

Exponential Functions.

1. The amount A grams of a radioactive substance after a time t minutes is given by $A = A_0 e^{-kt}$ where A_0 is the initial amount of the substance and k is a constant.

In 3 minutes, 10 grams of the substance Bismuth are reduced to 9 grams through decay.

Find the value of k . (3)

2. The amount of A_t micrograms of a certain radioactive substance remaining after t years decreases according to the law $A_t = A_0 e^{-0.002t}$, where A_0 is the amount present initially.

(a) If the 600 micrograms are left after 1000 years, how many micrograms were present initially? (3)

(b) The half-life of a substance is the time taken for the amount to decrease to half its initial amount. What is the half-life of this substance? (4)

3. A mug of tea cools according to the law $T_t = T_0 e^{-kt}$, where T_0 is the initial temperature and T_t is the temperature after t minutes. all temperatures are in $^{\circ}\text{C}$.

(a) A particular mug of tea cooled from boiling point (100°) to 75°C in a quarter of an hour. Calculate the value of k .

(b) By how many degrees will the temperature of this tea fall in the next quarter of an hour? (5)

4. The value V (in £ million) of a cruise ship t years after launch is given by the formula $V = 252e^{-0.06335t}$.

(a) What was the value when the ship was launched? (1)

(b) The owners decide to sell the ship once its value falls below £20 million. After how many years will it be sold? (4)

TOTAL (20)