Warmup (The time at night when people make a wish)

↗ **In 1951, there were 256 fish in a pond. In 1952, there were 352 fish in the pond.**

1. **If the population of fish is growing linearly, how many fish lived in the pond in 1955?** 352 – 256 = 96 fish increase per year

352 + 3(96) = 640 fish

2. **If the population of fish is growing exponentially, how many fish lived in the pond in 1955?**

$\frac{352}{256} = 1.375$, so 37.5% increase per year

$352 \cdot 1.375^3 \approx 915$ fish

Quiz Tuesday

Exponential Growth and Decay
Compound Interest
Exponent Rules, continued.

An exponential function of the form $f(x) = ab^x$ passes through the points (0, –3) and (5, –96). What would be the rule for the function?

- Ⓐ $f(x) = -2^x$
- Ⓑ $f(x) = -32^x$
- Ⓒ $f(x) = -3(2)^x$
- Ⓓ $f(x) = -3(32)^x$

C

COPY:

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.

Understanding the Formula

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

(n = # of times you compound (calculate) the interest per year

☐ **WHY is r divided by n in this formula?**

☐ **WHY is n multiplied by t in this formula?**

Write a compound interest function that would give the total amount of money after "t" years.

$15,000 invested at a rate of 4.8% compounded monthly.

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

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

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

$15,000 invested at a rate of 4.8% compounded monthly

How much will you have after 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.

Compound Interest

Billy puts $10,000 in a savings account. The interest rate for his bank is .8% compounded quarterly.

↗ Write an equation to model this situation.

$f(t) = 10,000(1.002)^{4t}$

↗ How much will he have in his account in five years?

$10,407.69

Compound Interest

Kiptyn has $5000 on his credit card statement that he has not paid off. His credit card company charges 15% interest compounded monthly.

↗ Write an equation to model this situation. $K(t) = 5000(1.0125)^{12t}$

↗ How much will he owe in three years? $7819.72

↗ How much more is this than the amount he would have paid if he had not procrastinated his payment?

$2819.72

Compare and Contrast

☐ Bob wants to put $1,000,000 in the bank to gain interest for five years. He can't decide which bank to put his money in.

☐ Who Wants to be a Millionaire? Bank gives 16% interest compounded annually.

☐ Ke$ha Bank gives 16% interest compounded quarterly.

☐ Piggy Bank gives 16% interest compounded monthly.

1. Before you calculate anything, which bank do you think Billy should put his money in?
2. Write an equation for each bank.
3. How much will Billy have in each bank account after five years?

Compare and Contrast

☐ Bob wants to put $1,000,000 in the bank to gain interest for five years. He can't decide which bank to put his money in.

☐ Who Wants to be a Millionaire? Bank gives 16% interest compounded annually.

☐ Ke$ha Bank gives 16% interest compounded quarterly.

☐ Piggy Bank gives 16% interest compounded monthly.

☐ **Earl's Bank gives 16% SIMPLE interest.**

1. Predict: Will Earl's bank be better than all, worse than all, or somewhere in the middle?
2. Calculate the amount Bob will have after 5 years in Earl's bank.

Exponent Rules, cont.

Solve this equation.

$$2^{3x} = 2^6$$

$$x = 2$$

Exponent Rules, cont.

Solve this equation.

$$2^{3x+1} = 2^{10}$$

$$x = 3$$

Exponent Rules, cont.

Solve this equation.

$$3^{3x} = 27$$

$$x = 1$$

Exponent Rules, cont.

Solve this equation.

$$4^{x-5} = 64$$

$$x = 8$$

Exponent Rules, cont.

Solve this equation.

$$5^{x+1} = 125$$

$x = 2$

Exponent Rules, cont.

Solve this equation.

$$6^{2x-1} = 36$$

$x = 1.5$

Exponent Rules, cont.

Solve this equation.

$$3^{x-6} = 27$$

$x = 9$

Exponent Rules, cont.

Challenge!
Solve this equation.

$$2^{x+4} = 8^x$$

$x = 6$

Homework

Worksheet