Solve each equation. Round to the nearest hundredth.

1. $15^{2x} = 8$

$\log_{15} 8 = 2x$

find $\log_{15} 8$ and divide by 2

$x = 0.38$

2. $2^{x+7} = 101$

$\log_2 101 = x + 7$

find $\log_2 101$ and subtract 7

$x = -0.34$

3. $5(7)^{4x+1} - 6 = 38$

$+6 \quad +6$

$\frac{5(7)^{4x+1}}{5} = \frac{44}{5}$

$7^{4x+1} = 8.8$

$\log_7(8.8) = 4x+1$

find $\log_7(8.8)$ then subtract 1 and finish by dividing by 4

$x = 0.03$

You can now finish Hwk #2.

Practice Sheet: Logarithms

You are also now ready for Quiz #1.

Solve to the nearest hundredth.

$\log_2(x + 1) = 6$

$2^6 = x+1$

$64 = x+1$

$-1 \quad -1$

$x = 63$

Solve to the nearest hundredth.

$\log_x(x + 6) = 2$

$x^2 = x + 6$

$x^2 - x - 6 = 0$

$(x-3)(x+2) = 0$

$x = 3, \cancel{-2}$

$x = 3$

-6

+2 -3

-1

What is π ?

The number π is a mathematical constant. Originally defined as the ratio of a circle's circumference to its diameter, it now has various equivalent definitions and appears in many formulas in all areas of mathematics and physics

What is e ?

Simple Interest:

You only get paid interest on the initial investment no matter how long you leave your money in the account.

$$I = prt$$

You invest $5000 at 6% annual interest for 10 years.

How much will you have at the end of 10 years if you get simple interest?

$I = 5000(0.06)(10) = \$3000$

$\text{TOTAL} = 5000 + 3000 = \$8000$

initial investment

interest

Compounded Interest:

Interest is added to the initial investment then you get paid interest on that new total, etc...

You invest $5000 at 6% annual interest for 10 years.

How much will you have at the end of 10 years?

$100 + 6 = 106\%$ $b = 1.06$

$y = 5000(1.06)^{10}$

$y = \$8954.24$

You invest $5000 at 6% annual interest for 10 years.

How much will you have at the end of 10 years if you get interest monthly?

monthly Interest rate:

$\frac{6\%}{12} = 0.5\%$

$100\% + 0.5\% = 100.5\%$

$b = 1.005$

$y = 5000(1.005)^{120}$

$y = \$9096.98$

the exponent will be 120 ⟶ 12 times a year for 10 years.

The following formula calculates the total amount of money you will end up with depending on how often you get paid interest.

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

P = Principal - original amount

r = Interest rate as a decimal

n = # times per year interest is calculated

t = # years

Suppose you invest $1 at 100% interest for 1 year.

$A = P(1 + \frac{r}{n})^{nt} \rightarrow A = 1(1 + \frac{1}{n})^{n1}$

$P = 1$

$r = 100\% \rightarrow 1$

n = # times per year interest is calculated

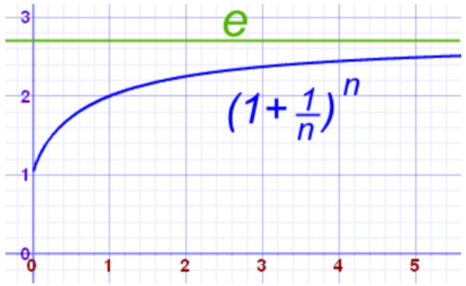
$t = 1$

Frequency of compounding	#times per year compound interest (n)	$1\left(1+\frac{1}{n}\right)^n$	Dollar Value
Annually	$n = 1$	$1\left(1+\frac{1}{1}\right)^1$	2.00
Semiannually	$n = 2$	$1\left(1+\frac{1}{2}\right)^2$	2.25
quarterly	$n = 4$	$1\left(1+\frac{1}{4}\right)^4$	2.441
monthly	$n = 12$		2.613
weekly	$n = 52$		2.693
daily	$n = 365$		2.715
hourly	$n =$ 8760		2.718
every minute	$n =$ 525,600		2.718
every second	$n =$ 31,536,000		2.718

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

After a while there is very little change in the dollar value. This equation is said to have a limit of approximately 2.718 → e

the value of $\boxed{(1 + 1/n)^n}$ approaches $\boxed{e}$ as n gets bigger and bigger:



n	$(1 + 1/n)^n$
1	2.00000
2	2.25000
5	2.48832
10	2.59374
100	2.70481
1,000	2.71692
10,000	2.71815
100,000	2.71827

$\approx e$

Where is e used?

Like π, e is a mathematical constant most often found in formulas.

e is called Euler's constant.

Leonhard Euler: Swiss mathematician

Equation of a Catenary: $$y = \frac{a}{2}\left(e^{\frac{x}{a}} + e^{\frac{-x}{a}}\right)$$

Catenary: A catenary is the shape that a cable assumes when it's supported at its ends and only acted on by its own weight. It is used extensively in construction, especially for suspension bridges

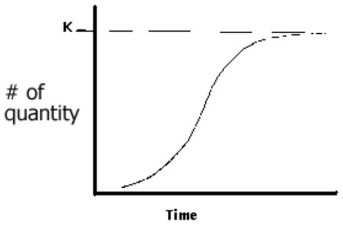
A famous Catenary:

Another famous Catenary.

Logistic Growth:

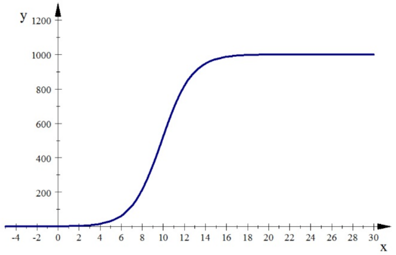
When the rate of growth of a quantity slows down after initially increasing (or decreasing) exponentially.

Graph



The equation below models the spread of flu in a school of 1000 students where y represents the number of students infected after x days.

$$y = \frac{1000}{1 + 990e^{-0.7x}}$$



The more often interest is calculated the more money you will earn.

What is more often than every second?

Continuously

Compounding Interest Continuously

$$y = Pe^{rt}$$

years

Amount after t years

Principal

Annual Interest rate as a decimal