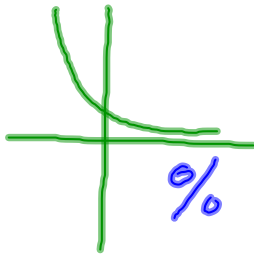


7.2 Exponential Decay Functions

Room for Notes:

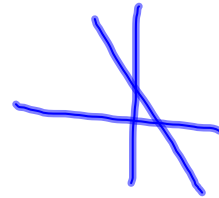


$$y = ab^x$$

$a \geq 0$   
 $0 < b < 1$   
 ↑  
 fraction

mult. by fraction, the amt will get smaller & smaller over time.

linear  
constant



When a real-life quantity decreases by a fixed percentage over a set time period, the amount of the quantity can be modeled by the equation:

$$y = a(1-r)^t$$

↑ initial amt      ↑ rate      ← time      decay factor

1. The value of a new 1994 Toyota Camry was  $\overset{a}{\$20,400}$ . Its value depreciates by  $\overset{r}{15\%}$  each year.

a) Write a function relating the value of the car  $V$  to the age of the car in years  $t$ .

$$V = 20,400(1-.15)^t$$

$$20,400(.85)^t$$

b) Find the value of the car in 2006.

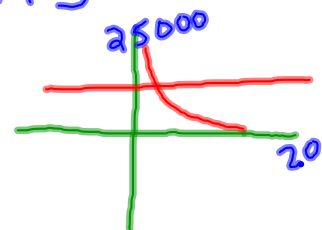
$$V = 20,400(.85)^{12} = \$2901.73$$

c) When was the car worth \$10,000?

logs

$$10,000 = 20,400(.85)^x$$

$y_2$        $y_1$        $x = 4.39 \text{ yrs.}$



d) When will the car be worth nothing?

"mathematically"  
never

2. The value of a snowmobile has been decreasing by 7% each year since it was newly purchased. After 3 years, the value is \$3000. What was the original cost of the snowmobile?

$$3000 = a (1 - 0.07)^3$$

$$3000 = a (.93)^3$$

$$\frac{(3000)}{(.93)^3} = a$$

$$a = \$3729.69$$

3. The number  $E$  of eggs a chicken produces each year can be modeled by the equation:

$$E = 179.2(0.89)^{\frac{w}{52}} \text{ where } w \text{ is the age of the chicken in weeks and } w \geq 22.$$

- a) What is the decay factor and the percent decrease?

$$(.89) \quad 11\%$$

$0 < b < 1$

- b) Estimate the egg production of a chicken that is 2.5 years old (assume 52 weeks in a year).

$$E = 179.2 (.89)^{\frac{130}{52}} \approx 134 \text{ eggs}$$

- c) How could you rewrite the equation so that time is measured in years rather than in weeks?

$$E = 179.2 (.89)^{2.5}$$

4. Mrs. Woodnorth's Honda Civic was worth \$21,500 new. Over the past two years, it has depreciated in value by \$3,302.40.

a) What is the decay factor? What is the percent of depreciation?

$$\begin{array}{r} 21,500 \\ - 3,302.40 \\ \hline 18,197.60 \end{array}$$

$$21,500(1-r)^t = 18,197.60$$

$$\frac{21,500(1-r)^t}{21,500} = \frac{18,197.60}{21,500}$$

$$(1-r)^t = .8464$$

b) At this rate, how much will the Civic be worth after 3 more years?

$$21,500(1-.08)^t$$

$$21,500(.92)^5 =$$

$$\$14,170.25$$

let  $x = (1-r)$

$$x^2 = .8464$$

$$x = .92$$

$$1-r = .92$$

$$-r = -.08$$

$$r = .08$$