Which of the following graphs grows faster?

Linear Function

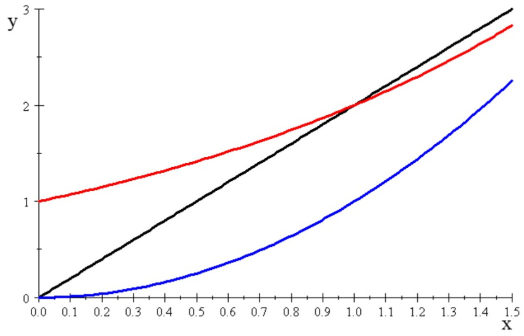
1. $y = 2x$

Power Function (squaring)

2. $y = x^2$

Exponential Function

3. $y = 2^x$



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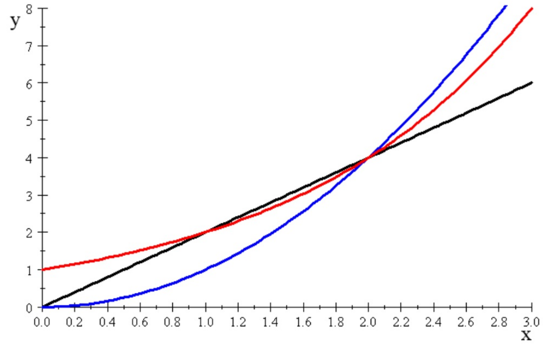

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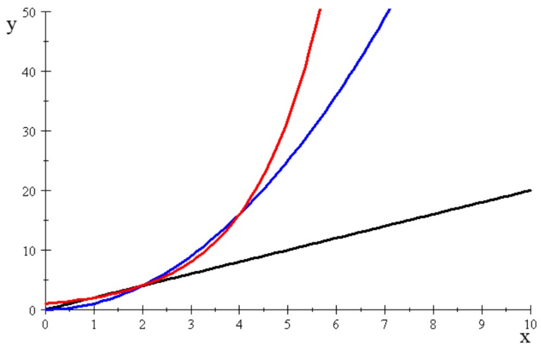


An exponential function will always overtake a linear and a power function...at some point.

Sec 8-1: Exponential Functions

$$y = a \bullet b^x$$

Real Life meaning:

Values of a: $a \neq 0$ ⟶ Initial Amount

GRAPH ⟶ y-INT

Values of b: $b > 0$ ⟶ Growth/Decay Factor

Values of x: real number ⟶ # of time periods

Finish each sentence:

The larger the value of the base, the faster the graph grows.

The closer the base is to zero, the faster the graph decays.

The closer the base is to one, the flatter the graph is. If b=1 the graph is constant (a horizontal line).

$$Y = a \cdot b^x$$

Exponential Growth: Value of b: $b > 1$

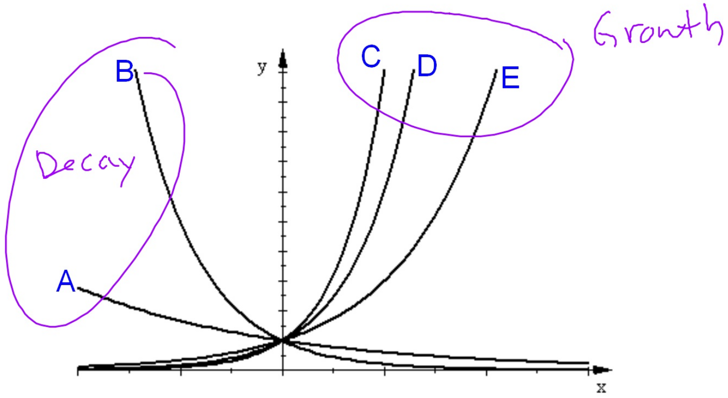
b is called the growth factor

Exponential Decay: Value of b: $0 < b < 1$

b is called the decay factor

$y = 6^x$ D $y = 0.8^x$ A $y = 3^x$ E

$y = 0.5^x$ B $y = 10^x$ C

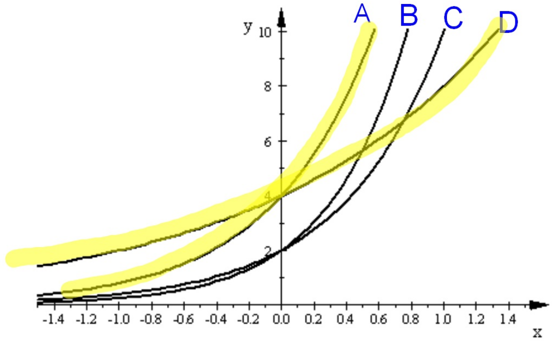


$y = 4(2)^x$ D

$y = 4(5)^x$ A

$y = 2(5)^x$ C

$y = 2(8)^x$ B



When an exponential models a "real life" situation:

$$y = a \cdot b^x$$

The initial amount

Growth Factor $b>1$ or Decay Factor $0<b<1$

Number of time periods
Future: $t > 0$
Past: $t < 0$
Present: $t=0$

Finding the growth/decay factor.

1. The # of people with the flu increases 12.2% each day. b= 1.122

100% + 12.2%
112.2%

2. The value of a machine at the factory decreases 21% per year. b= .79

100% - 21%
= 79%

3. The half-life of a radioactive material is 4 hrs.

b= .5

4. The number of cells doubles every 15 minutes.

b= 2

$$y = a \cdot b^x$$

The population of a city has been increasing 1.4% each year. The population of the city in 1995 was 120,000.

1. Model this situation with an exponential eq. $b = 1.014$

$y = 120{,}000(1.014)^x$

2. Find the population in 2012.

$x = 17$ 151,994

3. What was the population in 1990?

$x = -5$ 111,942

An investment was worth $150,000 and it increased in value 1.5% each month.

a) Model this situation with an exponential equation.

$b = 1.015$

$y = 150{,}000(1.015)^x$

b) What is the investment worth in 2 years?

$x = 24$

$214{,}425.42$

The number of union employees in the industry in 1975 was 64,000. In 1980 the number of union employees was 60,800.

1. Find the percent change in the # of union employees.

$\%\text{ change} = \frac{\text{final} - \text{original}}{\text{original}} = 5\%$ decrease

2. Model this situation with an exponential equation.

$y = 64{,}000(.95)^x$ ← # of 5 year periods

3. Find the number of union employees in 2000.

$x = 5$ 49,522

4. Find the number of union employees in 2012.

$x = \frac{37}{5} = 7.4$ 43,786

The number of cells doubles everay 20 minutes. At 6:00pm there were 80 cells.

a) Model this situation with an exponential equation.

$y = 80(2)^x$

b) Find the number of cells at midnight.

$x = 6 \text{ hrs} \times 60 \frac{\text{min}}{\text{hr}} = \frac{360 \text{ min}}{20 \text{ min}} = 18$

$y = 80(2)^{18}$

$20{,}971{,}520$

The half-life of a medicine is 30 minutes. At 9:00 am you took a 500mg dose. How much of the medicine is left in your system at 6:00 pm?

$9 \text{ hrs} \times 2 = 18$

$500(.5)^{x} \leftarrow 18$

$= .0019$