8-3 Exponential Review

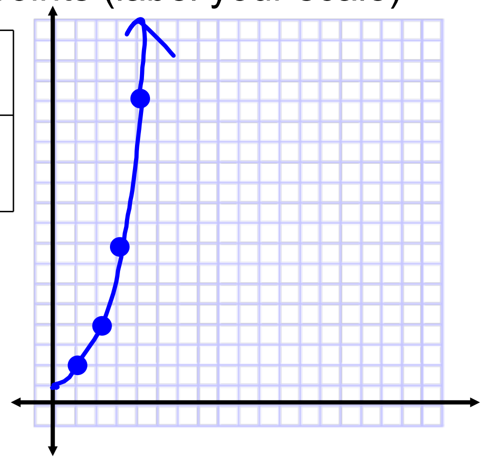
Warm-Up

1. Find the next three terms in the sequence

   2, 6, 18, 54, 162, 486, [illegible], 1458

2. Fill in the table, then plot the points (label your scale)

n	0	1	2	3	4	5
f(n)	1	2	4	8	16	32



EXPONENTIAL FUNCTION

$$f(x) = \underline{a}(\underline{b})^x \leftarrow \text{Exponent}$$

Initial Value
* (y-intercept)

Base
(Multiplier)

Exponential Growth and Decay

When b>1, the function represents **exponential growth**

When 0<b<1, the function represents **exponential decay**

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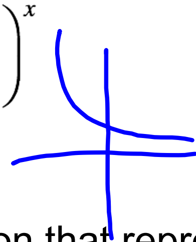
Determine whether each function represents growth or decay

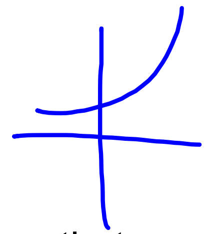
a. $f(x) = \underline{13}\left(\frac{1}{3}\right)^x$

decay



b. $g(x) = \left(\frac{3}{2}\right)^x$

growth



Write one equation that represents growth and one that represent decay

John researches a baseball card and find that it is currently worth \$3.25. However, it is supposed to increase in value 11% per year. $f(t) = a(1 \pm \underline{r})^t$

a) Write an exponential equation to represent this situation

$f(t) = 3.25(1.11)^t$

b) How much will the card be worth in 10 years?

$\underline{f(10)} = 3.25(1.11)^{10} = \$9.23$

c) Use your graphing calculator to determine in how many years will the card be worth \$26.

$26 = 3.25(1.11)^t$

$y_1 = 26$

$y_2 = 3.25(1.11)^t$

$t = 20$ years

You Try!

On federal income tax returns, self employed people can depreciate the value of business equipment. Suppose a computer valued at $2765 depreciates at a rate of 30% per year. $f(t) = a(1 \pm r)^t$ .3

a) Write an exponential equation to model this situation

$f(t) = 2765(.7)^t$

b) How much will this computer be worth in 5 years?

\$469.71

c) Use your graphing calculator to determine in how many years will the computer be worth $350.

$350 = 2765(.7)^t$

t = 5.8 yrs

The population of Orem in 1950 was 4,000 and was increasing at a rate of 2.6% per year.

(1+.026)

a) Predict the population of Orem in 1975 and 2000.

$f(t) = 4000(1.026)^t$

$f(25) = 4000(1.026)^{25} = 7599$

$f(50) = 4000(1.026)^{50} = 14435$

b) Using your graphing calculator, predict when Orem's population will hit 200,000 people.

$200{,}000 = 4000(1.026)^t$

t = 152.4 yrs after 1950

2102

The half-life of Carbon-14 is 5700 years. If a fossil decayed from 15 grams to 1.875 grams, how old is the fossil? (use your calculator)

r n $=a$ t t n

$$f(t) = a\left(\frac{1}{2}\right)^{t/n}$$

$$1.875 = 15\left(\frac{1}{2}\right)^{t/5700}$$

$$t = 17{,}100 \text{ yrs}$$

Compound Interest Formula

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

P is the principal le

r is the annual interest rate

n is the number of compounding periods per year

annually = 1
semiannually = 2
daily = 365

t is the time in years

Write an equation then find the final amount for each investment.

a. $1000 at 8% compounded semiannually for 15 years

$$A(15) = 1000\left(1+\frac{.08}{2}\right)^{2(15)} = \$3{,}243.40$$

~~You~~ Try!

b. $1750 at 3.65% compounded daily for 10 years

Using a calculator, determine how many years it will take for the amount to reach $4000.

The value e is called the natural base

The exponential function with base e, $f(x)=e^x$, is called the natural exponential function.

$$e \approx 2.71828182827\ldots$$

what you need to know is $e \approx 2.7$

Many banks compound the interest on accounts daily or monthly. However, some banks compound interest continuously, or at every instant, by using the *continuous compounding formula.*

Continuous Compounding Formula

If *P* dollars are invested at an interest rate *r*, that is compounded continuously, then the amount, *A*, of the investment at time *t* is given by

$$\boxed{A(t) = Pe^{rt}}$$

A person invests \$1550 in an account that earns 4% annual interest compounded continuously. $A=Pe^{rt}$

a. Write an equation to represent this situation

$A(t)=1550e^{.04t}$

b. Using a calculator, find when the value of the investment reaches \$2000. $2000=1550e^{.04t}$

An investment of \$1000 earns an annual interest rate of 7.6%.

Compare the final amounts after 8 $=t$ years for interest *compounded quarterly* and for interest *compounded continuously*

$A(8)=1000\left(1+\frac{.076}{4}\right)^{4(8)}$

$A=1000e^{.076(8)}=$