MATH 242 - Quiz 2 REMIX

02/15/2024

1. **[4 pts]** Evaluate the definite integral.

$$\int_0^1 x^4 e^{-x^5+1} dx$$

$u = -x^5 + 1$

$du = -5x^4 dx$

$-\frac{1}{5} du = x^4 dx$

$$-\frac{1}{5}\int_1^0 e^u du = \left(\frac{1}{5}e^u\right)\Big|_0^1 = \frac{1}{5}e - \frac{1}{5}$$

2. **[6 pts]** The equation below describes the exponential growth of a population of bacteria, starting from some initiailly known population A_0. The bacteria reproduce in such a way that any initial population always doubles every 18 hours. Use this information to determine the value of the constant k and then use it to predict the time it takes for the initial population A_0 to become 100 times larger.

$$A(t) = A_0 e^{kt}$$

$2A_0 = A_0 e^{18k}$

$\frac{\ln(2)}{18} = k$

$100A_0 = A_0 e^{\frac{\ln(2)}{18}t}$

$\frac{18\ln(100)}{\ln(2)} = t$