Name: Kely

CC ALGEBRA 2

Date: 4/23/18

TROICI

DO NOW:

The loudness of sound is measured in units called decibels (dB). These units are measured by first assigning an intensity I_0 to a very soft sound that is called the threshold sound. The sound to be measured is assigned an intensity, I, and the decibel rating, d, of this sound is found using $d = 10 \log \frac{I}{I_0}$. The threshold sound audible to the average person is 1.0×10^{-12} W/m² (watts per square meter).

↳ I_0

Consider the following sound level classifications:

Moderate	45-69 dB
Loud	70-89 dB
Very loud	90-109 dB
Deafening	>110 dB

I

How would a sound with intensity 6.3×10^{-3} W/m² be classified?

(1) moderate

(2) loud

(3) very loud

(4) deafening

$d = 10 \log \frac{I \rightarrow \text{intensity}}{I_0 \rightarrow \text{threshold sound}}$

$d = 10 \log \frac{6.3 \times 10^{-3}}{1.0 \times 10^{-12}}$

$d = 97.9934$

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LESSON #6: NEWTON'S LAW OF COOLING

Newton's law of cooling is used to model the temperature of an object placed in an environment of a different temperature. The temperature of the object t hours after being placed in the new environment is modeled by the formula:

$$T = T_a + (T_0 - T_a)e^{-kt}$$

T **: the temperature of the object after a time of t hours has elapsed**

T_a **: the temperature of the surroundings, assumed to be constant** Fridge

T_0 **: the initial temperature of the object**

k **: the decay constant**

t **: time in hours**

1. Suppose a frozen package of hamburger meat is removed from a freezer that is set at $0°F$ and placed in a refrigerator that is set at $38°F$. Six hours after being placed in the refrigerator, the temperature of the meat is $12°F$. Determine the decay constant, *k*, rounded to the nearest thousandth.

T_a $t=6$ T_0 T want K

$$T = T_a + (T_0 - T_a)e^{-Kt}$$

$$12 = 38 + (0 - 38)e^{-K \cdot 6}$$

$$-38 \quad -38$$

$$-26 = (-38)e^{-6K}$$

$$\frac{-26}{-38} = \frac{(-38)e^{-6K}}{-38}$$

$$\frac{13}{19} = e^{-6K}$$

$$\frac{\ln \frac{13}{19}}{-6} = \frac{-6K}{-6}$$

$$\boxed{K = .063}$$

$\nearrow T_0 \quad \nearrow T_a \quad \nearrow t$

2. A pot of tea is heated to 90 ° C. A cup of the tea is poured into a mug and taken outside where the temperature is 18 ° C. After 2 minutes, the temperature of the cup of tea is approximately 65 ° C. Use the Newton's Law of Cooling formula above Determine the value of the decay constant, k to the nearest ten thousandth.

$\downarrow T \qquad K = ?$

$$T = T_a + (T_0 - T_a)e^{-kt}$$

T : the temperature of the object after a time of t hours has elapsed

T_a : the temperature of the surroundings, assumed to be constant

T_0 : the initial temperature of the object

k : the decay constant

t : time in hours

$$\frac{2\,\text{min}}{x\,\text{hr}} = \frac{60\,\text{min}}{1\,\text{hr}}$$

$$\frac{2}{60} = \frac{60x}{60}$$

$$x = \frac{1}{30}\text{hr}$$

$$65 = 18 + (90 - 18)e^{-K \cdot \left(\frac{1}{30}\right)}$$

$$-18 \quad -18$$

$$\frac{47}{72} = \frac{(72)e^{-K/30}}{72}$$

$$\frac{47}{72} = e^{-K/30}$$

$$\frac{\ln \frac{47}{72}}{1} = \frac{-K}{30}$$

$$-K = -12.7955$$

$$\boxed{K = 12.7956}$$

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LAB #3

T_a T_0

1. After sitting out of the refrigerator for a while, a turkey at room temperature (68°F) is placed into an oven at 8 a.m., when the oven temperature is 325°F. Newton's Law of Heating explains that the temperature of the turkey will increase proportionally to the difference between the temperature of the turkey and the temperature of the oven, as given by the formula below:

$$T = T_a + (T_0 - T_a)e^{-kt}$$

T : **the temperature of the object after a time of t hours has elapsed**

T_a : **the temperature of the surroundings, assumed to be constant**

T_0 : **the initial temperature of the object**

k : **the decay constant**

t : **time in hours**

T t

a. The turkey reaches the temperature of approximately 100° F after 2 hours. Find the value of k, to the *nearest thousandth*.

$100 = 325 + (68 - 325)e^{-k \cdot 2}$
$-325 \quad -325$
$-225 = (-257)e^{-2K}$
$\frac{-225}{-257} = \frac{(-257)e^{-2K}}{-257}$
$\frac{225}{257} = e^{-2K}$
$\ln\frac{225}{257} = \frac{-2K}{-2}$
2

$\boxed{K = .066}$

b. Determine the Fahrenheit temperature of the turkey, to the *nearest degree*, at 3 p.m.

$\hookrightarrow T$

$\hookrightarrow t = 7$ hours

$T = 325 + (68 - 325)e^{-.066 \cdot 7} \rightarrow$ CALC!

$T = 163.0842$

$\boxed{T \approx 163°}$

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