

Warmup 11/ (*XVII*)

Mental Monday

Estimate: How many cheeseballs are in the container?

A number that is too high: _____

A number that is too low: _____

Your guess: _____



736

≈ ~~2000~~ cheese balls

Nutrition Facts

Serving Size: 1 oz
(28g/about 32 balls)

Servings: 23

Calories 130
Fat Cal 60

HW Review: Exponential Graphs

Linear or Exponential?

Linear

$$f(x) = 25x + 25$$

Linear or Exponential?

Exp.

$$f(x) = 25^x$$

Intro: Percent Increase & Decrease

- Marvin has \$400. He increases his money by 10% each year.
- DISCUSS: DO YOU THINK THIS IS LINEAR OR EXPONENTIAL???
- The more money you have, the more 10% would be. So it's not a constant rate of change, and it can't be linear.
- But why is it exponential??? Let's find out...

Percent Increase: A “shortcut”

- One way to add 3% to a number is to find 3% and then add that to the original number.
- However, is there a way you can add 3% all in one step???
- To add 3% to any number, you can multiply it by 1.03.
- The “1” takes into account the original number. The “.03” adds the extra 3%.

- If Marvin is increasing his money by 10% each year, he is multiplying by **1.1** each year.
- When you add (or subtract) a percent, you are actually multiplying. This is why percent increase/decrease functions are exponential.
- 10% increase for 5 years:
 $400 \cdot 1.1 \cdot 1.1 \cdot 1.1 \cdot 1.1 \cdot 1.1$ or $400 \cdot 1.1^5$
- 10% increase for x years:
 $400 \cdot 1.1^x$

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Exponential Growth Functions

Write an Expression for the Situation.

Annual sales for a company are \$149,000 and are increasing at a rate of 25% per year.

$$149,000 \cdot 1.25^x$$

Write an Expression for the Situation

The original value of a painting is \$1400, and the value increases by 9% each year.

$$1400 \cdot 1.09^x$$

Write an Expression for the Situation

The cost of tuition at a college is \$12,000 and is increasing at a rate of 6% per year.

$$12000 \cdot 1.06^x$$

A condo in Austin, Texas, was worth \$80,000 in 1990. The value of the condo increased by an average of 3% each year. Write a function to model this situation. Then find the value of the condominium in 2005.

$$y = 80,000(1.03)^x; \$124,637$$

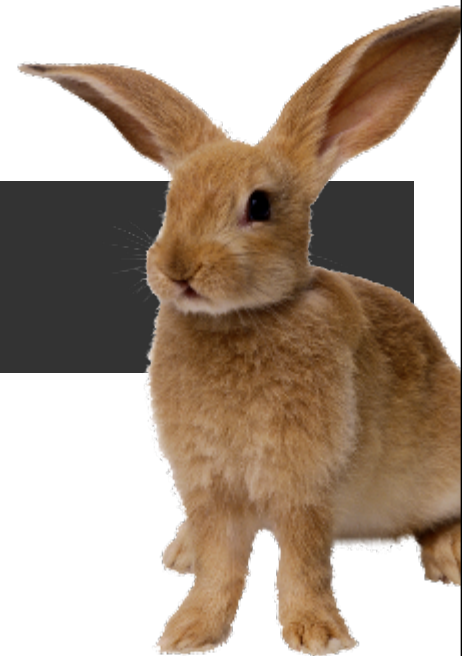
Twelve students at a particular high school passed an advanced placement test in 2000. The number of students who passed the test increased by 16.4% each year thereafter. Write a function to model this situation. Find the number of students who passed the test in 2004.

$$y = 12 (1.164)^x ; 22$$

Interpret the equation.

- If x is the number of months that have gone by after it was bought, the value of a baseball card is given by the function $f(x) = 5(1.125)^x$.
- Use the equation to describe what is happening with the value of the baseball card. *The original value is \$5 and the value increases by 12.5% each year.*

Science Application!



- In the absence of predators, the natural growth rate of rabbits is 4% per year. A population begins with 100 rabbits. The function $f(x) = 100(1.04)^x$ gives the population of rabbits in x years.

- About how long will it take the population of rabbits to double? → reach 200
- About how long will it take the population of rabbits to reach 1000?

About 18 years

$$100 \cdot 1.04^{17} \approx 194$$

$$100 \cdot 1.04^{18} \approx 203$$

≈ 59 years

Wally's Warehouse was founded in 2001. In 2004, there were 216 employees that worked there. In 2005, there were 324 employees that worked there.

$$\frac{324}{216} = 1.5 \text{ so } 50\% \text{ increase per year}$$

1. If the number of employees is increasing exponentially, how many employees will there be in 2006?

$$324 \times 1.5 =$$

486

2. How many employees were there at the start in 2001?

$$64 \leftarrow \frac{216}{1.5^3}$$

3. Write an exponential equation that models the number of employees over the years.

$$y = 64(1.5)^x$$

Exponential Decay

The fish population in a local stream is decreasing at a rate of 3% per year. The original population was 48,000. Write a function to model this situation. Find the population after 7 years.

$$y = 48,000 (0.97)^x; 38,783$$

The population of a small Midwestern town is 4500. The population is decreasing at a rate of 1.5% per year. Write a function to model this situation. Then find the number of people in the town after 25 years.

$$y = 4500(0.985)^t; 3084$$

Real Life Application!

Ms. Bolus purchased her car for \$11 600. It is depreciating at a rate of 12% per year. Mr. Lischwe purchased his car for \$9700. It is depreciating at a rate of 7% per year. Write a function to model both situations.

Bolus	$f(x) = 11600(.88)^x$
Lischwe	$f(x) = 9700(.93)^x$



Real Life Application!

-How much is each car worth 2 years from now? **B: \$8983.04 L: \$8389.53**

-In how many years will Mr. Lischwe's car be worth more than Ms. Bolus' car?
4 years

Bolus	$f(x) = 11600(.88)^x$
Lischwe	$f(x) = 9700(.93)^x$



Homework

- Worksheet