

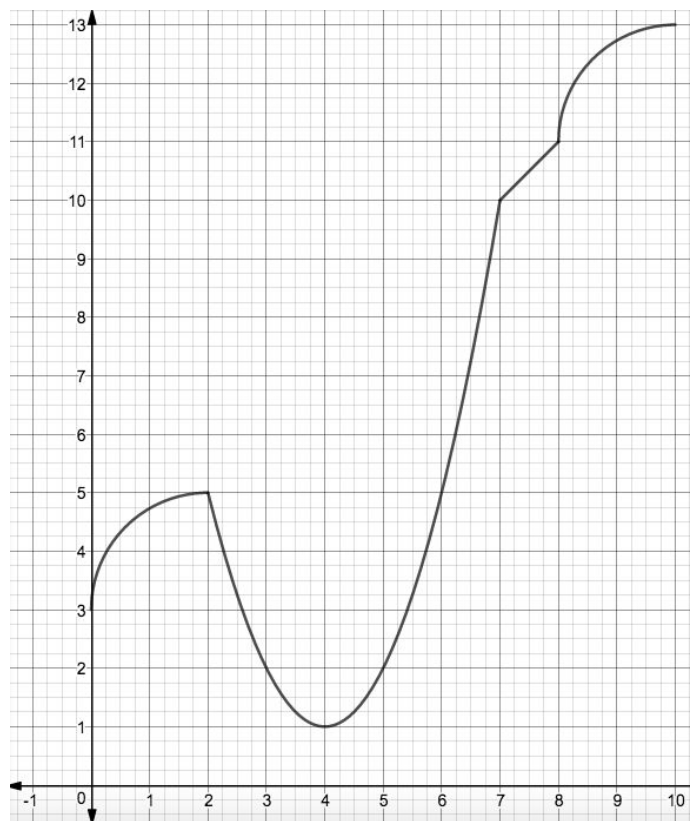
## D07 Review Problems

*At this point in the course, you should know these topics well.*

*They are heavily involved in our current work.*

Use this function  $f$  and its graph at right for questions 1-8.

$$f(x) = \begin{cases} \sqrt{-x^2 + 4x + 3} & 0 \leq x < 2 \\ x^2 - 8x + 17 & 2 \leq x < 7 \\ x + 3 & 7 \leq x < 8 \\ \sqrt{-x^2 + 20x - 96} + 11 & 8 \leq x \leq 10 \end{cases}$$



**[+1]** 1. Give all  $x$  values in  $(0,10)$  where  $f'(x) = 0$ :

**[+1]** 2. Give all  $x$  values in  $(0,10)$  where  $f'(x)$  is undefined:

**[+1]** 3. Give all sub-intervals of  $(0,10)$  where function  $f$  is decreasing:

**[+1]** 4. Give all sub-intervals of  $(0,10)$  where function  $f$  is concave up:

**[+4]**5. Give the x-values for each of the following:

(a) all local (relative) maximum points:

(b) all global (absolute) maximum points:

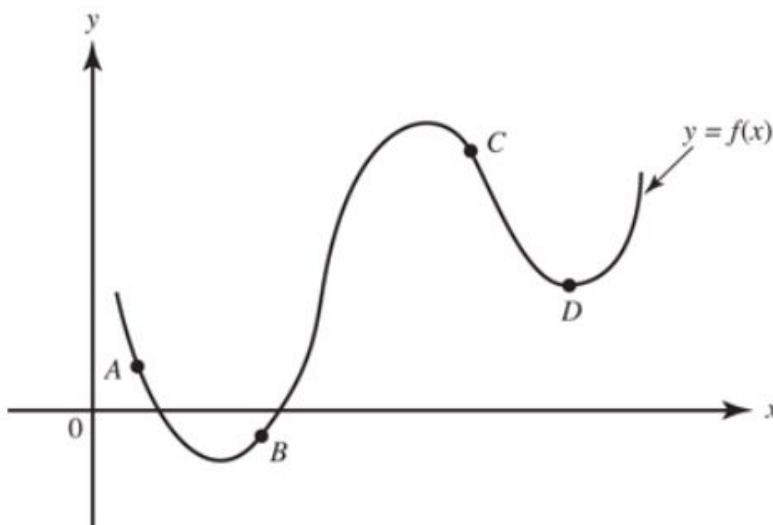
(c) all global (absolute) minimum points:

(d) all critical points:

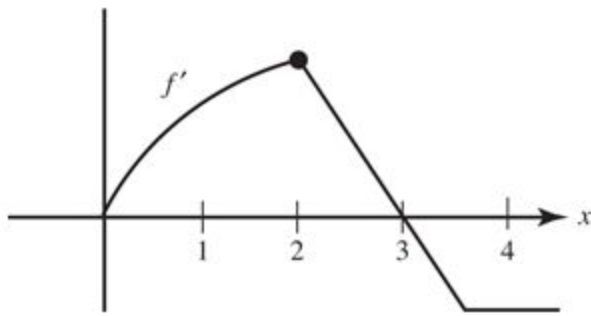
**[+2]**6. Is (2,5) a point of inflection? Explain why or why not.

**[+1]**7. At which one point (A, B, C, or D) on the following graph of  $y = f(x)$  is the following statement true:

$$f'(x) < 0 \text{ and } f''(x) > 0?$$



[+1] 8. \_\_\_\_



The graph of  $f'$ , which consists of a quarter-circle and two line segments, is shown above. At  $x = 2$  which of the following statements is true?

- (A)  $f$  is not continuous.
- (B)  $f$  is continuous but not differentiable.
- (C)  $f$  has a local maximum.
- (D) The graph of  $f$  has a point of inflection.

[+1] 9. \_\_\_\_

Let  $G(x) = [f(x)]^2$ . In an interval around  $x = a$ , the graph of  $f$  is increasing and concave downward, while  $G$  is decreasing. Which describes the graph of  $G$  there?

- (A) concave downward
- (B) concave upward
- (C) point of inflection
- (D) quadratic

**[+9] 10. Free-Response (Calculator OK)**

A function  $f$  is defined on the interval  $[0,4]$ , and its derivative is  $f'(x) = e^{\sin x} - 2 \cos 3x$ .

- (a) On what interval is  $f$  increasing? Justify your answer.
- (b) At what value(s) of  $x$  does  $f$  have local maxima? Justify your answer.
- (c) How many points of inflection does the graph of  $f$  have? Justify your answer.

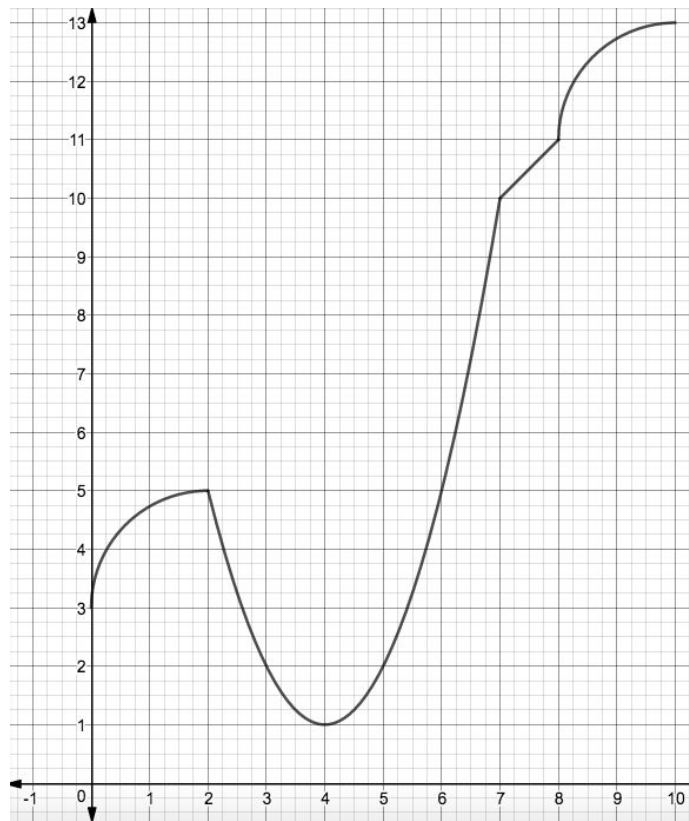
### Standard 12 Problems

DO NOT USE A CALCULATOR ON THIS SECTION. SHOW WORK!

[20 points]

Use this function  $f$  and its graph at right for questions 1 and 2.

$$f(x) = \begin{cases} \sqrt{-x^2 + 4x} + 3 & 0 \leq x < 2 \\ x^2 - 8x + 17 & 2 \leq x < 7 \\ x + 3 & 7 \leq x < 8 \\ \sqrt{-x^2 + 20x - 96} + 11 & 8 \leq x \leq 10 \end{cases}$$



**[+2]** 1. Point  $(4,1)$  is a local minimum point. Tell how you would know this by using the first derivative test. (Note: Rely on the equation not the graph!)

**[+2]** 2. Point  $(4,1)$  is a local minimum point. Tell how you would know this by using the second derivative test. (Note: Rely on the equation not the graph!)

[+2] 3. Show work and do NOT use a calculator.

The derivative of a function  $f$  is given for all  $x$  by

$$f'(x) = x^2(x + 1)^3(x - 4)^2.$$

The set of  $x$  values for which  $f$  is a relative minimum is

- (A)  $\{0, -1, 4\}$
- (B)  $\{-1\}$
- (C)  $\{0, 4\}$
- (D)  $\{0, -1\}$

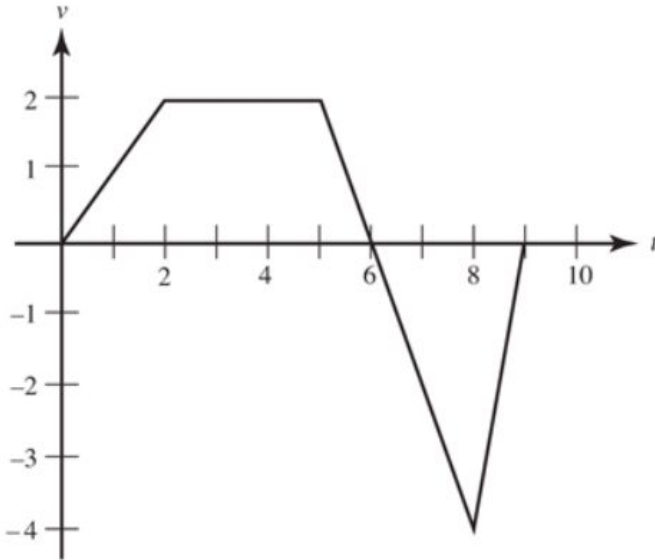
[+2] 4. Show work and do NOT use a calculator.

The maximum value of the function  $f(x) = xe^{-x}$  is

- (A)  $\frac{1}{e}$
- (B) 1
- (C) -1
- (D)  $-e$

[+1] 5. \_\_\_\_

The graph below shows the velocity of an object moving along a line for  $0 \leq t \leq 9$ .



At what time(s) does the object attain its maximum acceleration?

- (A)  $2 < t < 5$
- (B)  $t = 6$
- (C)  $t = 8$
- (D)  $8 < t < 9$

[+2] 6. \_\_\_\_ Show work and do NOT use a calculator!

The value of  $c$  for which  $f(x) = x + \frac{c}{x}$  has a local minimum at  $x = 3$  is

- (A) -9
- (B) 0
- (C) 6
- (D) 9

**[+9] 7. No Calculator Free Response**

Given the function  $f(x) = e^{2x}(x^2 - 2)$ :

- (a) For what values of  $x$  is  $f$  decreasing?
- (b) Does this decreasing arc reach a local or a global minimum? Justify your answer.
- (c) Does  $f$  have a global maximum? Justify your answer.