

Calculus I, Math 170, Kriloff  
Exam 2

A correct answer with little or no supporting work will be worth very little, so show **all** work. **Simplify** and use **complete sentences** and **correct notation** throughout. When finished, **check** your work. Attach extra paper if needed.

1. (11 points) The position in centimeters of a mass on a spring after  $t$  seconds is given by  $s(t) = 8 \cos\left(\frac{\pi}{4}t\right)$ . Find the exact acceleration at  $t = 1$  second. Include units.

2. (7 points) Find the **differential** of the function  $y = (3x - \sec x)^4$ .

3. (9 points) Use implicit differentiation and solve for  $\frac{dy}{dx}$  in  $y^3 - xy = 10$ .

4. (6 points) If  $y = f(x)$ , write the formula for the linear approximation to  $f(x)$  at  $x = a$ .

$$f(x) \approx$$

5. (20 points) Find the following or state that there are none. Assume that the domain of  $f$  is all real numbers and that its **derivative** is  $f'(x) = \frac{x-2}{\sqrt{x}}$ .

(a) Critical value(s) (or number(s)) of  $f$ :

(b) Interval(s) where  $f$  is increasing:

(c) Interval(s) where  $f$  is decreasing:

(d) Value(s) of  $x$  at which  $f$  has a local maximum.

(e) Value(s) of  $x$  at which  $f$  has a local minimum.

(f)  $f''(x) =$

(g) Interval(s) where  $f$  is concave down.

(h) Value(s) of  $x$  at which  $f$  has an inflection point.

6. (6 points) Give a complete sentence stating the Extreme Value Theorem.

7. (15 points) A ladder 12 feet long rests against a vertical wall. The base of the ladder begins to slide along the ground at a rate of 1.5 ft/sec. How fast is the top of the ladder descending when the base is 4 feet away from the wall? Include units. Start by completing the following.

Let \_\_\_ be

Let \_\_\_ be

Information given:

Information to find:

8. (9 points) Calculate the exact limit. Show steps carefully.

$$\lim_{x \rightarrow -\infty} \frac{4x}{-x + \sqrt{3x^2 + 1}}$$

Replace with question 3.5

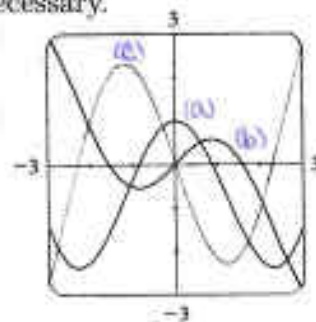
BONUS

9. (4 points) Label each graph as  $f$ ,  $f'$ , or  $f''$ . No explanation necessary.

(a)

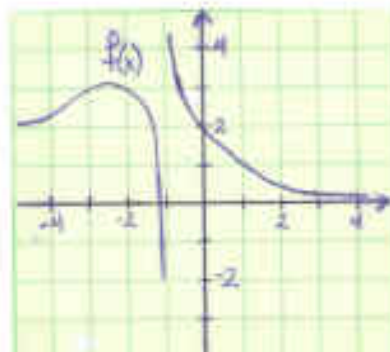
(b)

(c)



10. (8 points) The graph of the function  $f$  is given.

(a) Write the equations of the asymptotes.



(b) Write four mathematical equations involving limits to describe the behavior of  $f$  near all of its asymptotes.

11. (9 points) State whether the following are **always**, **sometimes**, or **never** true. No explanation required. Each part is 3 points, all or nothing.

(a) If  $f$  is differentiable, then  $\frac{d}{dx}f(\sqrt{x}) = \frac{f'(\sqrt{x})}{2\sqrt{x}}$ .

(b) If  $f''(4) = 0$ , then  $(4, f(4))$  is an inflection point of the curve  $y = f(x)$ .

(c) If  $f(x) = x^n$ , where  $n$  is a positive integer, then  $f^{(n+1)}(x) = 0$ .

Replace with question 10 from 3.9