

**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									

	Marker's Use Only	Examiner's Use Only
	Marker No.	Examiner No.
1		
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11		
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13		
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Total		

Checker's Use Only	
Checker No.	
Total	

### 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	= $\pi rl$
	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)

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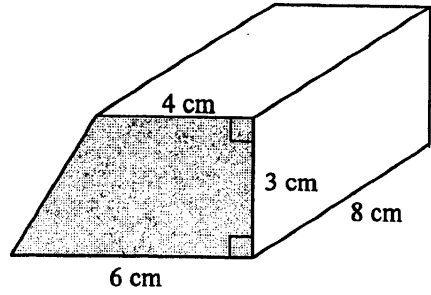


Figure 1

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

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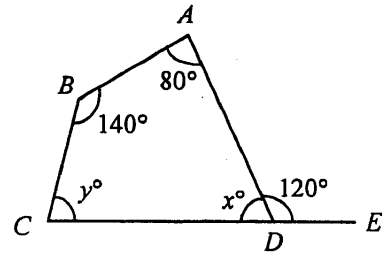


Figure 2

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

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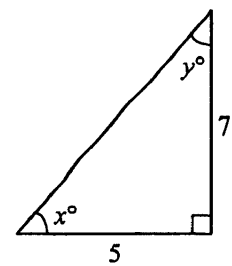


Figure 3

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



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



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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  $\triangle ECD$ ?

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(b) Find  $y$ .

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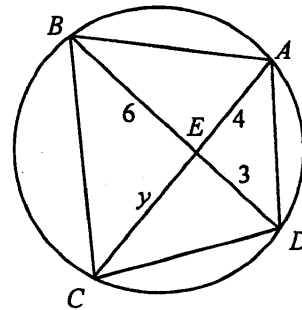


Figure 4

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.

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

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

(5 marks)

(a) Find the slope of  $AB$ .

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

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

(5 marks)

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

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(b) Factorize  $f(x)$ .

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**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)

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

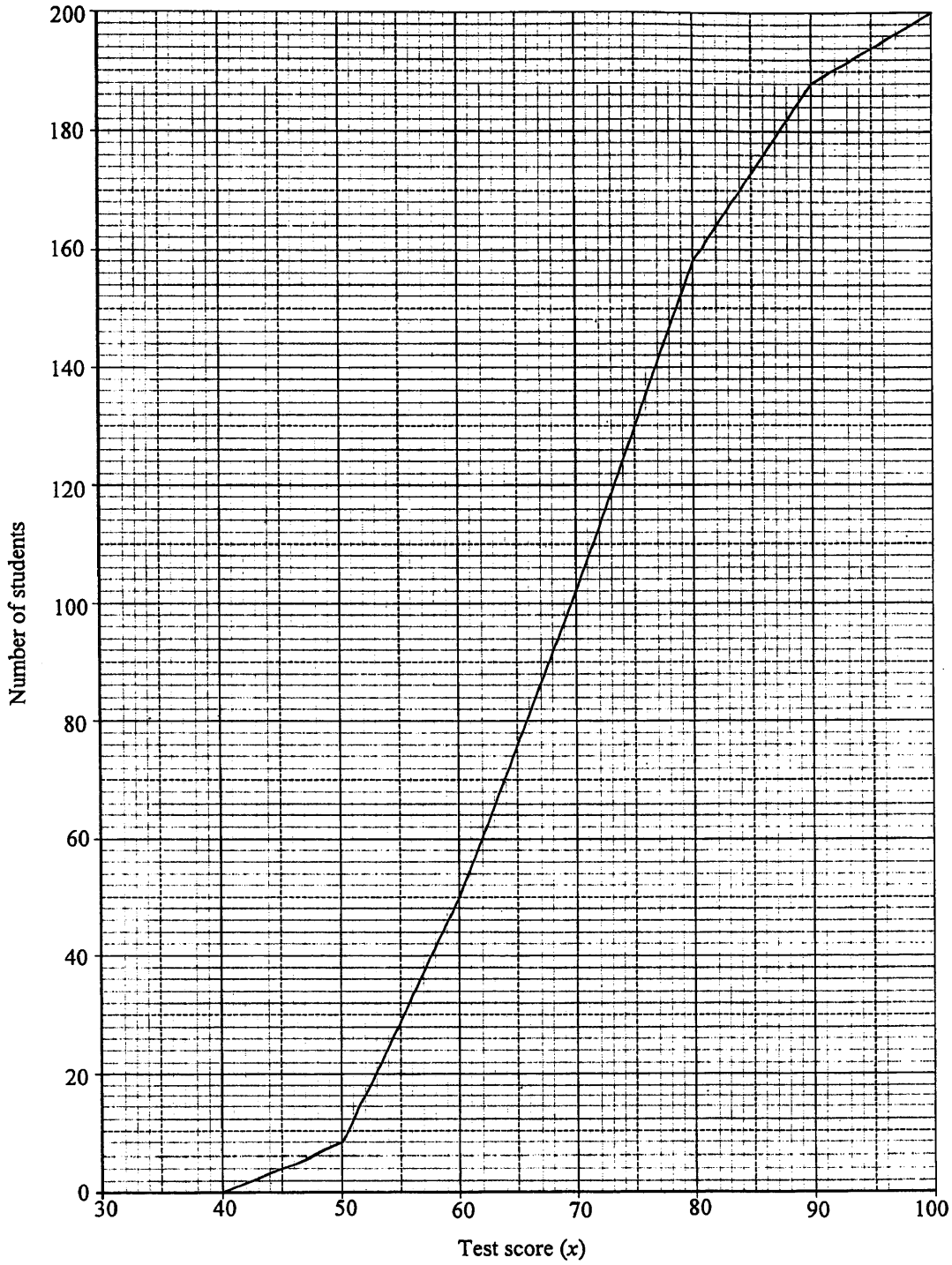


Figure 5

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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)

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(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)

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(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)

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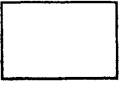
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13. In Figure 6.1,  $A_1B_1C_1D_1$  is a square of side 14 cm.  $A_2, B_2, C_2$  and  $D_2$  divide  $A_1B_1, B_1C_1, C_1D_1$  and  $D_1A_1$  respectively in the ratio 3 : 4 and form the square  $A_2B_2C_2D_2$ . Following the same pattern,  $A_3, B_3, C_3$  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  $A_4B_4C_4D_4, A_5B_5C_5D_5, \dots, A_nB_nC_nD_n, \dots$

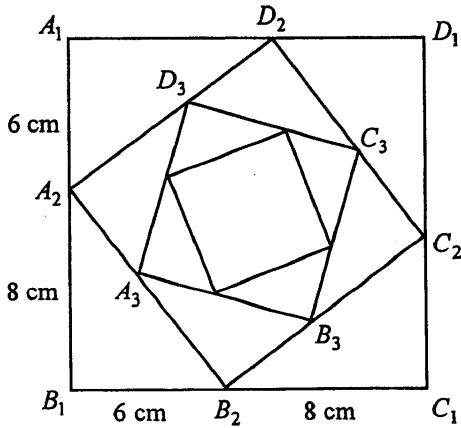


Figure 6.1

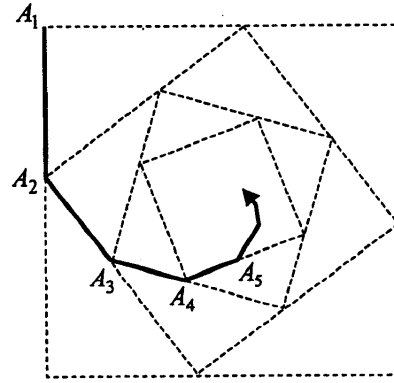


Figure 6.2

- (a) Find  $A_2B_2$ . (2 marks)

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

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- (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)

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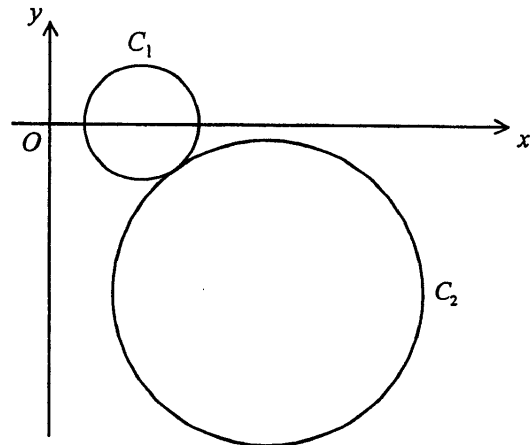
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**SECTION B (33 marks)**

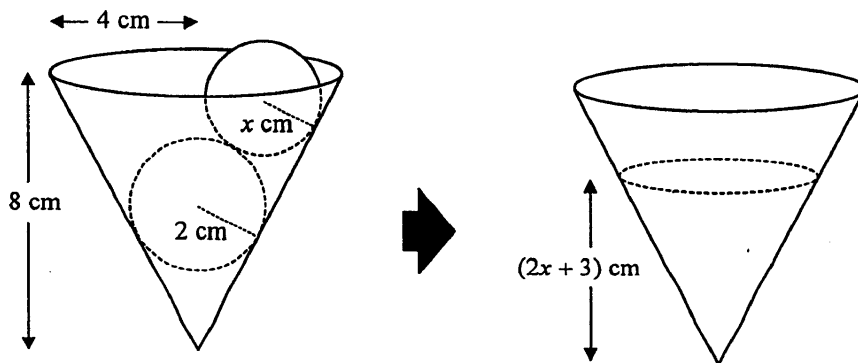
Answer any **THREE** questions in this section and write your answers in the CE(A)2 Answer Book. Each question carries 11 marks.

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  $y = 2x^3 - 9x^2$

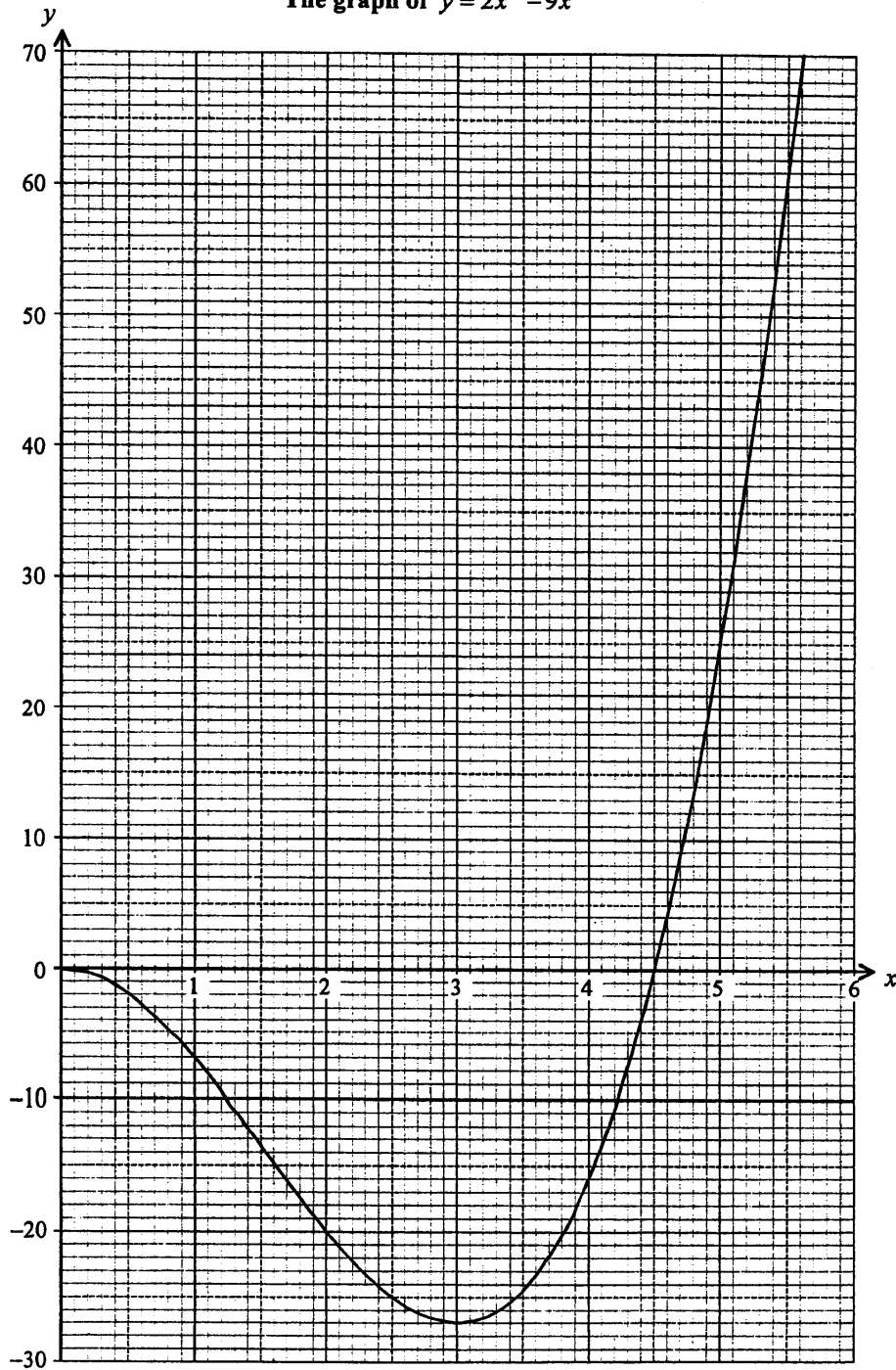


Figure 9.2

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  $35^\circ$ , the shadow of the sign post on the horizontal ground is  $DBC$ .

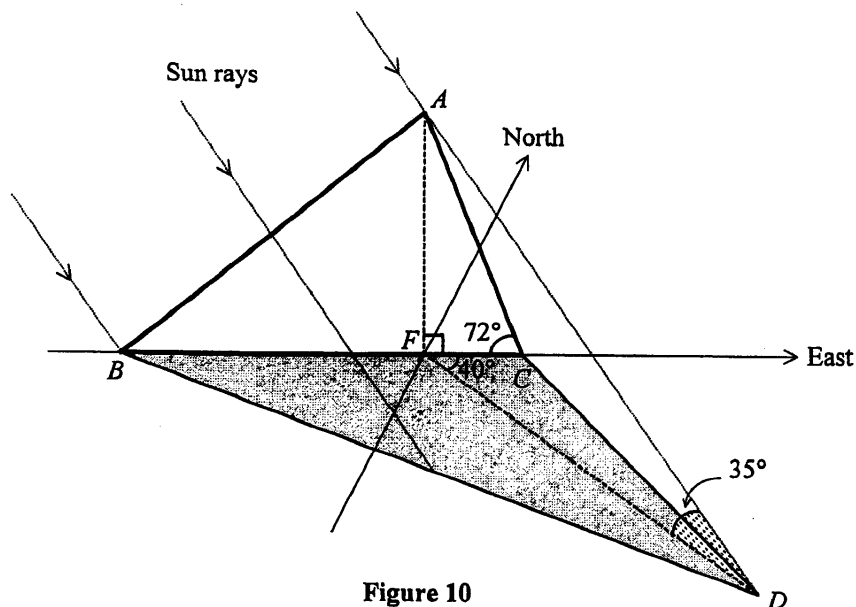


Figure 10

- (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  $35^\circ$ . 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.

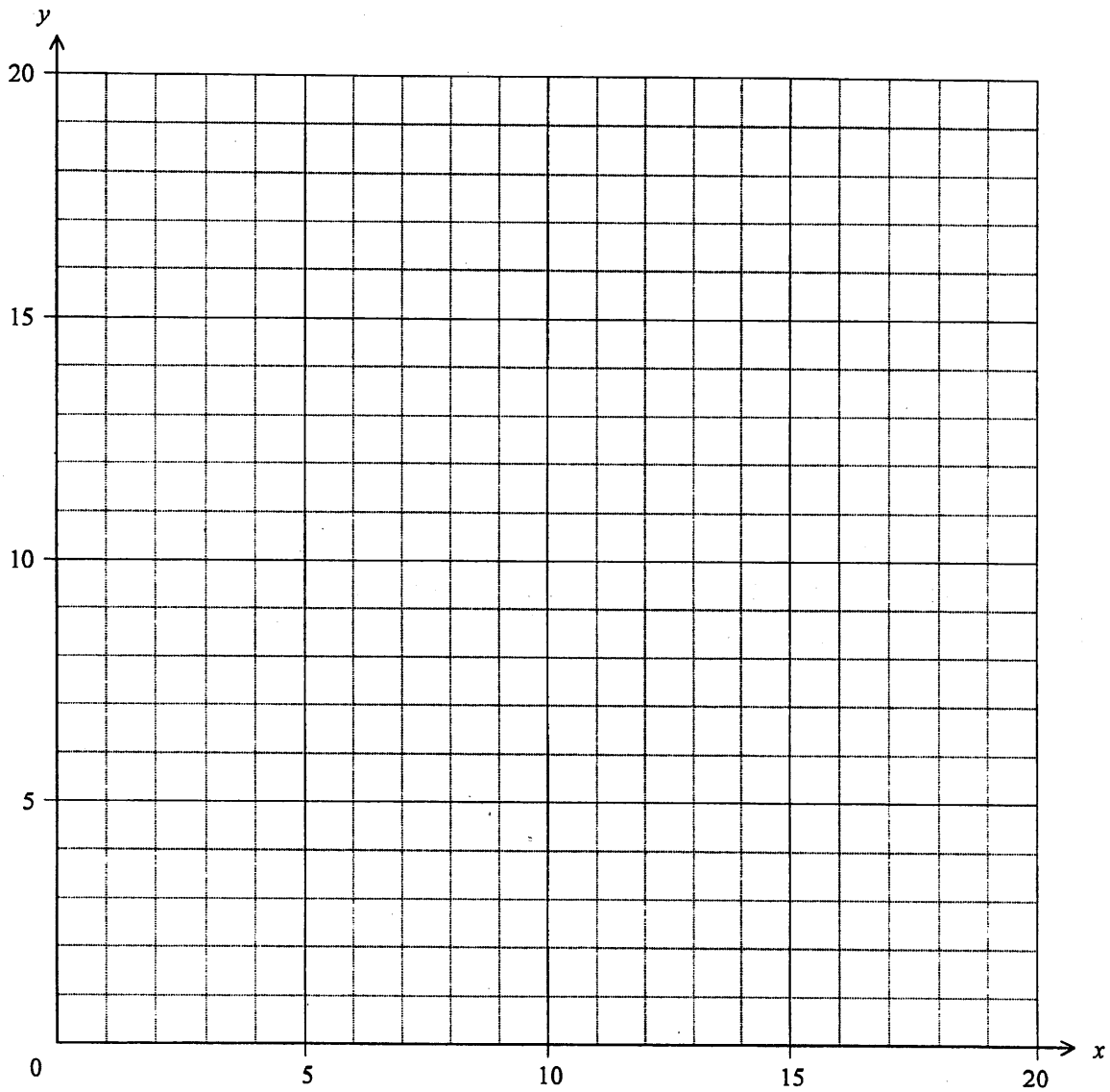


Figure 11

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