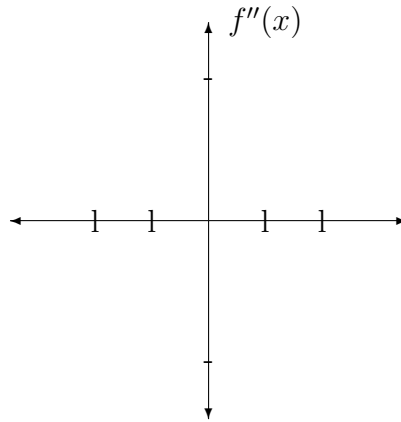


Name _____

- What is the derivative of $f(x) = 4x^3 + 3x + 2$?
 - $f'(x) = x^4 + \frac{3}{2}x^2 + 2x$
 - $f'(x) = x^2 + 3$
 - $f'(x) = 4x^2 + 3x + 2$
 - $f'(x) = 12x^2 + 3$
- What is the derivative of $f(x) = \cos(x^2)$?
 - $\sin x^2$
 - $-2x \sin(x^2)$
 - $-2x \cos(x^2)$
 - $-\cos(2x)$
- What are the critical points of $f(x) = 4x^3 - 3x^2 - 90x + 23$? (Pick the best answer.)
 - $x = -3$
 - $x = \frac{-5}{2}$
 - $x = \frac{-5}{2}, 3$
 - $x = \frac{5}{2}, -3$
- Does the function $f(x) = \sin^3 x$ have a local maximum in the interval $(-3, 3)$? If so for what x does $f(x)$ have a local maximum value?
 - $x = \frac{\sqrt{2}}{2}$
 - $x = -\frac{\pi}{2}$
 - $x = \frac{\pi^2 + 2\pi}{8}$
 - $x = \frac{\pi}{2}$
 - none of the above
- What are the critical points of $f(x) = x^2 e^{-x}$? (Pick the best answer.)
 - $x = 2$
 - $x = -2$
 - $x = 0$
 - $x = 0, 2$
 - None of above
- Which of the following formulas tells the distance between two points in the plane $(x_1, y_1), (x_2, y_2)$?

- a) $D = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}$ b) $D = \sqrt{(x_1 + y_1)^2 + (x_2 + y_2)^2}$
- c) $D = \sqrt{(x_1 - y_1)^2 + (x_2 - y_2)^2}$ d) $D = (x_1 - y_1)^2 + (x_2 - y_2)^2$
- e) $D = \sqrt{(x_1 - y_1) + (x_2 - y_2)}$
7. Find the interval on which the function $f(x) = x^3 + 3x^2 + 9x$ is increasing.
- a) $(-\infty, \infty)$ b) $(-1, 3)$
- c) $(-3, -1)$ d) $(1, 2)$
- e) none of the above
8. Find the interval on which the function $f(x) = x^3 + 3x^2 + 9x$ is decreasing.
- a) $(-2, 0), (2, \infty)$ b) $(-\infty, -2), (0, 2)$
- c) $(-\sqrt{2}, 0), (\sqrt{2}, \infty)$ d) $(-\infty, -\sqrt{2}), (0, \sqrt{2})$
- e) none of the above
9. What is (are) the inflection point(s) of $f(x) = x^3 - 3x^2 - 45x$?
- a) $x = 1$ b) $x = -3, 5$
- c) $x = -3, 5, 1$ d) -1
- e) None of above
10. Suppose f is a twice differentiable function and c is a critical point for which $f''(c) = 10$. Then the 2nd Derivative Test says that c is which of the following:
- a) A local maximum. b) A local and global minimum.
- c) A local minimum d) A local and global maximum.
- e) it cannot be determined
11. f is a function for which $f''(x) = \frac{x(x^2+3)}{x^2+1}$. On what interval(s) is the function concave up?

For problems 16 and 17. Use the following graph of $f''(x)$.



16. Where is f concave up? Choose the best answer.

- a) $(-\infty, -1)$
- b) $(-1, 1)$
- c) $(1, 2)$
- d) $(2, 3)$
- e) $(3, \infty)$

17. Where is f' decreasing? Mark all that apply.

- a) $(-\infty, -1)$
- b) $(-1, 1)$
- c) $(1, 2)$
- d) $(2, 3)$
- e) $(3, \infty)$

Name _____

PO# _____

Free Response Portion

Directions: Fill in your name and PO# on the line above. Make sure to turn this sheet in separately from the rest of the exam. This portion of the exam is worth 25 points (as labelled). You must show all work to receive credit. Your answer should be written in the spaces provided.

(5 Points) You must construct an open topped rectangular box with volume 576in^3 and with its bottom twice as long as it is wide. Find the dimensions of the box that will minimize its total surface area.

Dimensions= _____

Name _____

PO# _____

Free Response Portion

(10 Points) Given the function $f(x) = xe^{-x}$ find the first and second derivatives of $f(x)$. Use the First and Second Derivative Test to determine the critical points, inflection points, and local extrema and also to determine where the function is increasing, decreasing, and is concave up or down. Make sure to show all work and reasons for your answer. If there is no answer then write that.

$f'(x) =$ _____

$f''(x) =$ _____

Critical points _____

Inflection Points _____

Local Max _____

Local Min _____

Concave Up _____

Concave Down _____

Increasing _____

Decreasing _____