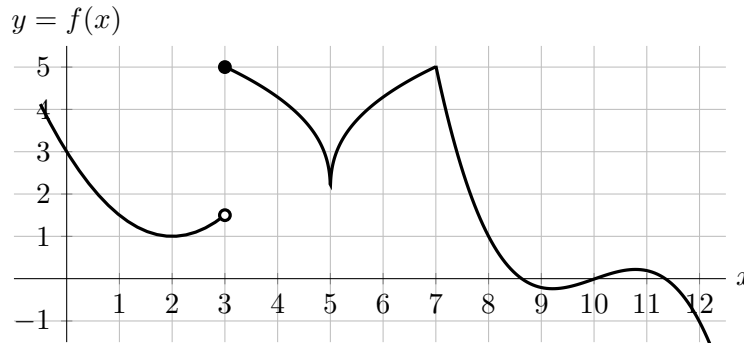


6. [4 points] The graph of the function  $f(x)$  is shown below. Note that  $f(x)$  has a vertical tangent line at  $x = 5$ .



- a. [2 points] On which of the following intervals does the function  $f(x)$  satisfy the hypotheses of the Mean Value Theorem? Circle the correct answer(s).

  $[0,2]$ 
  $[1,3]$ 
  $[2,4]$ 
  $[3,5]$ 
 NONE OF THESE

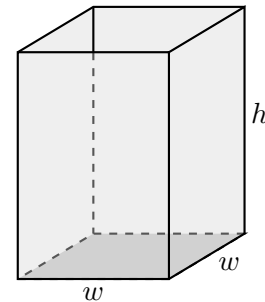
- b. [2 points] On the interval  $[8, 12]$  the hypotheses of the Mean Value Theorem are true for the function  $f(x)$ . What does the conclusion of this theorem say in this interval?

**Answer:**

*Solution:* There is some  $c$  on the interval  $(8, 12)$  such that  $f'(c) = \frac{f(12) - f(8)}{12 - 8} = -\frac{1}{2}$ .

7. [5 points]

Yi is constructing a cardboard box. The base of the box will be a square of width  $w$  inches. The height of the box will be  $h$  inches. Yi will use gray cardboard for the sides of the box and brown cardboard for the bottom (the box does not have a top). Gray cardboard costs \$0.05 per square inch, while brown cardboard costs \$0.03 per square inch. Yi wants to spend \$20 on the cardboard for his box.



Write a formula for  $h$  in terms of  $w$ .

*Solution:* The area covered by the gray and the brown cardboard are  $A_g = 4wh$  and  $A_b = w^2$  respectively. Then the cost of the cardboard, in dollars, used in the cardboard is  $C = 0.05A_g + 0.03A_b$ . Hence  $w$  and  $h$  satisfy

$$C = 20 = 0.05(4wh) + 0.03w^2 = 0.2wh + 0.03w^2.$$

Then

$$h = \frac{20 - 0.03w^2}{0.2w}.$$

**Answer:**  $h = \frac{20 - 0.03w^2}{0.2w}$