

EXPONENTIAL GROWTH AND DECAY

What is exponential growth?

- *A quantity grows exponentially if it increases by the same percent each time.
- *The higher the rate of growth, the steeper the curve.
- *words that mean growth: increase, appreciate, gains value

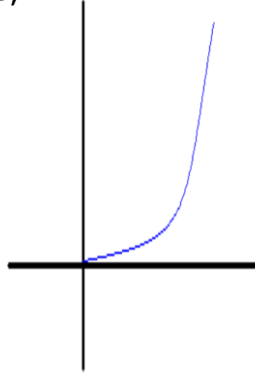
Exponential Growth Model

$$y = C(1 + r)^t$$

t = time period

C = initial amount (starting amount)

r = rate as a decimal



Goals Aligned to the Common Core Standards

- You will be able to understand the constraints of an exponential function.
- You will be able to identify an exponential function in a real-life situation.

Examples:

In 1971, there were 294,105 females participating in high school sports. Since then, that number has increased at an average of 8.5% per year. How many females will participate in sports in 2011?

$$t = 40 \qquad C = 294,105 \qquad r = .085$$

$$y = 294,105(1 + .085)^{40}$$
$$y = 7685850.547 \qquad \text{so } 7,685,850 \text{ girls}$$

Mrs. Griffee received a job as a teacher with a starting salary of \$34,000. According to her contract, she will receive a 1.5% increase in her salary every year. How much will Mrs. Griffee earn in 7 years?

$$t = 7 \qquad C = 34,000 \qquad r = .015$$

$$y = 34,000(1 + .015)^7$$
$$y = 37,734.727 \qquad \text{so } \$37,734.73$$

How much must you deposit into an account with a rate of 8% for 6 years in order to have about \$795?

$$Y = \$795 \qquad t = 6 \qquad r = .08$$

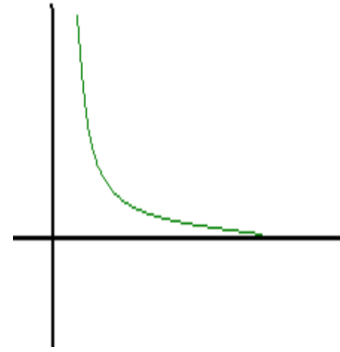
$$795 = C(1 + .08)^6$$
$$795 = C(1.5869)$$
$$500.977 = C \qquad \text{so approximately } \$501$$

What is exponential decay?

*A quantity decays exponentially if it decreases by the same percent each time.

*The higher the rate of decay, the steeper the curve.

*words that mean decay: decrease, depreciate, loses value



Exponential Decay Model

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

t = time period

C= initial (starting amount)

r= rate as a decimal

Examples:

A business earned \$85,000 in 1990. Then its earnings decreased by 2% each year for 10 years. What were the earnings in 10 years?

$$t = 10$$

$$C = 85,000$$

$$r = .02$$

$$y = 85,000(1 - .02)^{10}$$

$$y = 69451.188$$

so \$69,451.19

A farmer buys a tractor for \$50,000. If the tractor depreciates 10% per year, find the value of the tractor in 7 years.

$$t = 7$$

$$C = 50,000$$

$$r = .10$$

$$y = 50,000(1 - .1)^7$$

$$y = 23914.845$$

Answer: \$23,914.85

Compound Interest

* **Compound interest** is interest added to the principal of a deposit or loan so that the added interest also earns interest from then on.

$$A = P \left(1 + \frac{r}{n} \right)^{nt}$$

A= final amount

P= initial (starting amount)

r= rate as a decimal

n= number of times compounded in a year

t = time period

Examples:

Kenzie's parents invested \$14,000 at 6% per year compounded monthly. How much money will there be in the account after 10 years?

$$P = \mathbf{\$14,000}$$

$$r = \mathbf{.06}$$

$$n = \mathbf{12}$$

$$t = \mathbf{10}$$

$$y = 14,000 \left(1 + \frac{.06}{12} \right)^{12 \cdot 10}$$

$$y = 14,000 (1.819)$$

$$y = 25,471.554 \quad \mathbf{\text{so } \$25,471.55}$$

You deposit \$500 in an account that pays 4% interest compounded yearly. What is the balance after 5 years?

$$P = \mathbf{\$500}$$

$$r = \mathbf{.04}$$

$$n = \mathbf{1}$$

$$t = \mathbf{5}$$

$$y = 500 \left(1 + \frac{.04}{1} \right)^{1 \cdot 5}$$

$$y = 500 (1.21665)$$

$$y = 608.326 \quad \mathbf{\text{so } \$608.33}$$

Determine the amount of an investment if \$300 is invested at an interest rate of 3.5% compounded monthly for 22 years.

$$A = \mathbf{\$300}$$

$$r = \mathbf{.035}$$

$$n = \mathbf{12}$$

$$t = \mathbf{22}$$

$$300 = P \left(1 + \frac{.035}{12} \right)^{12 \cdot 22}$$

$$300 = P(2.1573)$$

$$139.063 = P \quad \mathbf{\text{so } \$139.06}$$