AMS 11A **Study Guide 3** ECON 11A

Derivatives, I

1. What can you say about $\lim_{x\to 0} \dfrac{x}{|x|}$?

2. Give an example of a function that is **continuous** at the point $x = 0$, but is **not differentiable** at $x = 0$. Justify your answer.

3. For each of the functions $f(x)$ given below, simplify the expression $\dfrac{f(x+h) - f(x)}{h}$. Express your answer in terms of x and h.

(a) $f(x) = x^2$

(b) $f(x) = x^3$

(c) $f(x) = 1/x$

(d) $f(x) = \sqrt{x}$

(Hint: multiply the numerator and denominator by $\left(\sqrt{x+h} + \sqrt{x}\right)$, then simplify.)

4. For the functions and points given below, *use the definition of the derivative* to find the slope of the graph of $y = f(x)$ at the point x_0, and the equation of the tangent line to the graph $y = f(x)$ at the point $(x_0, f(x_0))$.

(a) $f(x) = x^2; \quad x_0 = 1.$

(b) $f(x) = 3x^2 + 2x - 1; \quad x_0 = 2.$

(c) $f(x) = \dfrac{2}{x}; \quad x_0 = 3.$

(d) $f(x) = 3\sqrt{x}; \quad x_0 = 4.$

5. Use the ***rules of differentiation*** to compute the derivatives of the functions below.

(a) $f(x) = 3x^2 - 2x + 5$

(b) $y = 2\sqrt{x} - \dfrac{3}{x^2}$

(c) $h(x) = (2x + 5)(x^2 + 2x + 3)$