

100 Points

Show all your work.

1. Evaluate the following limits:

a. (2 pts) $\lim_{x \rightarrow 2} \left(\frac{x-2}{x^2-16} \right)$

b. (6 pts) $\lim_{x \rightarrow 1} \left(\frac{2x^2+x-3}{x^2-1} \right)$

c. (2 pts) $\lim_{x \rightarrow 8^+} \left(\frac{|8-x|}{8-x} \right)$

d. (2 pts) $\lim_{x \rightarrow 3} \left[\frac{x+5}{x^4(x-3)} \right]$

e. (6 pts) $\lim_{x \rightarrow 1} \left(\frac{\sqrt{x+3}-2}{x-1} \right)$

f. (2 pts) $\lim_{x \rightarrow 3} (\pi^2)$

20 Points

2. (10 pts) **Use the definition of derivative** to find the derivative of $f(x) = \frac{1}{2-x}$

10 Points

30 Points

3. If a ball is thrown into the air with a velocity of 96 ft/sec from the top of a 256 foot tall building its height (in feet) after t seconds is given by $s(t) = 256 + 96t - 16t^2$.

a. (5 pts) Find the maximum height reached by the ball.

5 Points

b. (5 pts) Find the velocity of the ball when it hits the ground.

5 Points

4. a. (5 pts) Find the point on the graph of $f(x) = x^4$ such that the tangent line has a slope of 32 at this point.

5 Points

b. (3 pts) Find the equation of the tangent line to the curve at this point. (Leave your equation in point-slope form.)

3 Points

c. (3 pts) Find the equation of the normal line to the curve at this point. (Leave your equation in point-slope form.)

3 Points

21 Points

5. Find the derivatives of the following functions: (**DO NOT** simplify your answers.)

a. (6 pts) $f(x) = \sqrt{7x} + \sqrt[5]{x^2} + \frac{3}{x^2} + 5x - \cos(9)$

6 Points

b. (5 pts) $f(x) = \frac{x^2 + 3x - 1}{x^4 + 1}$

5 Points

c. (5 pts) $f(x) = \frac{x^3 - 2x\sqrt{x} + 5}{x^2}$

5 Points

d. (6 pts) $f(x) = (x^2 + x + 7)(x^{1/2} + 3x^{-1} - 2x + 1)$

6 Points

22 Points

6. Use the given graph of $f(x)$ to answer the following questions:

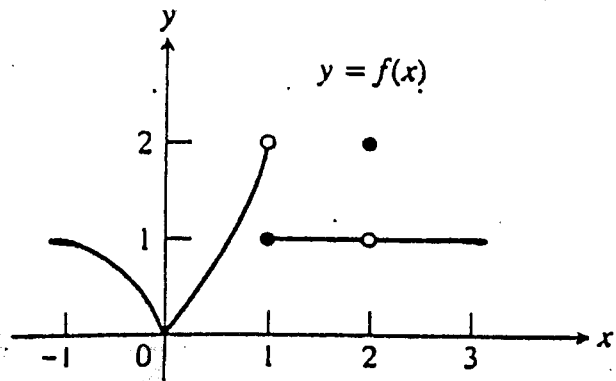
a. (1 pt) $\lim_{x \rightarrow 0} f(x) = \underline{\hspace{2cm}}$

b. (1 pt) $\lim_{x \rightarrow 2} f(x) = \underline{\hspace{2cm}}$

c. (1 pt) $\lim_{x \rightarrow 1^-} f(x) = \underline{\hspace{2cm}}$

d. (1 pt) $\lim_{x \rightarrow 1^+} f(x) = \underline{\hspace{2cm}}$

e. (1 pt) $\lim_{x \rightarrow 1} f(x) = \underline{\hspace{2cm}}$



f. (6 pts) List the numbers at which f is discontinuous. For each number state the type of discontinuity and the conditions from the definition of continuity which are violated.

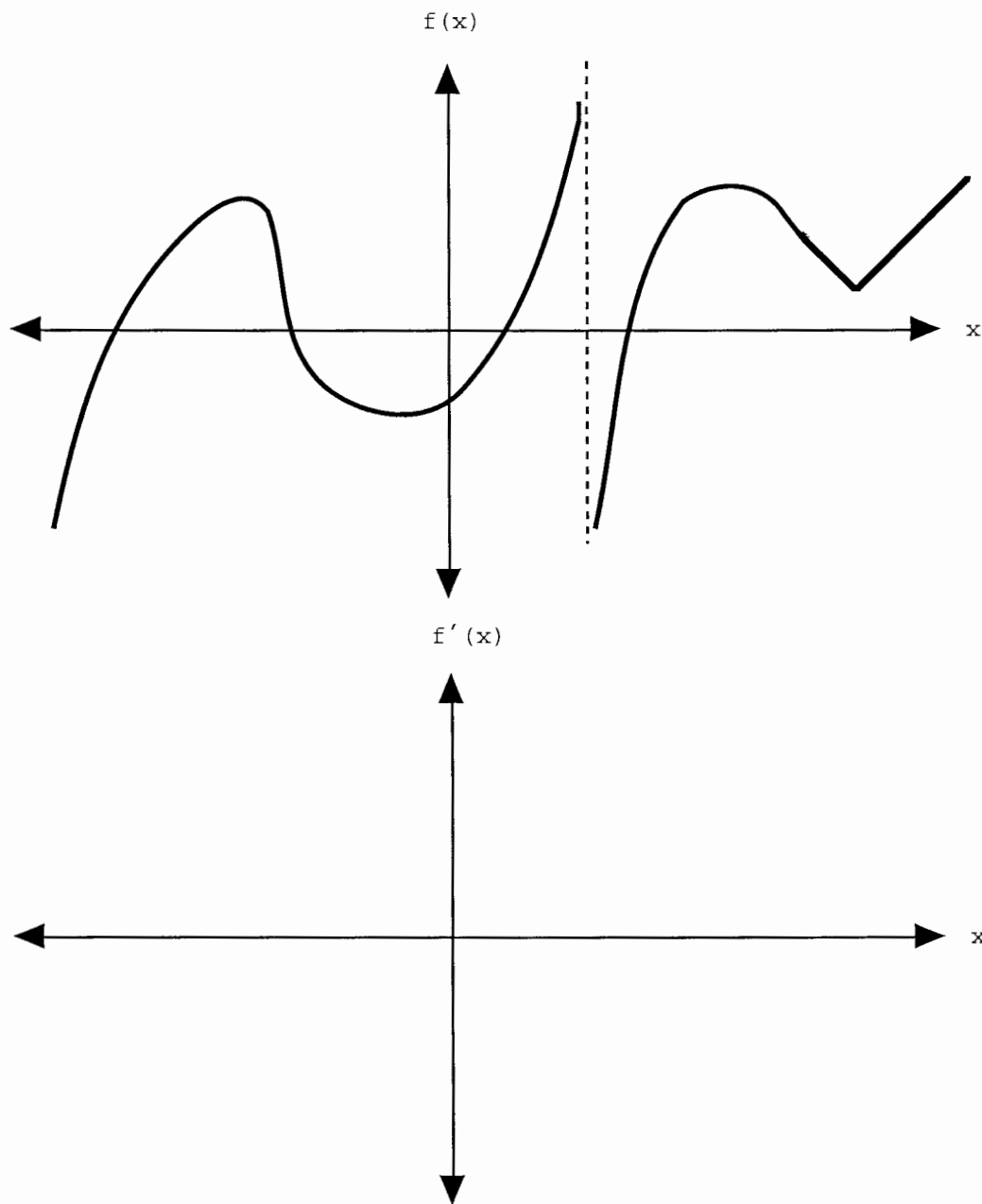
6 Points

g. (6 pts) List the numbers at which f is not differentiable and state why f is not differentiable at that number.

6 Points

17 Points

7. (10 pts) The graph of the function $f(x)$ is given below. Use it to sketch the graph of $f'(x)$.



10 Points