1. (5 pts each) Find the average rate of change of $f(x) = x^2 + 5x + 2$ over the intervals.

   a.   [2, 2.1]

   b.   [2, 2.001]

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 $x = 2$?

3. (10 pts) Compute $f'(x)$ by the limit definition and use it to find the (instantaneous) slope of f at $x = 2$.

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

a. Is f continuous @ $x = -1$? Explain.

b. Does $\lim_{x \to 3} f(x)$ exist? If so, what is it? If not, why not?
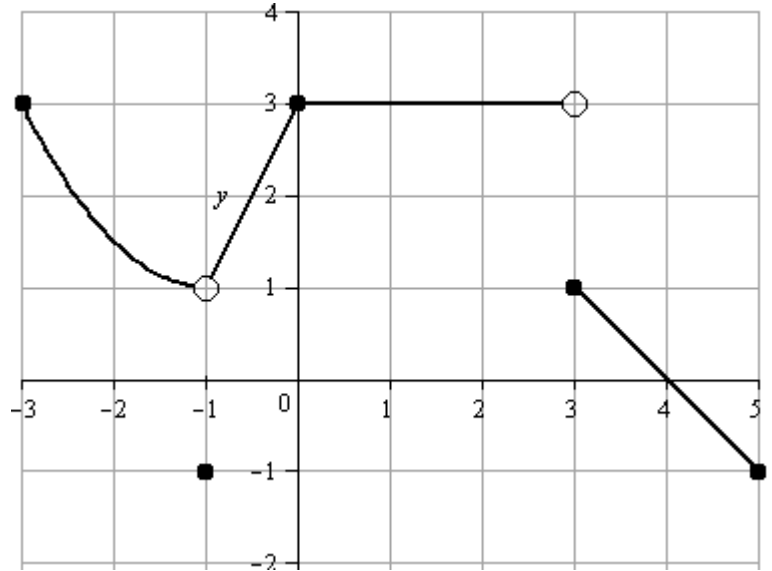
c. Evaluate $\lim_{x \to -1} f(x)$

d. 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 $\lim_{x \to 3} (3x + 7) = 16$.

6. Differentiate. Do not simplify.
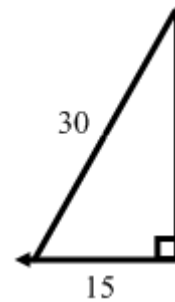
   a. $3x^5 - 11x^2 + \dfrac{4}{x^{3/2}}$ b. $\left(x^3 + 7x\right)^{5/9}$

   c. $\sin^3(3x^5 - 1)$ d. $\sin(x)\tan(5x)$

   e. $\dfrac{\cos(3x)}{\left(x^2 - 2x\right)^{2/3}}$

7. (10 pts) How fast is the base of a 30-foot ladder moving away from a wall, if, when it's 15 feet away from the wall, the *top* of the ladder is falling at 10 feet per second?

8. (10 pts) Sketch the graph of $f(x) = 4x^3 + 3x^2 - 36x - 27$. Include all local extremes and inflection points. The more complete your graph, the more points (intercepts, shape, etc.)

9. Use differentials to approximate $\sin(65^0)$.