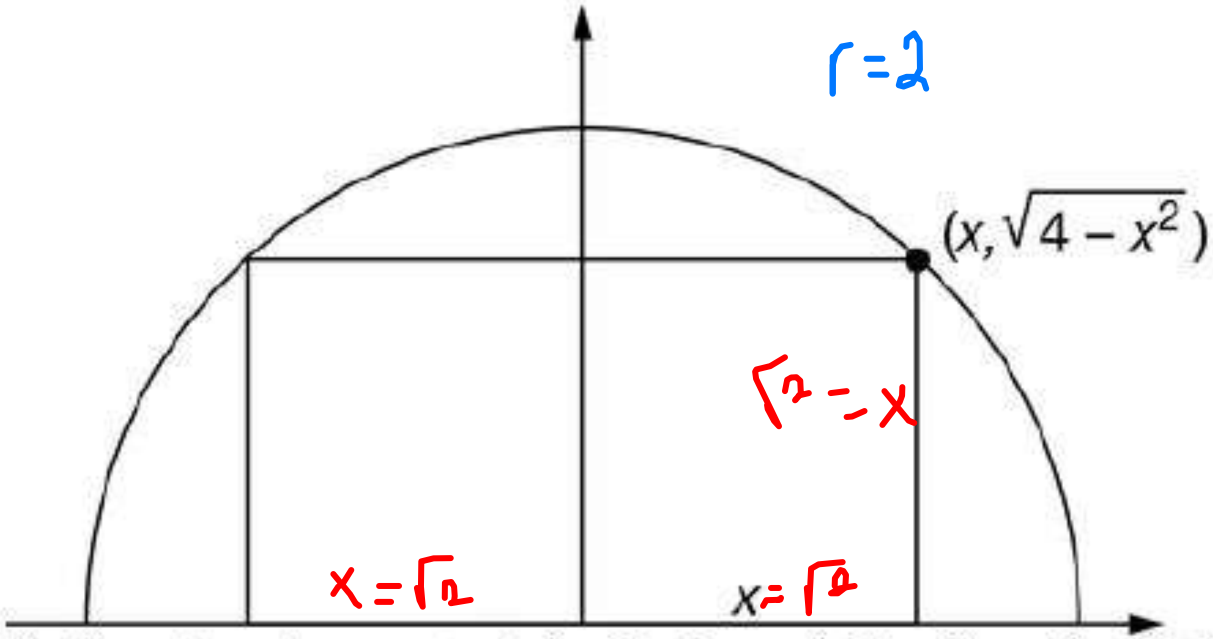
1.



Interval
$0 < x < 2$

$x = \sqrt{2}$ only critical value in interval

max

The figure above shows a rectangle inscribed in a semicircle with a radius of 2. The area of such a rectangle is given by $A(x) = 2x\sqrt{4-x^2}$, where the width of the rectangle is $2x$. It can be shown that $A'(x) = \frac{-2x^2}{\sqrt{4-x^2}} + 2\sqrt{4-x^2}$ and A has critical values of $\cancel{-2}$, $\cancel{-\sqrt{2}}$, $\sqrt{2}$, and $\cancel{2}$. It can also be shown that $A'(x)$ changes from positive to negative at $x = \sqrt{2}$. Which of the following statements is true?

area = lw

length = $2\sqrt{2}$

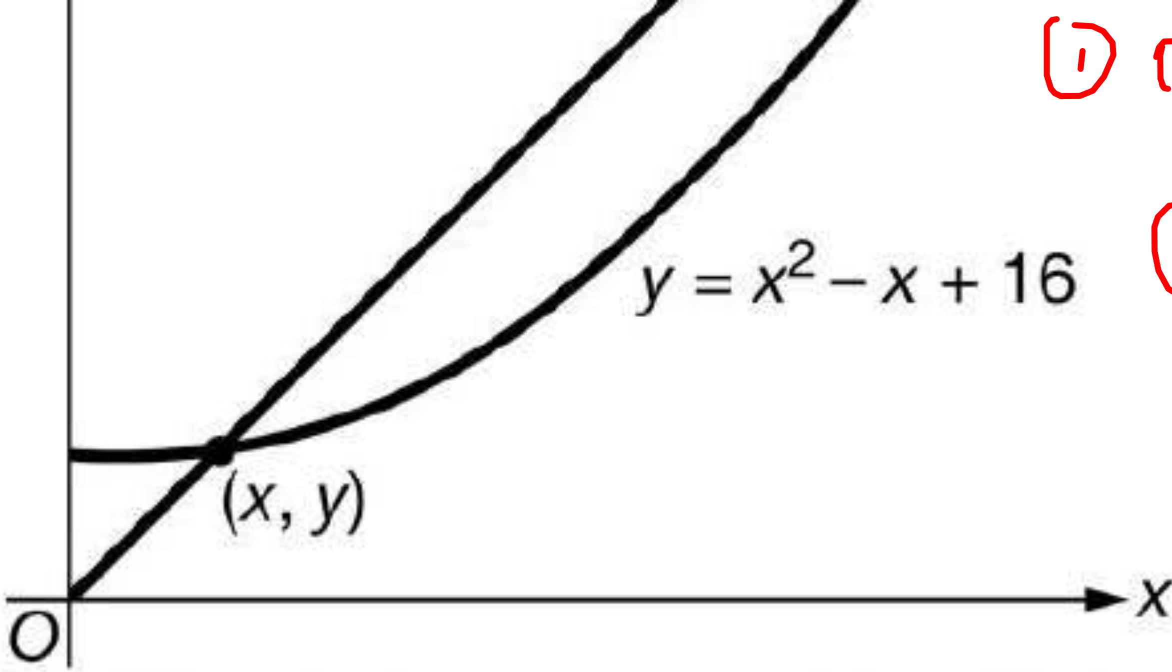
$2\sqrt{2} \times \sqrt{2}$

(A) The inscribed rectangle with maximum area has dimensions $\sqrt{2}$ by $\sqrt{2}$.

(B) The inscribed rectangle with ~~minimum~~ area has dimensions $\sqrt{2}$ by $\sqrt{2}$.

(C) The inscribed rectangle with maximum area has dimensions $2\sqrt{2}$ by $\sqrt{2}$.

(D) The inscribed rectangle with ~~minimum~~ area has dimensions $2\sqrt{2}$ by $\sqrt{2}$.



① $m = \frac{y}{x} = \frac{x^2 - x + 16}{x}$

$m = \boxed{x - 1 + \frac{16}{x}}$

② EVT guarantees a min + a max on an interval

$\frac{dm}{dx} = 1 - \frac{16}{x^2} = 0$ $x = 4$

x	m
1	16
4	7
8	9

Consider all lines in the xy-plane that pass through both the origin and a point (x, y) on the graph of $y = x^2 - x + 16$ for $1 \leq x \leq 8$. The figure above shows one such line and the graph of $y = x^2 - x + 16$. Which of the following statements is true?

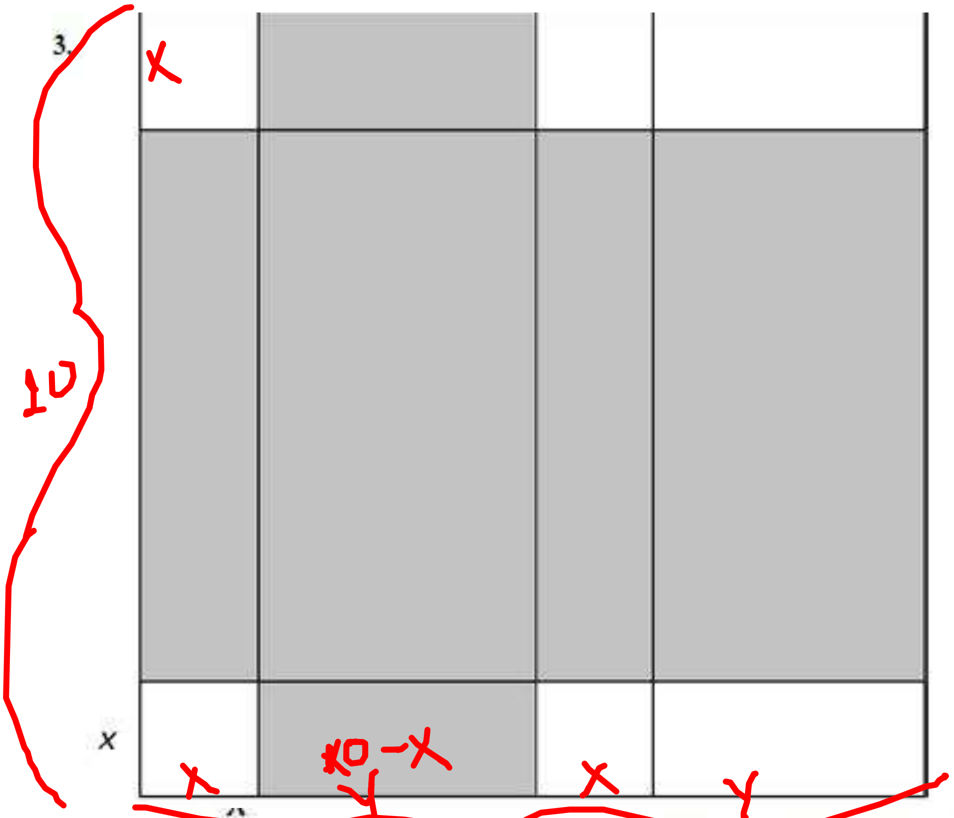
(A) The line with minimum slope passes through the graph of $y = x^2 - x + 16$ at $x = 1$.

✓ (B) The line with minimum slope passes through the graph of $y = x^2 - x + 16$ at $x = 4$.

(C) The line with minimum slope passes through the graph of $y = x^2 - x + 16$ at $x = 7$.

(D) The line with minimum slope passes through the graph of $y = x^2 - x + 16$ at $x = 8$.

3.



The figure above represents a square sheet of cardboard with side length 20 inches. The sheet is cut and pieces are discarded. When the cardboard is folded, it becomes a rectangular box with a lid. The pattern for the rectangular box with a lid is shaded in the figure. Four squares with side length x and two rectangular regions are discarded from the cardboard. Which of the following statements is true? (The volume V of a rectangular box is given by $V = lwh$.)

(A) When $x = 10$ inches, the box has a minimum possible volume.

(B) When $x = 10$ inches, the box has a maximum possible volume.

(C) When $x = \frac{10}{3}$ inches, the box has a minimum possible volume.

(D) When $x = \frac{10}{3}$ inches, the box has a maximum possible volume.

$V = lwh$ length $(20-2x)$

$x+y+x+y=20$

$\frac{2x}{2}+\frac{2y}{2}=\frac{20}{2}$ $x+y=10$

width $(10-x)$ $y=10-x$

volume $= x(20-2x)(10-x)$

$x(200-20x-20x+2x^2)$

$200x-40x^2+2x^3$

$2x^3-40x^2+200x$

$\frac{dx}{dy} = 6x^2-80x+200$

$2(3x-10)(x-10)$

max $\boxed{x=\frac{10}{3}}$ $x=\cancel{10}$ min