**Modeling Exponential Functions: What is the Percent Change?**

In this activity we will identify whether situations are exponential growth or exponential decay, determine the percent rate of change (percent change), write equations that model situations and use the equations to solve problems.

1. Kerosene, a fuel oil used for heaters and jet engines, is running through a pipe. A filter is placed inside the pipe to remove harmful pollutants. The percentage of pollutants that will be left depends on the length of the filter. The table below shows this relationship.

|  |  |
| --- | --- |
| **Filter Length (feet)** | **Percentage of****Pollutant Left** |
| 0 | 50 |
| 1 | 40 |
| 2 | 32 |
| 3 | 25.6 |
| 4 | 20.48 |

1. What is the constant multiplier?
2. Is it a growth factor or a decay factor?
3. What is the percent rate of change?
4. Write an equation that models this situation.
5. How much pollutant will be left if the filter is 6 feet long?
6. How long must the filter be to have less than 10% pollutant, which is a safe level for use in jets?
7. Goombas are a fictional species of animated mushrooms in Super Mario Galaxy 2. There population growth over time is shown in the table below.

|  |  |
| --- | --- |
| **Month** | **Goomba** **Population** |
| 0 | 120 |
| 1 | 130.8 |
| 2 | 142.57 |
| 3 | 155.4 |
| 4 | 169.39 |

1. What is the constant multiplier?

1. Is it a growth factor or a decay factor?
2. What is the percent rate of change?
3. Write an equation that models this situation.
4. When would the number of Goombas reach 260?
5. The rabbit population at Multiplication Farms is shown in the table below.

|  |  |
| --- | --- |
| **Month** | **Rabbit** **Population** |
| 0 | 6 |
| 1 | 12 |
| 2 | 24 |
| 3 | 48 |
| 4 | 96 |

1. What is the constant multiplier?
2. Is it a growth factor or a decay factor?
3. What is the percent rate of change?
4. Write an equation that models this situation.
5. How many rabbits will there be after 9 months?
6. When would the population of rabbits exceed 10 million?
7. The amount of aspirin in the bloodstream *x* hours after taking a 325mg pill is shown in the table.

|  |  |
| --- | --- |
| **Hour** | **Milligrams of Aspirin** |
| 0 | 325 |
| 1 | 276.25 |
| 2 | 234.81 |
| 3 | 199.59 |
| 4 |  |

1. What is the constant multiplier?
2. Is it a growth factor or a decay factor?
3. What is the percent rate of change?
4. Write an equation that models this situation.
5. If you need 120 mg in the bloodstream to be effective, when should you take another aspirin?
6. The fish population (in hundreds) in a pond is shown in the table below.

|  |  |
| --- | --- |
| **Month** | **Fish** **Population****(in hundreds)** |
| 0 | 30 |
| 1 | 31.5 |
| 2 | 33.08 |
| 3 | 34.73 |
| 4 | 36.47 |

1. What is the constant multiplier?
2. Is it a growth factor or a decay factor?
3. What is the percent rate of change?
4. Write an equation that models this situation.
5. How many fish will there be in the pond after 8 months?
6. When would the population be over 5000 fish? (5,000 = \_\_\_\_\_\_ hundred)
7. The amount of chlorine in a swimming pool is shown in the table below.

|  |  |
| --- | --- |
| **Day** | **Grams of Chlorine** |
| 0 | 400 |
| 1 | 320 |
| 2 | 256 |
| 3 | 204.8 |
| 4 |  |

1. What is the constant multiplier?
2. Is it a growth factor or a decay factor?
3. What is the percent rate of change?
4. Write an equation that models this situation.
5. How much chlorine will there be after 5 days?
6. If 100 grams of chlorine is needed to be effective, when should they put in another tablet of chlorine?
7. The amount of bacteria in a cut is shown in the table below.

|  |  |
| --- | --- |
| **Hour** | **Number of Bacteria****(in thousands)** |
| 0 | 1 |
| 1 | 1.22 |
| 2 | 1.49 |
| 3 | 1.82 |
| 4 | 2.22 |

1. What is the constant multiplier?
2. Is it a growth factor or a decay factor?
3. What is the percent rate of change?
4. Write an equation that models this situation.
5. How many bacteria are in the cut after 24 hours?
6. How many bacteria are in the cut after 48 hours?
7. Jamal bought a car and the salesperson said that the value of the car would follow the model $V\left(t\right)=19,500∙\left(0.88\right)^{t},$ where *V* is the value of the car (in dollars) and *t* is the number of years gone by since the purchase.
8. What was the original price of the car?
9. Is the value increasing or decreasing? How do you know?
10. What is the percent rate of the change each year?
11. The population of Rochester was projected to follow the function $P\left(t\right)=18,500∙(1.011)^{t}$ where *P* is the population of *R*ochester *t* years after 2010.
12. What was the original population of Rochester in 2010?
13. Is the population increasing or decreasing? How do you know?
14. What is the percent rate of the change each year?