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Warmup 11/$(0! \cdot \sqrt{100})$

- If you were to write an exponential function in each of the following cases, what would the **growth factor** be?

1. Increasing by 24% per year
2. Decreasing by 24% per year
3. Increasing by 4.5% per year
4. Decreasing by 3.33% per year
5. Decreasing by 99% per year
6. Tripling every year
7. Increasing by 200% every year

GET A CALCULATOR!!!

Review Homework

The population of Pittsburgh was about 12,600 in 1820. Between 1820 and 1840 the population grew exponentially, increasing by about 70% each decade.

a. Construct an exponential function in the form $f(t) = ab^t$ that models the population t decades after 1820.

b. According to your model, what was the population of Pittsburgh in 1825? What about 1839?

c. According to your model, by what percentage did the population increase between 1826 and 1836?

A Midwestern town had a population of 7500 in 2010. If the town is growing at a rate of 2% per year, then how many people did it have in 2002?

Suppose a town's population grows by 100% every year. If it had **6000** people in 2010, how many people did it have in 2011?

How many people did it have in 2012?

How many people did it have in 2009???

A Midwestern town had a population of 7500 in 2010. If the town is growing at a rate of 2% per year, then how many people did it have in 2002?

$7500 = P(1.02)^8$

P= about 6401 people

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.

1. **If the number of employees is increasing exponentially, how many employees will there be in 2006?** 486
2. **How many employees were there at the start in 2001?** 64
3. **Write an exponential equation that models the number of employees over the years.** $y=64(1.5)^x$

Jessica purchased a trash compactor for $849.00. The value of the compactor can be modeled by the function $V(t) = 849(0.9)^t$, where t represents the number of years that have passed since Jessica made her purchase.

Based on the function, what happens to the value of the trash compactor?

- A The value of the compactor increases by a rate of 90%.
- B The value of the compactor increases by a rate of 10%.
- C The value of the compactor decreases by a rate of 90%.
- D The value of the compactor decreases by a rate of 10%.

D

The change in the population of fruit flies can be modeled by the equation $P(t) = 3(1.50)^t$, where t is time in days. Which statement describes the change in the population of fruit flies?

- A 1.50% decrease daily
- B 1.5% increase daily
- C 50% increase daily
- D 150% decrease daily

C

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OBJECTIVE:

- Use exponential functions to model compound interest

What is interest?

Simple Interest

- **Simple Interest** is always paid on only the initial amount.
- You deposit $500 into a savings account. You will earn 3% interest per year. If we are using simple interest, how much money will you have in your bank account after 5 years?

- Simple interest is **not** very common.
- If you take out a loan and you only pay interest on the original amount, the bank doesn't get as much money. Who can explain why?

Compound Interest

- **Compound Interest** is paid on the initial amount *and* interest already earned in the past.
- You deposit $500 into a savings account. You will earn 3% interest per year. If we are using **compound** interest, how much total money would you have in your bank account after 5 years?

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Compound Interest

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

A represents the balance after t years.
P represents the principal, or original amount.
r represents the annual interest rate expressed as a decimal.
n represents the number of times interest is compounded per year.
t represents time in years.

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Reading Math

For compound interest

- *annually* means "once per year" (n = 1).
- *quarterly* means "4 times per year" (n =4).
- *monthly* means "12 times per year" (n = 12).

Write a compound interest function to model each situation. Then find the balance after the given number of years.

$1200 invested at a rate of 2% compounded quarterly; 3 years.

$A = P\left(1 + \frac{r}{n}\right)^{4t}$

$= 1200\left(1 + \frac{0.02}{4}\right)^{4t}$

$= 1200(1.005)^{4t}$

$= 1200(1.005)^{12}$

≈ 1274.01

The balance after 3 years is $1,274.01.

Write a compound interest function to model each situation. Then find the balance after the given number of years.

\$15,000 invested at a rate of 4.8% compounded monthly; 2 years.

$$A = P\left(1+\frac{r}{n}\right)^{12t}$$

$$= 15,000\left(1+\frac{0.048}{12}\right)^{12t}$$

$= 15,000(1.004)^{12t}$

$A = 15,000(1.004)^{12(2)}$

$= 15,000(1.004)^{24}$

$\approx 16,508.22$

The balance after 2 years is \$16,508.22.

Write a compound interest function to model each situation. Then find the balance after the given number of years.

\$1200 invested at a rate of 3.5% compounded quarterly; 4 years

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

$$= 1,200\left(1+\frac{0.035}{4}\right)^{4t}$$

$= 1,200(1.00875)^{4t}$

$A = 1200(1.00875)^{4(4)}$

$= 1200(1.00875)^{16}$

≈ 1379.49

Write a compound interest function to model each situation. Then find the balance after the given number of years.

\$4000 invested at a rate of 3% compounded monthly; 8 years

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

$$= 4,000\left(1+\frac{0.03}{12}\right)^{12t}$$

$= 4,000(1.0025)^{12t}$

$A = 4,000(1.0025)^{12(8)}$

$= 4,000(1.0025)^{96}$

≈ 5083.47

The balance after 4 years is \$5,083.47.

Homework

- Worksheet