

MATHEMATICS PAPER 2

11.15 am – 12.45 pm (1½ hours)

Subject Code 180

1. Read carefully the instructions on the Answer Sheet. After the announcement of the start of the examination, you should first stick a barcode label and insert the information required in the spaces provided. No extra time will be given for sticking the barcode label after the 'Time is up' announcement.
2. When told to open this book, you should check that all the questions are there. Look for the words '**END OF PAPER**' after the last question.
3. All questions carry equal marks.
4. **ANSWER ALL QUESTIONS.** You are advised to use an HB pencil to mark all the answers on the Answer Sheet, so that wrong marks can be completely erased with a clean rubber. You must mark the answers clearly; otherwise you will lose marks if the answers cannot be captured.
5. You should mark only **ONE** answer for each question. If you mark more than one answer, you will receive **NO MARKS** for that question.
6. No marks will be deducted for wrong answers.

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	$= \text{base area} \times \text{height}$
PYRAMID	Volume	$= \frac{1}{3} \times \text{base area} \times \text{height}$

There are 36 questions in Section A and 18 questions in Section B.
The diagrams in this paper are not necessarily drawn to scale.
Choose the best answer for each question.

Section A

1. $5^{334} \left(\frac{-1}{5} \right)^{333} =$

- A. -5 .
- B. -0.2 .
- C. 0 .
- D. 5 .

2. If $\frac{2+a}{a} = \frac{2-x}{x}$, then $x =$

- A. $\frac{a}{1+a}$.
- B. $\frac{2a}{1+a}$.
- C. $\frac{a}{2+a}$.
- D. $\frac{2a}{2+a}$.

3. $(x-2y)(x+2y-2) =$

- A. $x^2 + 2y^2 + 2x + 4y$.
- B. $x^2 + 2y^2 - 2x + 4y$.
- C. $x^2 - 4y^2 + 2x + 4y$.
- D. $x^2 - 4y^2 - 2x + 4y$.

4. If x and y are non-zero numbers with $x < y$, which of the following must be true?

I. $-x > -y$

II. $\frac{1}{x^2} > \frac{1}{y^2}$

III. $x^3 < y^3$

- A. I and II only
- B. I and III only
- C. II and III only
- D. I, II and III

5. The solution of $2(1-x)+5 \geq 17$ is

- A. $x \leq -5$.
- B. $x \geq -5$.
- C. $x \leq -12$.
- D. $x \geq -12$.

6. The price of 5 pens and 4 pencils is \$46 while the price of 2 pens and 3 pencils is \$24. Find the price of 3 pens and 2 pencils.

- A. \$20
- B. \$24
- C. \$26
- D. \$30

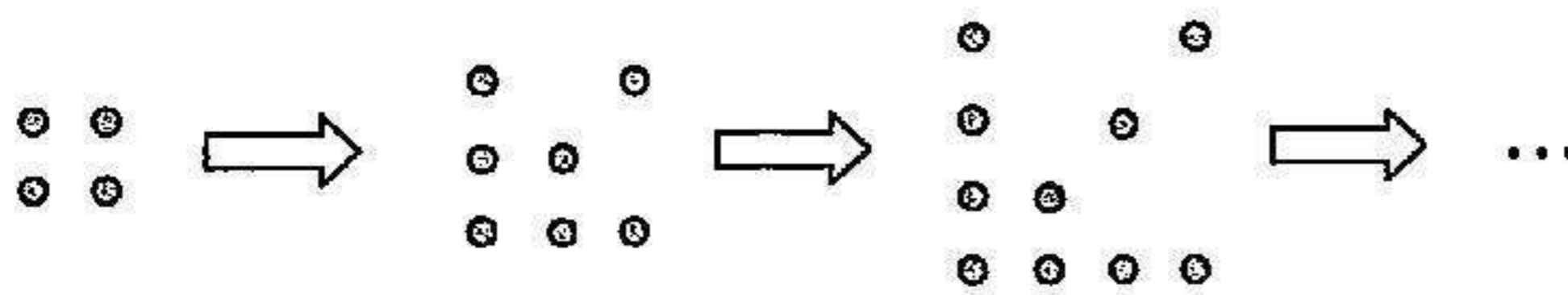
7. Which of the following statements about the graph of $y = 25 - (x-3)^2$ is true?

- A. The x -intercepts of the graph are -2 and 8 .
- B. The y -intercept of the graph is 25 .
- C. The equation of the axis of symmetry of the graph is $x = -3$.
- D. The y -coordinate of the vertex of the graph is 16 .

8. Let $f(x) = x^2 + 2x + k$, where k is a constant. Find $f(5) - f(3)$.

- A. 20
- B. $k + 8$
- C. $k + 35$
- D. $2k + 50$

9. In the figure, the 1st pattern consists of 4 dots. For any positive integer n , the $(n+1)$ th pattern is formed by adding 3 dots to the n th pattern. Find the number of dots in the 8th pattern.



- A. 22
- B. 25
- C. 28
- D. 31

10. A sum of \$15000 is deposited at an interest rate of 6% per annum for 10 years, compounded monthly. Find the interest correct to the nearest dollar.

- A. \$9000
- B. \$11863
- C. \$12291
- D. \$27291

11. The length of a rectangle is decreased by 20% but its breadth is increased by $k\%$. If the area of the rectangle remains unchanged, find the value of k .

- A. 20
- B. 25
- C. 75
- D. 80

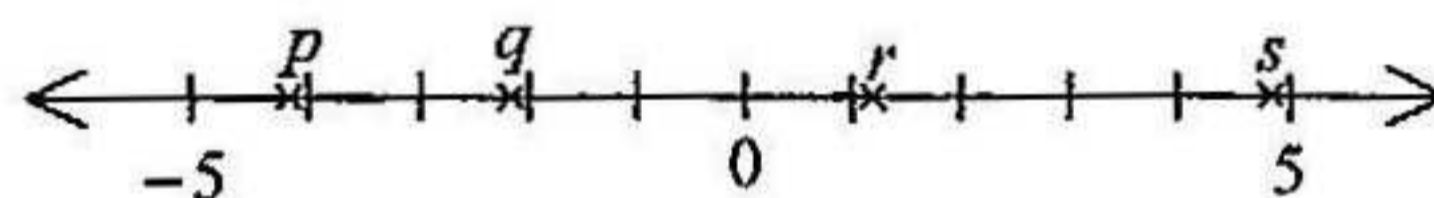
12. Let m and n be non-zero numbers. If $\frac{2m-n}{m-2n} = 3$, then $m:n =$

- A. 1:5 .
- B. 5:1 .
- C. 5:7 .
- D. 7:5 .

13. It is given that a varies directly as b and inversely as c^2 . When $b=6$ and $c=3$, $a=-2$. When $a=-9$ and $c=4$, $b =$

- A. 5 .
- B. 36 .
- C. 48 .
- D. 576 .

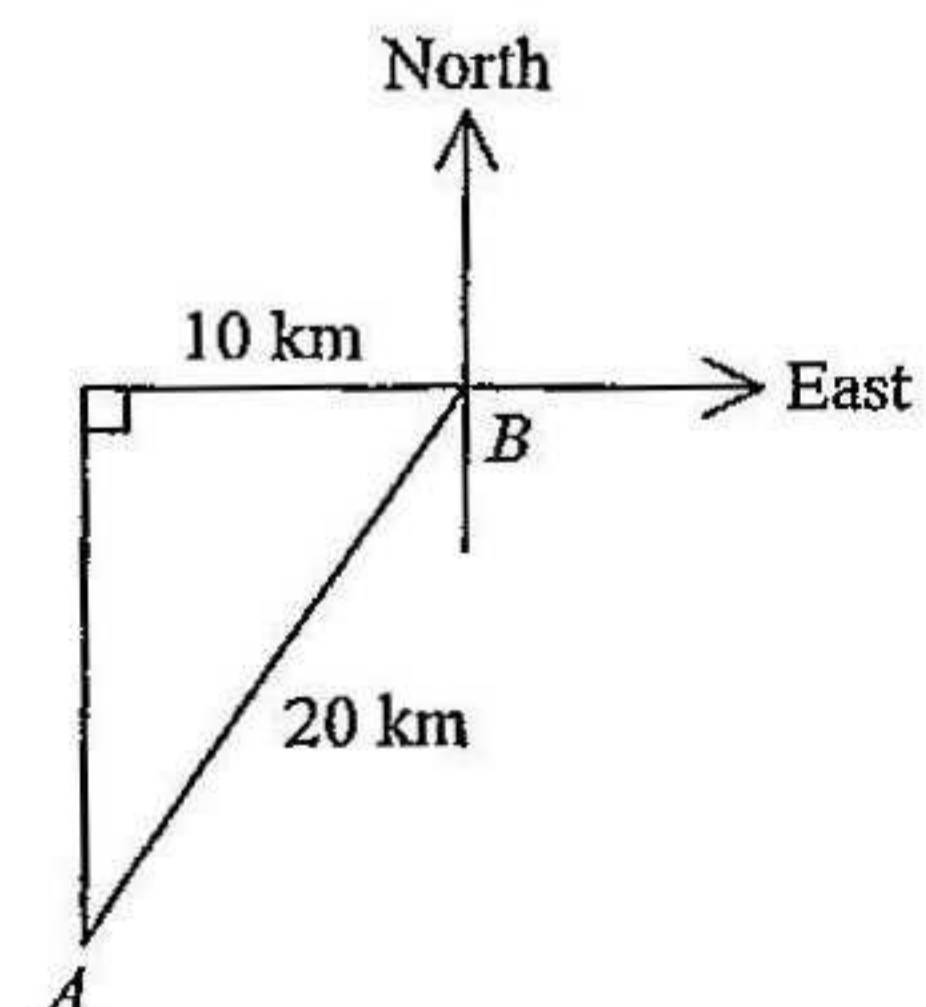
14. The figure shows the positions of four real numbers p , q , r and s on the number line. Which of the following is the best estimate of $(p-q)(r+s)$?



- A. -36
- B. -12
- C. 12
- D. 36

15. In the figure, the bearing of B from A is

- A. 030° .
- B. 060° .
- C. 210° .
- D. 240° .

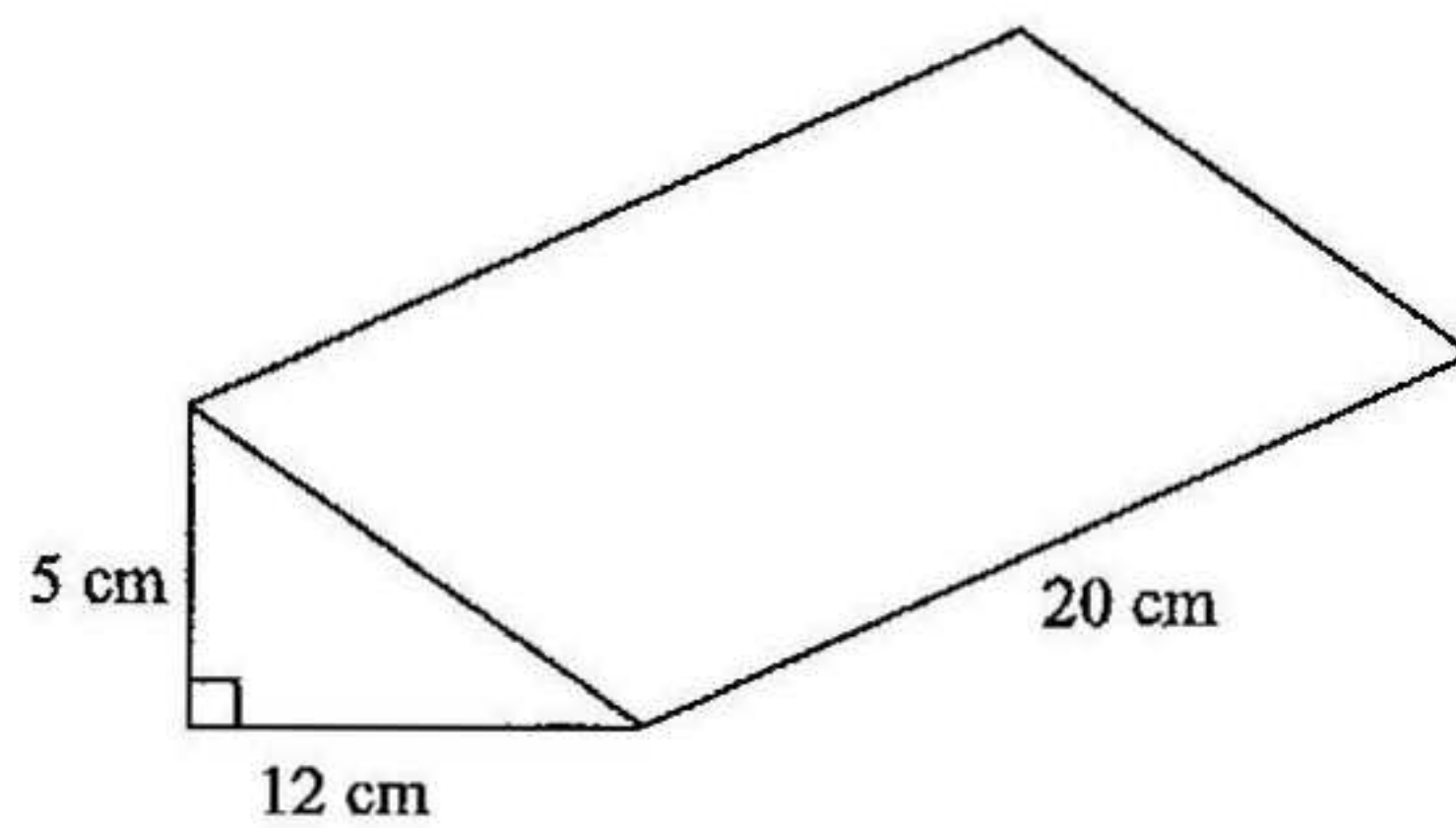


16. If the radius and the area of a sector are 12 cm and $48\pi \text{ cm}^2$ respectively, find the perimeter of the sector correct to the nearest 0.1 cm .

- A. 25.1 cm
- B. 36.6 cm
- C. 49.1 cm
- D. 99.4 cm

17. In the figure, the total surface area of the solid right triangular prism is

- A. 120 cm^2 .
- B. 600 cm^2 .
- C. 660 cm^2 .
- D. 720 cm^2 .

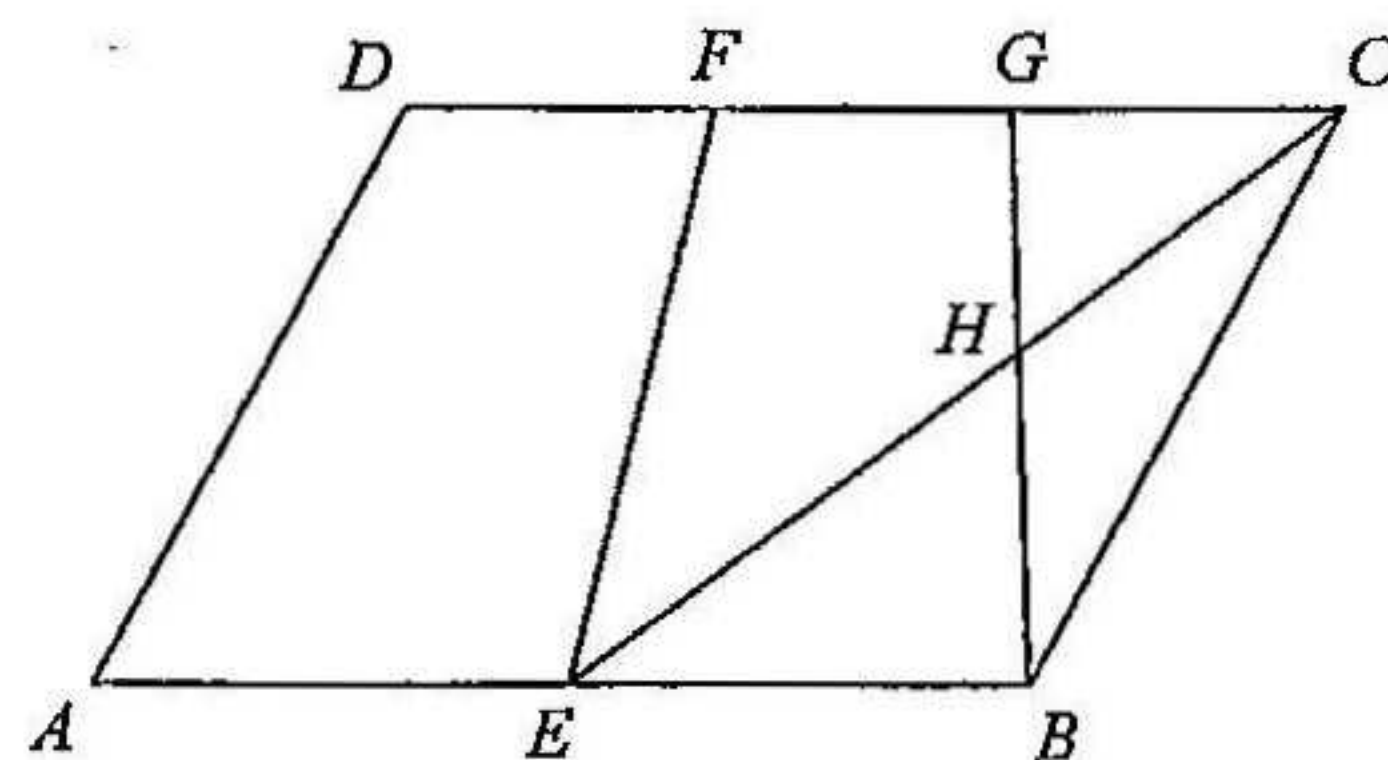


18. If the volume of a solid hemisphere of radius r is equal to the volume of a solid right circular cylinder of height h and base radius r , then $r:h=$

- A. 2:3 .
- B. 3:2 .
- C. 3:4 .
- D. 4:3 .

19. In the figure, $ABCD$ is a parallelogram. E is the mid-point of AB . F and G are points lying on CD such that $DF = FG = GC$. BG and CE intersect at H . If the area of $\triangle BCH$ is 6 cm^2 , then the area of the quadrilateral $EFGH$ is

- A. 10 cm^2 .
- B. 12 cm^2 .
- C. 15 cm^2 .
- D. 16 cm^2 .



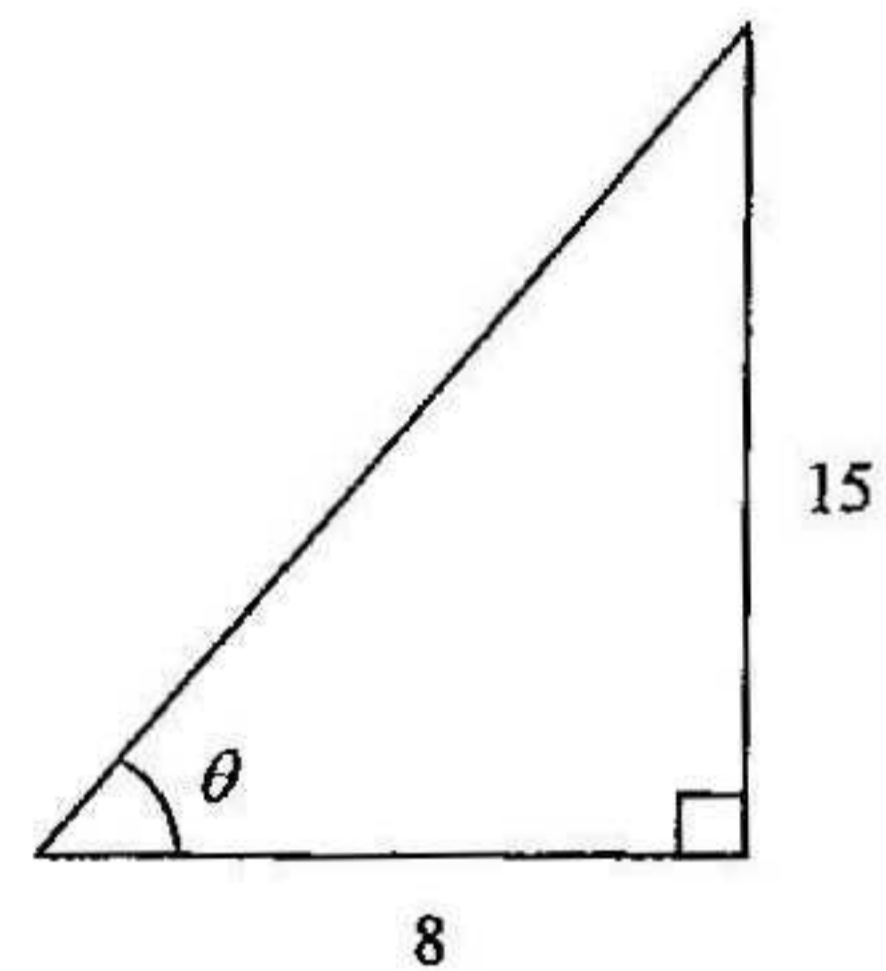
20. If x , y and z are the angles of a triangle with $x + y = 90^\circ$, which of the following are true?

- I. $\tan x \tan y = \sin z$
- II. $\cos y + \cos z = \sin x$
- III. $\sin^2 x + \sin^2 y = \sin^2 z$

- A. I and II only
- B. I and III only
- C. II and III only
- D. I, II and III

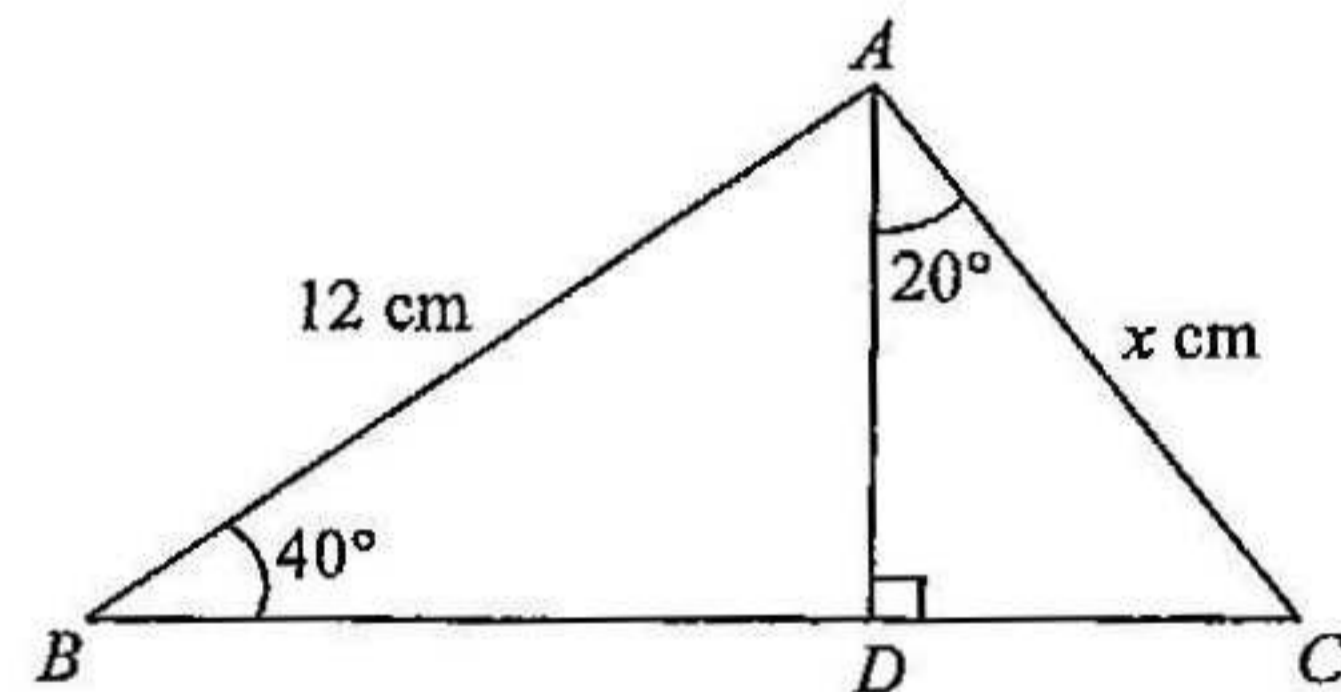
21. In the figure, $\cos \theta - \sin \theta =$

- A. $\frac{3}{5}$
- B. $\frac{-3}{5}$
- C. $\frac{7}{17}$
- D. $\frac{-7}{17}$



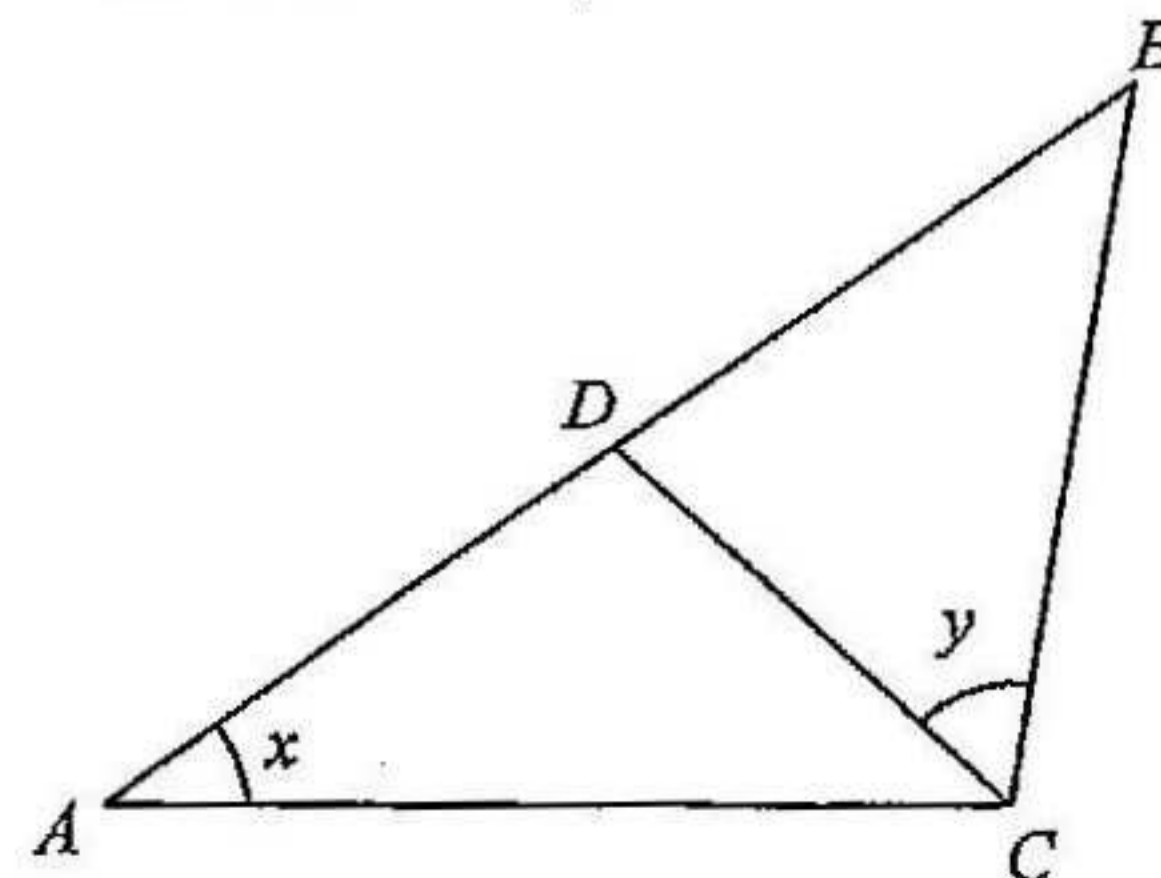
22. In the figure, D is a point lying on BC such that AD is perpendicular to BC . Find x correct to 2 decimal places.

- A. 6.86
- B. 7.25
- C. 8.21
- D. 9.78



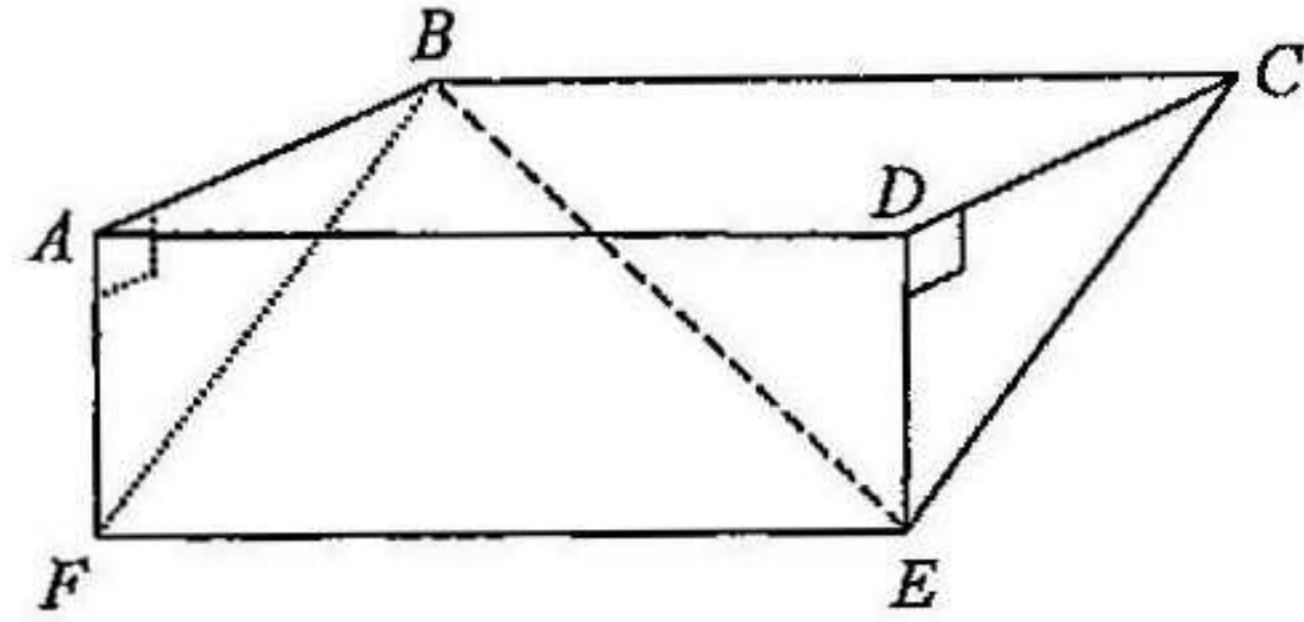
23. In the figure, D is a point lying on AB such that $AD = BD = CD$. Find $x + y$.

- A. 75°
- B. 90°
- C. 95°
- D. 105°

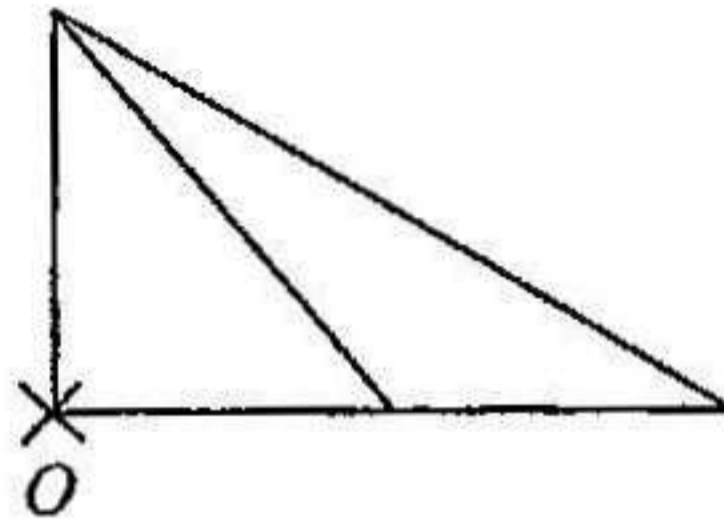


24. The figure shows a right prism $ABCDEF$ with a right-angled triangle as the cross-section. The angle between BE and the plane $ABCD$ is

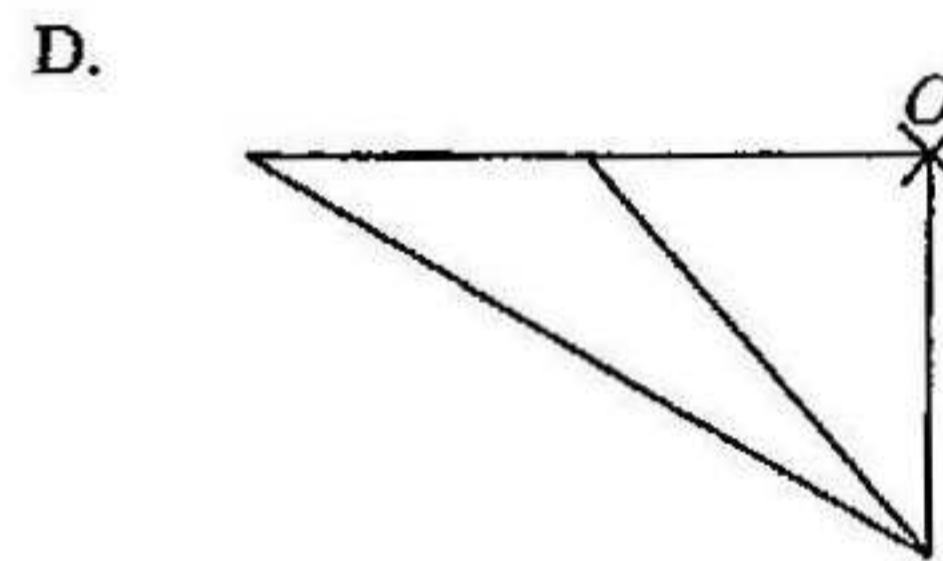
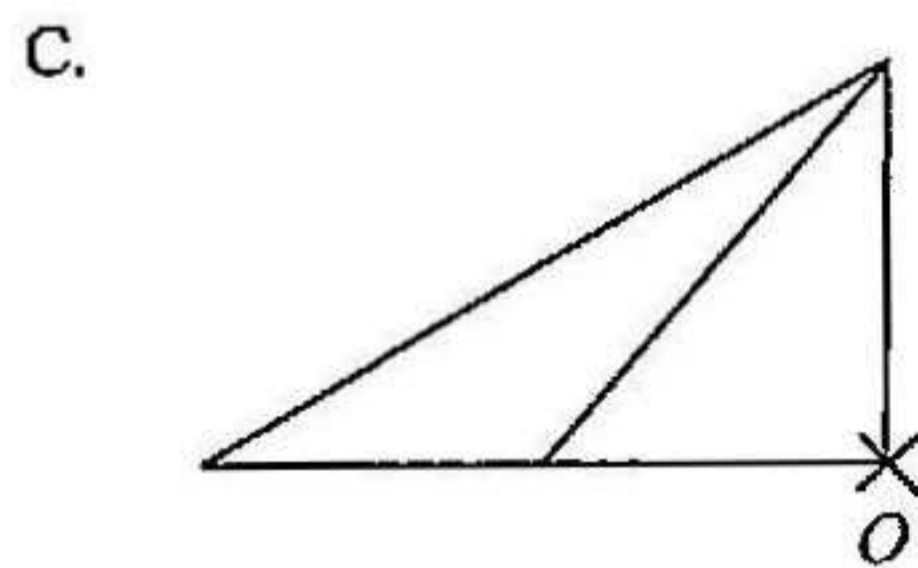
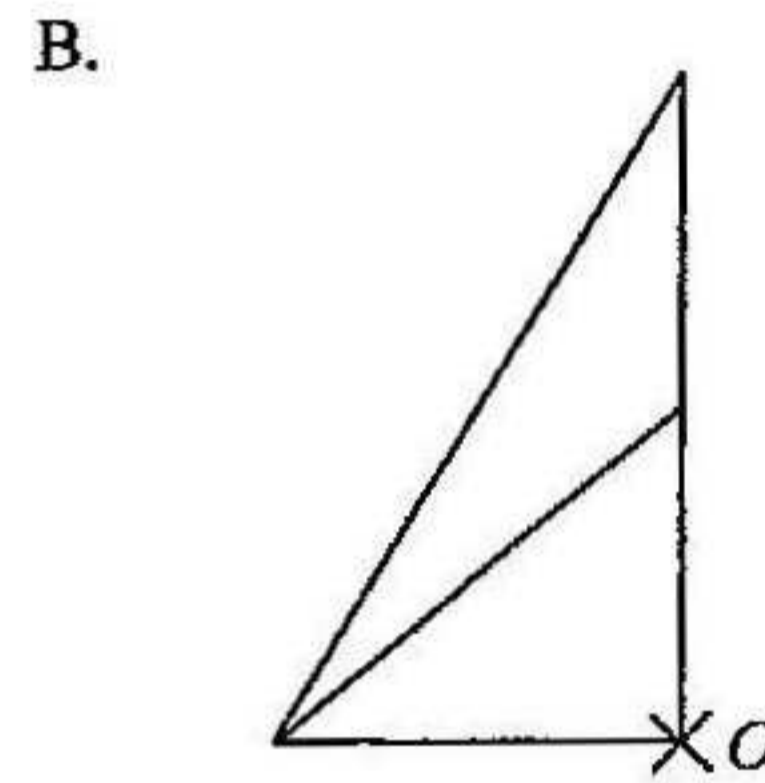
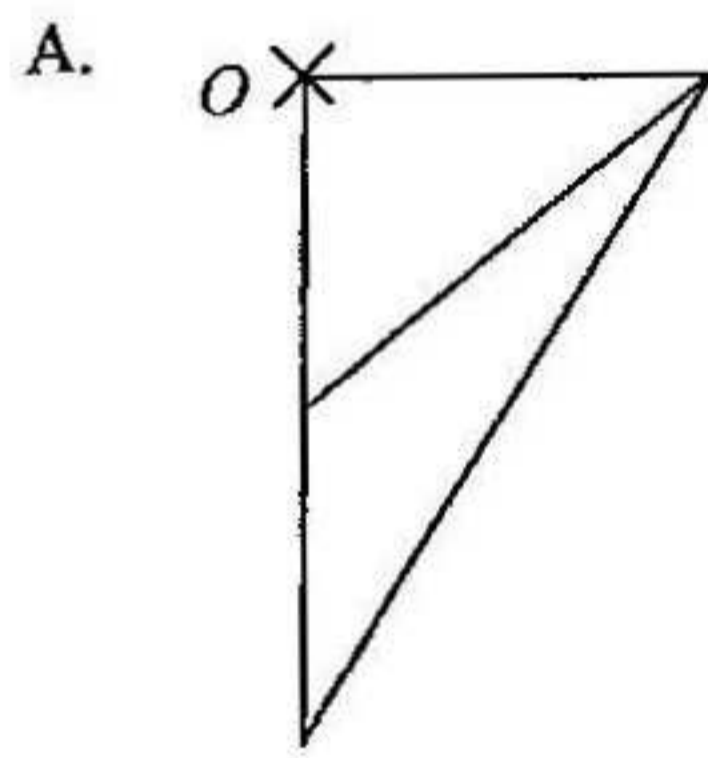
- A. $\angle ABE$.
- B. $\angle CBE$.
- C. $\angle DBE$.
- D. $\angle EBF$.



25.

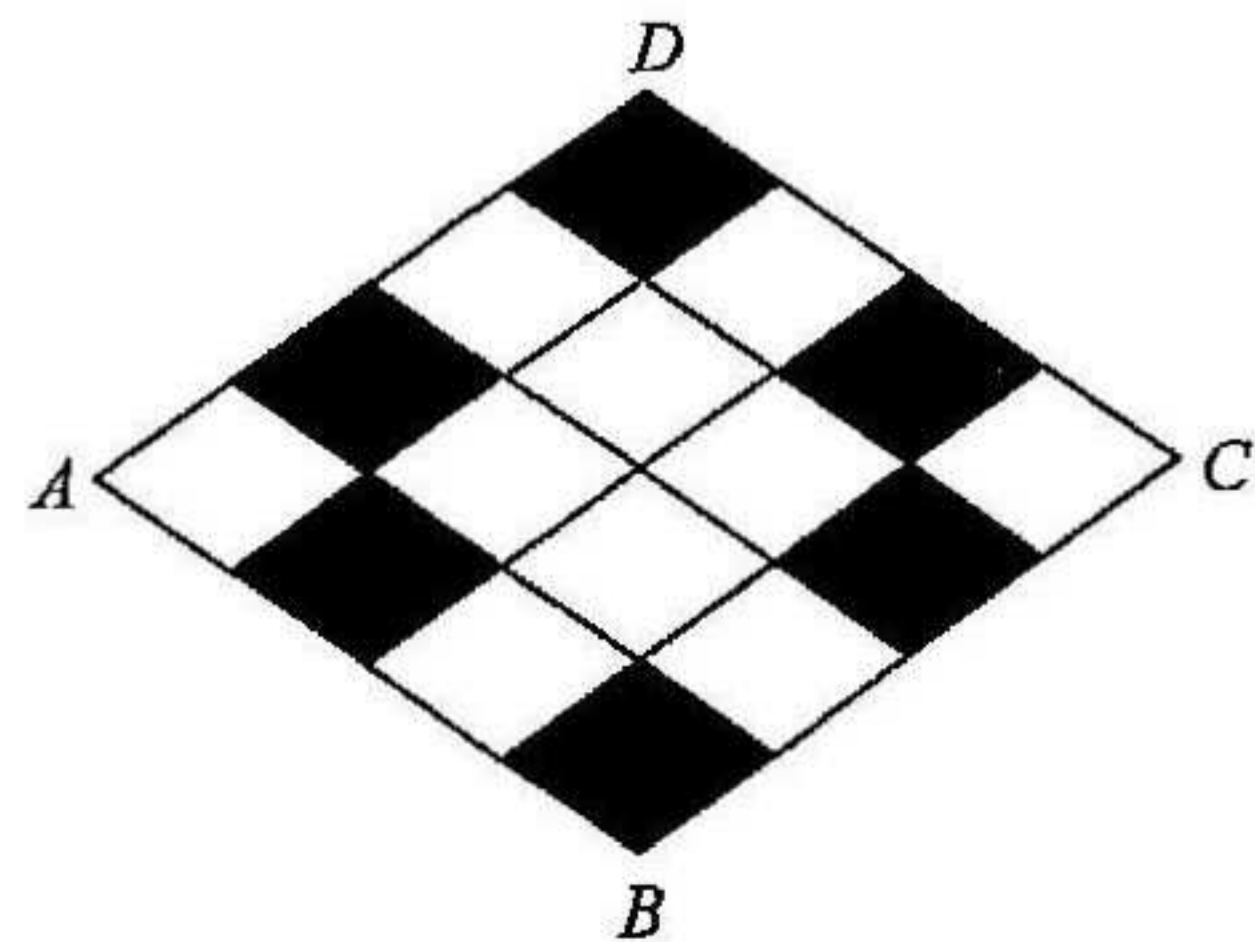


If the plane figure above is rotated anticlockwise about the point O through 270° , which of the following is its image?



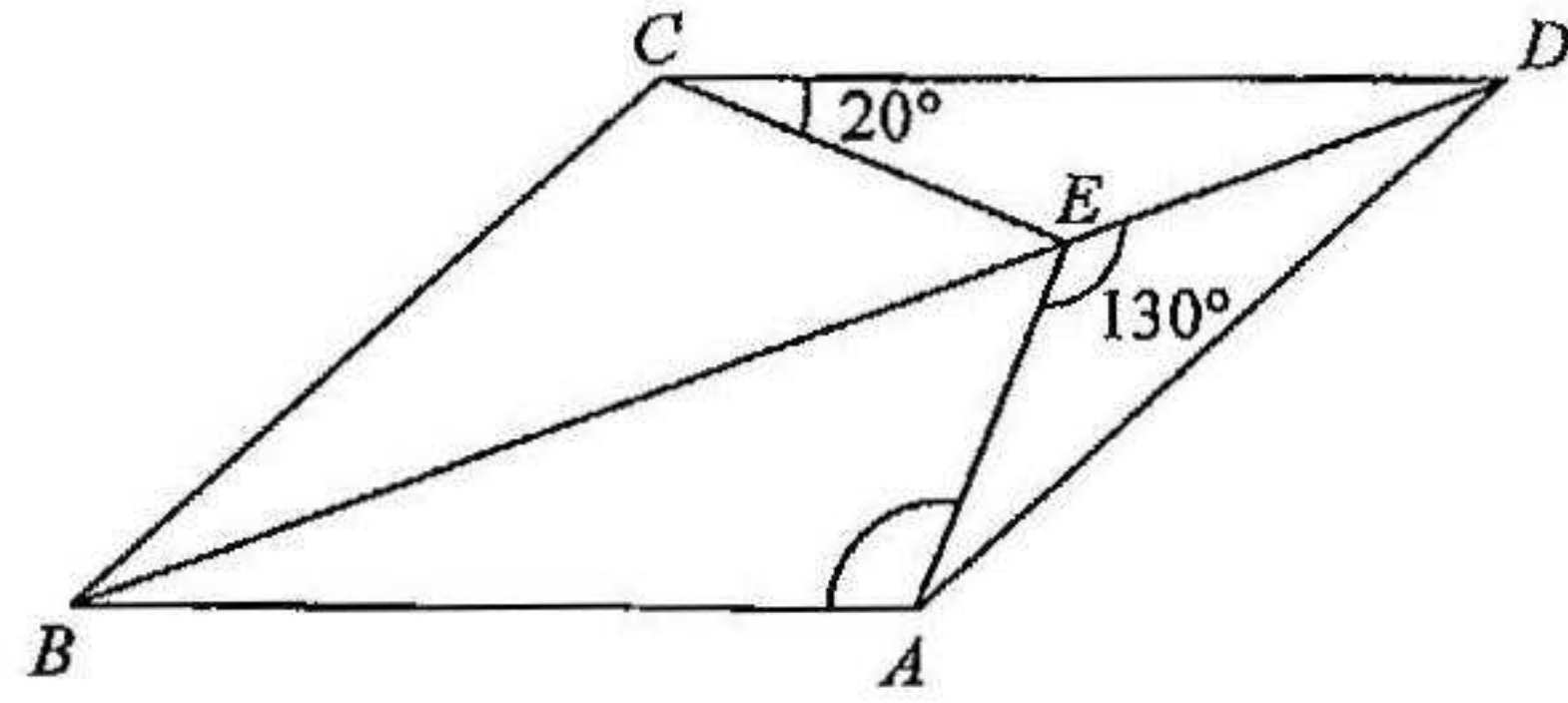
26. In the figure, the rhombus $ABCD$ is divided into sixteen identical rhombuses and six of them are shaded. The number of axes of reflectional symmetry of the rhombus $ABCD$ is

- A. 2.
- B. 3.
- C. 4.
- D. 6.



27. In the figure, BE is a diagonal of the parallelogram $ABCD$. If $\angle DCE = 20^\circ$, $\angle AED = 130^\circ$ and $CE = DE$, then $\angle BAE =$

- A. 100° .
- B. 105° .
- C. 110° .
- D. 115° .



28. If the sum of the exterior angles of a regular n -sided polygon is 3 times an interior angle of the polygon, then $n =$

- A. 3.
- B. 4.
- C. 6.
- D. 12.

29. The coordinates of the point A are $(-3, 2)$. If A is translated downwards by 7 units to the point B , then the coordinates of the reflection image of B with respect to the straight line $x = 1$ are

- A. $(5, 5)$.
- B. $(5, -5)$.
- C. $(-5, 5)$.
- D. $(-5, -5)$.

30. If the polar coordinates of the point P are $(2, 150^\circ)$, then the rectangular coordinates of P are

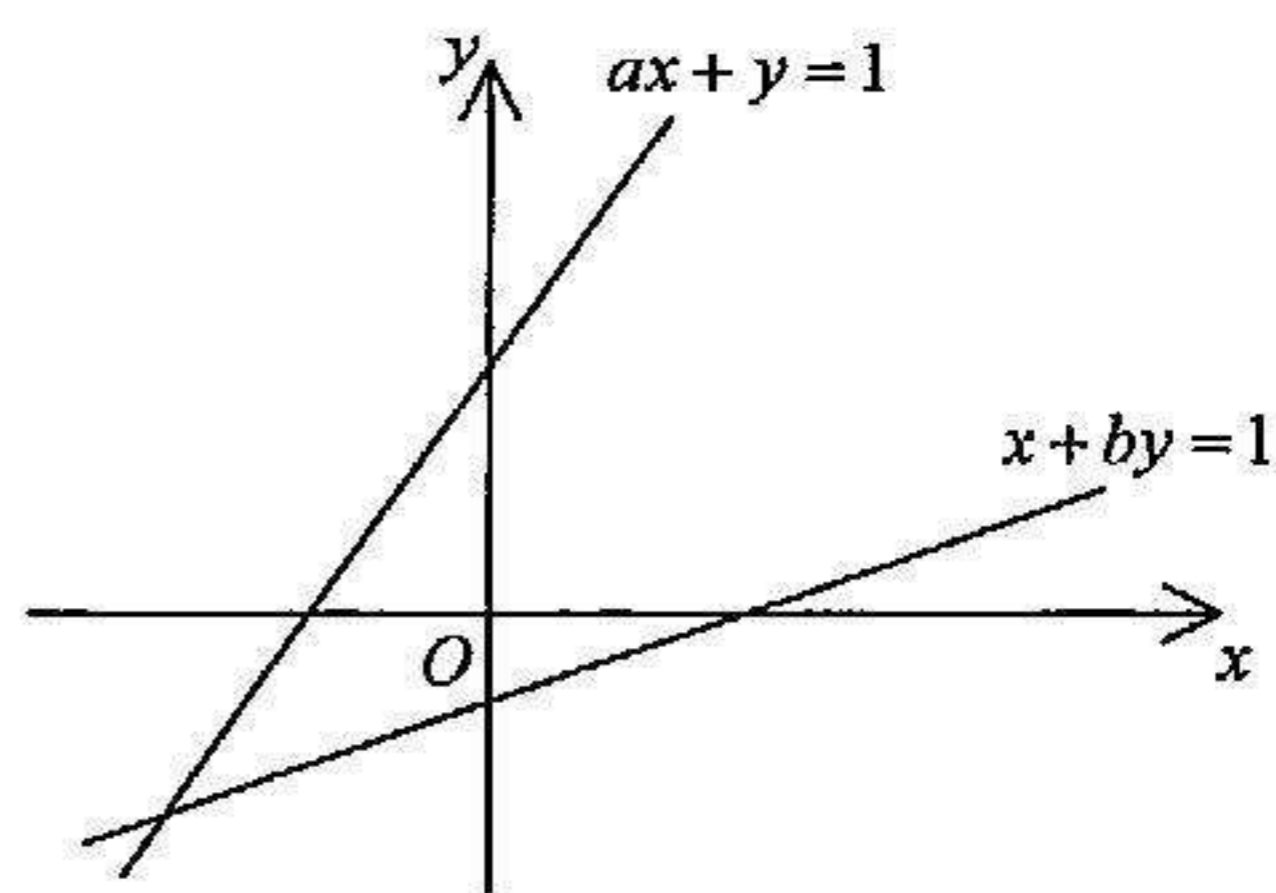
- A. $(-1, \sqrt{3})$.
- B. $(\sqrt{3}, -1)$.
- C. $(1, -\sqrt{3})$.
- D. $(-\sqrt{3}, 1)$.

31. If the straight line $x + 3y - 211 = 0$ is perpendicular to the straight line $kx - 3y + 211 = 0$, then $k =$

- A. -9 .
- B. -1 .
- C. 1 .
- D. 9 .

32. The figure shows the graph of $ax + y = 1$ and the graph of $x + by = 1$. Which of the following is true?

- A. $a > 0$
- B. $b > 0$
- C. $ab < 1$
- D. $ab > 1$



33. Two fair dice are thrown. Find the probability that the sum of the two numbers thrown is not less than 10.

- A. $\frac{1}{6}$
- B. $\frac{5}{6}$
- C. $\frac{1}{12}$
- D. $\frac{11}{12}$

34. The weights of seven boys are 70 kg, 55 kg, 53 kg, 56 kg, 64 kg, 54 kg and x kg. If the mean weight of the boys is 58 kg, then the median of their weights is

- A. 54 kg.
- B. 55 kg.
- C. 56 kg.
- D. 57 kg.

35. Which of the following can be obtained from any box-and-whisker diagram?

- I. Mean
 - II. Mode
 - III. Range
 - IV. Upper quartile
- A. I and II only
 - B. I and III only
 - C. II and IV only
 - D. III and IV only

36. The stem-and-leaf diagram below shows the distribution of the ages of 24 members of a committee.

<u>Stem (tens)</u>	<u>Leaf (units)</u>								
1	a								
2	2	2	3	7	8	8			
3	3	3	4	5	5	6	7	9	
4	1	1	b	6					
5	0	5	8						
6	0	1							

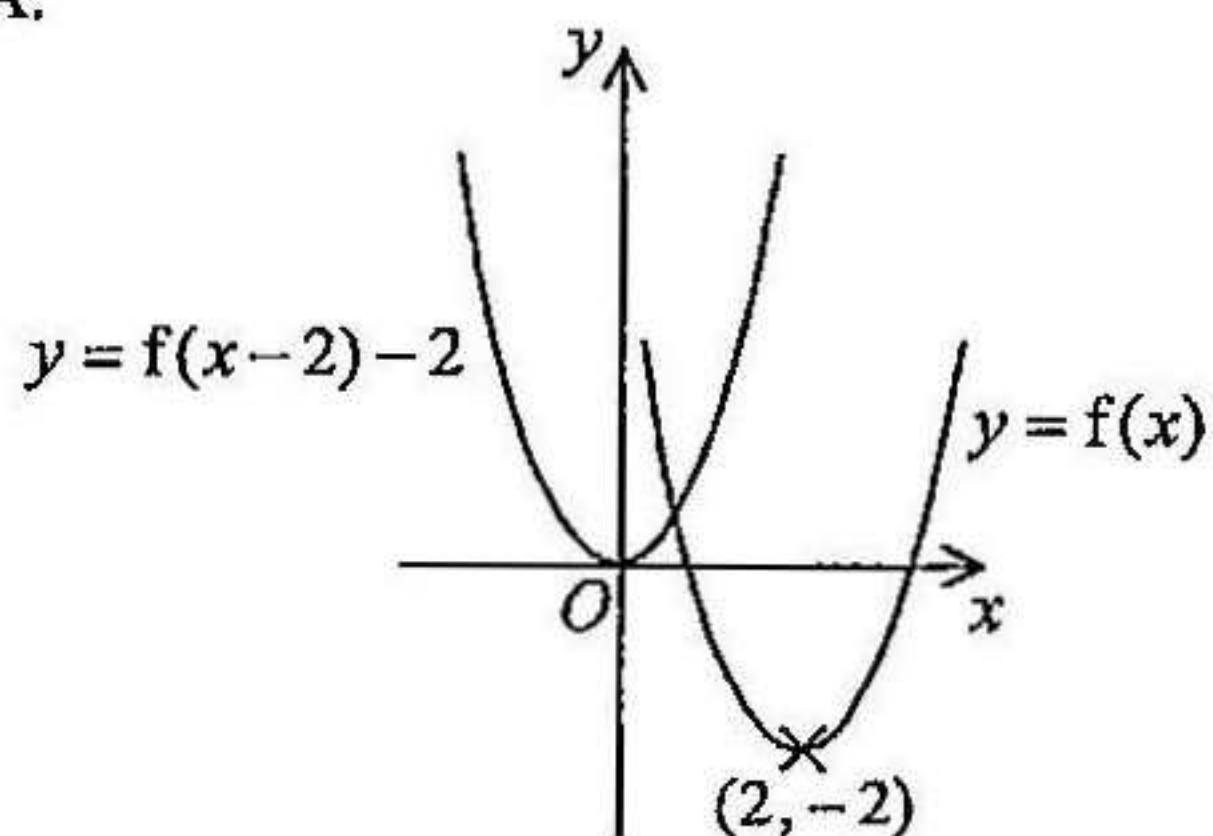
If the range and the inter-quartile range of the distribution are 42 and 18 respectively, then

- A. $a = 8$ and $b = 5$.
- B. $a = 8$ and $b = 6$.
- C. $a = 9$ and $b = 5$.
- D. $a = 9$ and $b = 6$.

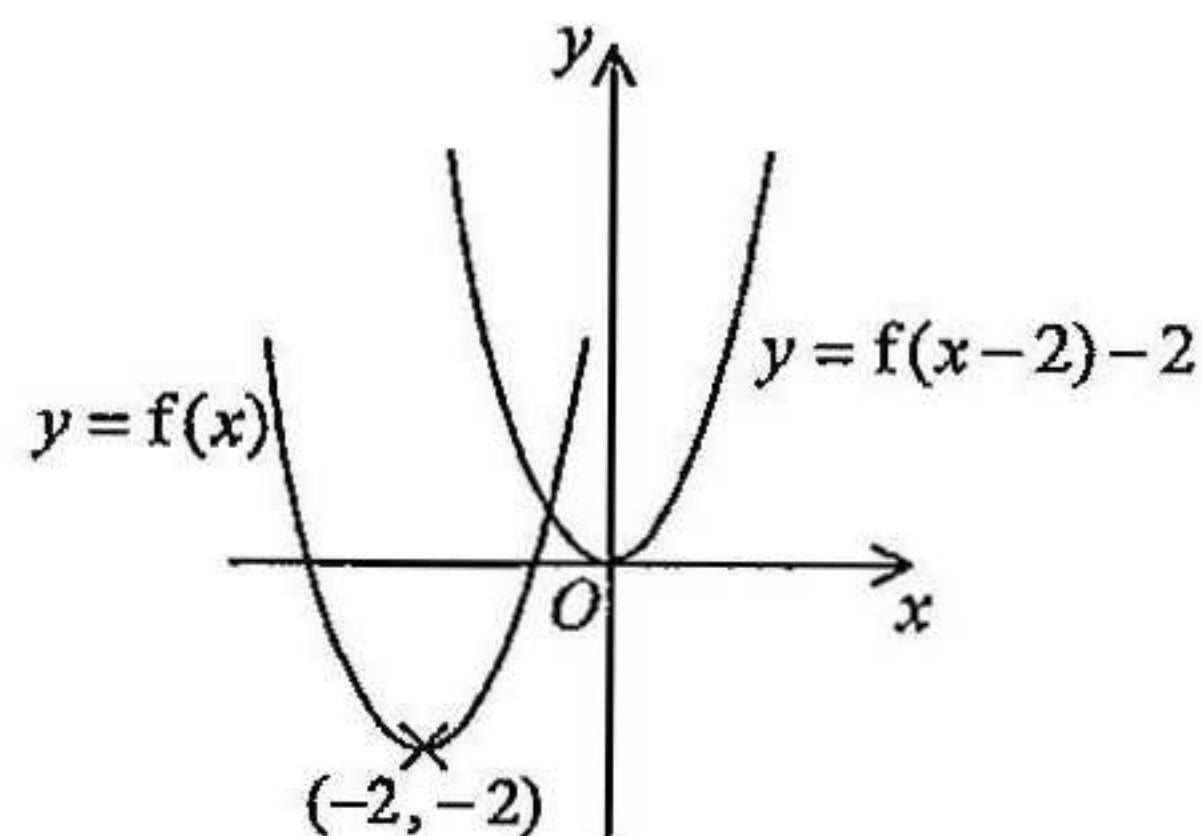
Section B

37. Which of the following may represent the graph of $y = f(x)$ and the graph of $y = f(x-2) - 2$ on the same rectangular coordinate system?

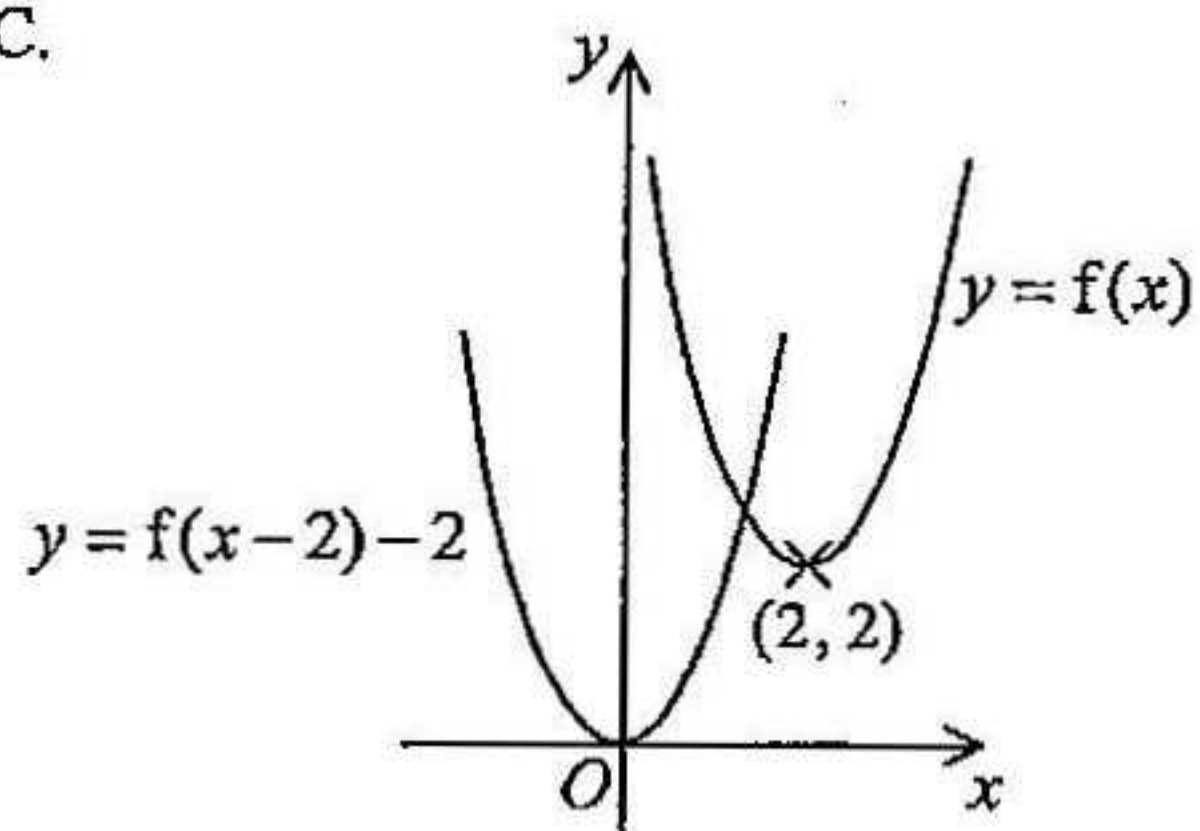
A.



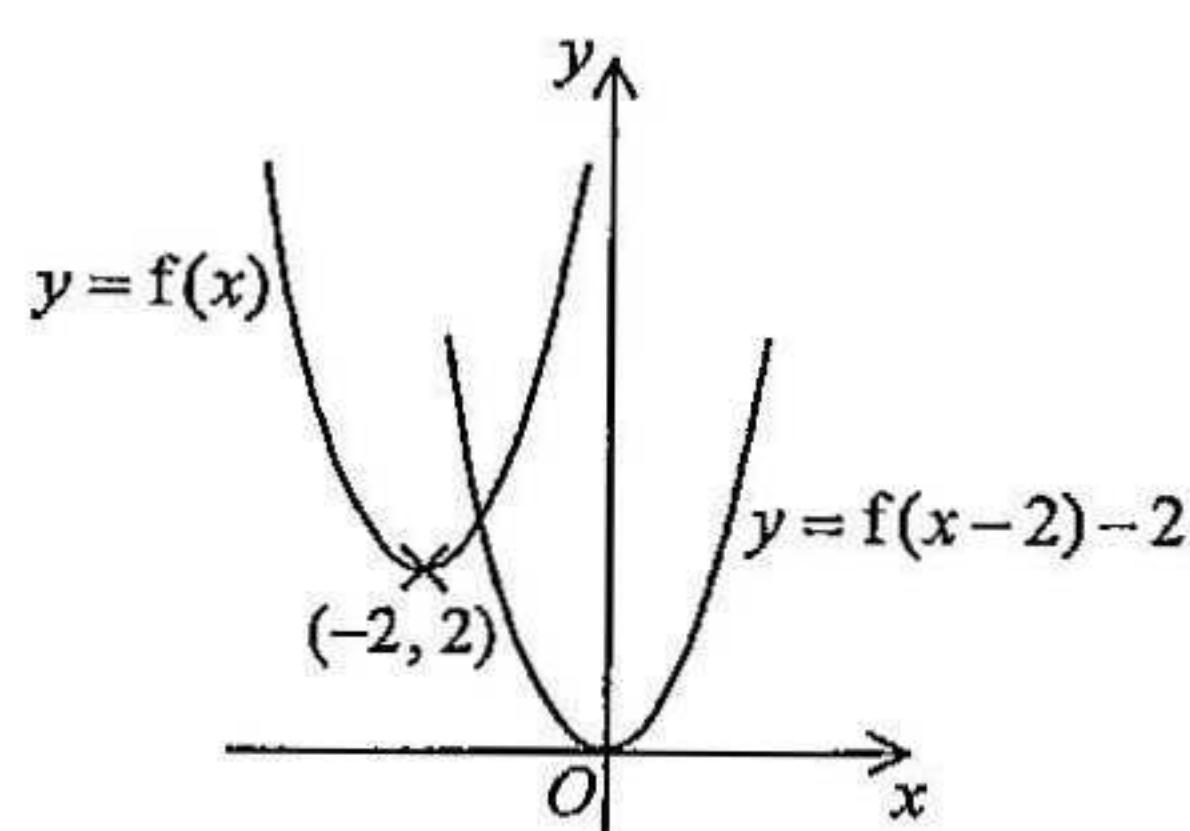
B.



C.

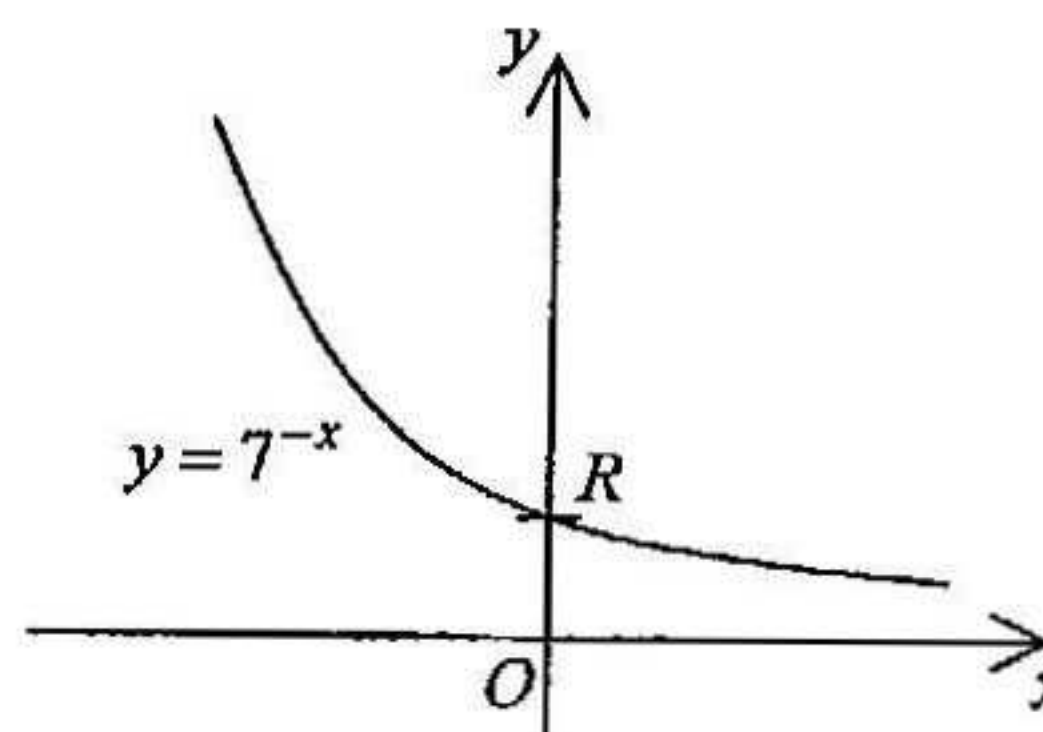


D.



38. The figure shows the graph of $y = 7^{-x}$. The coordinates of R are

- A. $(1, 0)$.
- B. $(0, 1)$.
- C. $(7, 0)$.
- D. $(0, 7)$.



39. Which of the following is the least?

- A. 1234^{1811}
- B. 2345^{1711}
- C. 3456^{1511}
- D. 7890^{1411}

40. Let $f(x) = 2x^2 + ax - 3$, where a is a constant. If $f(x)$ is divisible by $2x + 1$, find the remainder when $f(x)$ is divided by $x - a$.

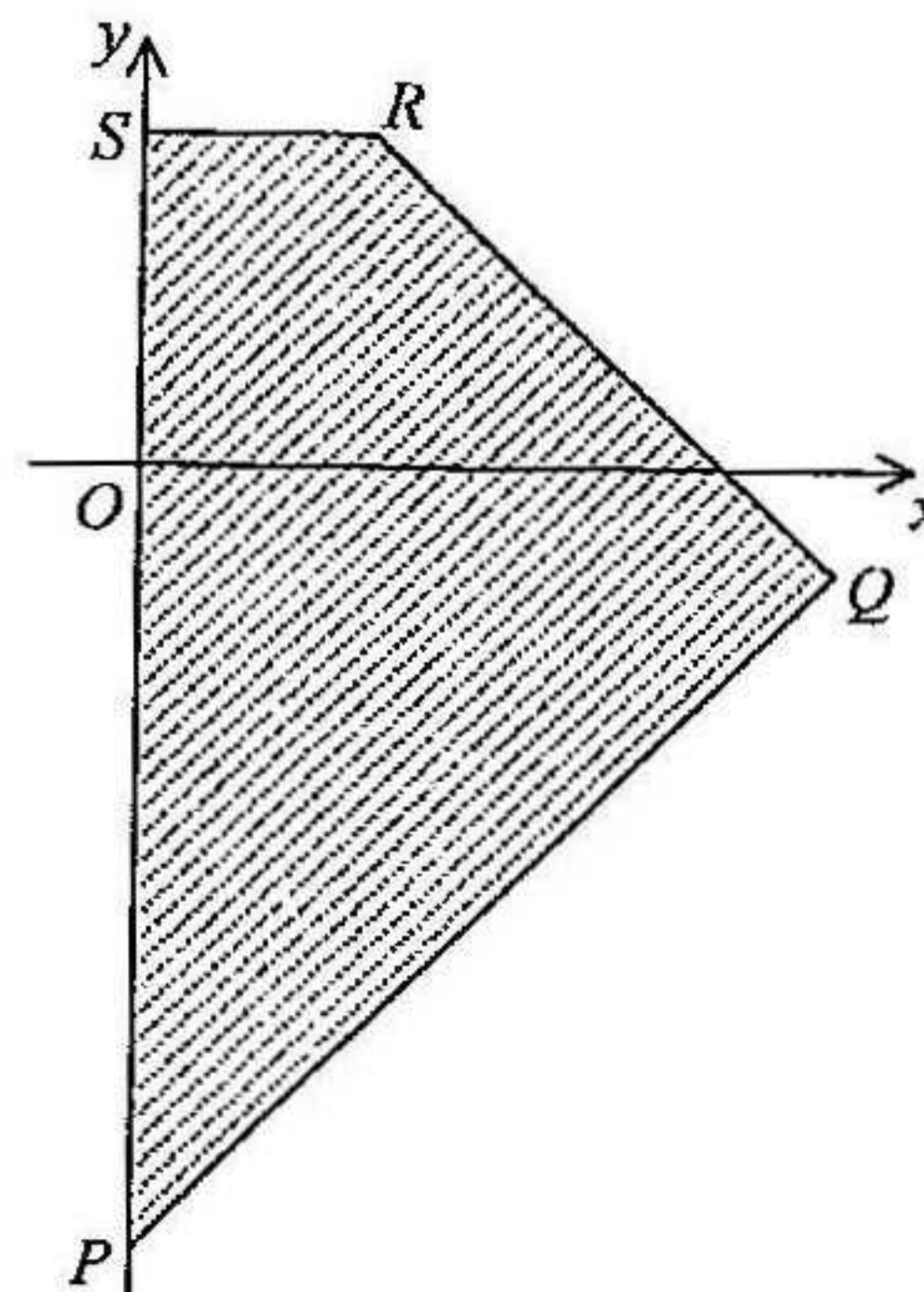
- A. -52
- B. 22
- C. 46
- D. 72

41. $1000010000101_2 =$

- A. $5 + 2^7 + 2^{12}$.
- B. $5 + 2^8 + 2^{13}$.
- C. $10 + 2^7 + 2^{12}$.
- D. $10 + 2^8 + 2^{13}$.

42. In the figure, the equations of PQ , QR and RS are $x - y = 7$, $x + y = 5$ and $y = 3$ respectively. If (x, y) is a point lying in the shaded region $PQRS$ (including the boundary), at which point does $2x - 3y + 35$ attain its greatest value?

- A. P
- B. Q
- C. R
- D. S



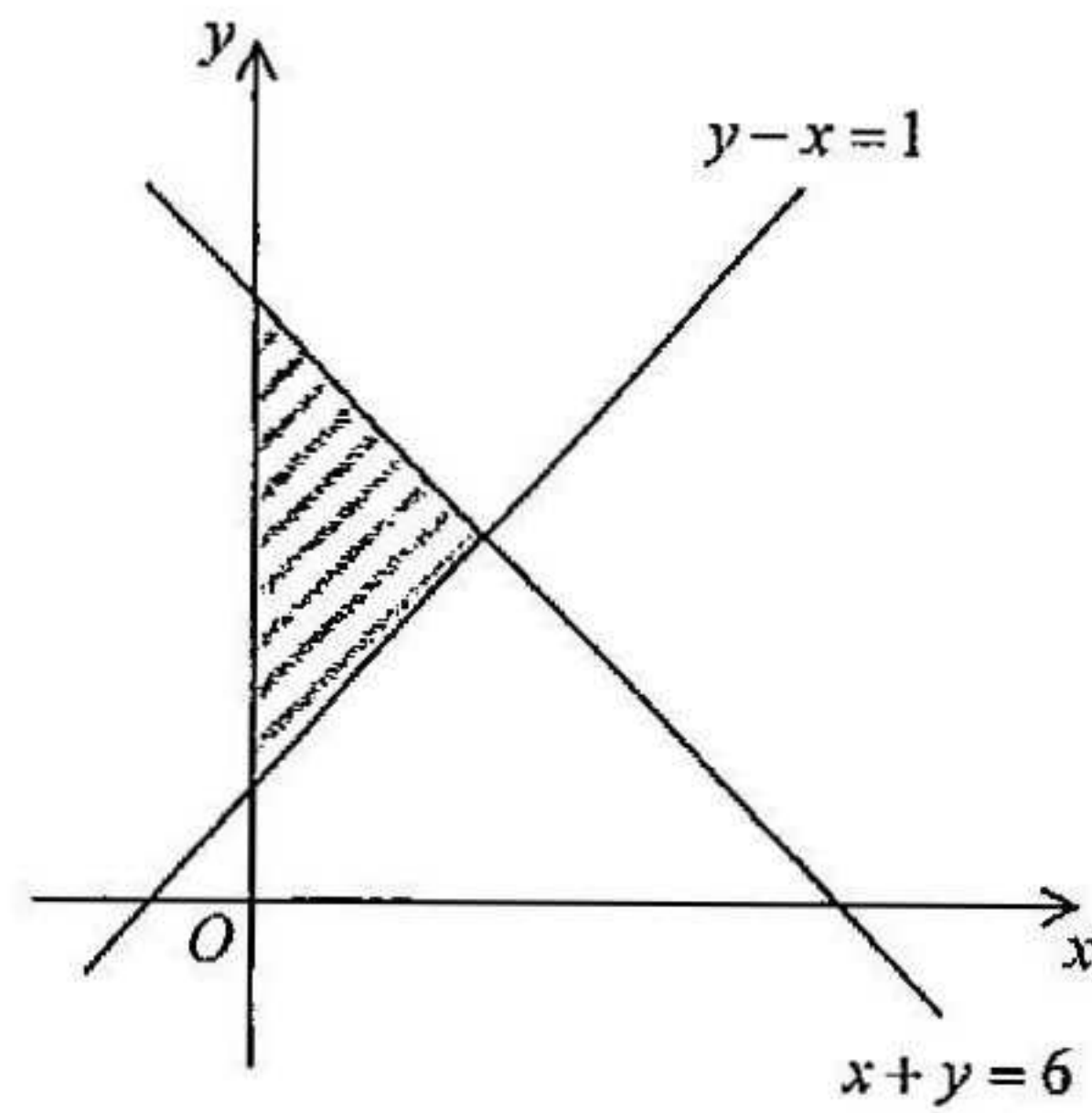
43. Which of the following systems of inequalities has its solution represented by the shaded region in the figure?

A.
$$\begin{cases} y - x \geq 1 \\ x + y \geq 6 \\ x \geq 0 \end{cases}$$

B.
$$\begin{cases} y - x \geq 1 \\ x + y \leq 6 \\ x \geq 0 \end{cases}$$

C.
$$\begin{cases} y - x \leq 1 \\ x + y \geq 6 \\ y \geq 0 \end{cases}$$

D.
$$\begin{cases} y - x \leq 1 \\ x + y \leq 6 \\ y \geq 0 \end{cases}$$



44. If the 3rd term and the 12th term of an arithmetic sequence are 42 and 6 respectively, then the sum of the first n terms of the sequence is

A. $28n + 2n^2$.

B. $32n + 2n^2$.

C. $52n - 2n^2$.

D. $56n - 2n^2$.

45. The product of the 1st term and the 2nd term of a geometric sequence is 18 while the product of the 3rd term and the 4th term of the sequence is 288. The product of the 4th term and the 5th term of the sequence is

A. 576.

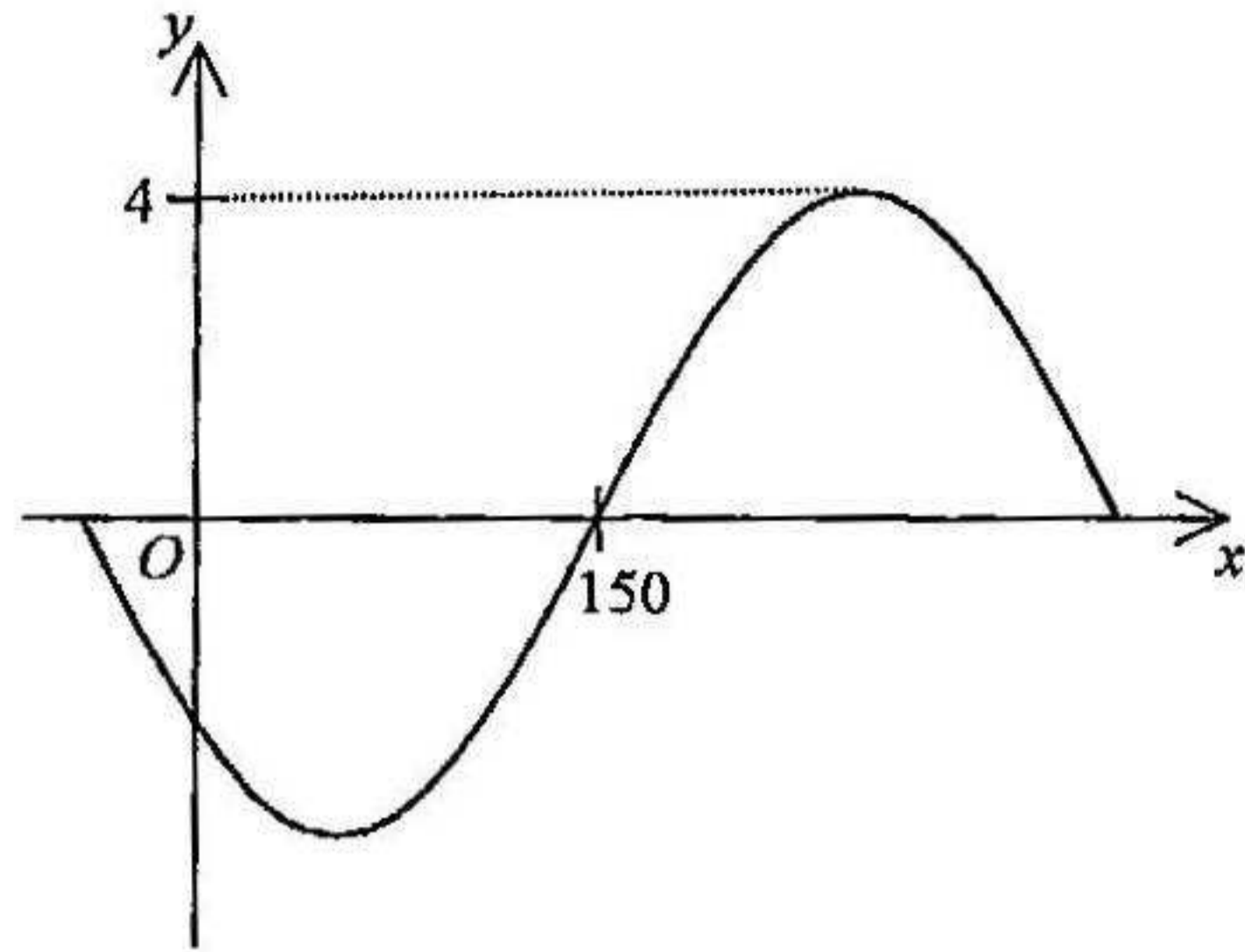
B. 864.

C. 1152.

D. 5184.

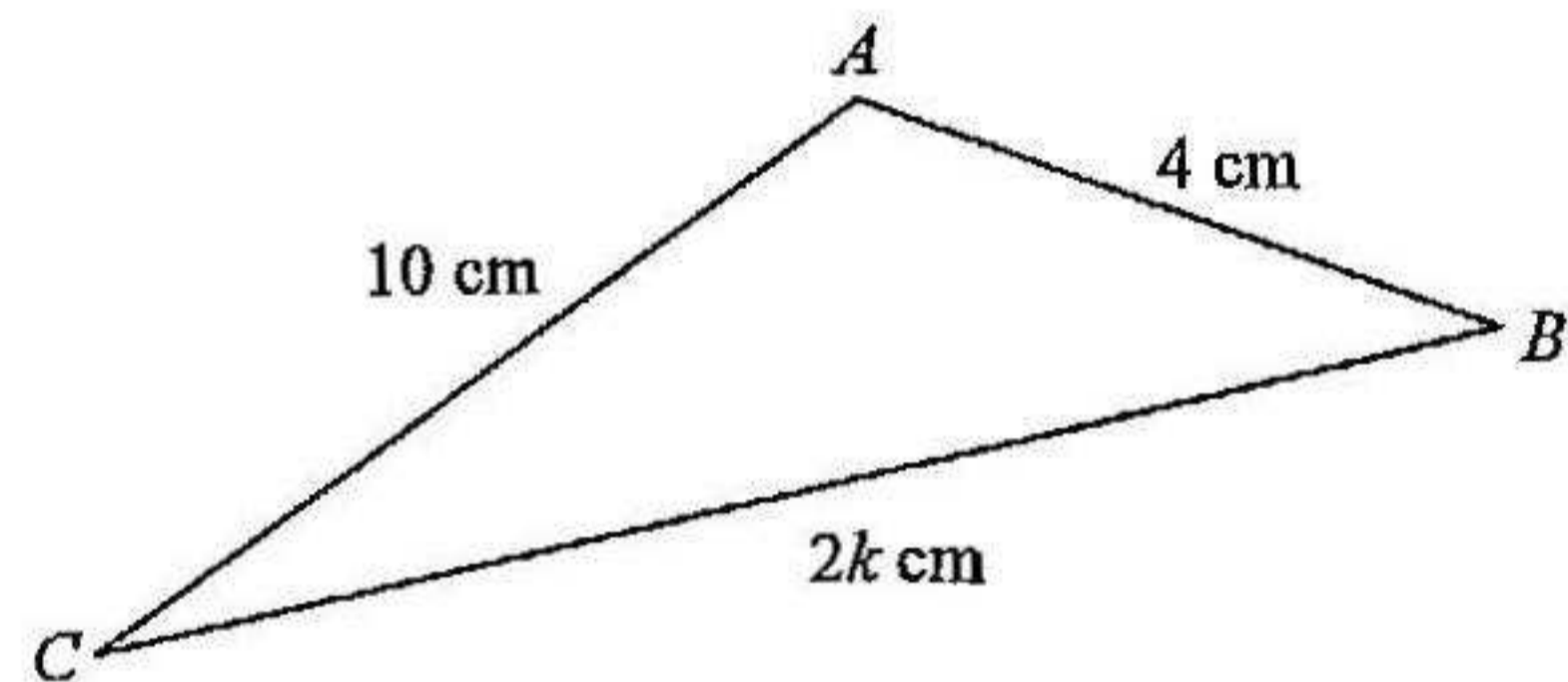
46. Let a be a constant and $-90^\circ < \theta < 90^\circ$. If the figure shows the graph of $y = a \cos(x^\circ + \theta)$, then

- A. $a = 4$ and $\theta = 60^\circ$.
- B. $a = 4$ and $\theta = -60^\circ$.
- C. $a = -4$ and $\theta = 60^\circ$.
- D. $a = -4$ and $\theta = -60^\circ$.



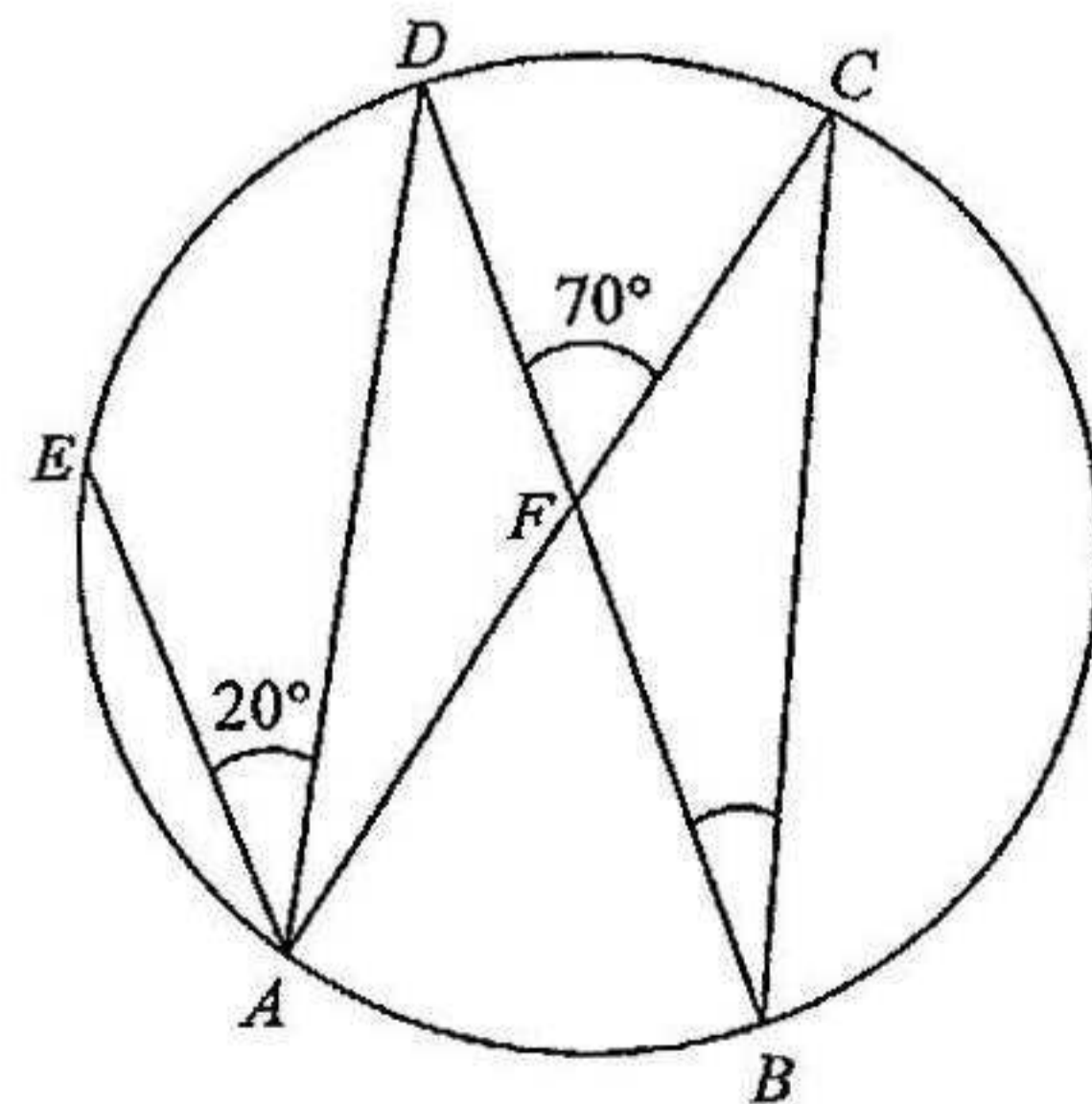
47. In the figure, the area of $\triangle ABC =$

- A. $\sqrt{(k^2 - 9)(49 - k^2)} \text{ cm}^2$.
- B. $\sqrt{(k^2 - 9)(49 + k^2)} \text{ cm}^2$.
- C. $\sqrt{(k^2 + 9)(49 - k^2)} \text{ cm}^2$.
- D. $\sqrt{(k^2 + 9)(49 + k^2)} \text{ cm}^2$.



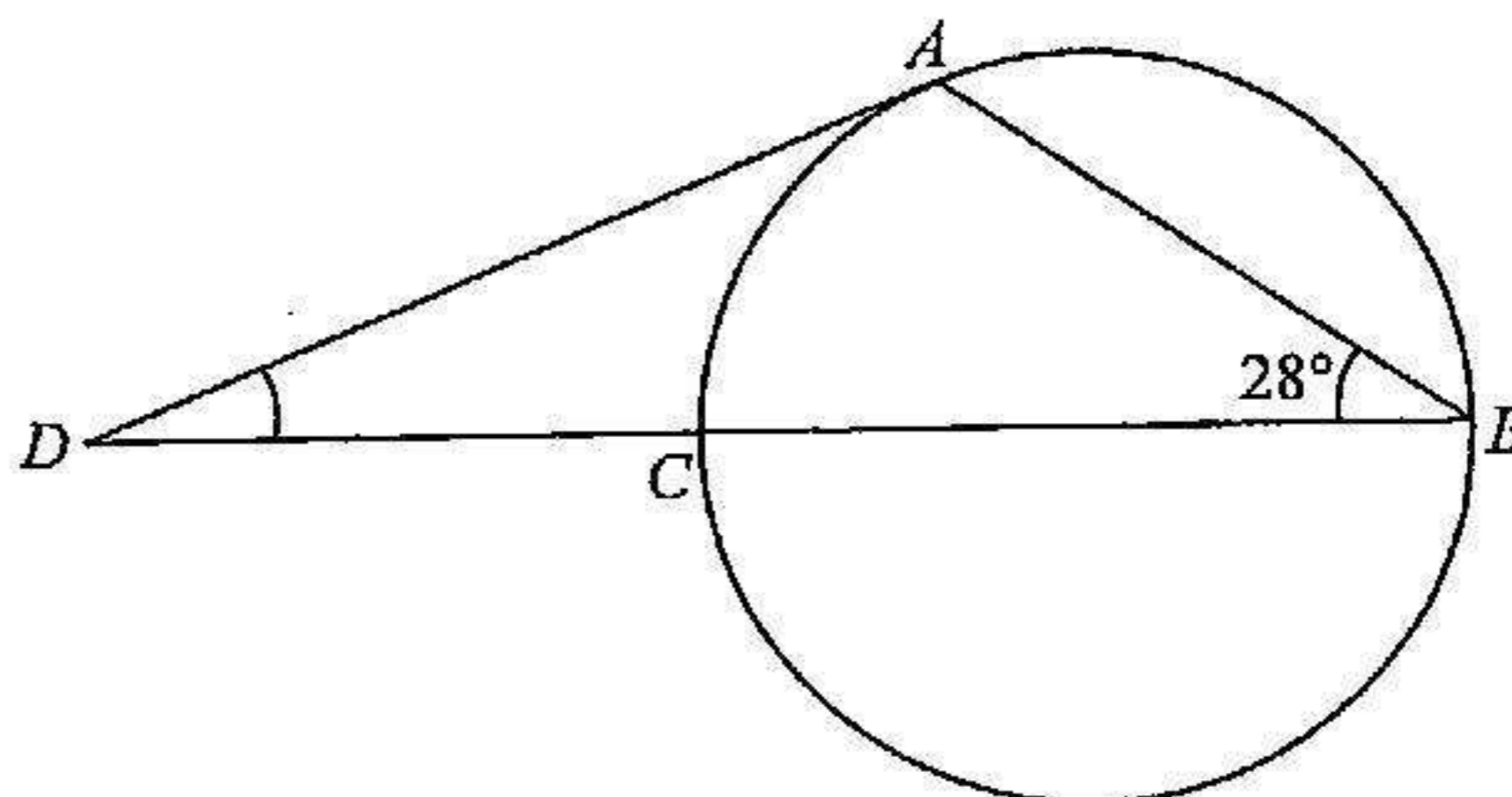
48. In the figure, $ABCDE$ is a circle. AC and BD intersect at F . If $AE \parallel BD$, $\angle DAE = 20^\circ$ and $\angle CFD = 70^\circ$, then $\angle CBD =$

- A. 20° .
- B. 35° .
- C. 45° .
- D. 50° .



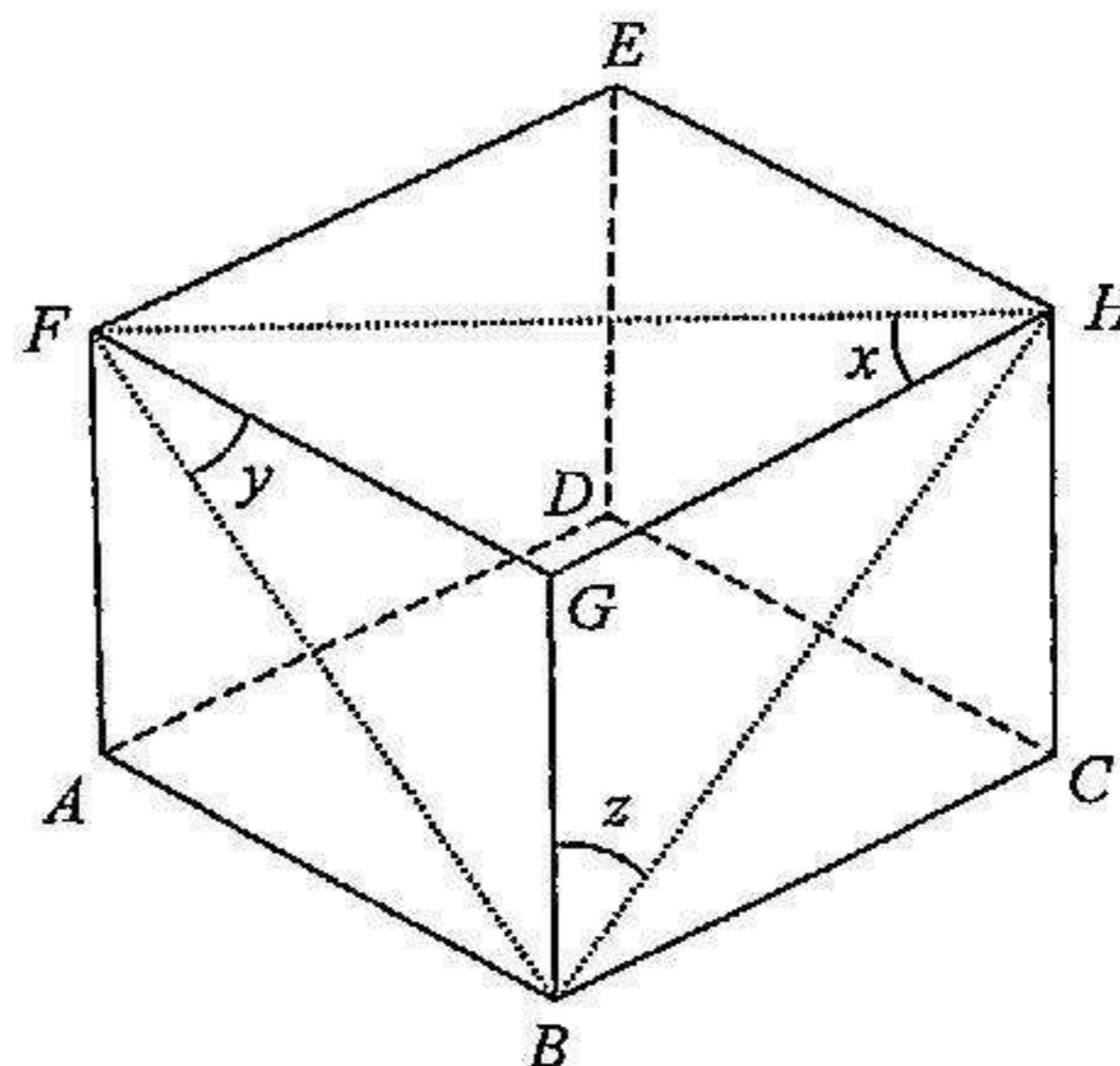
49. In the figure, BC is a diameter of the circle ABC . BCD is a straight line and DA is the tangent to the circle at A . If $\angle ABC = 28^\circ$, then $\angle ADB =$

- A. 22° .
 B. 28° .
 C. 34° .
 D. 62° .



50. In the figure, $ABCDEFGH$ is a cuboid. If $\angle FHG = x$, $\angle BFG = y$ and $\angle HBG = z$, then $\tan z =$

- A. $\tan x \tan y$.
 B. $\frac{1}{\tan x \tan y}$.
 C. $\frac{\tan x}{\tan y}$.
 D. $\frac{\tan y}{\tan x}$.



51. A circle C touches the x -axis and passes through the point $(-3, 1)$. If the centre of C lies on the y -axis, then the equation of C is

- A. $x^2 + y^2 - 5y = 0$.
 B. $x^2 + y^2 - 10y = 0$.
 C. $x^2 + y^2 + 3x - y = 0$.
 D. $x^2 + y^2 + 6x - 2y + 10 = 0$.

52. A box contains 2 red cards, 3 blue cards and 4 yellow cards. Mary repeats drawing one card at a time randomly from the box with replacement until a red card is drawn. Find the probability that Mary needs at least three draws.

- A. $\frac{5}{12}$
B. $\frac{7}{12}$
C. $\frac{49}{81}$
D. $\frac{343}{729}$

53. The manager of a popular restaurant designs a questionnaire to collect the opinions from customers about the food provided by the restaurant. The manager has four relatives who are customers of the restaurant and only these four relatives are selected as a sample to fill in the questionnaire. Which of the following are disadvantages of this sampling method?

- I. The sample size is too small.
II. The customers are not randomly selected.
III. Not all the customers are selected.

- A. I and II only
B. I and III only
C. II and III only
D. I, II and III

54. There are three groups of students in a tutorial class. The following table shows the mean mark of each of the three groups of students in a Mathematics test.

Group	Mean mark
Group A	60 marks
Group B	70 marks
Group C	80 marks

Which of the following must be true?

- I. In the test, the mean mark of all students in the tutorial class is 70 marks.
II. In the test, the mean mark of all students of Group A and Group B is lower than the mean mark of all students of Group B and Group C.
III. In the test, the student who gets the highest mark is in Group C.

- A. I only
B. II only
C. I and III only
D. II and III only

END OF PAPER