**Exponential Decay: Depreciation Problems**

Most cars lose value each year by a process known as **depreciation.** You may have heard before that a new car loses a large part of its value in the first 2 or 3 years and continues to lose its value, but more gradually, over time. That is because the car does not lose the same **amount** of value each year, it loses approximately the same **percentage** of its value each year. What kind of model would be useful for calculating the value of a car over time?

Let us look at an example of depreciation: Suppose the value of car when new is $20,000 and it depreciates at a rate of 20% each year. What is the percentage rate of depreciation each year?

The percentage rate of depreciation is 20%, which means that 80% of the value of the car remains every year. We can calculate this percentage rate by subtracting 20% from 100% in order to calculate the value remaining of 80% each year.

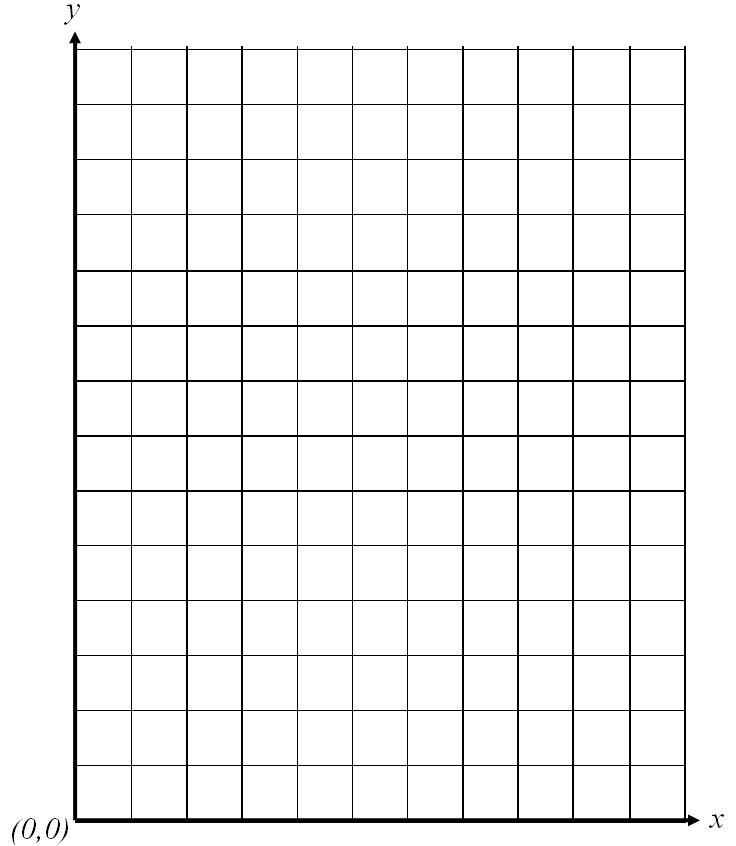
What is the initial value of the car? $\_\_\_\_\_\_\_\_\_\_\_

What is the percentage rate? 100% - 20% = \_\_\_% each year. Write that percentage as a decimal. \_\_\_\_\_\_

Let us look at the depreciation data over a 5 year period of time (rounded to the nearest dollar).

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Number of Years** | 0 | 1 | 2 | 3 | 4 | 5 |
| **Value of the Car** | 20,000 | 16,000 |  |  | 8,192 |  |

Graph the table on the graph below.



Write an explicit equation for the data in order to calculate the value of deprecation for any year.

Y = initial value (1 – percentage rate of depreciation)time

Y = 20,000(1 - 0.20)x

Y = 20,000(0.80)x

Use this equation to find the depreciated value of the car for year 8.

Y = 20,000(0.80)8 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

When will the depreciated value of the car be worth $5000? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Estimate this value to the nearest tenth of a year with your calculator by inputting the equation in your calculator in Y1 and 5000 in Y2 then find the point of intersection (2nd TRACE, 5, ENTER 3 times).

**YOUR TURN**

Matt bought a new car at a cost of $25,000.  The car depreciates approximately 15% of its value each year.

a.)  What is the percentage **rate of depreciation** for the value of this car?    
       (Remember that the percentage rate of depreciation is 0 <  *b* < 1.)

b.)  Write an equation to model the decay value of this car.  
                 y =   
                 where *y* is the value of the car;  *x* is the number of years since new purchase

|  |  |
| --- | --- |
| c.)  What will the car be worth in 10 years? | http://www.regentsprep.org/Regents/math/algtrig/ATP8b/jeep.gif |