### 2.3 Day2 - Log/Expo Apps and Modeling

Over a period of time, a cup of hot coffee cools to the temperature of the surrounding air. **Newton's Law of Cooling**, named after Sir Isaac Newton, states that the temperature of a heated object decreases exponentially over time toward the temperature of the surrounding medium.

#### **NEWTON'S LAW OF COOLING**

The function  $T = C + (T_{\theta} - C)e^{kt}$  models Newton's Law of Cooling. It allows you to predict the temperature T of an object, t time after it is placed in a constant-temperature cooling environment.

 $T_{\theta}$  is the initial temperature of the object, and C is the constant temperature inside the room where the object is. The number k is a cooling constant for the particular object in question.

T = temperature of an object after time has passed

C = constant temperature of the room object is in

 $T_0$  = temperature of the object initially

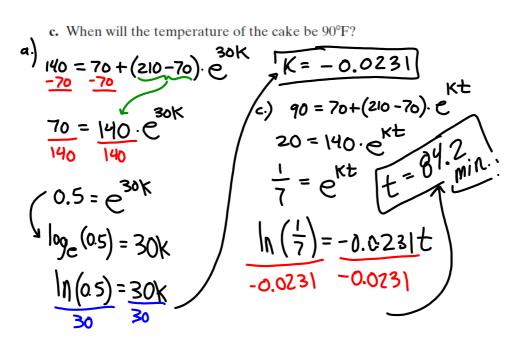
k =cooling constant

t =time that has passed

# EXAMPLE Using Newton's Law of Cooling $T = \mathbf{C} + (T_{\theta} - \mathbf{C})e^{kt}$

A cake removed from the oven has a temperature of 210°F. It is left to cool in a room that has a temperature of 70°F. After 30 minutes, the temperature of the cake is 140°F.

**a.** Use Newton's Law of Cooling to find a model for the temperature of the cake, *T*, after *t* minutes.



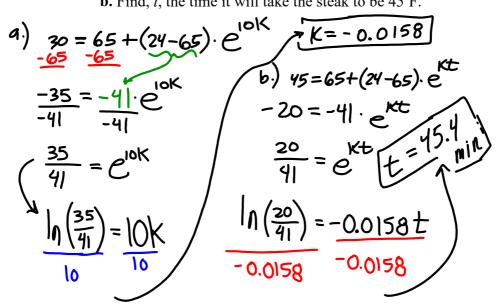
### **Check Point**

$$T = \mathbf{C} + (T_{\theta} - \mathbf{C})e^{kt}$$

A frozen steak initially has a temperature of 24°F. It is left to thaw in a room that has a temperature of 65°F. After 10 minutes, the temperature of the steak has risen to 30°F. After how many minutes will the temperature of the steak be 45°F?

**a.** Find, *k*, the constant.

**b.** Find, t, the time it will take the steak to be 45°F.



## HW 2.3 - Day 2 Answers

3.)a.) 
$$k = -0.0419$$

b.) 
$$t = 69.6$$
 minutes

4.)a.) 
$$k = -0.1643$$

b.) 
$$t = 11.5$$
 minutes