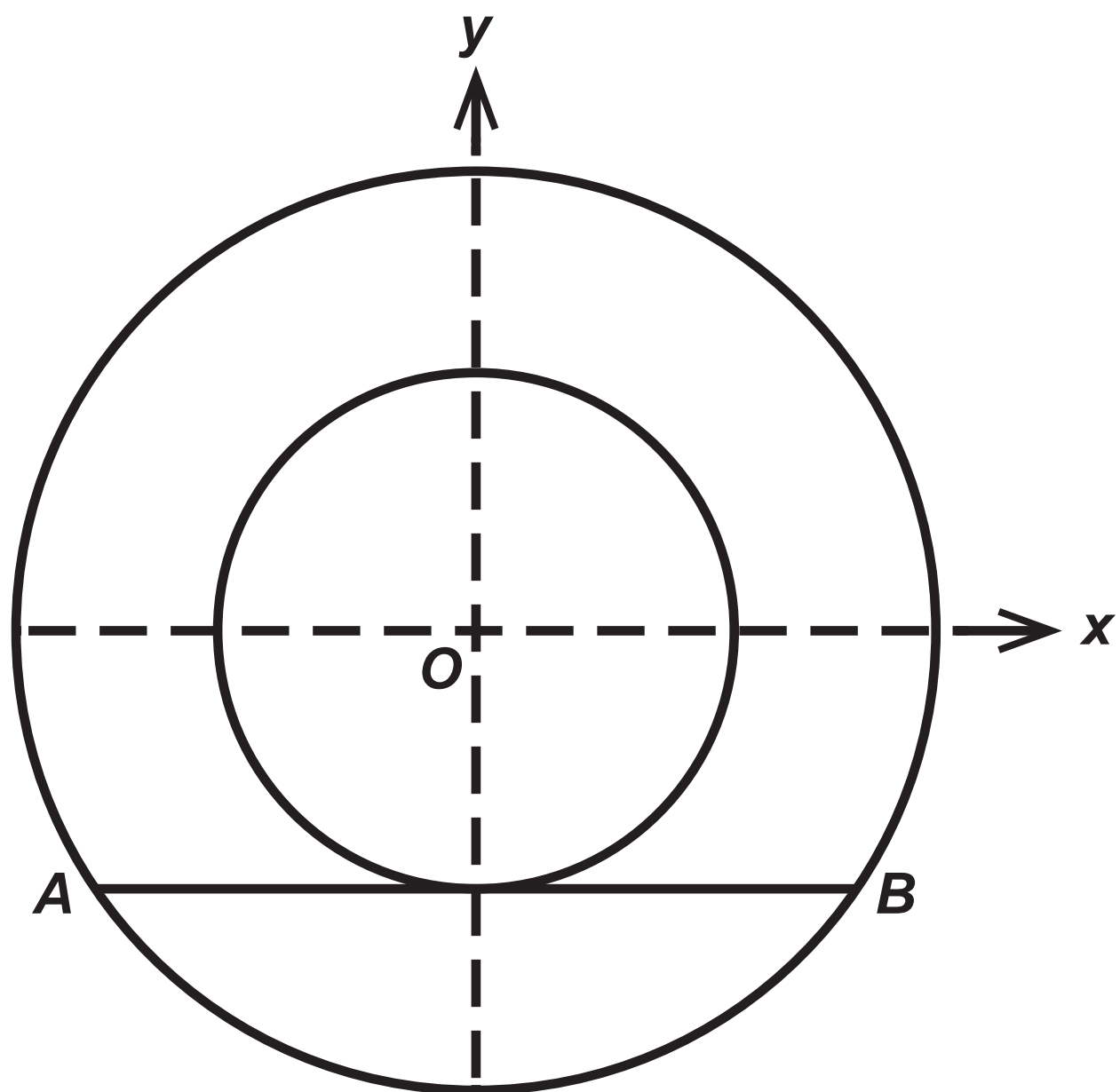
Question 15 (b)

Diagram NOT drawn to scale

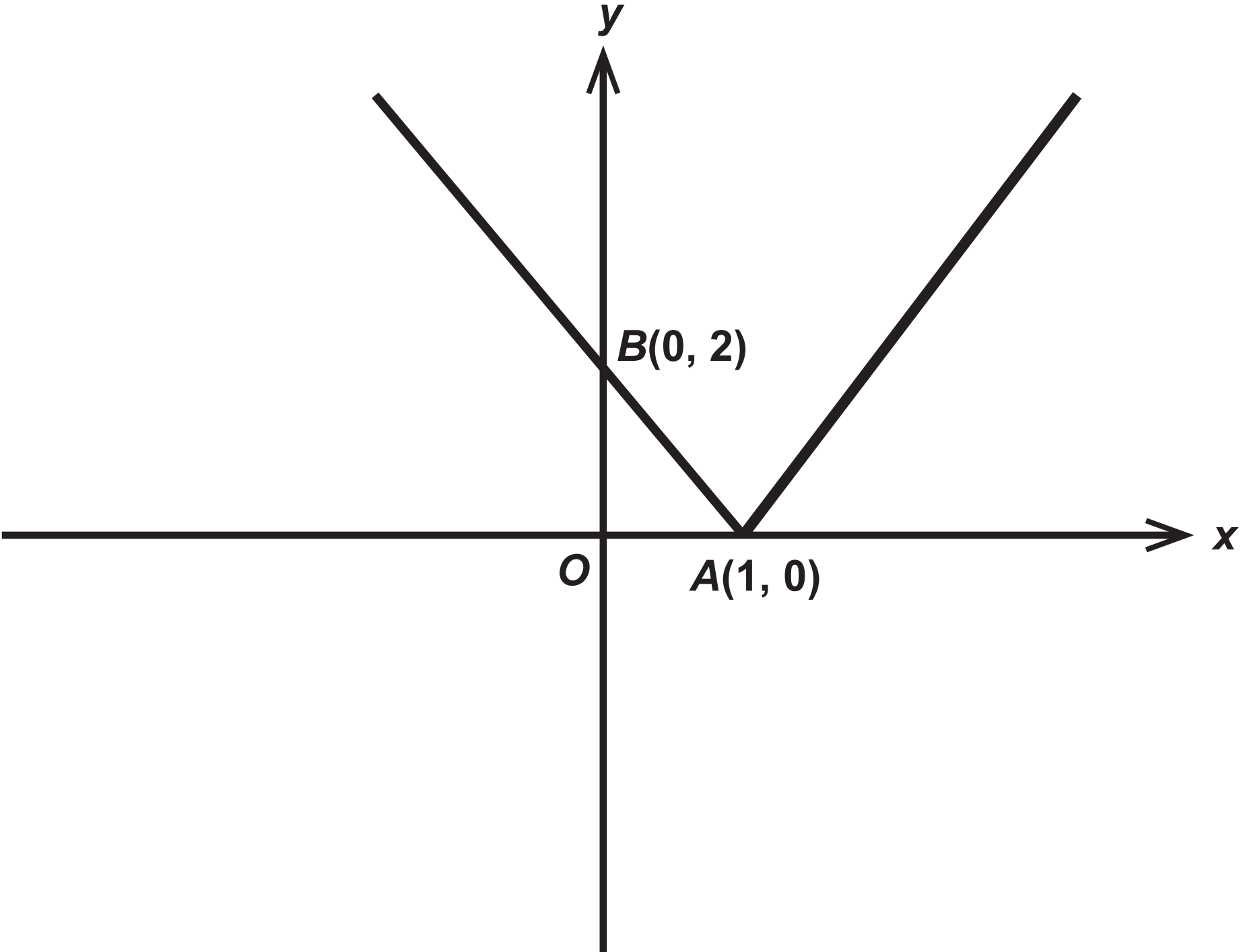


Question 17

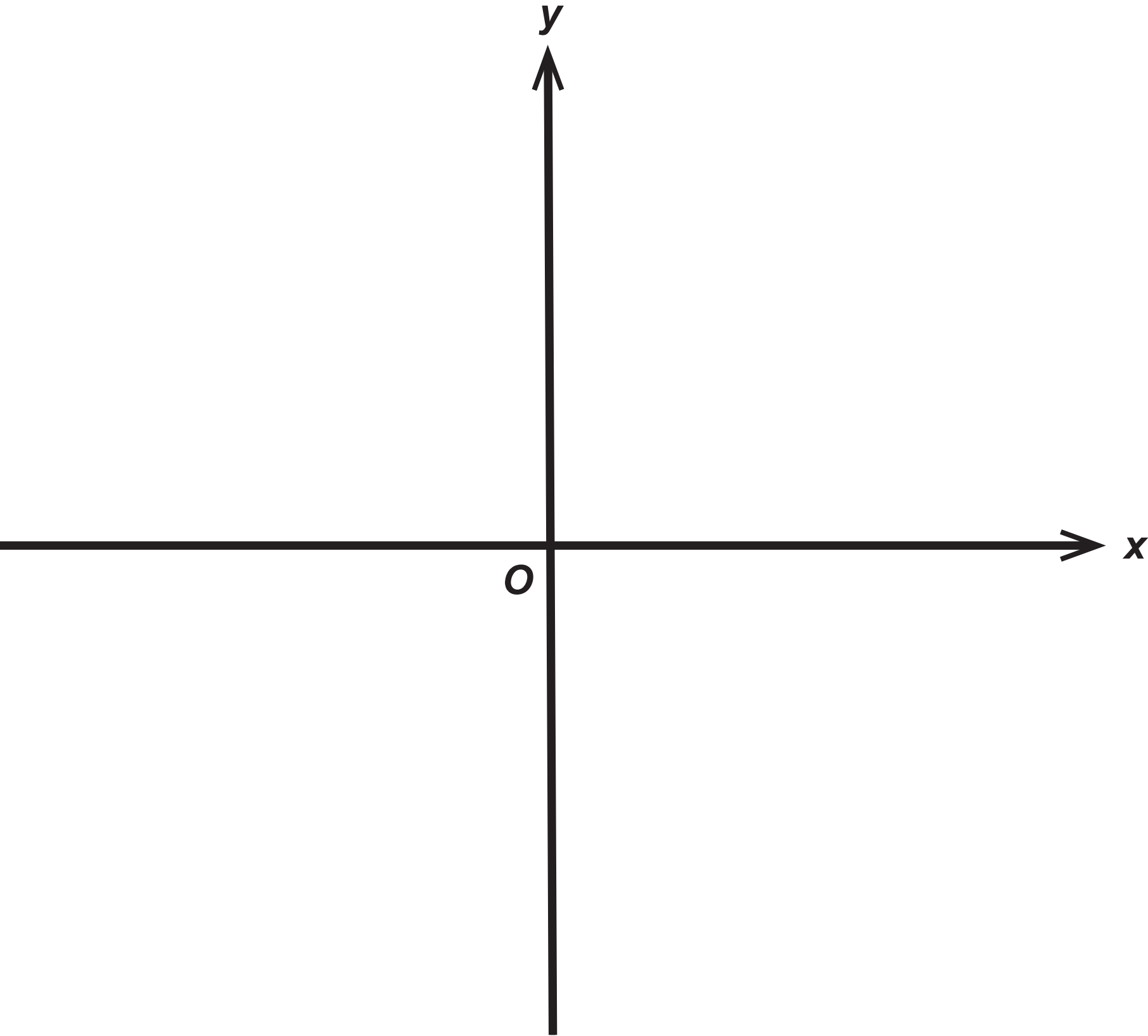
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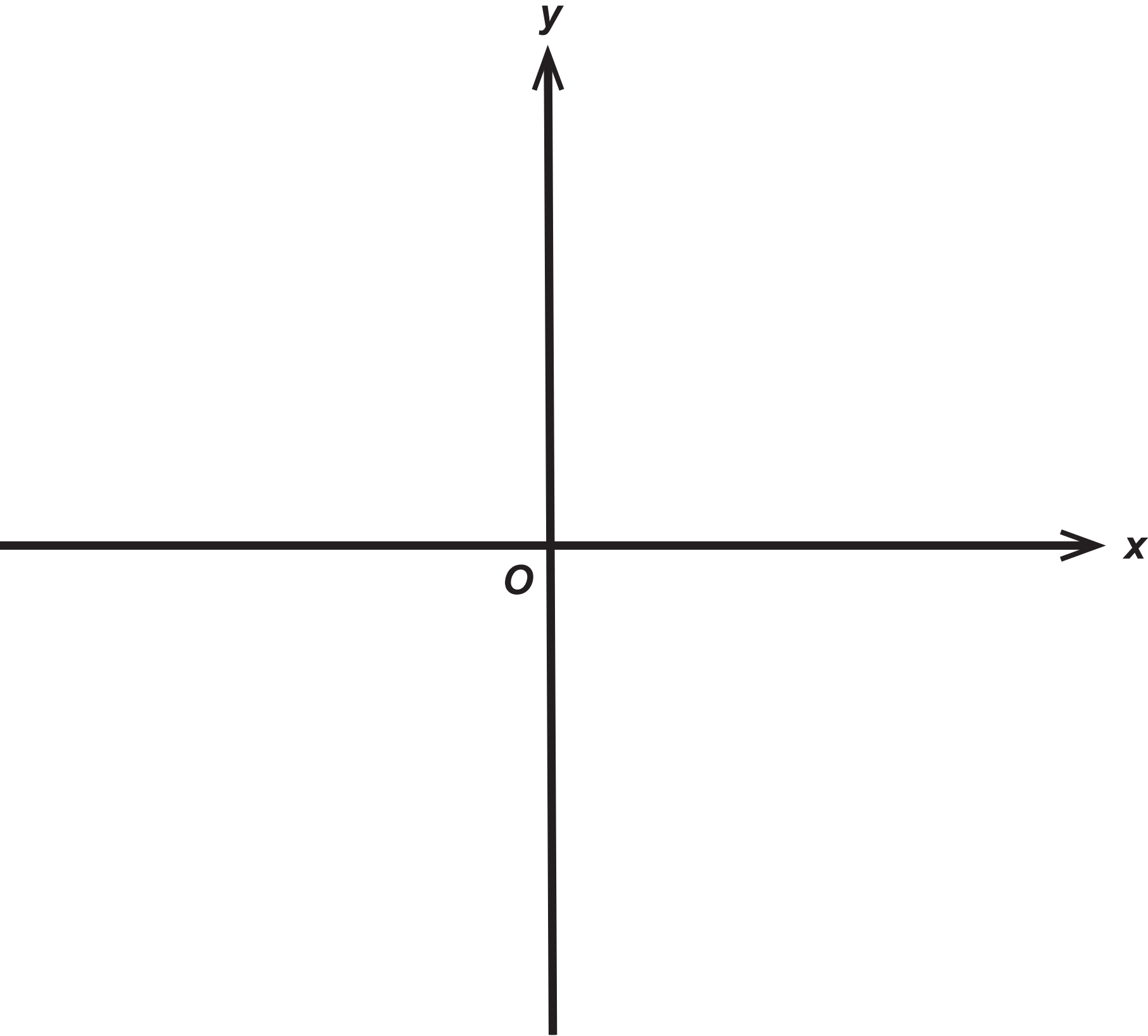
Question 18



Question 18 (a)



Question 18 (b)



Question 21 (b)

Table

	Car	Motorbike
Distance travelled (miles)	160	48
Fuel used (litres)	x	
Fuel consumption (Miles per litre)	$\frac{160}{x}$	



GCSE – NEW
C300UA0-1



MATHEMATICS – COMPONENT 1
NON – CALCULATOR MATHEMATICS
HIGHER TIER

THURSDAY, 25 MAY 2017 – MORNING

Spare Diagram Booklet

Surname:	
Other Names:	
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Candidate Number:	0

Question 1

Information

Too much chocolate is bad for your health.

How many pieces of chocolate did you eat yesterday?

Tick (✓) one box.

1 – 2

☐

3 – 4

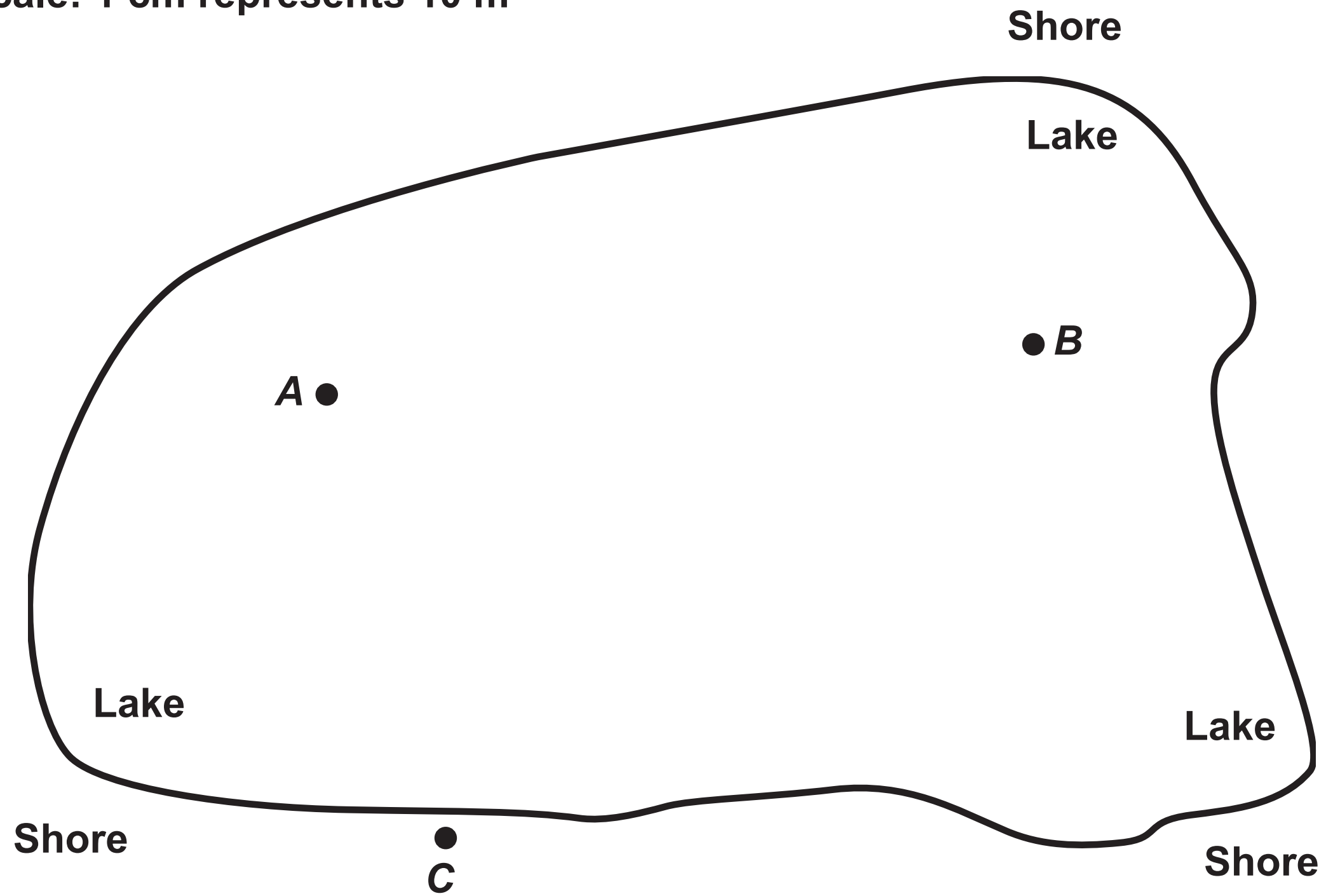
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5 – 6

☐

Question 3

Scale: 1 cm represents 10 m

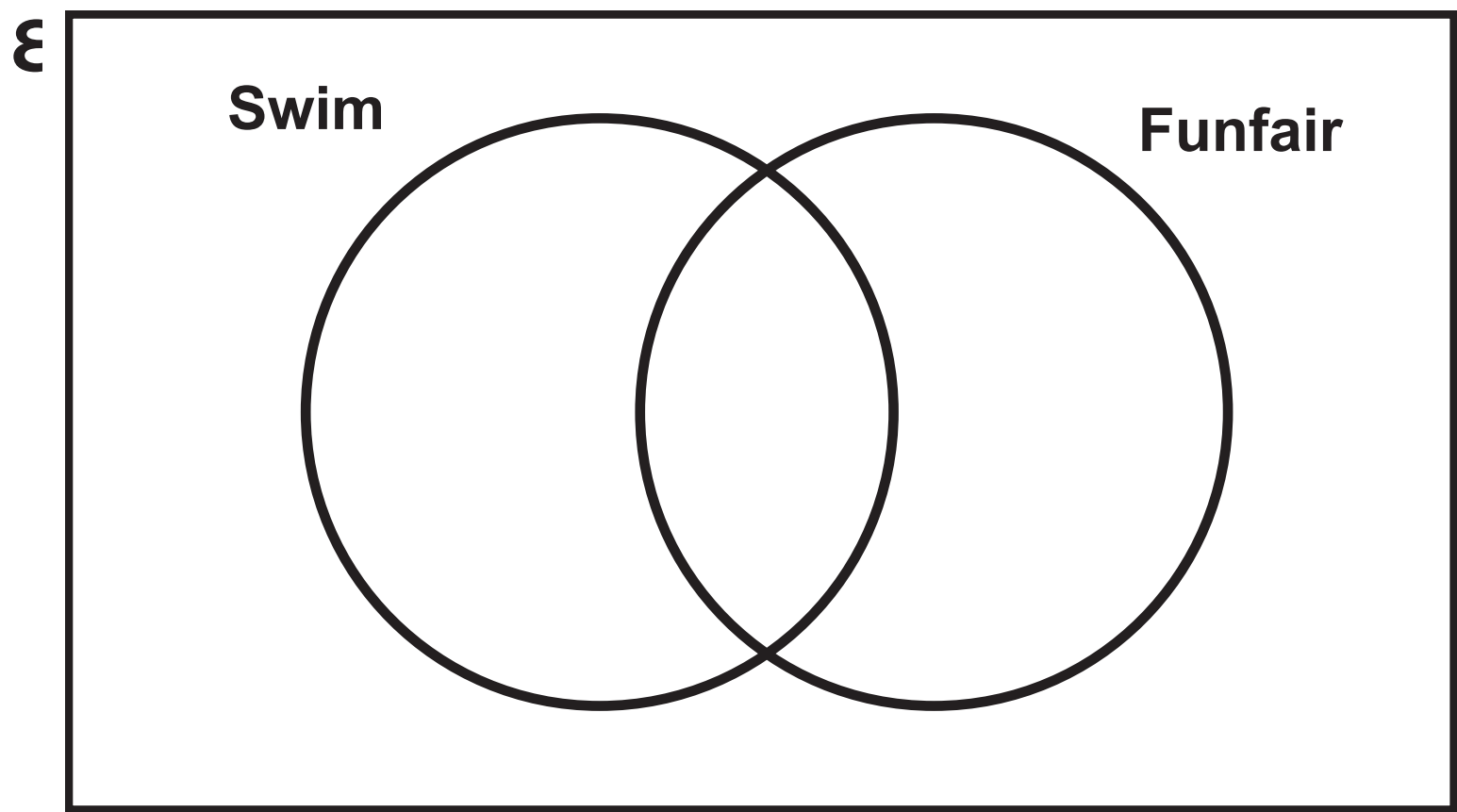


Question 5

Table

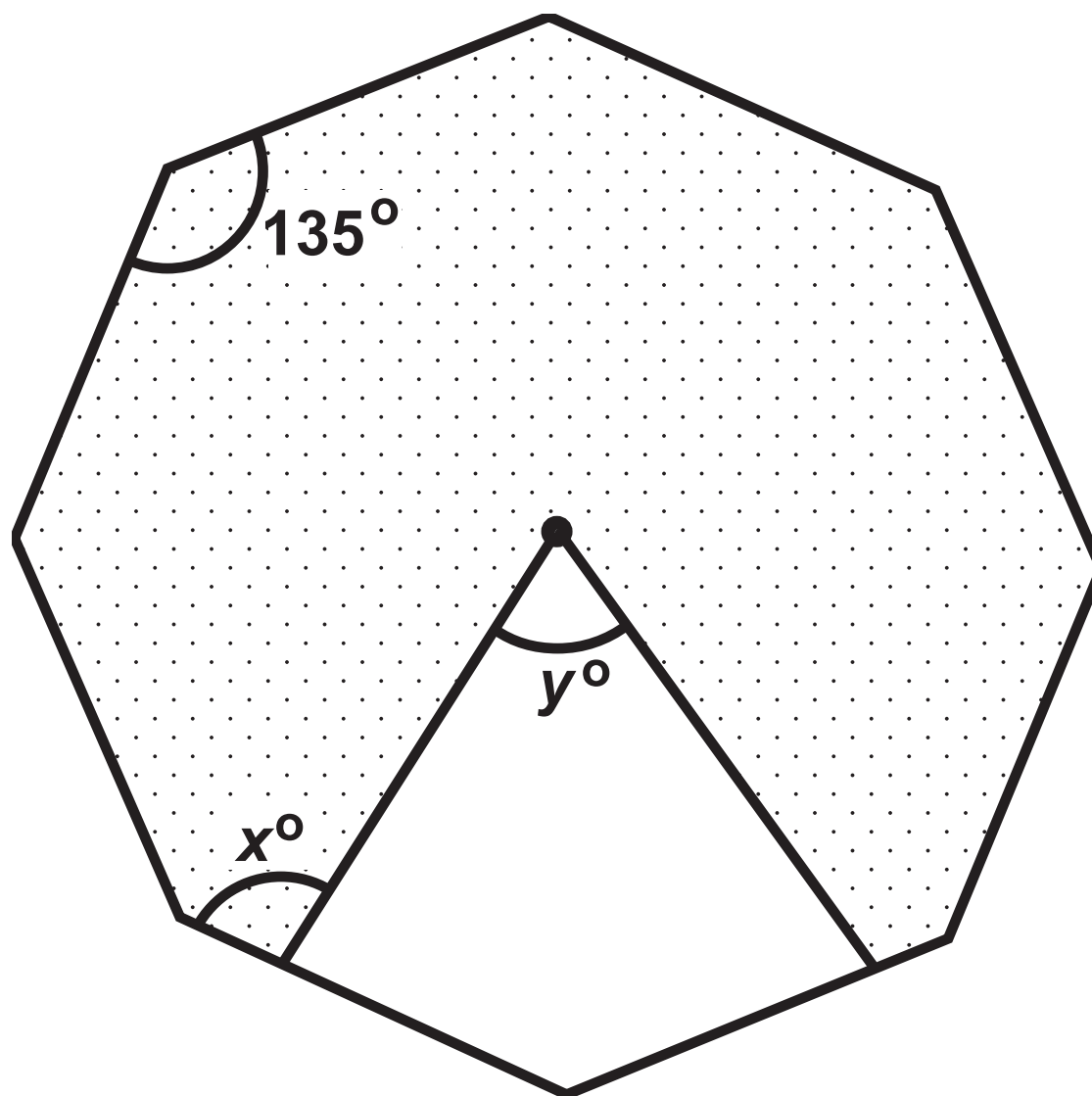
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Question 6



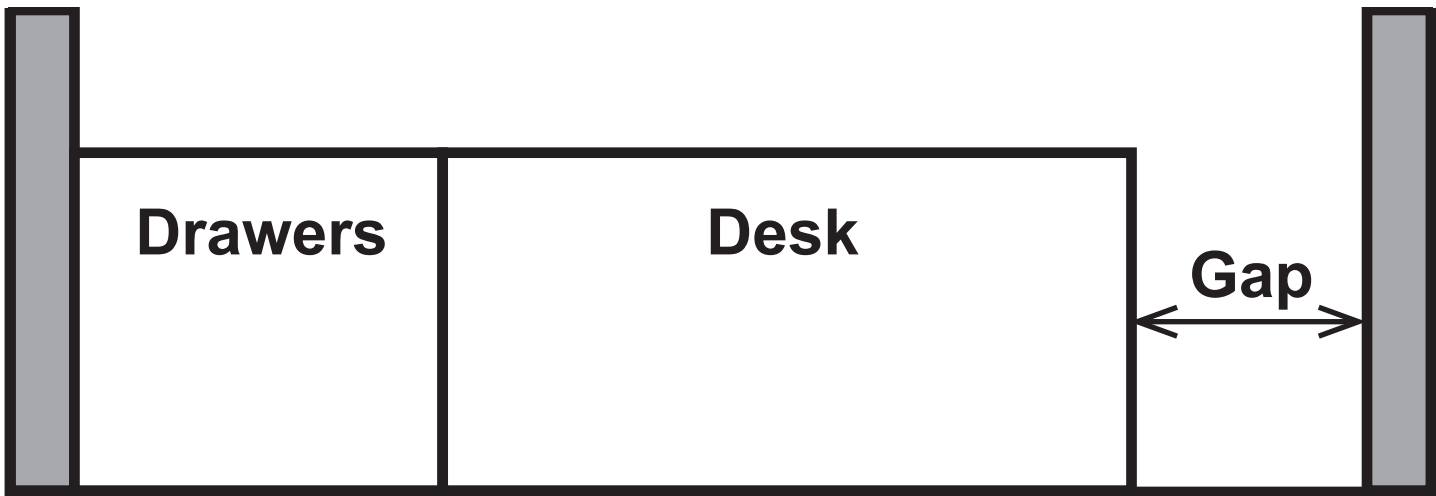
Question 10

Diagram NOT drawn to scale



Question 11

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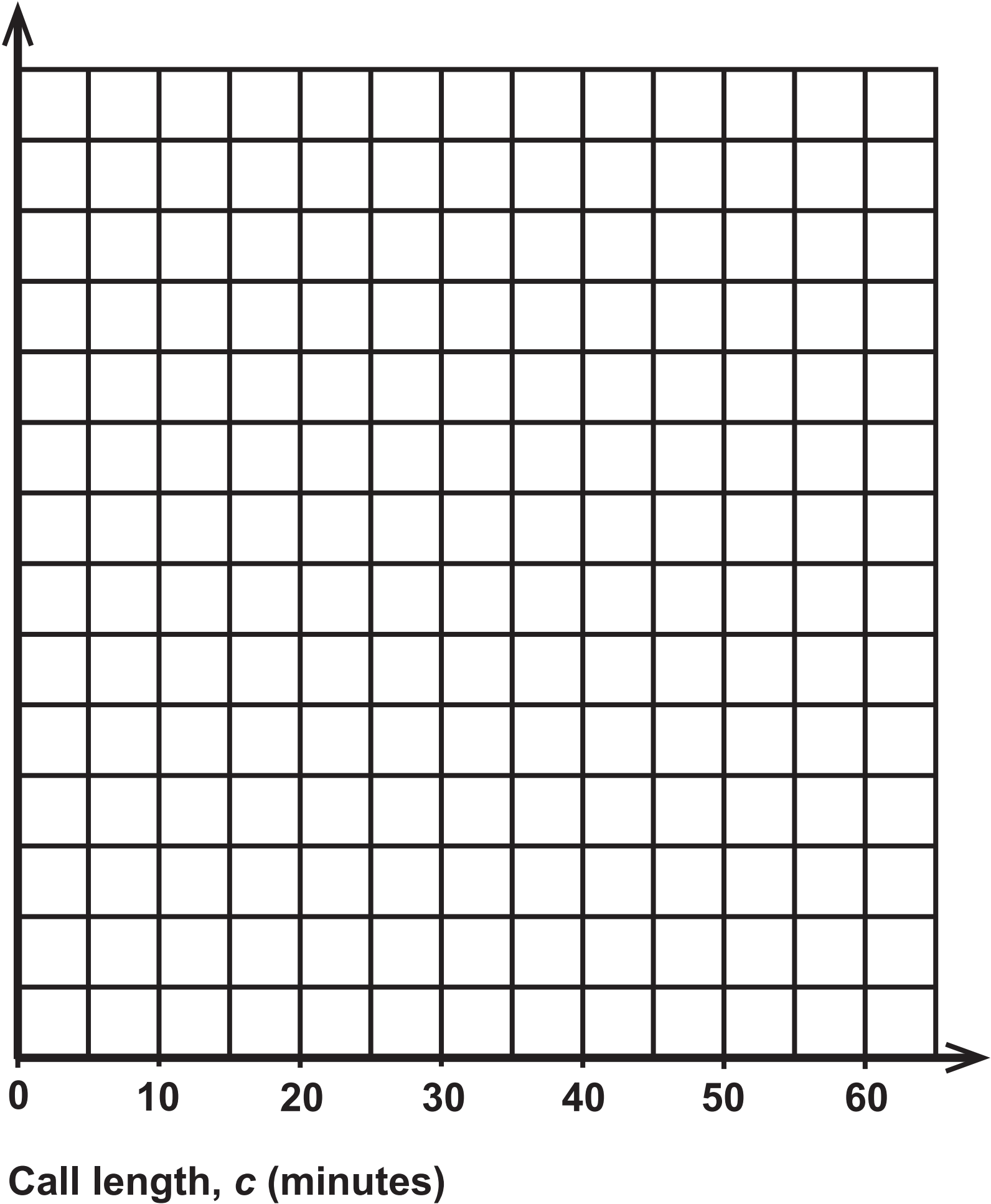


Question 12

Table

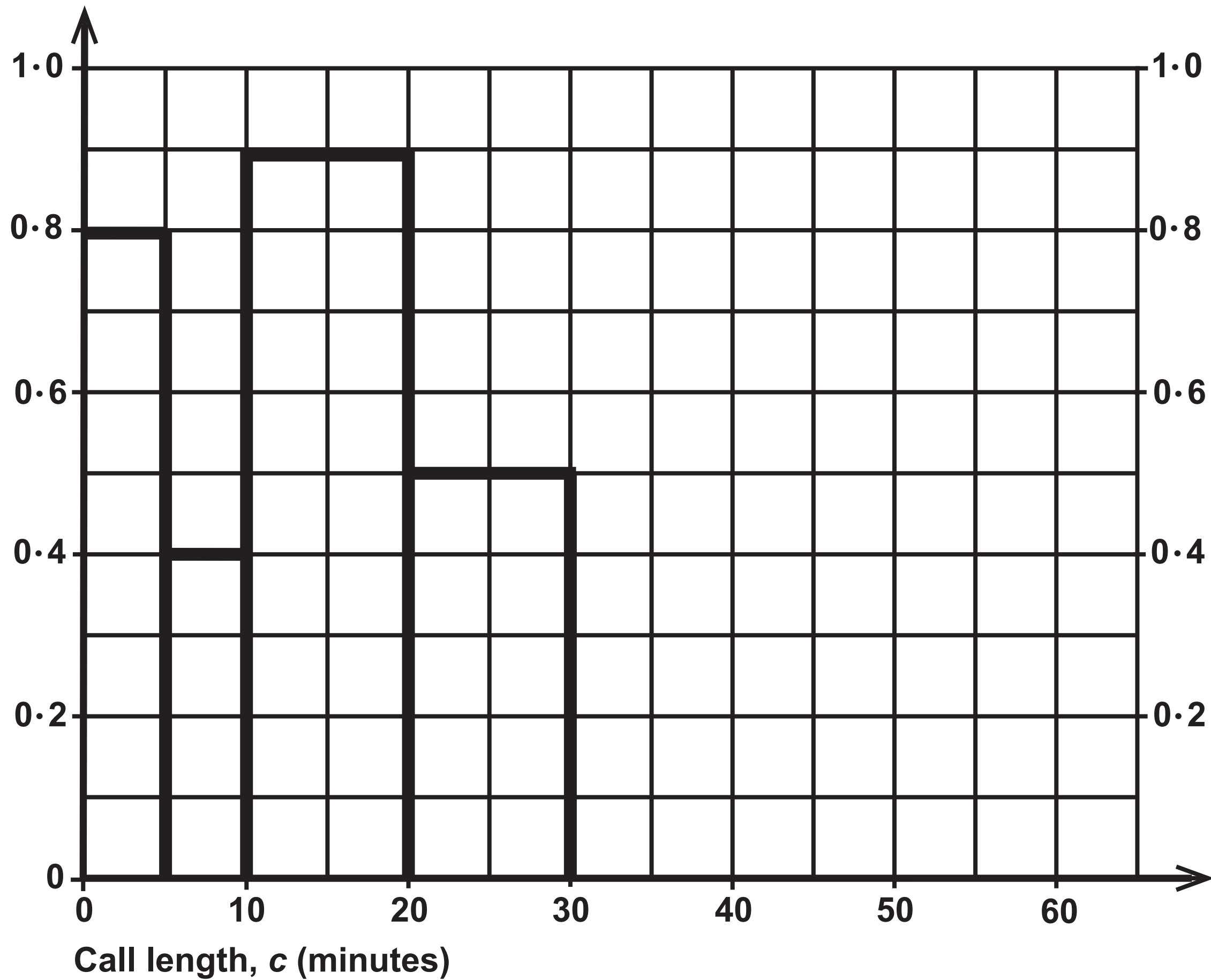
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$30 < c \leq 60$	6	

Question 12 (b)



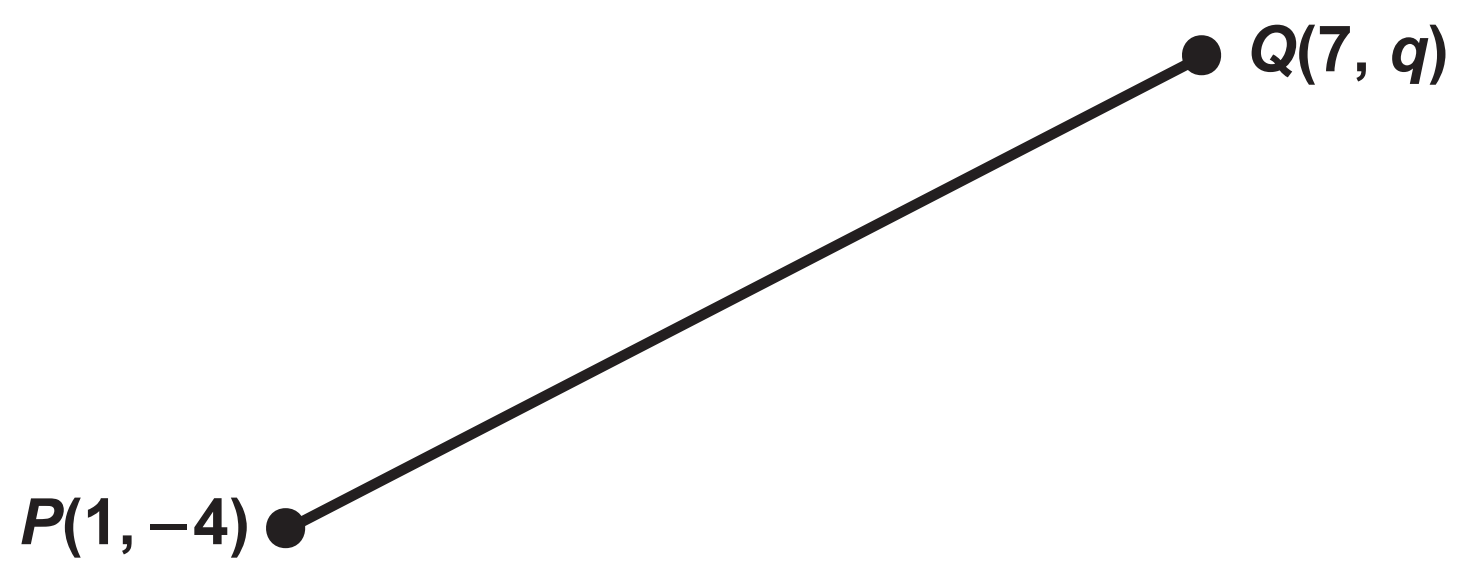
Question 12 (d)

Frequency density



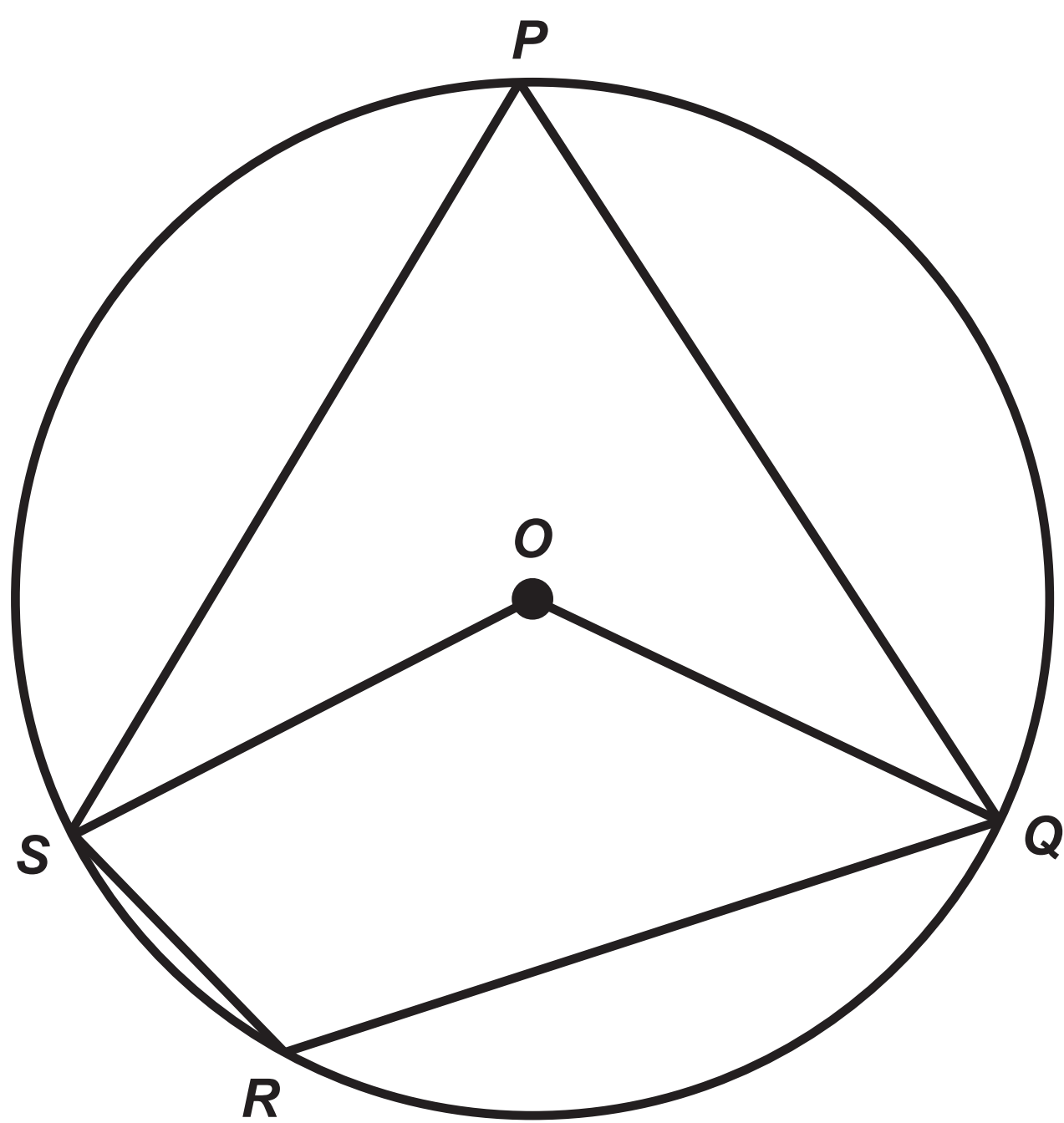
Question 14

Diagram NOT drawn to scale



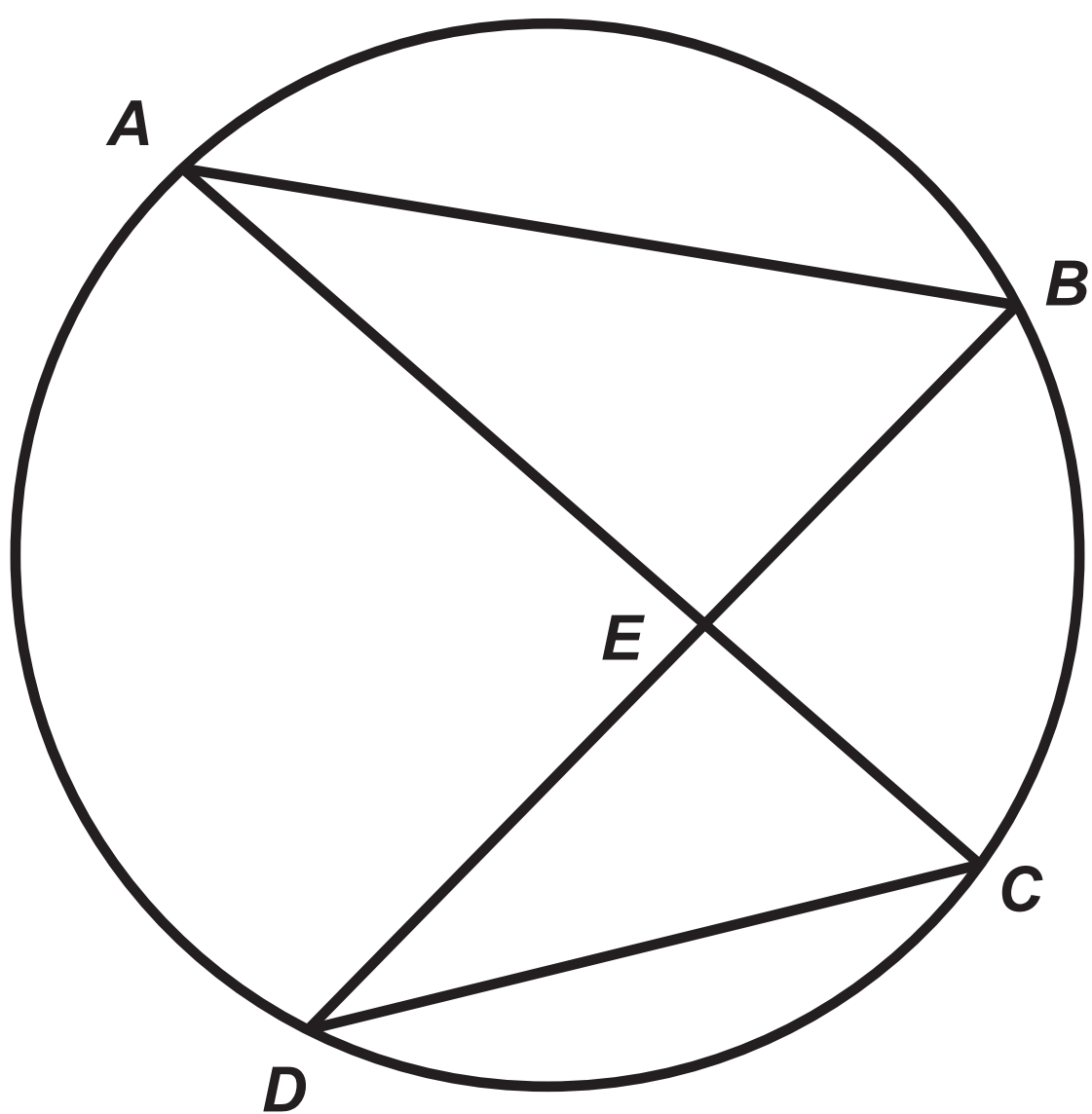
Question 15 (a)

Diagram NOT drawn to scale



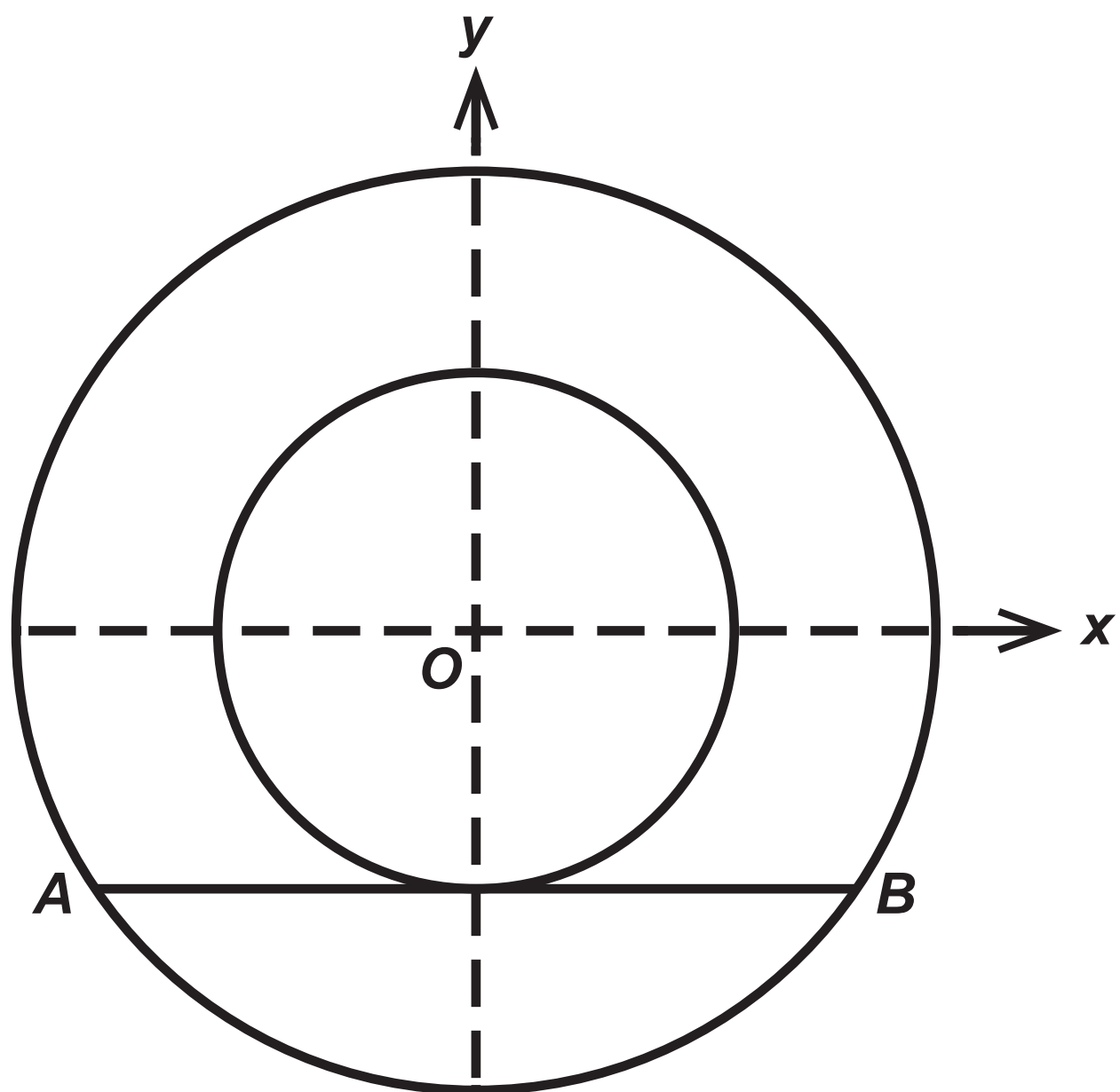
Question 15 (b)

Diagram NOT drawn to scale

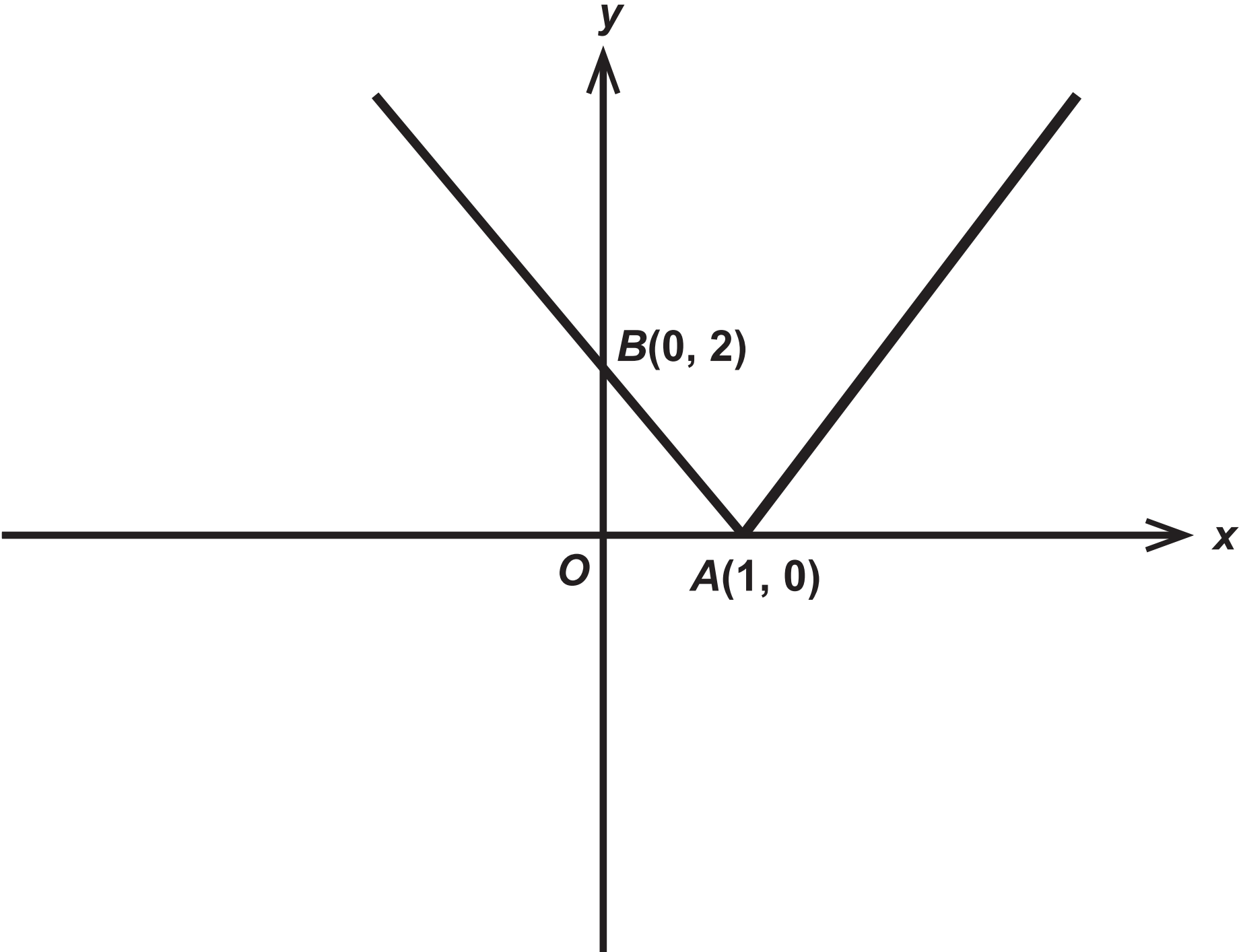


Question 17

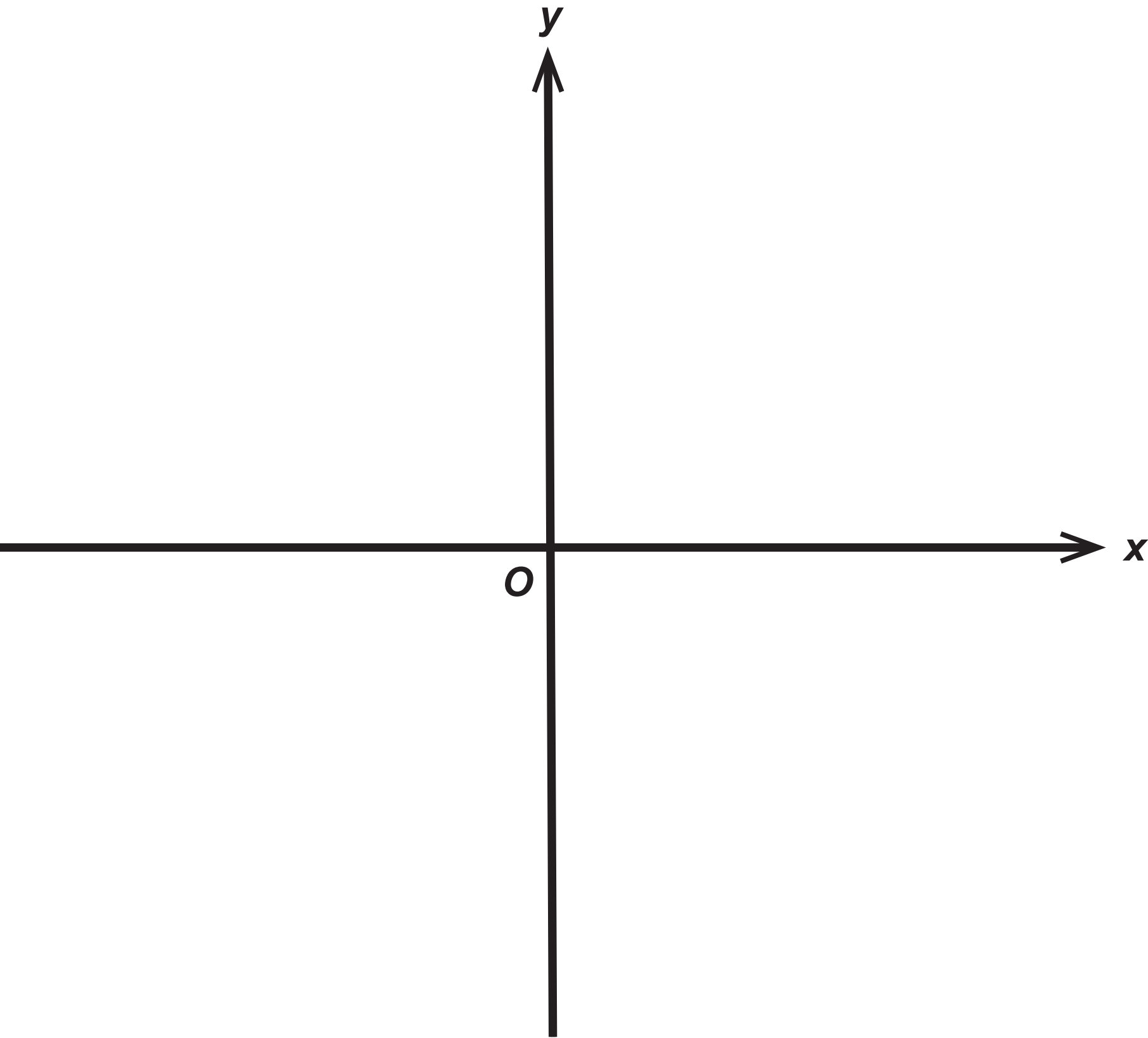
Diagram NOT drawn to scale



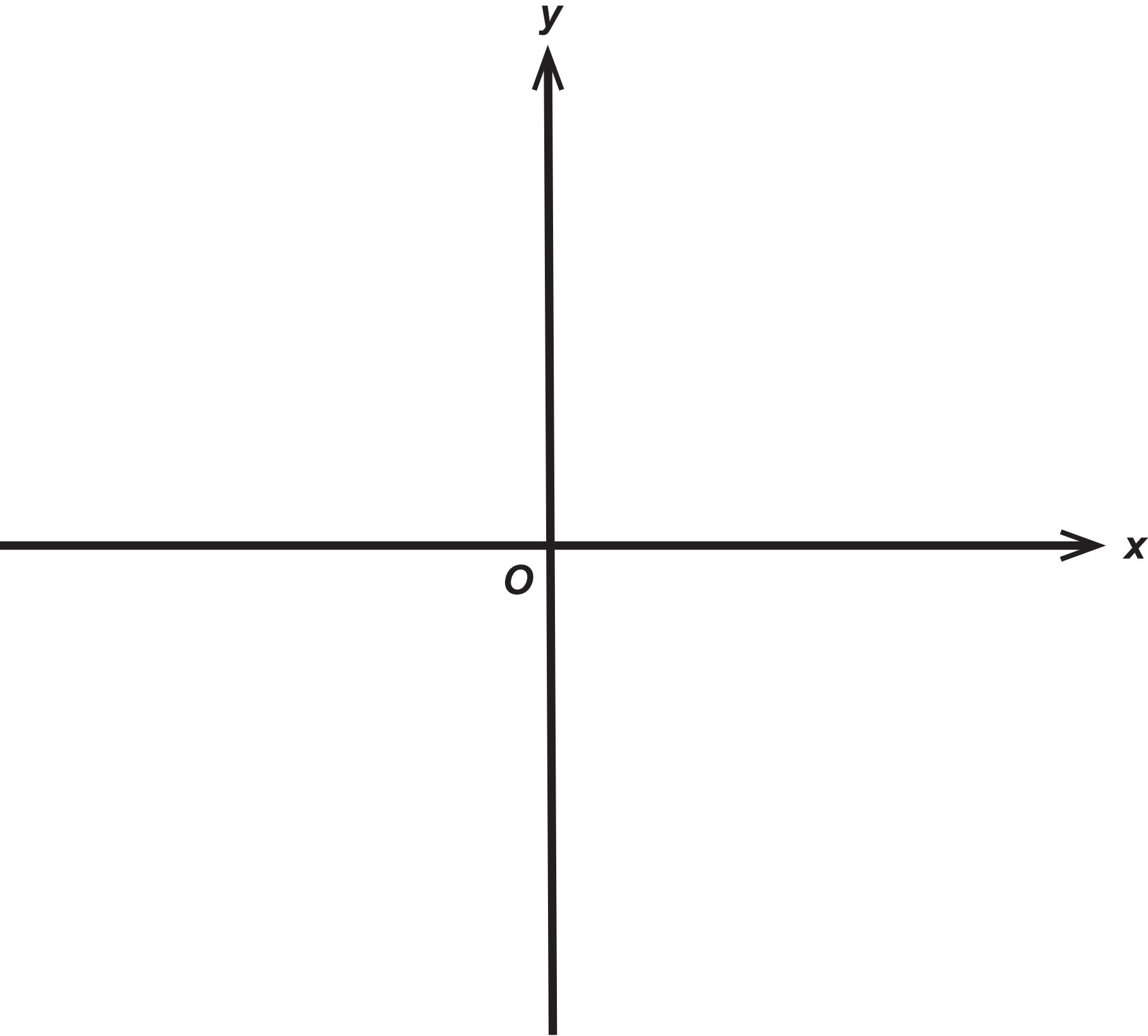
Question 18



Question 18 (a)



Question 18 (b)



Question 21 (b)

Table

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**FORMULA LIST
FOUNDATION TIER
AND HIGHER TIER
GCSE – NEW**

**You must not write on these formula
pages.**

**Anything you write on these formulae
pages will gain NO credit.**

AREA AND VOLUME FORMULAE

Where r is the radius of the sphere or cone,
 l is the slant height of a cone and
 h is the perpendicular height of a cone:

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

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

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

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

KINEMATICS FORMULAE

Where a is a constant acceleration,
 u is initial velocity, v is final velocity,
 s is displacement from the position
when $t = 0$ and t is time taken:

$$v = u + at$$

$$s = ut + \frac{1}{2}at^2$$

$$v^2 = u^2 + 2as$$