

Placement Exam — Questions

Econ 4020 requires solid mastery of some basic mathematical skills. My experience in teaching this course since the mid-1990s when I first introduced it is that students without these skills, no matter how bright, don't do well. This exam will help you evaluate your skill set. I will never see your score. Solutions can be found [here](#), and you can grade yourself. This exam should take no more than 75 minutes. A safe score is 70% or better (without aids). Finally, I have learned that of all the math we will use, students are least prepared in probability theory. Unfortunately, this material does not become critical until after the drop date. So trying it out and feeling good about the class in mid-March may not be a good signal of what is to come.

1. Consider the function $f(x) = 2x^3 - 9x^2 - 24x + 1$. Where does f take its maximum on the interval $[-2, 7]$? How would you prove it? (Plot it and look is not an acceptable answer.)
2. What is the solution set to the inequality system

$$3x - 3y = 0$$

$$2x + y \geq 0$$

$$-x + 4y \geq 0$$

$$x + y = 1$$

$$x, y \geq 0$$

3. For what values of β do the following series converge? Give the sum the following infinite series as a simple algebraic expression in β :

1. $\sum_{n=0}^{\infty} \beta^n$.

2. $\sum_{n=5}^{\infty} \beta^n$.

4. Suppose that an employer wants to screen potential employees for drug use by pre-employment testing. The employer's test has a false-positive rate of 5%. That is, a non-user has a 5% chance of a positive test result. The test has a false-negative rate of 10%. That is, a drug-user has a 10% chance of nonetheless getting a negative result. The percentage of drug users in the total population is 5%. What is the probability that an individual who gets a positive test result is in fact a drug user?
5. Suppose that the cumulative distribution function of a random variable defined on the set $[-\pi/4, \pi/4]$ is $F(x) = (1 + \sin(x))/2$. What is its mean?