Principles of Calculus Modeling: An Interactive Approach by Donald Kreider, Dwight Lahr, and Susan Diesel
Exercises for Section 3.2

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1. (1 pt)
Bacterial growth
Bacteria grow in a certain culture at a rate proportional to the amount present. Suppose there are 100 bacteria present initially and the amount doubles in 1 hour. How many will there be in an additional 0.5 hours?

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2. (1 pt)
Dissolving sugar
Sugar dissolves in water at a rate proportional to the amount still undissolved. Suppose there are 50 grams of sugar initially and after 3 minutes only 20 grams are left. What is the total time it takes for 90 percent of the sugar to dissolve?

__________________ minutes

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3. (1 pt)
Radioactive decay
A radioactive substance decays at a rate proportional to the amount present. If 30 percent of such a substance decays in 16 years, what is the half-life of the substance?

__________________ years

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4. (1 pt)
Electric current
When a simple electrical circuit containing inductance and resistance but no capacitance has the electromotive force removed, the rate of decrease of the current is proportional to the current. The current is $I(t)$ amperes t seconds after cutoff.

If $I = 40$ when $t = 0$, and $I = 15$ when $t = 0.01$, what is the formula for $I(t)$?

$I(t) =$ __________________

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5. (1 pt)
Warming
An object in a room warms at a rate proportional to the difference between its temperature and room temperature. Suppose the object warms up from 15 degrees Celsius to 20 degrees Celsius in 7 minutes and the room is being maintained at 30 degrees Celsius. How much longer will it take for the object to warm up to 25 degrees Celsius?

__________________ minutes

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6. (1 pt)
Cooling
An object thrown into a large body of water cools at a rate proportional to the difference between its temperature and the water temperature. Suppose know that the water is at a temperature of 27 degrees Celsius. After 4 minutes the object's temperature is 67 degrees, and after 9 minutes the object's temperature is 47 degrees Celsius. What was the temperature of the object when it was thrown into the water?

__________________ degrees Celsius

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7. (1 pt)
Population growth
Suppose that we can model the growth of population in Townsville by assuming that the population will grow at a rate proportional to the population present. Our data tells us that there were 29400 people in Townsville in 1916 when the town was established, and 64400 people in 1961. What will the population in Townsville be in 2050?

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8. (1 pt)
Carbon Dating
The half-life of Carbon-14 is about 5700 years. If there is only 6 percent left of the C-14 originally present in an object, how old is the object?

__________________ years

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9. (1 pt)
Population Growth
Suppose that the population of Zeegers grows at a rate proportial to itself, doubling every 12500 years. When the Zeeger population has reached 93 percent more than their current population, they plan to invade Earth. How many years will it be before the Zeegers attack Earth?

__________________ years

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10. (1 pt)
Bacterial Growth
Suppose it takes 125 seconds for a certain bacteria culture to grow from a population of 150 organisms to 160 organisms. How many hours will it take for the bacteria culture to grow to a population of 1000000 organisms?

__________________ hours