

1. (1 point) Find the absolute maximum and absolute minimum values of the function

$$f(x) = x^3 - 12x^2 - 27x + 5$$

over each of the indicated intervals.

(a) Interval = $[-2, 0]$.

1. Absolute maximum = _____

2. Absolute minimum = _____

(b) Interval = $[1, 10]$.

1. Absolute maximum = _____

2. Absolute minimum = _____

(c) Interval = $[-2, 10]$.

1. Absolute maximum = _____

2. Absolute minimum = _____

2. (1 point) Find the x -coordinate of the absolute maximum and absolute minimum for the function

$$f(x) = 7 - 9x - \frac{5}{x^2}, \quad x > 0.$$

Enter *None* for any absolute extrema that does not exist.

x -coordinate of absolute maximum = _____

x -coordinate of absolute minimum = _____

3. (1 point) Find the x -coordinate of the absolute maximum and absolute minimum for the function

$$f(x) = 2x + \frac{19}{x}, \quad x > 0.$$

Enter *None* for any absolute extrema that does not exist.

x -coordinate of absolute maximum = _____

x -coordinate of absolute minimum = _____

4. (1 point) A cosmetics company is planning the introduction and promotion of a new lipstick line. The marketing research department has found that the demand in a particular city is given approximately by

$$p = \frac{12}{e^x}, \quad 0 \leq x \leq 2,$$

where x thousand lipsticks were sold per week at a price of p dollars each. At what price will the weekly revenue be maximized?

Price = _____

5. (1 point) The function $f(x) = -2x^3 + 39x^2 - 180x + 9$ has one local minimum and one local maximum.

This function has a local minimum at x equals _____ with value _____

and a local maximum at x equals _____ with value _____

6. (1 point) Consider the function $f(x) = x|x|$.

a.) On the interval $(-\infty, 0)$, $f''(x) =$ _____

b.) On the interval $(0, \infty)$, $f''(x) =$ _____

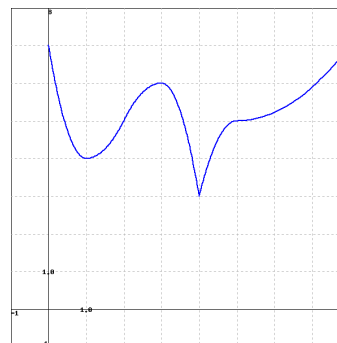
Thus,

c.) On the interval $(-\infty, 0)$, $f(x)$ is

d.) On the interval $(0, \infty)$, $f(x)$ is

e.) Does $f''(0)$ exist?

7. (1 point) Use the given graph of the function f to answer the following questions.



1. Find the *open* interval(s) on which f is concave upward.

Answer (in **interval notation**): _____

2. Find the *open* interval(s) on which f is concave downward.

Answer (in **interval notation**): _____

3. Find the coordinates of the points of inflection. **List your answers as points in the form (a, b) .**

Answer (separate by commas): _____

Note: You can click on the graph to enlarge the image.

8. (1 point) Suppose that

$$f(x) = \ln(6 + x^2)$$

(A) Use interval notation to indicate where $f(x)$ is concave up.

Note: When using interval notation in WeBWorK, you use **I** for ∞ , **-I** for $-\infty$, and **U** for the union symbol. If there are no values that satisfy the required condition, then enter "" without the quotation marks.

Concave up: _____

(B) Use interval notation to indicate where $f(x)$ is concave down.

Concave down: _____

(C) Find all inflection points of f . If there are no inflection points, enter -1000. If there are more than one, enter them separated by commas.

Inflection point(s) at $x =$ _____

9. (1 point)

Find the point P on the graph of the function $y = \sqrt{x}$ closest to the point $(8, 0)$

The x coordinate of P is: _____.

10. (1 point) An open box is to be made out of a 8-inch by 20-inch piece of cardboard by cutting out squares of equal size from the four corners and bending up the sides. Find the dimensions of the resulting box that has the largest volume.

Dimensions of the bottom of the box: _____ x _____

Height of the box: _____

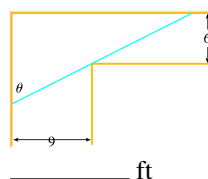
11. (1 point) A rancher wants to fence in an area of 1500000 square feet in a rectangular field and then divide it in half with a fence down the middle, parallel to one side.

What is the shortest length of fence that the rancher can use?

Length of fence = _____ feet.

12. (1 point)

A steel pipe is being carried down a hallway 9 ft wide. At the end of the hall there is a right-angled turn into a narrower hallway 6 ft wide. What is the length of the longest pipe that can be carried horizontally around the corner?



13. (1 point) A certain magical substance that is used to make solid magical spheres costs \$500 per cubic foot. The power of a magical sphere depends on its surface area, and a magical sphere can be sold for \$20 per square foot of surface area. If you are manufacturing such a sphere, what size should you make them to maximize your profit per sphere?

$r =$ _____ ft.

Note 1: the formulas for the volume and surface area of a sphere of radius r are $V = \frac{4\pi}{3}r^3$ and $A = 4\pi r^2$ respectively.

Note 2: on a real exam you would be expected to justify that the answer above is actually a maximum, rather than, say a minimum.

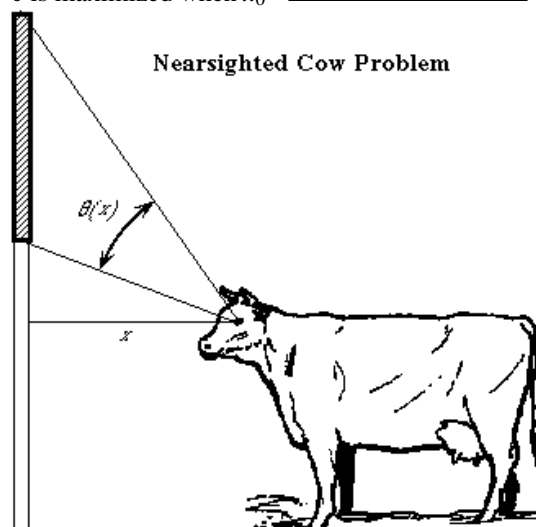
14. (1 point)

The Nearsighted Cow Problem: A Calculus Classic.

A rectangular billboard 5 feet in height stands in a field so that its bottom is 7 feet above the ground. A nearsighted cow with eye level at 4 feet above the ground stands x feet from the billboard. Express θ , the vertical angle subtended by the billboard at her eye, in terms of x . Then find the distance x_0 the cow must stand from the billboard to maximize θ .

$\theta(x) =$ _____

θ is maximized when $x_0 =$ _____



(Click on image for a larger view)