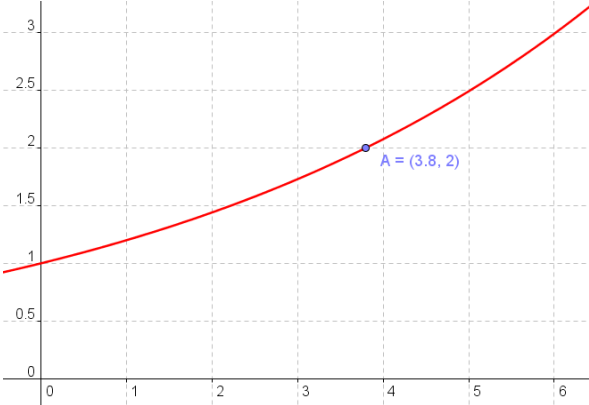$$2^6$$

→ POWER
INDEX
EXPONENT

BASE

How long will it take for
a sum of money to double
if invested at 20% compound
interest, compounded annually?"

A = (3.8, 2)

exponential

x	2^x
0	1
1	2
2	4
3	8
4	16
5	32
6	64
7	128
8	256
9	512
10	1024
11	2048
12	4096

logs

Use the table

to Solve

128 x 64

John

Napier

What power do I put on 2 to give output 512

pH
Scale

Richter
Scale

Log Scale

Compound
Interest

Decibel
Scale

f

Graph annotations: 2^x (black curve), $\log_2 x$ (green curve), $\log_m x$ (red curve), $\log_{10} x$ (blue curve)

note does not approach limit crawls to infinity
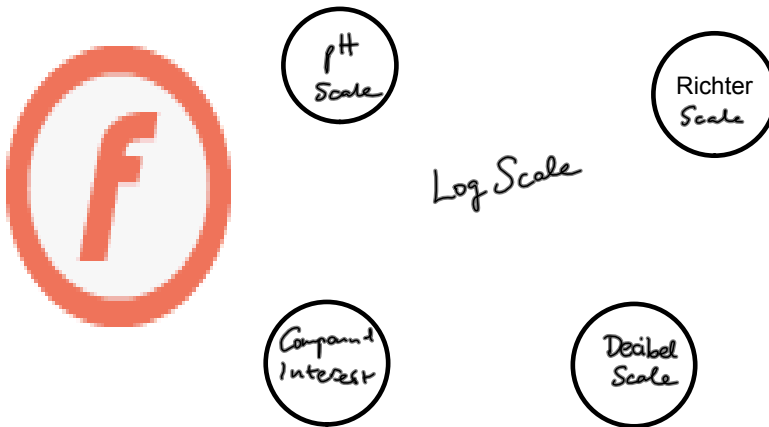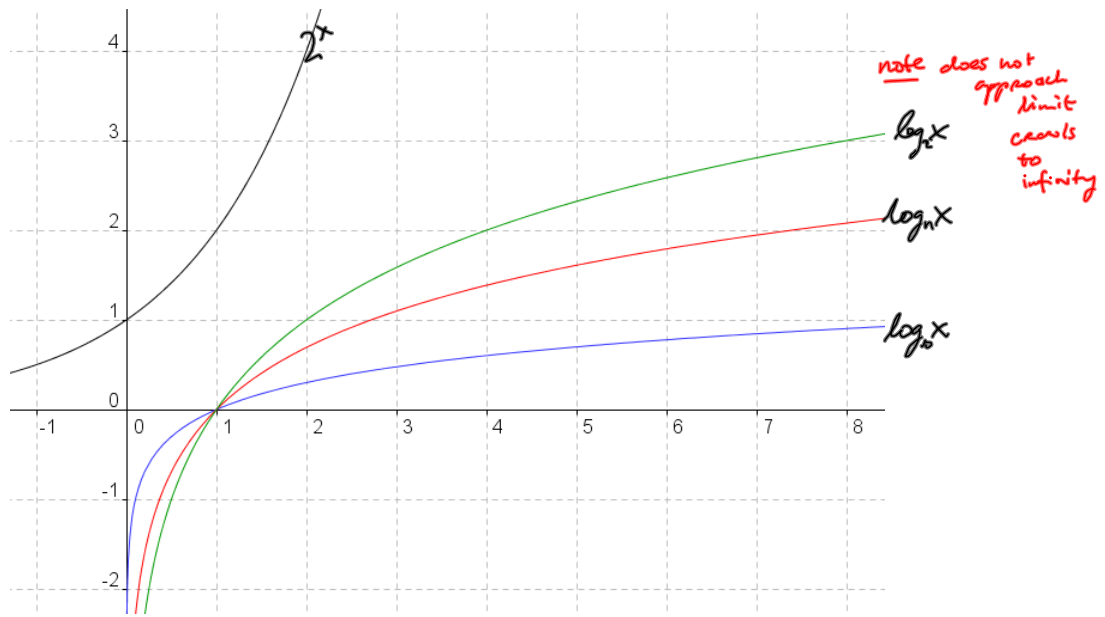
LOG → Process of going from output to input in an exponential function

LOGARITHMS   The logarithm of a number is the power that the base has to be raised to produce that number.

eg. $\log_3 9 = ?$ " WHAT IS LOG 9 TO THE BASE 3 ? "

BASE

This means if $3^n = 9$ what is the value of n?

POWER - INDEX - EXPONENT

We know THAT $3^2 = 9$ so $\log_3 9 = 2$

BASE

WHAT is :

$\log_{10} 1000 =$

$\log_2 64 =$

$\log_5 125 =$

REMEMBER THIS   JUNIOR CERT. QUESTION

$$\frac{\sqrt{125} \times 5^2}{(5^3)^2} = 5^n \qquad\qquad n = ?$$

We could use the "$\log_b a$" function on the
calculator to solve this type of question.

$$\Rightarrow \log_5 \left(\frac{\sqrt{125} \times 5^2}{(5^3)^2} \right) = -\frac{5}{2} \qquad \Rightarrow n = -\frac{5}{2} \qquad (\text{TRY THIS!})$$

LOGARITHMIC ALGEBRA

① $\log a.b = \log a + \log b$

② $\log \frac{a}{b} = \log a - \log b$

③ $\log a^n = n \log a$

INDICES ALGEBRA

① $a^{n+m} = a^n . a^m$

② $a^{n-m} = \frac{a^n}{a^m}$

③ $a^{nm} = (a^n)^m$

$$\log_b a \qquad\qquad \text{"base } b\text{"}$$

$$\log a = \log_{10} a, \quad \text{"base 10"} \quad \text{("COMMON LOG")}$$

$$\ln a = \log_e a, \quad \text{"base } e\text{"} \quad (\text{natural log})$$

$$\log_2 a \qquad\qquad \text{"base 2"} \quad (\text{"BINARY LOG"})$$

$$\log_a a = 1 \qquad (\text{because } a^1 = a)$$

$$\ln e = \log_e e = 1$$

$$\log 10 = \log_{10} 10 = 1$$

To change the base :

$$\log_b a = \frac{\log a}{\log b}$$

eg.. what is $\log_4 25 = \frac{\log 25}{\log 4} =$

$$\boxed{\log_\square \square} \qquad \boxed{\log} \qquad \boxed{\ln}$$

Base 10   Base e

CHANGE AN EXPONENTIAL EQUATION INTO A LOGARITHMIC EQUATION

$$b^n = a \quad \Rightarrow \quad \log_b a = n$$

eg.. $4^3 = 64$