

## Replacement Problems 127–132

Debbi is planning to prepare a large pork roast for dinner. It needs to be defrosted to room temperature before baking. She knows the freezer keeps items cooled to  $10^{\circ}\text{F}$ . Debbi learned in school that the temperature of an item, left on the kitchen counter to defrost, changes according to the equation:

$$\frac{dT}{dt} = 0.0003T(74 - T)$$

where  $T$  is the temperature of the item, measured in degrees Fahrenheit, and time is measured in minutes.

- 127–8 Find an equation that expresses the temperature of the roast as a function of time.
- 127–9 If Debbi removes the roast from the freezer at 10:00 a.m., what will its temperature be at noon?
- 128–12 To the nearest minute, what time will it be when the temperature of the roast is  $70^{\circ}$  (room temperature)?
- 130–20 If Debbi leaves the roast on the counter for an additional hour, what will its internal temperature be? Why did the temperature change so little during this hour?

Now its time to bake the roast. Let's assume that the roast has a temperature of  $70^{\circ}$  when it is placed in the oven that has been preheated to  $350^{\circ}$ . Let's further assume that the internal temperature of the roast increases logistically and is done in 3 hours. (Pork is done when it reaches an internal temperature of  $160^{\circ}$ .)

- 131–20 Find  $k$ , the constant of integration.
- 131–22 Find an equation that gives the internal temperature of the roast at any time after it has been placed in the oven.
- 132–6 If Debbi gets behind during the day, why would it not be a good idea to increase the oven temperature, and proportionately decrease the baking time?