

**Quiz #0: Math Tools**

(Started: July 19, 2011; Revised: January 18, 2012)

*Please write your name in the upper right corner. This quiz won't affect your grade, but it's an accurate indication of the kinds of tools we'll be using and a useful guide to me about your background. Please write your answers in the space provided. If you don't know an answer, perhaps you could suggest a way to get started.*

1. Consider the value of a consol, a bond that pays a coupon  $C$  at the end of every year, forever, beginning next year. If  $q = 1/(1 + r)$  is the discount factor (that's the term we'll use), what is the present discounted value

$$qC + q^2C + q^3C + \dots ?$$

What happens if  $C = r$ ?

2. Let consumption  $c$  be positive and utility  $u(c) = c^{1-\alpha}/(1-\alpha)$  for some parameter  $\alpha \geq 0$ . What is the derivative of  $u$ ? The second derivative? What are their signs?

3. Consider a random variable  $x$  that takes on the value one with probability  $p$  and zero with probability  $1 - p$ . What is the expected value or mean of  $x$ ? The variance? The standard deviation?

4. What does the function below represent?

$$p(x) = (2\pi\sigma^2)^{-1/2} \exp[-(x - \mu)^2/2\sigma^2]$$

5. Suppose you have two matrices,

$$A = \begin{bmatrix} 1 & 2 \\ 2 & 1 \end{bmatrix} \quad \text{and} \quad B = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix}.$$

What is  $AB$ ?  $BA$ ?