MATH 160 Exam 1 CCU Dept. of Math/Stats Sample B Name \_\_\_\_\_

Score \_\_\_\_\_

1. (5 points each) Find the exact value of the following limits if the limit exist. Show work in order to receive partial credit.

(a) 
$$\lim_{x \to -2} x^3 + 2x^2 + 3 =$$

(b) 
$$\lim_{x \to \frac{\pi}{3}} \sin(x) =$$

(c) 
$$\lim_{x \to 2} \frac{1}{x - 2} =$$

(d) 
$$\lim_{x \to -4} \frac{x^2 + 5x + 4}{x^2 + 3x - 4} =$$

(e) 
$$\lim_{x \to \infty} \frac{x^3 + 5x}{2x^3 - x^2 + 4} =$$

(f) 
$$\lim_{x \to -3} \frac{\frac{1}{3} + \frac{1}{x}}{3+x} =$$

For problems 2–4, consider the function f sketched below.



3. (10 points) Is f continuous for the following values of x? In the table below, circle YES or NO. If you circle yes, justify your answer using the definition of continuity. If you circle no, state what type of discontinuity occurs at that value of x.

x value	Continuous?	Reason
0	YES NO	
2	YES NO	

4. (10 points) Does f have a derivative at each of the following x values? In the table below, circle YES or NO. Explain your choice using calculus.

x value	Differentiable?		Reason
0	YES	NO	
2	YES	NO	

5. (a) (10 points) Given  $f(x) = \sqrt{x}$ , find f'(x) using the **definition of the derivative**. Do **not** use any shortcuts to find the derivative. Show work.

(b) (4 points) Find the slope of the tangent line to the graph of  $f(x) = \sqrt{x}$  at the point (4, 2).

(c) (4 points) Find an equation of the tangent line in part (b).

- 6. (4 points each) The vertical displacement (in feet) of a ball is given by  $s(t) = 96 + 80t 16t^2$ , where t is measured in seconds. Note: s'(t) = 80 32t.
  - (a) Find the average velocity of the particle over the time interval [1, 3]. Show work.

(b) Find the instantaneous velocity of the particle when t = 1.

(c) With what velocity will the ball hit the surface?

- 7. (12 points) Determine whether the statement is **true** or **false**. If it is true, explain why. If it is false, explain why or give an example that disproves the statement.
  - (a) If f is continuous at a,  $\lim_{x \to a} f(x) = f(a)$ .

(b) The equation  $x^{10} - 10x^2 + 5 = 0$  has a root in the interval [0, 1].

(c) If f is continuous at a, then f is differentiable at a.

(d) No function has more than one horizontal asymptote.