

**QUIZ 5 SOLUTIONS: LESSONS 5-6**  
**SEPTEMBER 7, 2018**

Write legibly, clearly indicate the question you are answering, and put a box or circle around your final answer. If you do not clearly indicate the question numbers, I will take off points. Write as much work as you need to demonstrate to me that you understand the concepts involved. If you have any questions, raise your hand and I will come over to you.

1. [6 pts] Evaluate  $\int_0^{\ln 4} xe^{-x} dx$ . Round your answer to the nearest hundredth.

**Solution:** This is an integration by parts problem. Let

$$\begin{aligned} u &= x & dv &= e^{-x} dx \\ du &= dx & v &= -e^{-x} \end{aligned}$$

Write

$$\begin{aligned} \int_0^{\ln 4} xe^{-x} dx &= -xe^{-x} \Big|_0^{\ln 4} - \int_0^{\ln 4} (-e^{-x}) dx \\ &= -xe^{-x} \Big|_0^{\ln 4} + \int_0^{\ln 4} e^{-x} dx \\ &= -xe^{-x} \Big|_0^{\ln 4} - e^{-x} \Big|_0^{\ln 4} \\ &= -xe^{-x} - e^{-x} \Big|_0^{\ln 4} \\ &= -\ln 4 e^{-\ln 4} - e^{-\ln 4} - (0e^0 - \underbrace{e^0}_1) \\ &= -\ln 4 e^{\ln 4^{-1}} - e^{\ln 4^{-1}} + 1 \\ &= -\ln 4 \left( \frac{1}{4} \right) - \frac{1}{4} + 1 \\ &\approx \boxed{.40} \end{aligned}$$

2. [4 pts] Suppose after a February snow storm in Madison, Wisconsin, the snow melts at a rate of 6 times the square of the number of inches of snow on the ground. Let  $A(t)$  be the number of inches of snow on the ground. Write down a differential equation that describes this situation.

**Solution:** The differential equation is

$$\boxed{\frac{dA}{dt} = -6A^2}.$$

There is a negative because the snow is melting.