

**MATHEMATICS PAPER I
Question/Answer Book**

8.30 am–10.30 am (2 hours)

This paper must be answered in English

1. Write your candidate number, centre number and seat number in the spaces provided on this cover.
2. This paper consists of THREE sections, A(1), A(2) and B. Each section carries 33 marks.
3. Attempt ALL questions in Sections A(1) and A(2). Write your answers in the spaces provided in this Question/Answer Book.
4. Attempt any THREE questions in Section B. Write your answers in the CE(A)2 Answer Book.
5. Unless otherwise specified, all working must be clearly shown.
6. Unless otherwise specified, numerical answers should either be exact or correct to 3 significant figures.
7. The diagrams in this paper are not necessarily drawn to scale.

Candidate Number										
Centre Number										
Seat Number										

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	Marker No.	Examiner No.
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FORMULAS FOR REFERENCE

SPHERE	Surface area	= $4\pi r^2$
	Volume	= $\frac{4}{3}\pi r^3$
CYLINDER	Area of curved surface	= $2\pi rh$
	Volume	= $\pi r^2 h$
CONE	Area of curved surface	= πrl
	Volume	= $\frac{1}{3}\pi r^2 h$
PRISM	Volume	= base area \times height
PYRAMID	Volume	= $\frac{1}{3} \times$ base area \times height

SECTION A(1) (33 marks)

Answer ALL questions in this section.

Write your answers in the spaces provided.

1. Figure 1 shows a right prism, the cross-section of which is a trapezium. Find the volume of the prism. (3 marks)

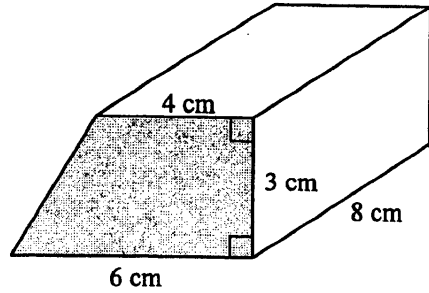


Figure 1

2. In Figure 2, CDE is a straight line. Find x and y . (3 marks)

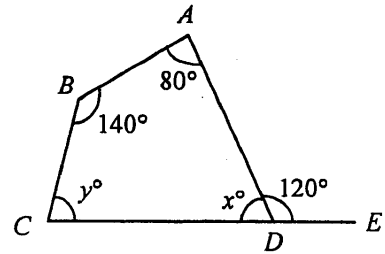


Figure 2

3. In Figure 3, find x and y . (3 marks)

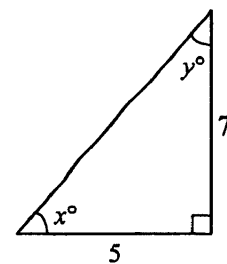


Figure 3

4. Simplify $\frac{a^3 a^4}{b^{-2}}$ and express your answer with positive indices. (3 marks)

5. Make x the subject of the formula $b = 2x + (1 - x)a$. (3 marks)

6. In Figure 4, A, B, C, D are points on a circle. AC and BD meet at E . (4 marks)

(a) Which triangle is similar to $\triangle ECD$?

(b) Find y .

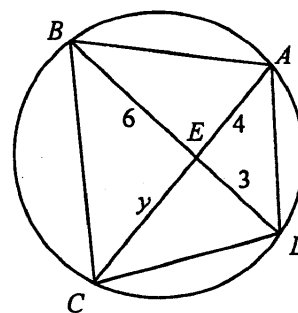


Figure 4

7. The marked price of a toy car is \$29. It is sold at a discount of 20%. (4 marks)

(a) Find the selling price of the toy car.

(b) If the cost of the toy car is \$18, find the percentage profit.

8. $A(0, 4)$ and $B(-2, 1)$ are two points.

(5 marks)

(a) Find the slope of AB .

(b) Find the equation of the line passing through $(1, 3)$ and perpendicular to AB .

9. Let $f(x) = x^3 + 2x^2 - 5x - 6$.

(5 marks)

(a) Show that $x - 2$ is a factor of $f(x)$.

(b) Factorize $f(x)$.

SECTION A(2) (33 marks)

Answer ALL questions in this section.

Write your answers in the spaces provided.

10. Two hundred students took a test in Mathematics. Figure 5 shows the cumulative frequency polygon of the distribution of the test scores.



- (a) Complete the tables below.

(3 marks)

Test score (x)	Cumulative frequency
$x \leq 50$	8
$x \leq 60$	50
$x \leq 70$	
$x \leq 80$	
$x \leq 90$	188
$x \leq 100$	200

Test score (x)	Frequency
$40 < x \leq 50$	8
$50 < x \leq 60$	42
$60 < x \leq 70$	
$70 < x \leq 80$	
$80 < x \leq 90$	30
$90 < x \leq 100$	12

- (b) If the passing score is 55, estimate the passing percentage of the students in the test. (4 marks)

The cumulative frequency polygon of the distribution of test scores of 200 students

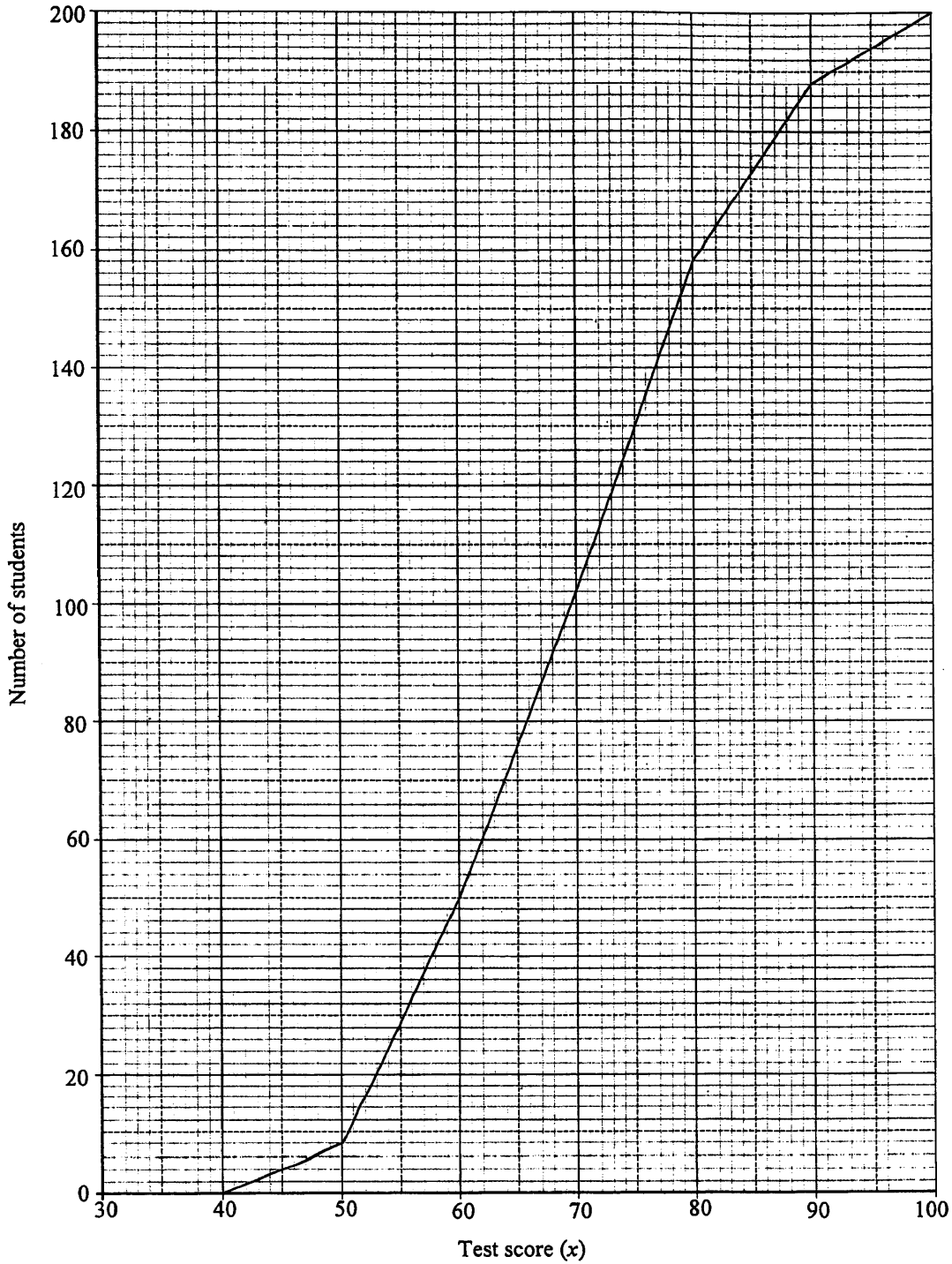


Figure 5

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11. There are 8 white socks, 4 yellow socks and 2 red socks in a drawer. A boy randomly takes out 2 socks from the drawer.

(a) Find the probability that the socks taken out are both white. (3 marks)

(b) Find the probability that the socks taken out are of the same colour. (4 marks)

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12. The monthly service charge $\$S$ of mobile phone network A is partly constant and partly varies directly as the connection time t minutes. The monthly service charges are $\$230$ and $\$284$ when the connection times are 100 minutes and 130 minutes respectively.

(a) Express S in terms of t . (4 marks)

(b) The service charge of mobile phone network B only varies directly as the connection time. The charge is $\$2.20$ per minute. A man uses about 110 minutes connection time every month. Should he join network A or B in order to save money? Explain your answer. (3 marks)



13. In Figure 6.1, $A_1B_1C_1D_1$ is a square of side 14 cm. A_2, B_2, C_2 and D_2 divide A_1B_1, B_1C_1, C_1D_1 and D_1A_1 respectively in the ratio 3 : 4 and form the square $A_2B_2C_2D_2$. Following the same pattern, A_3, B_3, C_3 and D_3 divide A_2B_2, B_2C_2, C_2D_2 and D_2A_2 respectively in the ratio 3 : 4 and form the square $A_3B_3C_3D_3$. The process is repeated indefinitely to give squares $A_4B_4C_4D_4, A_5B_5C_5D_5, \dots, A_nB_nC_nD_n, \dots$

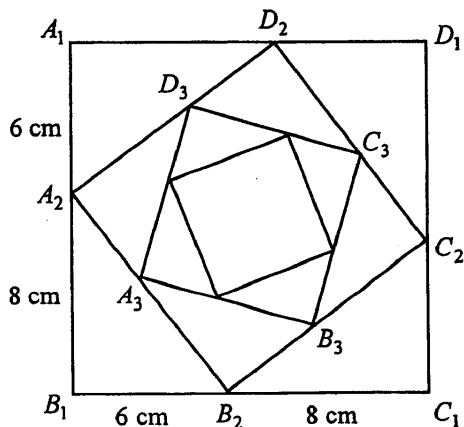


Figure 6.1

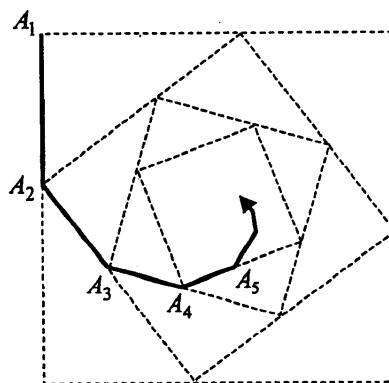


Figure 6.2

- (a) Find A_2B_2 . (2 marks)

- (b) Find $A_2A_3 : A_1A_2$. (2 marks)

- (c) An ant starts at A_1 and crawls along the path $A_1A_2A_3 \dots A_n \dots$ as shown in Figure 6.2. Show that the total distance crawled by the ant cannot exceed 21 cm. (3 marks)

14. In Figure 7, O is the centre of the semicircle $ABCD$ and $AB = BC$. Show that $BO \parallel CD$. (5 marks)

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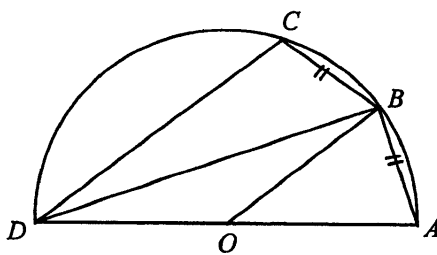


Figure 7

SECTION B (33 marks)

Answer any **THREE** questions in this section and write your answers in the CE(A)2 Answer Book. Each question carries 11 marks.

15. Figure 8 shows two circles C_1 and C_2 touching each other externally. The centre of C_1 is $(5, 0)$ and the equation of C_2 is $(x-11)^2 + (y+8)^2 = 49$.

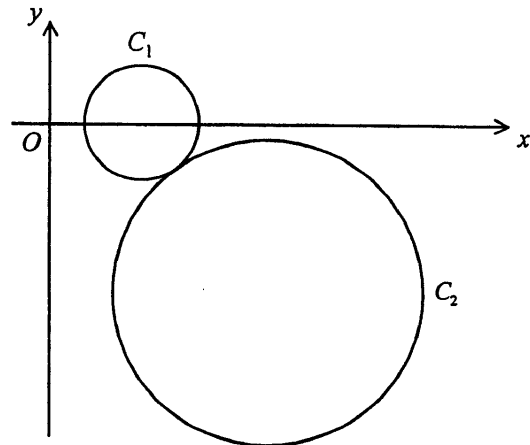


Figure 8

- (a) Find the equation of C_1 . (3 marks)
- (b) Find the equations of the two tangents to C_1 from the origin. (4 marks)
- (c) One of the tangents in (b) cuts C_2 at two distinct points A and B . Find the coordinates of the mid-point of AB . (4 marks)
16. Figure 9.1 shows a paper cup in the form of a right circular cone of base radius 4 cm and height 8 cm. Two spherical ice-cream balls of radii 2 cm and x cm respectively are put into the cup. The ice-cream balls then completely melt into a liquid form. The depth of the liquid in the cup is $(2x + 3)$ cm when the axis of the cup is vertical. (Assume the volume of ice-cream does not change on melting.)

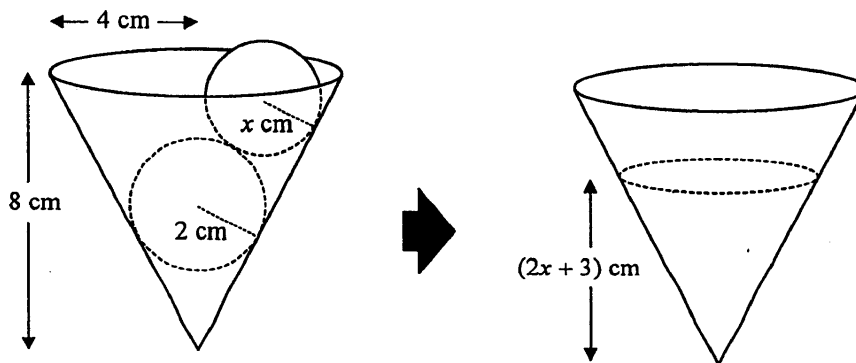


Figure 9.1

- (a) Show that $8x^3 - 36x^2 - 54x + 101 = 0$. (7 marks)
- (b) Figure 9.2 shows the graph of $y = 2x^3 - 9x^2$ for $x \geq 0$. By adding a suitable straight line to the graph, find x correct to 1 decimal place. (4 marks)

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16.(Cont'd)

If you attempt Question 16, fill in the details in the first three boxes above and tie this sheet **INSIDE** your CE(A)2 answer book.

The graph of $y = 2x^3 - 9x^2$

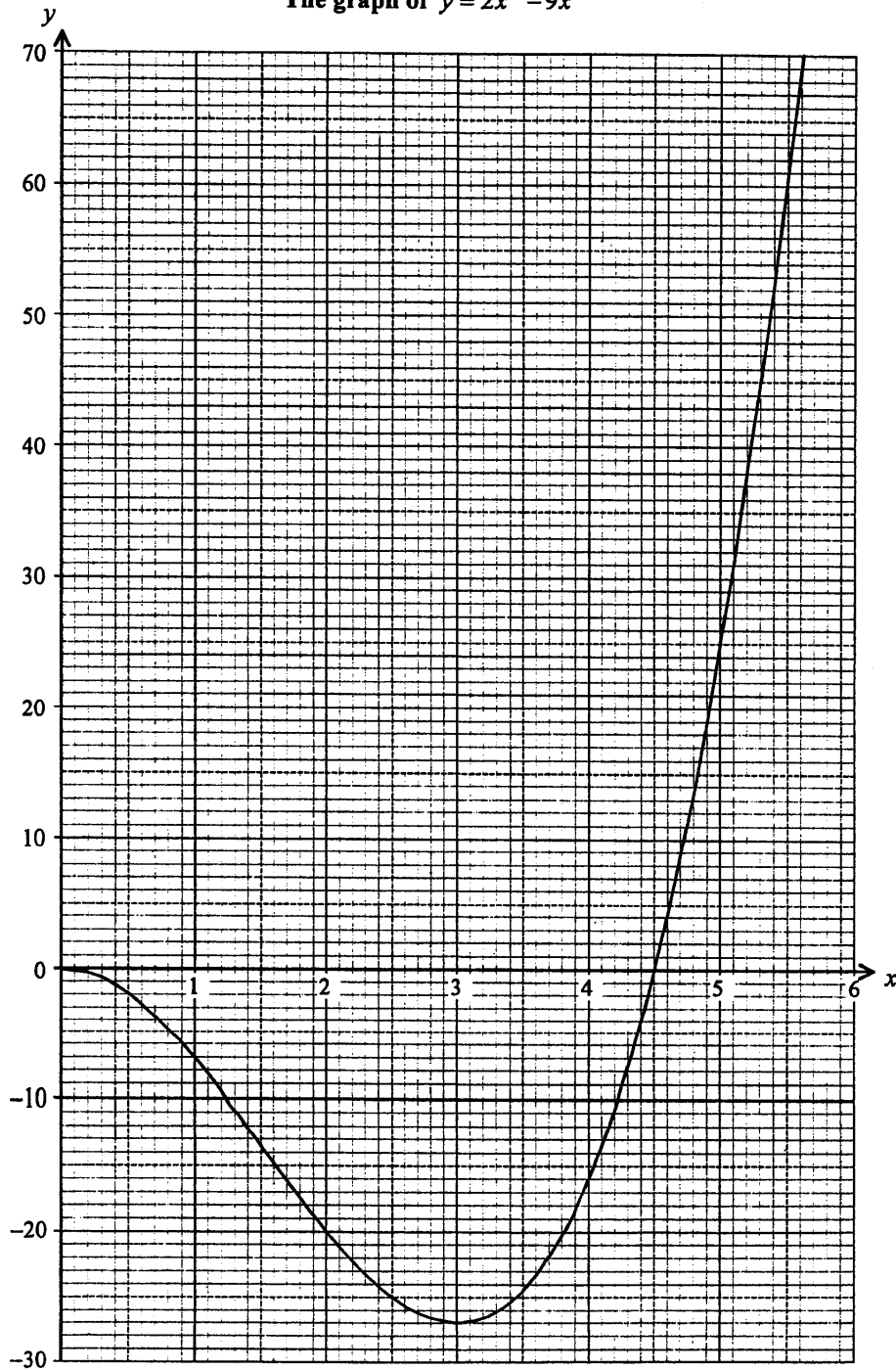


Figure 9.2

17. In Figure 10, triangular sign post ABC stands vertically on the horizontal ground along the east-west direction. $AC = 4$ m, $BC = 6$ m, $\angle ACB = 72^\circ$ and F is the foot of the perpendicular from A to BC . When the sun shines from $N50^\circ W$ with an angle of elevation 35° , the shadow of the sign post on the horizontal ground is DBC .

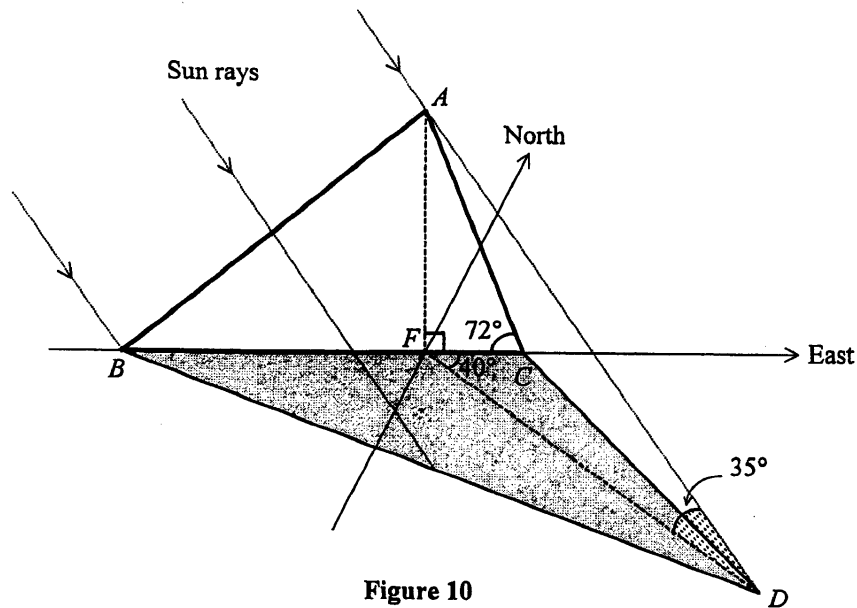


Figure 10

- (a) Find AF and FD . (4 marks)
- (b) Find the area of the shadow DBC . (5 marks)
- (c) Suppose the sun shines from $Nx^\circ W$, where $50 < x < 90$, but its angle of elevation is still 35° . State **with reasons** whether the area of the shadow of the sign post on the horizontal ground is greater than, smaller than or equal to the area obtained in (b). (2 marks)
18. Miss Chan makes cookies and cakes for a school fair. The ingredients needed to make a tray of cookies and a tray of cakes are as follows:

	Flour	Sugar	Eggs
Cookies	0.32 kg	0.24 kg	2
Cakes	0.28 kg	0.36 kg	10

Miss Chan has 4.48 kg of flour, 4.32 kg of sugar and 100 eggs, from which she makes x trays of cookies and y trays of cakes.

- (a) Write down the inequalities that represent the constraints on x and y . Let R be the region of points representing ordered pairs (x, y) which satisfy these inequalities. Draw and shade the region R in Figure 11. (7 marks)
- (b) The profit from selling a tray of cookies is \$90, and that from selling a tray of cakes is \$120. If x and y are integers, find the maximum possible profit. (4 marks)

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18.(Cont'd)

If you attempt Question 18, fill in the details in the first three boxes above and tie this sheet **INSIDE** your CE(A)2 answer book.

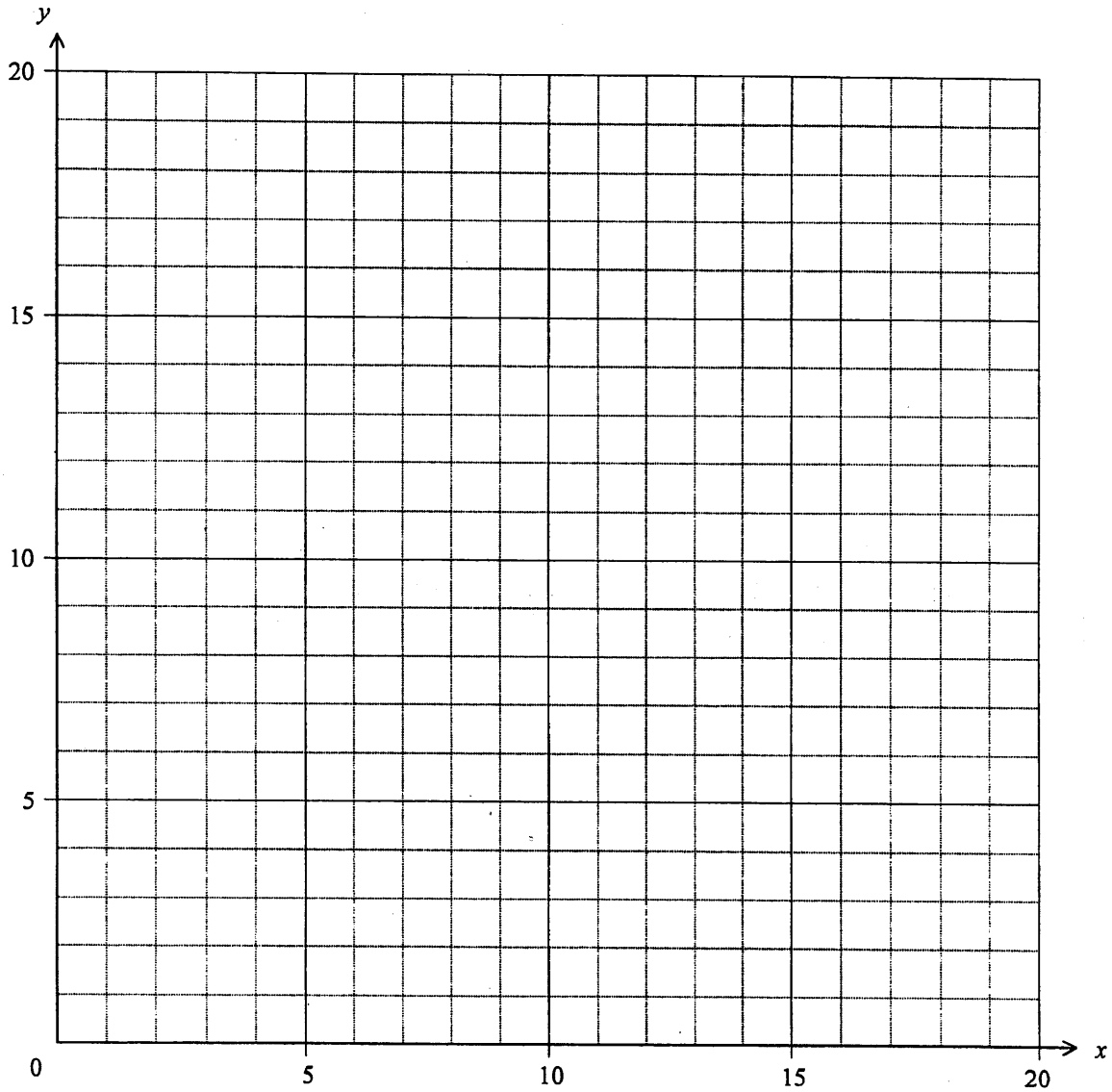


Figure 11

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