

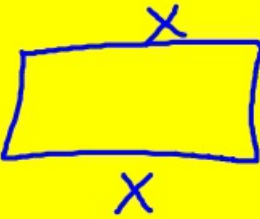
1.) Two functions are shown: $f(x) = 1/2(2)^x$

$$g(x) = 5x + 2$$

What is the largest integer value of x such that $f(x) \leq g(x)$?

$f(x)$		$g(x)$	
x	y	x	y
0	1/2	0	2
1	1	1	7
2	2	2	12
3	4	3	17
4	8	4	22
5	16	5	27
6	32	6	32
7	64	7	37

2.) The width of a rectangle is $3/4$ its length. The perimeter of the rectangle is 420 ft. What is the length, in feet, of the rectangle?

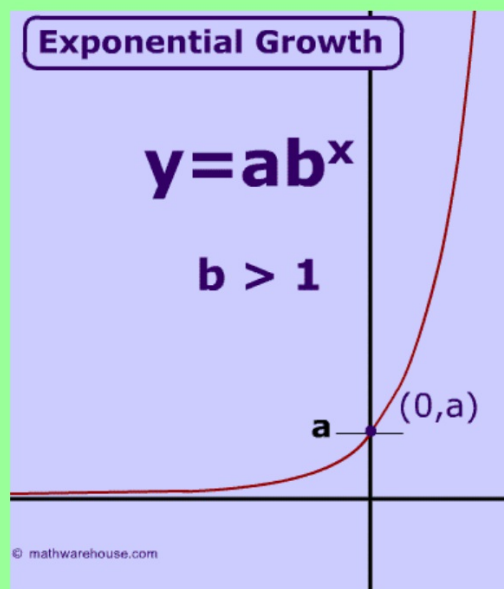
$x = \text{length}$ $\frac{3}{4}x$  $\frac{3}{4}x$ ~~$\frac{8}{7}$~~ $\frac{7}{2}x = 420$ $(\frac{2}{7})$

$\frac{3}{4}x = \text{width}$

$x = 120$

Length = 120 ft

Exponential Growth



Exponential Growth

Occurs when a quantity increases by the same rate over time.

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

a = initial value

r = rate of change

t = time

Examples:

1. The original value of an investment is $\$1400$ and the value increases by 9% each year. Write an exponential growth function to model this situation. Then, find the value of the investment after 25 years.

Step 1: Identify a, r, and t.

$$A = 1400$$

$$R \text{ (percent to decimal)} = 9\% \rightarrow 0.09$$

$$T = 25$$

Step 2: Plug values into formula $y = a(1 + r)^t$.

$$y = 1400(1.09)^t$$

$$y = 1400(1.09)^{25}$$

Step 3: Solve for y.

$$\boxed{\$12,072.31}$$

The cost of tuition at a college is $\$12,000$ and is increasing at a rate of 6% each year. Write an exponential growth function to model this situation. Then, find the tuition cost after 4 years.

Step 1: Identify a , r , and t .

$$A = 12,000$$

$$R \text{ (percent to decimal)} = 6\% \rightarrow 0.06$$

$$T = 4$$

Step 2: Plug values into formula $y = a(1 + r)^t$.

$$y = 12,000(1.06)^t$$

Step 3: Solve for y .

$$y = 12,000(1.06)^4$$

$$\boxed{\$15,149.72}$$

3. The number of student athletes at a local high school is 300 and is increasing at a rate of 8% per year. Write an exponential growth function to model this situation. Then, find the number of student athletes after 5 years.

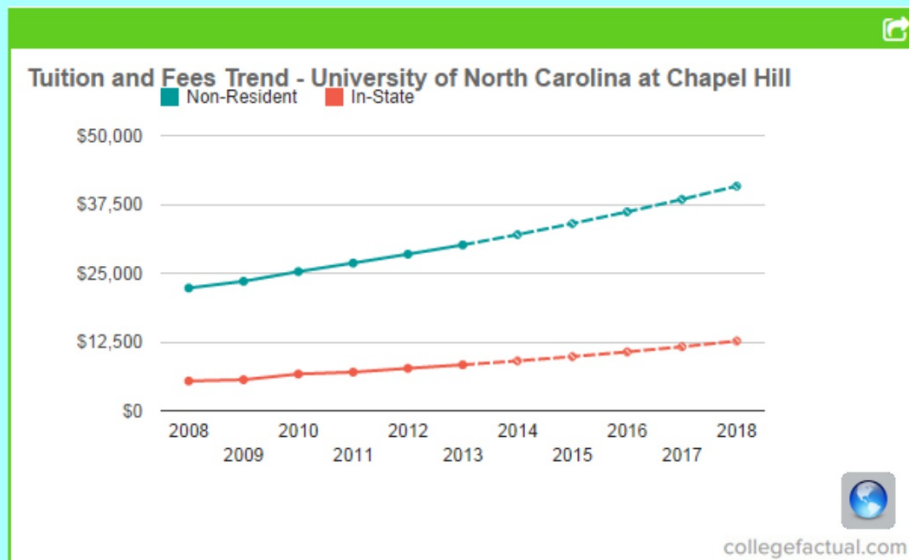
$$y = 300(1.08)^t$$

$$y = 300(1.08)^5$$

440 student athletes

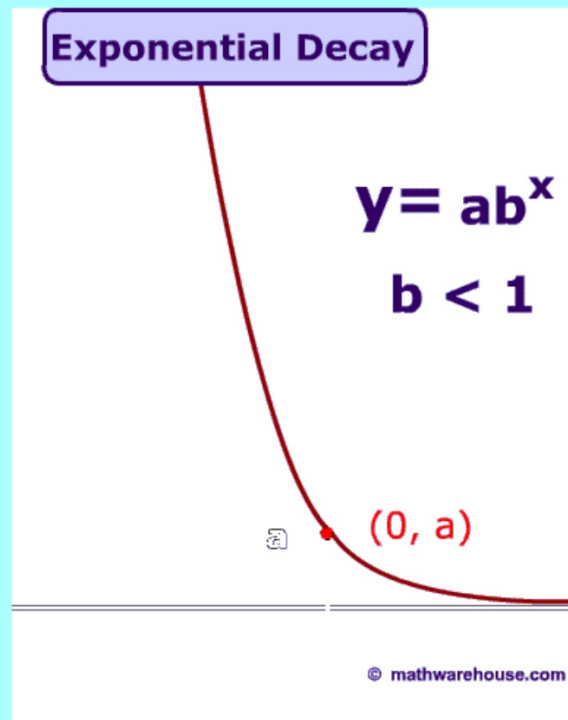
Real World Model

The cost to attend the University of North Carolina at Chapel Hill increases on average 6.5% per year.



Costs from 2008 - 2018

Exponential Decay



Exponential Decay

Occurs when a quantity decreases by the same rate over time.

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

a = initial value

r = rate of change

t = time

Key Words:

Decreasing, depreciates, loses

less than 1

7. The population of a town is decreasing at a rate of 1% per year. In 2000 there were 1300 people. Write an exponential decay function to model this situation. Then, find the population in 2008.

$$t = 8$$

Step 1: Identify a , r , and t .

$$A = 1300$$

$$R \text{ (percents to decimals)} = 1\% \rightarrow 0.01$$

$$T = 8$$

Step 2: Plug values into formula-- $y = a(1 - r)^t$

$$y = 1300(1 - 0.01)^t$$

$$y = 1300(0.99)^t$$

Step 3: Solve for y .

$$y = 1300(0.99)^8$$

1199 people

8. The value of a car is $\overset{a}{\$18,000}$ and depreciating at a rate of $\overset{r}{12\%}$ per year. Write an exponential decay function to model this situation. Then, find the value of the car after $\overset{t}{10}$ years.

Step 1: Identify a, r, and t.

$$A = 18,000$$

$$R \text{ (percents to decimals)} = 12\% \rightarrow 0.12$$

$$T = 10$$

Step 2: Plug values into formula-- $y = a(1 - r)^t$

$$y = 18000(0.88)^t$$

$$y = 18000(0.88)^{10}$$

Step 3: Solve for y

$$\boxed{\$5013.02}$$

9. A farmer buys a tractor for $\overset{a}{\$50,000}$. If the tractor depreciates $\overset{r}{10\%}$ per year, write an exponential decay function to find the value of the tractor in $\overset{t}{7}$ years.

$$y = 50,000(0.90)^t$$

$$y = 50,000(0.90)^7$$

$\boxed{\$23,914.85}$

Try These...

4. Annual sales for a company are \$149,999 and are increasing at a rate of 6% per year. Write an exponential growth function to model this situation. Then, find the annual sales after 7 years.
5. The population of a small town is 1600 and is increasing at a rate of 3% per year. Write an exponential function to model this situation. Then, find the population of the town after 10 years.
6. In 1985, there were 285 cell phone subscribers in Mayville. The number of subscribers increased by 75% per year after 1985. How many subscribers were in Mayville in 2008?
 $t =$ years since 1985

- 10.** An investment of \$8200 loses value at a rate of 2% per year. Write an exponential decay function to find the value of the investment after 9 years.
- 11.** The value of a book is \$58 and decreases at a rate of 7% per year. Write an exponential decay function to find the value of the book after 8 years.
- 12.** The population in Haywardville is decreasing at a rate of 2.5% per year. If the population in 2000 was 28,000, what will be the expected population in 2015 if this rate of decrease continues?

Label each exponential function model as growth or decay and identify the rate (%).

1.) $y = 200(1.05)^5$ G 5%

2.) $y = 4(0.85)^{12}$ D 15%

3.) $y = 1200(1.085)^{120}$ G 8.5%

4.) $y = 36(0.91)^7$ D 9%

5.) $y = -2(1.09)^{24}$ G 9%

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

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

Given $f(x) = 0.60 (0.75)^x$, identify the growth/decay factor, growth/decay rate, and the initial value.

Growth/Decay Factor: .25

Growth/Decay Rate: 25%

Initial Value: 0.60

Given $f(x) = 250 (1.07)^x$, identify the growth/decay factor, growth/decay rate, and the initial value.

Growth/Decay Factor: 0.07

Growth/Decay Rate: 7%

Initial Value: 250