

CLO: SWBAT write and evaluate exponential expressions to model growth and decay situations.

Lesson 31: Exponential Decay

Date: December 2, 2015

***Get your calculator out!**

Warm Up

- 1) Kate deposits \$100 in an account that pays 5% interest annually. She makes no other deposits or withdrawals. Which equation can be used to calculate the amount, A , in Kate's account for any year, n ?

$$\frac{5}{100} = .05$$

~~A. $A(n) = 100(1.5)^n$~~

~~B. $A(n) = 1.05(100)^n$~~

C. $A(n) = 100(1.05)^n$

~~D. $A(n) = 100(5)^n$~~

- 2) A population of 100 frogs increases at an annual rate of 22%. How many frogs will there be in 5 years?

$$y = 100(1 + .22)^5$$

$$y = 100(1.22)^5$$

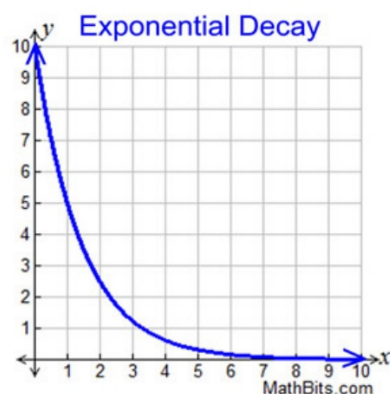
$$y = 100(2.7) = 270 \text{ frogs}$$

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Exponential Decay

Exponential Decay: Decreasing at a rate proportional to the current value

Example: $y = 2(.8)^x$



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Examples of real-life situations that involve **exponential decay** are:

Population loss (extinction)

Car values

Half-life (radioactive decay)

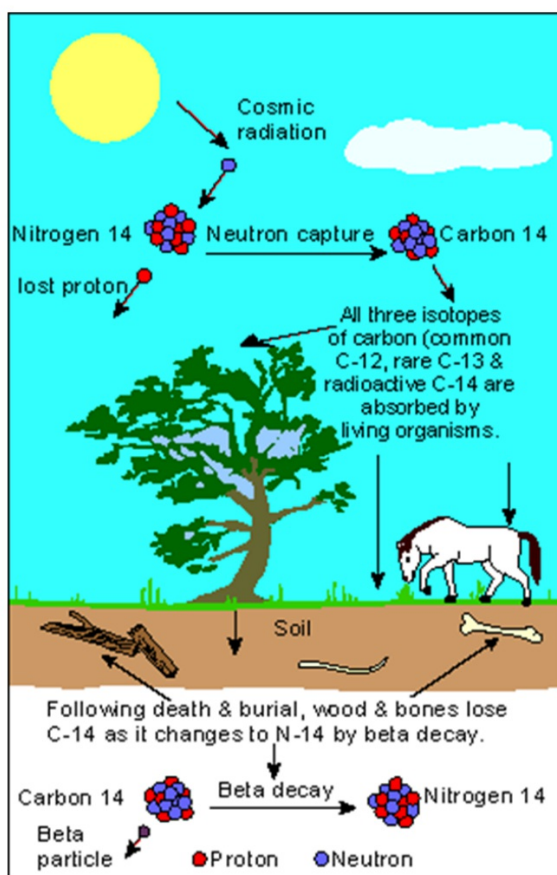
This is called **depreciation** (decreasing in value)

Exponential Decay Formula:

NEW SOLUTION $\longrightarrow y = A(1 - r)^x$ TIME

ORIGINAL START VALUE \uparrow RATE (as a decimal) \swarrow

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All living things contain Carbon 14. When they die, the C-14 begins to decay. We can determine how long something has been dead by the amount of C-14 left.

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Growth or Decay?

Determine if the following equations represent exponential growth, exponential decay or neither.

1) $y = 4 (1.21)^t$
growth
 $1.21 > 1$

2) $y = 24 (1.05)^t$
growth
 $1.05 > 1$

3) $y = 7 (0.98)^t$
decay
 $.98 < 1$

4) $y = 1 + 14t$
linear

5) $y = 9 (0.14)^t$
decay
 $0.14 < 1$

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Example

1. Olivia purchased a music system worth \$18,000 in the year 2001. It loses its value by 6% per year. What is the value of the music system in 2003?

$$y = A(1-r)^x$$

$$A = 18000$$

$$r = 6\% = \frac{6}{100} = .06$$

$$x = 2$$

$$y =$$

$$y = 18000(1-.06)^2$$

$$y = 18000(.94)^2$$

$$y = 18000(.88)$$

$$y = \$15840$$

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If you start with 200 M&M's and you eat half of them every 10 minutes, how many M&M's will you have after 30 minutes?

$$\begin{aligned}A &= 200 \\r &= 50\% = .5 \\x &= 3 \\y &= \end{aligned}$$

$$\begin{aligned}y &= 200(1-.5)^3 \\y &= 200(.5)^3 \\y &= 200(0.125) \\y &= 25\end{aligned}$$

An adult takes 400 mg of ibuprofen. Each hour, the amount of ibuprofen in the person's system decreases by about 29%. How much ibuprofen is left after 6 hours?

$$x = 400(1 - 0.29)^6$$

Exit Slip

Ryan bought a bike for \$47,000 in the year 2002. Its value depreciates by 2% per year. What is the value of the bike in 2006?

