MA 41600 / STAT 41600

ALGEBRA AND CALCULUS PRE-REQUISITE KNOWLEDGE

The expectation for a 3-credit, 8-week course is a total of 15 hours per week of work on the part of the learner. This assumes the learner is well-prepared. If there are gaps in prerequisite knowledge, time required increases. The following 10 questions should be relatively easy. If m is the number of questions that you find difficult and n is the number of questions you are unable to do, then a completely made up (though still reasonable) estimate of additional time required each week for the course is

$$t = \frac{1}{10}\left(\sum_{i=0}^{m}\left(\frac{i}{2}\right)^2 + \sum_{i=0}^{n} i^2\right)$$

So, if you find a few of the questions difficult $(t = 0.35)$, you may need some extra time to refresh your calculus. If you can't do any of the 10 $(t = 38.5)$, you're unlikely to do well in the course.

1. Compute

$$\int_0^\infty \lambda e^{-\lambda x}\, dx$$

2. Compute

$$\int_0^\infty \lambda x e^{-\lambda x}\, dx$$

3. Compute

$$\frac{1}{\sqrt{2\pi}} \int_{-\infty}^{\infty} e^{-\frac{x^2}{2}}\, dx$$

Hint: Use a change of variables to compute

$$\left(\frac{1}{\sqrt{2\pi}} \int_{-\infty}^{\infty} e^{-\frac{x^2}{2}}\, dx\right)\left(\frac{1}{\sqrt{2\pi}} \int_{-\infty}^{\infty} e^{-\frac{y^2}{2}}\, dy\right)$$

4. Compute

$$\frac{1}{\sqrt{2\pi}} \int_{-\infty}^{\infty} x e^{-\frac{x^2}{2}}\, dx$$

For $p \in (0,1), \lambda > 0$:

5. Compute

$$\sum_{x=0}^{n} \binom{n}{x} p^x (1-p)^{n-x}$$

6. Compute

$$\sum_{x=0}^{n} x \binom{n}{x} p^x (1-p)^{n-x}$$

7. Compute

$$\sum_{x=1}^{\infty} (1-p)^{x-1} p$$

8. Compute

$$\sum_{x=1}^{\infty} x(1-p)^{x-1} p$$

9. Compute

$$\sum_{x=0}^{\infty} \frac{\lambda^x e^{-\lambda}}{x!}$$

10. Compute

$$\sum_{x=0}^{\infty} x \frac{\lambda^x e^{-\lambda}}{x!}$$