BC CALCULUS PRACTICE 9.3 **Name:** ______________________________ **Period** ________

Aisle __________ pg. 608; 5, 7, 9, 13, 15, 27, 29, 33, 35a, 37, 40

Show all necessary work neatly.

5. Suppose that an initial population of 10,000 bacteria grows exponentially at a rate of 1% per hour and that $y = y(t)$ is the number of bacteria present t hours later.

(a) Find an initial-value problem whose solution is $y(t)$.

(b) Find a formula for $y(t)$.

(c) How long does it take for the initial population of bacteria to double?

(d) How long does it take for the population of bacteria to reach 45,000?

7. Radon-222 is a radioactive gas with a half-life of 3.83 days. This gas is a health hazard because it tends to get trapped in the basements of houses, and many health officials suggest that homeowners seal their basements to prevent entry of the gas. Assume that 5.0×10^7 radon atoms are trapped in a basement at the time it is sealed and that $y(t)$ is the number of atoms present t days later.

(a) Find an initial-value problem whose solution is $y(t)$.

(b) Find a formula for $y(t)$.

(c) How many atoms will be present after 30 days?

(d) How long will it take for 90% of the original quantity of gas to decay?

9. Suppose that 100 fruit flies are placed in a breeding container that can support at most 10,000 flies. Assuming that the population grows exponentially at a rate of 2% per day. How long will it take for the container to reach capacity?

13. In each part, find an exponential growth model $y = y_0 e^{kt}$ that satisfies the stated conditions.

(a) $y_0 = 3$; doubling time $T = 6$.

(b) $y(0) = 4$; growth rate 2%.

(c) $y(1) = 1; y(10) = 200$.

(d) $y(1) = 2$; doubling time $T = 6$.

15. (a) Make a conjecture about the effect on the graphs of $y = y_0e^{kt}$ and $y = y_0e^{-kt}$ of varying k and keeping y_0 fixed. Confirm your conjecture with a graphing utility.

(b) Make a conjecture about the effect on the graphs of $y = y_0e^{kt}$ and $y = y_0e^{-kt}$ of varying y_0 and keeping k fixed. Confirm your conjecture with a graphing utility.

27. (a) If $1000 is invested at 8% per year compounded continuously, what will the investment be worth after 5 years?

(b) If it is desired that an investment at 8% per year compounded continuously should have a value of $10,000 after 10 years, how much should be invested now?

(c) How long does it take for an investment at 8% per year compounded continuously to double in value?

Newton's Law of Cooling states that the rate at which the temperature of a cooling object decreases and the rate at which a warming object increases are proportional to the difference between the temperature of the object and the temperature of the surrounding medium. Use this result in Exercises 29–32.

29. A cup of water with a temperature of 95°C is placed in a room with a constant temperature 21°C.

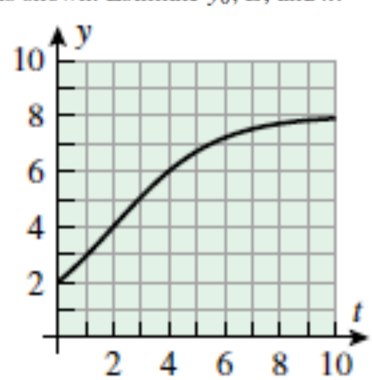
(a) Assuming that Newton's Law of Cooling applies, set up and solve an initial-value problem whose solution is the temperature of the water t minutes after it is placed in the room. [*Note:* The differential equation will involve a constant of proportionality.]

(b) How many minutes will it take for the water to reach a temperature of 51°C if it cools to 85°C in 1 minute?

37. The graph of a logistic model

$$y = \frac{y_0L}{y_0 + (L - y_0)e^{-kt}}$$

is shown. Estimate y_0, L, and k.



. Suppose that a population $y(t)$ grows in accordance with the logistic model

$$\frac{dy}{dt} = 10(1 - 0.1y)y$$

(a) What is the carrying capacity?
(b) What is the value of k?
(c) For what value of y is the population growing most rapidly?

40.

Suppose that the growth of a population $y = y(t)$ is given by the logistic equation

$$y = \frac{1000}{1 + 999e^{-0.9t}}$$

(a) What is the population at time $t = 0$?
(b) What is the carrying capacity L?
(c) What is the constant k?
(d) When does the population reach 75% of the carrying capacity?
(e) Find an initial-value problem whose solution is $y(t)$.