

MATH 242 - Quiz 2 REMIX V2

04/04/2024

1. [4 pts] Evaluate the definite integral.

$$\int_1^2 x^2 e^{x^3-5} dx$$

$$\begin{aligned} u &= x^3 - 5 \\ du &= 3x^2 dx \\ \frac{1}{3} du &= x^2 dx \end{aligned}$$

$$\frac{1}{3} \int_{-4}^3 e^u du$$

$$\frac{1}{3} \left(e^u \right)_{-4}^3$$

$$\boxed{\frac{e^3 - e^{-4}}{3}}$$

2. [6 pts] The equation below describes the exponential decay of a quantity of a radioactive substance, starting from some initially known amount of mass, A_0 . The radioactive decay is such that half the mass remains after 12 years. Use this information to determine the value of the constant k . Then predict the time it takes for the initial mass A_0 to become 10 times smaller.

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

$$\frac{A_0}{2} = A(12) = A_0 e^{12k}$$

$$\frac{1}{2} = e^{12k}$$

$$\left(\frac{\ln(\frac{1}{2})}{12} = k \right) \leftarrow$$

$$A(?) = \frac{A_0}{10} = A_0 e^{\frac{\ln(\frac{1}{2})}{12} t}$$

$$\frac{12 \ln(10)}{\ln(\frac{1}{2})} = t$$

$$\left[- \frac{12 \ln(10)}{\ln(2)} = t \right] \leftarrow$$