

# Lecture 13

## Section 4.5 Some Max-Min Problems

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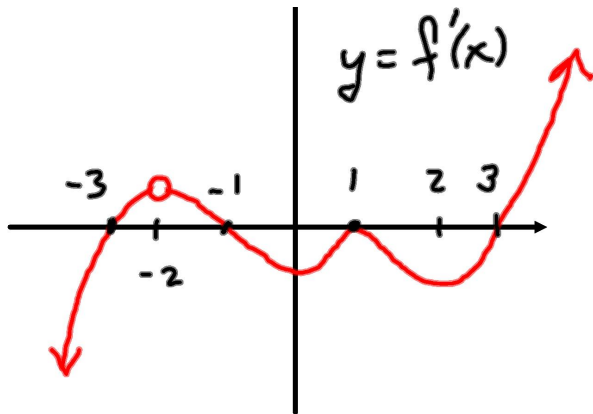
# Test 1

- The written questions on Test 1 have been graded on Monday, and should appear as a separate column in your CourseWare gradebook by Wednesday.
- You will have to add the two columns to get your total score on the exam.



## Quiz 1

Assume the domain of  $f$  is all real numbers. The graph of  $f'(x)$  is shown below. Give the number of critical values of  $f$ .

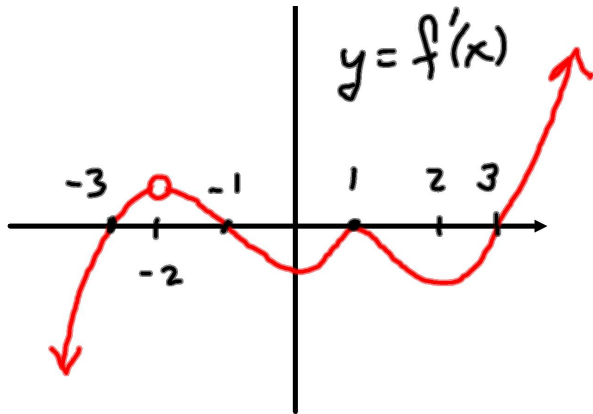


- a. 2
- b. 3
- c. 4
- d. 5
- e. None of these



## Quiz 2

Assume the domain of  $f$  is all real numbers. The graph of  $f'(x)$  is shown below. Give the number of local minima of  $f$ .



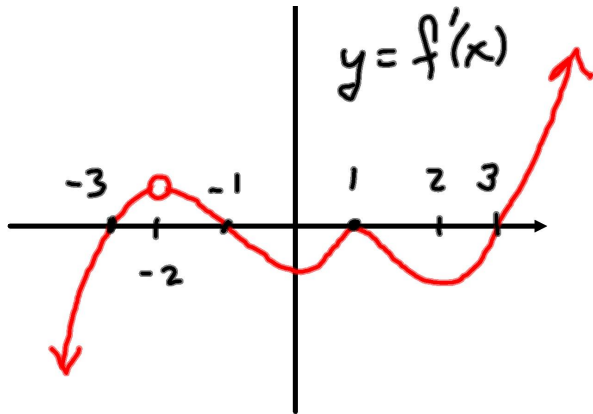
- a. 1
- b. 2
- c. 3
- d. 4
- e. None of these



## Quiz 3

Assume the domain of  $f$  is all real numbers. The graph of  $f'(x)$  is shown below. Give the number of local maxima of  $f$ .

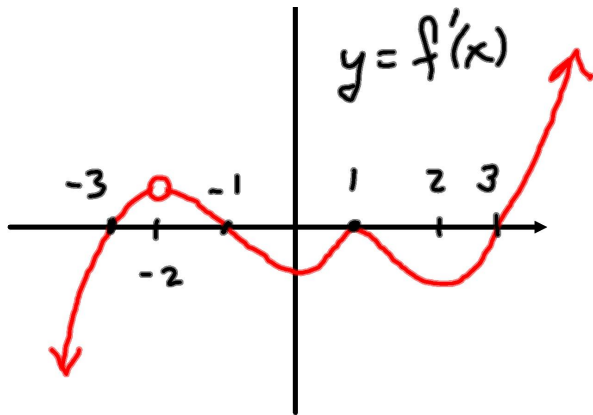
- a. 1
- b. 2
- c. 3
- d. 4
- e. None of these



## Quiz 4

Assume the domain of  $f$  is all real numbers. The graph of  $f'(x)$  is shown below. Give the number of intervals of increase of  $f$ .

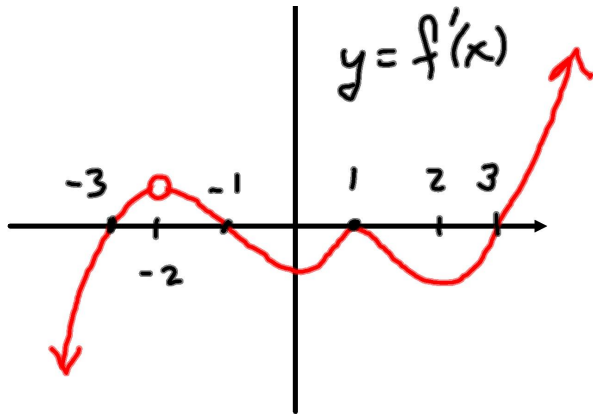
- a. 1
- b. 2
- c. 3
- d. 4
- e. None of these



## Quiz 5

Assume the domain of  $f$  is all real numbers. The graph of  $f'(x)$  is shown below. Give the number of intervals of decrease of  $f$ .

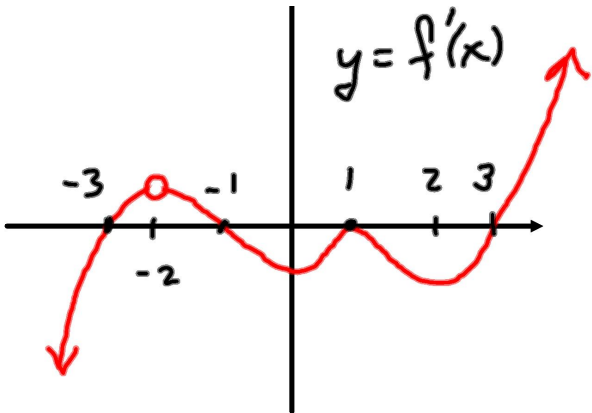
- a. 1
- b. 2
- c. 3
- d. 4
- e. None of these



## Quiz 6

Assume the domain of  $f$  is all real numbers. The graph of  $f'(x)$  is shown below. Classify the critical value at  $-3$  or state that the value is not a critical value.

- a. local maximum
- b. local minimum
- c. neither
- d. not a critical value
- e. None of these

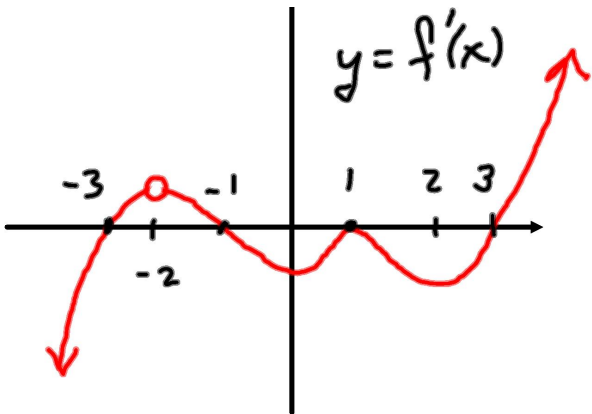




## Quiz 7

Assume the domain of  $f$  is all real numbers. The graph of  $f'(x)$  is shown below. Classify the critical value at  $-2$  or state that the value is not a critical value.

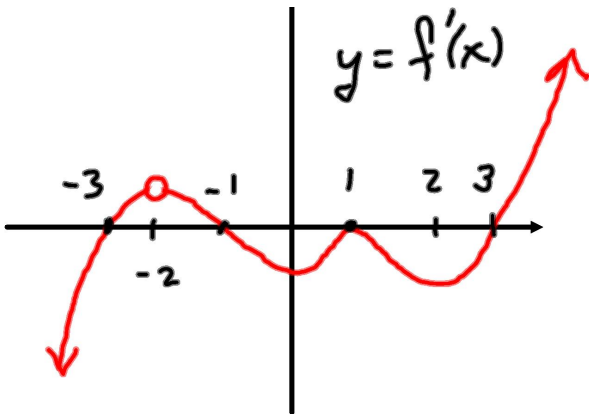
- a. local maximum
- b. local minimum
- c. neither
- d. not a critical value
- e. None of these



## Quiz 8

Assume the domain of  $f$  is all real numbers. The graph of  $f'(x)$  is shown below. Classify the critical value at  $-1$  or state that the value is not a critical value.

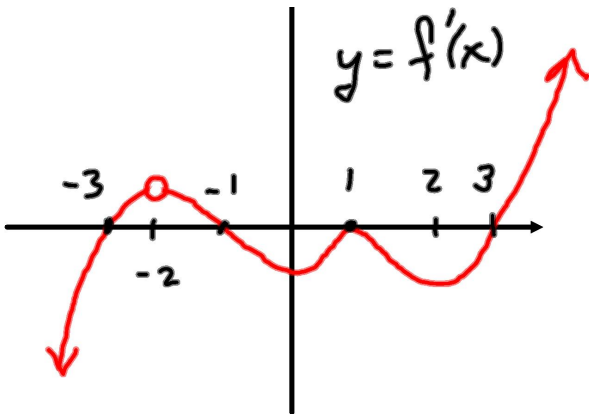
- a. local maximum
- b. local minimum
- c. neither
- d. not a critical value
- e. None of these



## Quiz 9

Assume the domain of  $f$  is all real numbers. The graph of  $f'(x)$  is shown below. Classify the critical value at 0 or state that the value is not a critical value.

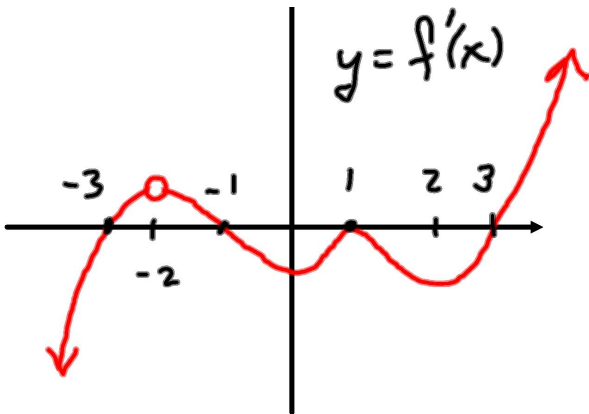
- a. local maximum
- b. local minimum
- c. neither
- d. not a critical value
- e. None of these



## Quiz 10

Assume the domain of  $f$  is all real numbers. The graph of  $f'(x)$  is shown below. Classify the critical value at 1 or state that the value is not a critical value.

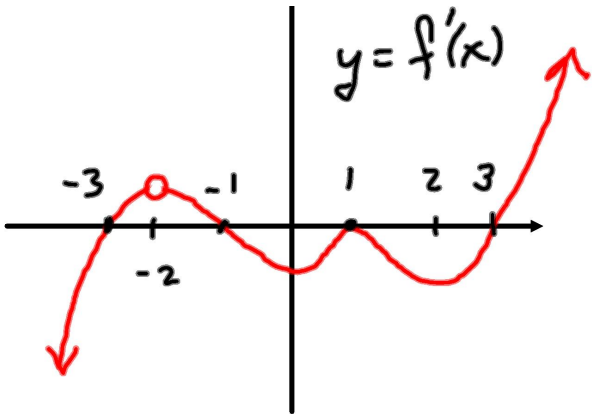
- a. local maximum
- b. local minimum
- c. neither
- d. not a critical value
- e. None of these



# Quiz 11

Assume the domain of  $f$  is all real numbers. The graph of  $f'(x)$  is shown below. Classify the critical value at 2 or state that the value is not a critical value.

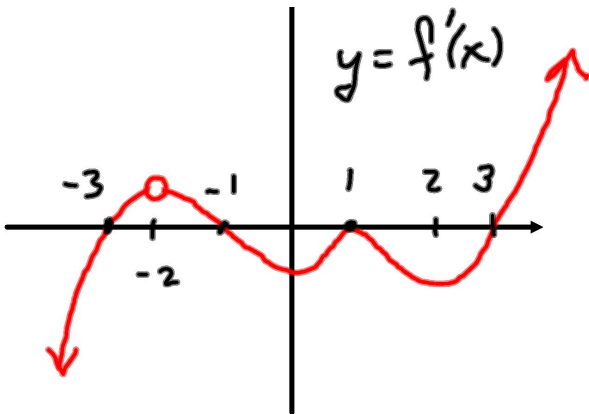
- a. local maximum
- b. local minimum
- c. neither
- d. not a critical value
- e. None of these



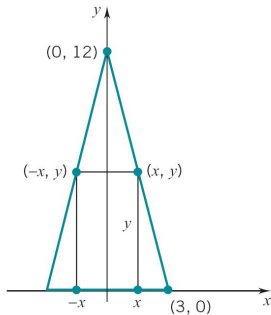
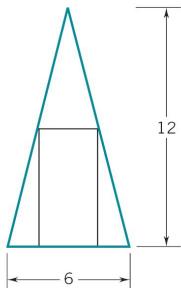
## Quiz 12

Assume the domain of  $f$  is all real numbers. The graph of  $f'(x)$  is shown below. Classify the critical value at 3 or state that the value is not a critical value.

- a. local maximum
- b. local minimum
- c. neither
- d. not a critical value
- e. None of these



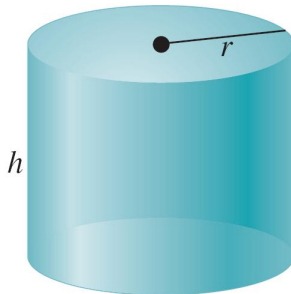
# Example 1



**Example 1** An isosceles triangle has a base of 6 units and a height of 12 units. Find the maximum possible area of a rectangle that can be placed inside the triangle with one side resting on the base of the triangle. What are the dimensions of the rectangle(s) of maximum area?



## Example 2

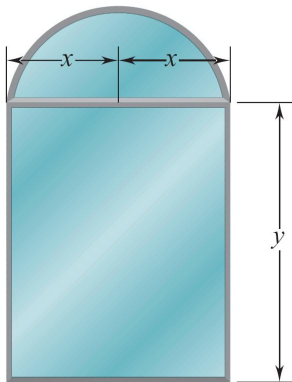


**Example 2** A soft-drink manufacturer wants to fabricate cylindrical cans for its product. The can is to have a volume of 12 fluid ounces, which is approximately 22 cubic inches. Find the dimensions of the can that will require the least amount of material. See Figure 4.5.3.





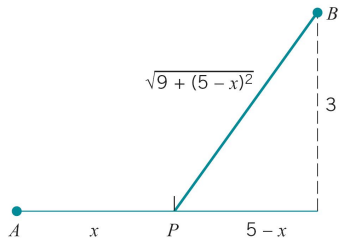
## Example 3



**Example 3** A window in the shape of a rectangle capped by a semicircle is to have perimeter  $p$ . Choose the radius of the semicircular part so that the window admits the greatest amount of light.



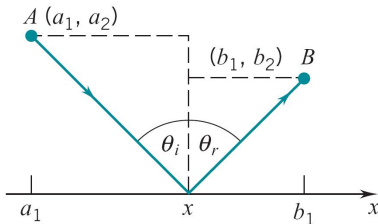
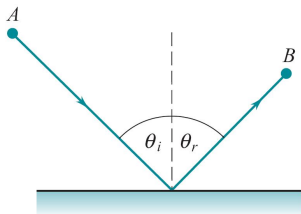
# Example 4



**Example 4** A state highway department plans to construct a new road between towns  $A$  and  $B$ . Town  $A$  lies on an abandoned road that runs east-west. Town  $B$  is 3 miles north of the point on that road that is 5 miles east of  $A$ . The engineering division proposes that the road be constructed by restoring a section of the old road from  $A$  up to a point  $P$  and joining it to a new road that connects  $P$  and  $B$ . If the cost of restoring the old road is \$200,000 per mile and the cost of the new road is \$400,000 per mile, how much of the old road should be restored in order to minimize the department's costs?



# Example 5



**Example 5** (*The angle of incidence equals the angle of reflection.*) Figure 4.5.6 depicts light from a point  $A$  reflected to a point  $B$  by a mirror. Two angles have been marked: the *angle of incidence*,  $\theta_i$ , and the *angle of reflection*,  $\theta_r$ . Experiment shows that  $\theta_i = \theta_r$ . Derive this result by postulating that the light that travels from  $A$  to the mirror and then to  $B$  follows the shortest possible path.†



# Example 6

**Example 6** A manufacturing plant has a capacity of 25 articles per week. Experience has shown that  $n$  articles per week can be sold at a price of  $p$  dollars each where  $p = 110 - 2n$  and the cost of producing  $n$  articles is  $600 + 10n + n^2$  dollars. How many articles should be made each week to give the largest profit?

$n$	$P$	$n$	$P$	$n$	$P$
8	8	14	212	20	200
9	57	15	225	21	177
10	100	16	232	22	148
11	137	17	233	23	113
12	168	18	228	24	72
13	193	19	217	25	25

