7.8 Practice Problems Adapted from AP Classroom (non secure).

1. During a chemical reaction, the rate of change of the amount of the chemical remaining is proportional to the amount remaining. At time $t = 0$, the amount of the chemical is 12 moles. At time $t = 4$, the amount of the chemical is 4 moles. At what time t is the amount of the chemical 3 moles? (A mole is a unit of measure used in chemistry.)

(A) $\frac{\ln 3}{4 \ln 4}$

(B) $\frac{\ln 4}{4 \ln 3}$

(C) $\frac{4 \ln 3}{\ln 4}$

(D) $\frac{4 \ln 4}{\ln 3}$

---

2. A kitten weighs 85 grams at birth. During the first four weeks after the kitten's birth, its weight in grams is given by the function W that satisfies the differential equation $\frac{dW}{dt} = kW$, where t is measured in days and k is some positive constant. Which of the following could be an expression for $W(t)$?

(A) $0.466t^2 + 85$

(B) $4e^{0.162t} + 81$

(C) $85e^{-0.347t-1} + 54$

(D) $85e^{0.059t}$

7.8 Practice Problems from AP Classroom (non secure).

3. Extreme heat applied to a colony of microorganisms causes the size P of the colony, measured in grams, to decrease according to the exponential decay model $\frac{dP}{dt} = -0.4P$, where the time t is measured in hours. The size Q of a second colony of microorganisms, also measured in grams, decreases at the constant rate of 1 gram per hour according to the linear model $\frac{dQ}{dt} = -1$. If at time $t = 0$ the first colony has size $P(0) = 2$ and the second colony has size $Q(0) = 3$, at what time will both colonies have the same size?

(A) 1.437

(B) 1.667

(C) 2.156

(D) 2.654

---

4. During optimal conditions, the rate of change of the population of a certain organism is proportional to the population at time t, in hours. At time $t = 0$ hours, the population is 300. At time $t = 24$ hours, the population is 1000. At what time t is the population 500?

(A) $t = \frac{\ln\left(\frac{3}{5}\right)}{24\ln\left(\frac{3}{10}\right)}$

(B) $t = \frac{\ln\left(\frac{5}{3}\right)}{\frac{1}{24}\ln\left(\frac{10}{3}\right)}$

(C) $t = \frac{24\ln 500}{\ln 1000}$

(D) $t = 300e^{\frac{500}{24}\cdot\ln\left(\frac{10}{3}\right)}$

7.8 Practice Problems from AP Classroom (non secure).

5. A dose of 400 milligrams of a drug is administered to a patient. The amount of the drug, in milligrams, in the person's bloodstream at time t, in hours, is given by $A(t)$. The rate at which the drug leaves the bloodstream can be modeled by the differential equation $\frac{dA}{dt} = kA$, where k is a constant. Which of the following could be an expression for $A(t)$?

(A) $A(t) = 400e^{-0.3t}$

(B) $A(t) = e^{-0.3t} + 399$

(C) $A(t) = 400e^{-0.347\,t-1} + 254$

(D) $A(t) = -1.5t^2 + 400$

---

6. The quantity R, in grams, of a certain radioactive substance decreases according to the exponential decay model $\frac{dR}{dt} = -0.05R$, where t is measured in seconds. During an experiment, a scientist determines that the rate of decay of a second substance with the quantity S, in grams, can be represented by a linear model $\frac{dS}{dt} = -4$, where t is measured in seconds. If at time $t = 0$, $R(0) = 100$ and $S(0) = 125$, at what time t, in seconds, will there be equal quantities of both substances?

(A) $t = 31.197$

(B) $t = 23.548$

(C) $t = 6.329$

(D) $t = 6.318$

Answers: 1. D, 2. D, 3. C, 4. B, 5. A, 6. B