

Name (20 pts): \_\_\_\_\_

Each problem is worth 20 points, and you must show all your work (excluding arithmetic) for full credit.

1. Find

$$\lim_{x \rightarrow 9} \left[ \frac{x - 5\sqrt{x} + 6}{\sqrt{x} - 3} \right]$$

algebraically or numerically.

2. For the function  $f(x)$  pictured below, determine where  $f(x)$  is continuous.

3. For the function  $f(x)$  pictured in problem 2, find the value of the following limits:

$\lim_{x \rightarrow 2^-} f(x)$	
$\lim_{x \rightarrow 2^+} f(x)$	
$\lim_{x \rightarrow 2} f(x)$	
$\lim_{x \rightarrow 4^-} f(x)$	
$\lim_{x \rightarrow 4^+} f(x)$	
$\lim_{x \rightarrow 4} f(x)$	
$\lim_{x \rightarrow -3^-} f(x)$	
$\lim_{x \rightarrow -3^+} f(x)$	
$\lim_{x \rightarrow -3} f(x)$	

4. Use the definition of the derivative to find

$$\frac{d}{dx} \frac{5}{x^2}$$

5. Find a formula for the tangent line to  $f(x) = \frac{5}{x^2}$  when  $x = 3$ .

6. Suppose the total cost of ownership of a bicycle is given (in dollars) by  $C(d) = 2500 + 0.01d + 0.00025\sqrt{d^3}$ , where  $d$  is the number of miles ridden since purchase. Find  $C(10,000)$ ,  $C'(10,000)$ , and  $C''(10,000)$ . Give units and interpret your answer.

7. Suppose the cost (in dollars) to produce  $q$  bushels of millet is given by  $C(q) = 55,000 + 2.28q + 3.04\sqrt{q}$ . Find the marginal profit when producing 5000 bushels, assuming millet sells for \$10 per bushel.

8. Find

$$\frac{d}{dx} \frac{\sqrt{x^3 + 7x^2 + 12x}}{\sqrt{4x + 12}}$$

9. Find

$$\frac{d}{dx} [(ax^2 + bx + c)(ux^2 + vx + w)]$$

10. Find

$$\frac{d}{dx} \left[ \frac{\sqrt{x}}{\sqrt{x} + 1} \right]$$