Find the inverse of each function:

J Bri.

$$y = 3^{x+2} - 4$$

$\log_3$

$x = 3^{y+2} - 4$

$+4$

$x+4 = 3^{y+2}$

$\log 3\,(x+4) = y+2$

$y = \log 3\,(x+4) - 2$

emalie

$$y = log_2(x+1) - 5$$

$x = \log_2(y+1) - 5$

$x+5 = \log_2(y+1)$

$2^{x+5} = y+1$

$y = 2^{x+5} - 1$

Exponential Growth and Decay

t in years.

6 months $t = .5 = \frac{6}{12}$

3 months $t = .25 = \frac{3}{12}$

convert to decimal.

$A =$ Amount at any given time

$P =$ Principal (amount you start with)

$r =$ rate (of increase or decrease) | percent

$t =$ time in years

Growth

$A = P(1 + r)^t$

Decay

$A = P(1 - r)^t$

$y = P(1+r)^x$

$500\% = 5$

$50\% = .5$

$5\% = .05$

$1.7\% = .017 = \frac{1.7}{100}$

Example 1

Decay $A = P(1-r)^t$

$P = 20$

Twenty grams of Carbon 15 is stored in a container. The amount C (in grams) of Carbon 15 present after *t* years decreases by 1.2%. $r = .012$
A. Write a model for the amount of Carbon 15 present in the container in terms of years since being contained. $A = 20(1-.012)^t$
B. How much Carbon 15 is present after 1500 years? $t = 1500$ $A = 20(.988)^{1500} = .000000273 \approx .0000003$
C. How long will it take for the Carbon to reach its half-life? $A = 10$ "t" $\frac{10}{20} = \frac{\cancel{20}(.988)^t}{\cancel{20}}$ $.5 = (.988)^t$ $\log_{.988}(.5) = t$ $t = 57.414$ years $t = \frac{\log .5}{\log .988}$
D. How long will it take for there to be 5 grams of Carbon 15? $\frac{5}{20} = \frac{20(.988)^t}{20}$ $.25 = .988^t$ $\log_{.988}(.25) = t$ $t = \frac{\log .25}{\log .988}$ $t = 114.83$ years

$$\boxed{A = 20(.988)^t}$$

$A = P(1+r)^t$ $P = 10$

$r = .07$

Example 2

In the year 1990, kids everywhere collected Beanie Babies. There was such a demand that these critters skyrocketed in value. Katie bought a Beanie Baby for \$10.00. The stuffed animals' value increased at a rate of 7% per year.

A.) Write an exponential growth model for the value of the Beanie Baby in terms of the number of years since the purchase.

$A = 10(1+.07)^t$ $A = 10(1.07)^t$

B.) What was the value of the Beanie Baby after 2 years? $t = 2$

$A = 10(1.07)^2 = \$11.45$

C.) How much is it worth today? $t = 28$

$A = 10(1.07)^{28} = \$66.49$

D.) How long did it take for Katie to double her original investment? $A = \$20$

t

$\frac{20}{10} = \frac{10(1.07)^t}{10}$ $2 = 1.07^t$

$\log_{1.07} 2 = t$

$t = \log 2 / \log 1.07 = 10.245$ years

Compound Interest

Compounded	n
Annually	1
Semi-Annually	2
Quarterly	4
Monthly	12
Weekly	52
Daily	365

Compounded "n" times a year

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

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

Compounded Continuously

$$A = Pe^{rt}$$

$$A = P \cdot e^{rt}$$

Example 3

Cobb County teachers got a windfall in the summer of 2006. All teachers got an extra check that summer to change the pay period of all teachers. All of the teachers got to make the decision of what to do with this money. A group of math teachers got together to find out how to make their money for the most for them. These teachers got $2500. How much money would the teachers have if they...

A) Put it in the bank and earned 4% interest yearly for 10 years. $r = .04$

$$A = 2500\left(1 + \frac{.04}{1}\right)^{1\cdot t} \qquad A = 2500(1+.04)^{1\cdot 10} = 2500(1.04)^{10}$$

$$A = \$3700.61$$

B) Put the money in a CD that earned 4% monthly for 10 years.

$$A = 2500\left(1 + \frac{.04}{12}\right)^{12t} \qquad A = 2500\left(1 + \frac{.04}{12}\right)^{12\cdot 10} = \$3727.08$$

C) Put the money in a special money market account that earned 4% continuously for 10 years.

$$A = Pe^{rt} = 2500\cdot e^{.04t} = 2500e^{(.04)(10)} = \$3729.56$$

(3) D) How long would it take the teachers to double their initial investment using the CD at 4% that earned interest monthly?

$$5000 = 2500\left(1 + \frac{.04}{12}\right)^{12t} \qquad \frac{5000}{2500} = \frac{2500}{2500}(1.003)^{12t}$$

$$2 = 1.003^{12t}$$

$$\left[\log_{1.003}(2)\right] = 12t$$

$$\frac{\log 2}{\log 1.003} = 12t$$

$$\frac{231.395}{12} = \frac{12t}{12}$$

$$t = 19.3 \text{ years}$$

E) How long would it take the teachers to double their initial investment using the money market that earned 4% continuously?

$$\frac{5000}{2500} = \frac{2500}{2500}e^{.04t}$$

$$2 = e^{.04t}$$

$$\frac{\ln 2}{.04} = \frac{.04t}{.04}$$

$$t = 17.3 \text{ years}$$

Example 4

Alissa received a check from her grandparents the summer before her Freshman year of college for $2500. Instead of spending it, Alissa decided to invest it in her bank. Her bank had many options:

A) Write a model for the amount of money in the bank account if it earned 4% interest semi-annually.

$$A = 2500\left(1 + \frac{.04}{2}\right)^{2t}$$

B) How much would be in the account in 4 years?

$$A = 2500\left(1 + \frac{.04}{2}\right)^{2 \cdot 4} = \$2929.15$$

C) Write a model for the amount of money in the bank account if it earned 4% interest monthly.

$$A = 2500\left(1 + \frac{.04}{12}\right)^{12t}$$

D) How much would be in the account in 4 years?

$$A = 2500\left(1 + \frac{.04}{12}\right)^{12 \cdot 4} = \$2933.00$$

E) Write a model for the amount of money in the bank account if it earned 4% interest continuously.

$$A = 2500e^{.04t}$$

F) How much would be in the account in 4 years?

$$A = 2500e^{.04(4)} = \$2933.78$$

G) Which option, A, C, or E, should Alissa choose? Why?