

MAT 201  
100 Points  
Fall, 2012

Midterm

Name \_\_\_\_\_

1. (5 pts each) Find the average rate of change of  $f(x) = x^2 - 3x + 2$  over the intervals.
- $[1, 1.1]$

b.  $[1, 1.001]$

2. (10 pts) Based on your work in #1 (and maybe a few more intervals), what would you estimate the rate of change of  $f$  is, at  $x = 1$ ?

3. (10 pts) Compute  $f'(x)$  by the limit definition and use it to find the (instantaneous) slope of  $f$  at  $x = 1$ .

4. (3 pts each) Use the graph of the function  $f(x)$  to evaluate / answer the following:

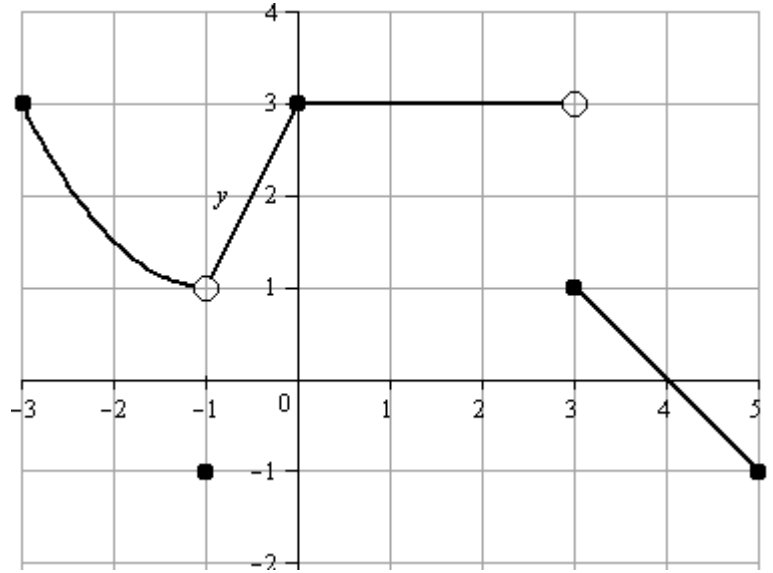
a.  $\lim_{x \rightarrow 3^-} f(x)$

b.  $\lim_{x \rightarrow 3^+} f(x)$

c.  $\lim_{x \rightarrow 3} f(x)$

d.  $\lim_{x \rightarrow -1} f(x)$

e. Where is  $f$  continuous?



f. Where does  $f$  have a removable discontinuity, and what would you define  $f$  to be at that point (or those points)?

5. (10 pts) Prove that  $\lim_{x \rightarrow 3} (5x - 2) = 13$ .

6. Differentiate. Do not simplify.

a.  $3x^5 - 11x^2 + 4x^{-3/2}$

b.  $(x^2 - 2x)^{2/3}$

c.  $(x^2 - 2x)^{2/3} \sin(5x)$

d.  $(\tan(3x)\cot(x))$

e.  $\frac{(x^2 - 2x)^{2/3}}{\sin(5x)}$

7. (10 pts) A conical tank, 10 feet high, with a radius of 5 feet is being filled at a rate of 0.5 cubic feet per second. At what rate is the level of the tank rising when the level of the tank is 4 feet?

8. (10 pts) Sketch the graph of  $f(x) = x^3 - x^2 - 8x + 12$ . Include all local extremes and inflection points. The more complete your graph, the more points (intercepts, shape, etc.)

9. Use the linearization of  $f(x) = \sqrt{x}$  to approximate  $\sqrt{39}$