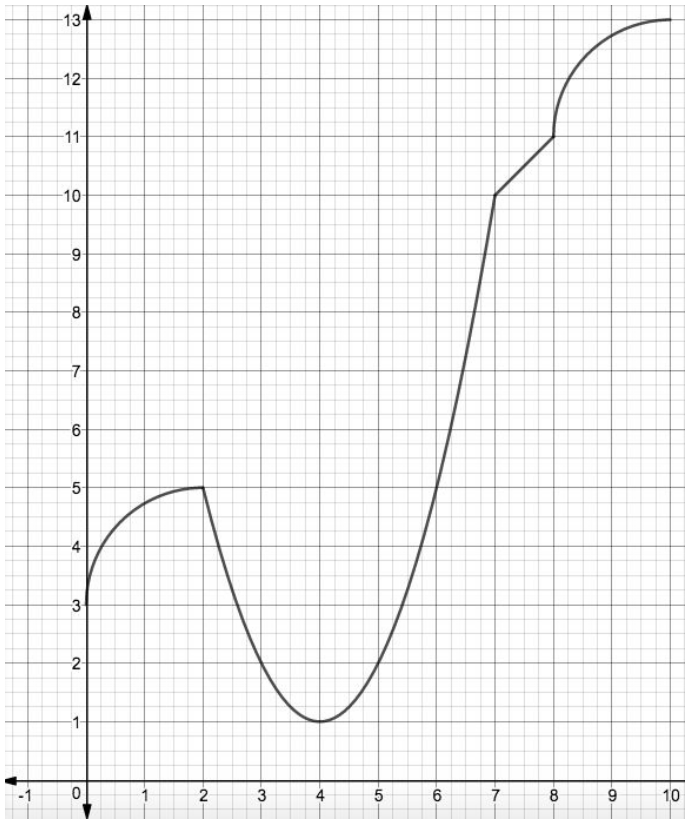
D07 Review Problems

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.

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



[+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:

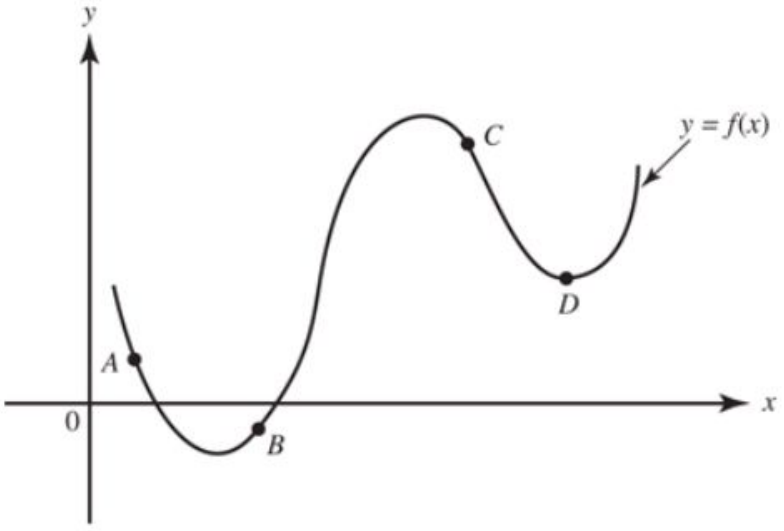
(c) all global (absolute) minimum points:

(d) all critical points:

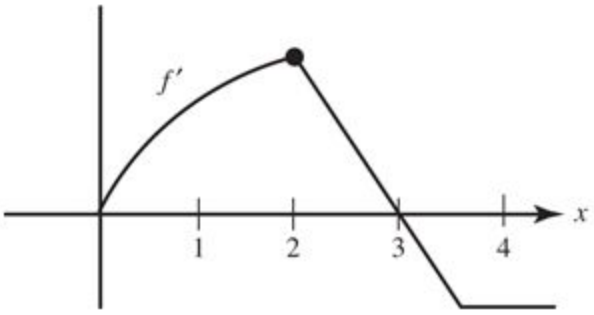
[+2]6. Is (2,5) a point of inflection? Explain why or why not.

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

$f'(x) < 0$ 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.

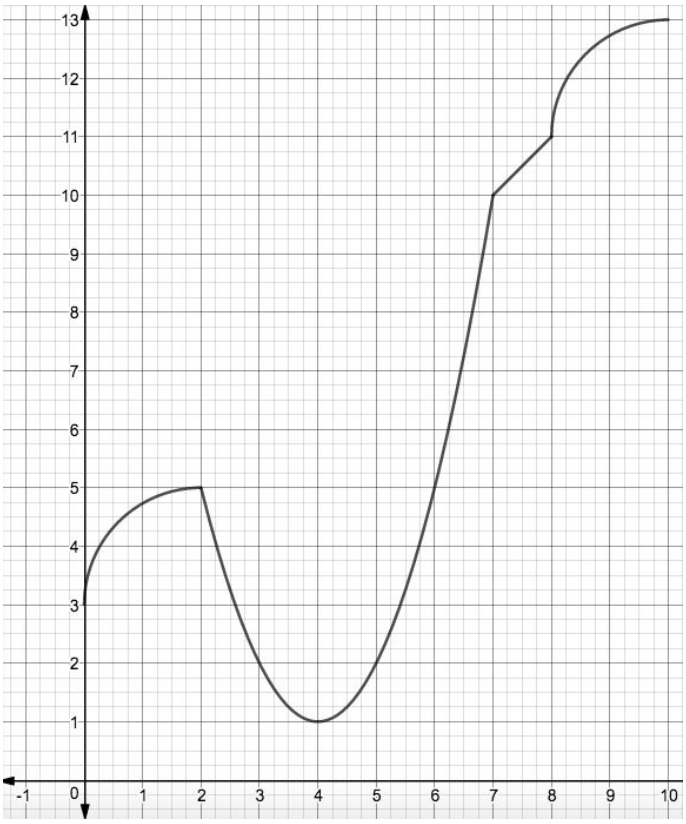
(c) How many points of inflection does the graph of f have? Justify your answer.

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.

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



[+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) $\frac{1}{e}$

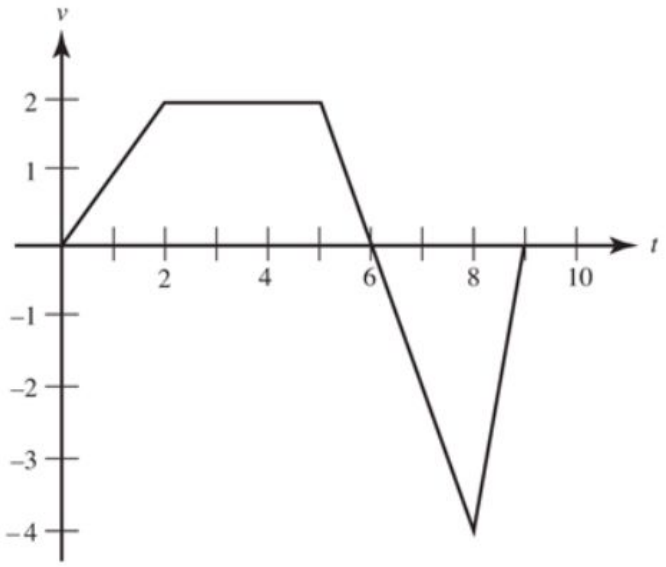
(B) 1

(C) -1

(D) $-e$

[+1] 5. ____

The graph below shows the <u>velocity</u> of an object moving along a line for $0 \le t \le 9$.



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.