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LOOK

EXPONENTIAL
FUNCTIONA function WHERE THE
independent variable (x) is
the exponentSimple example: $y = f(x) = 2^x$

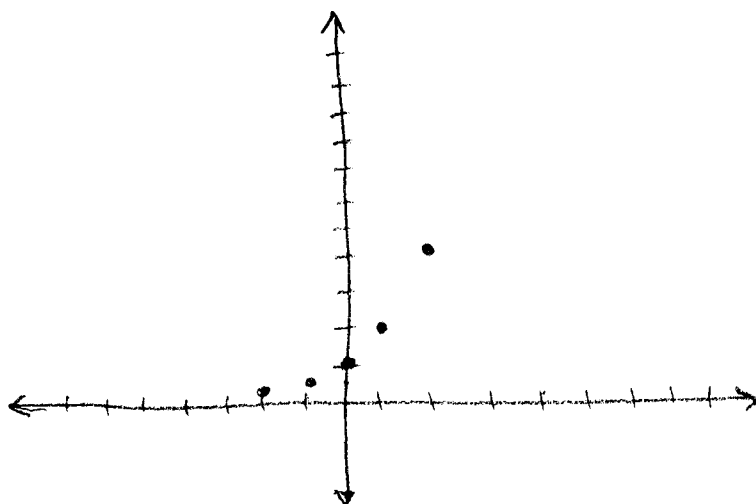
GRAPH ANY UNKNOWN FUNCTION... how?

T-Table

X	2^x
-2	$2^{-2} = \frac{1}{2^2} = \frac{1}{4}$
-1	$2^{-1} = \frac{1}{2}$
0	$2^0 = 1$
1	$2^1 = 2$
2	$2^2 = 4$

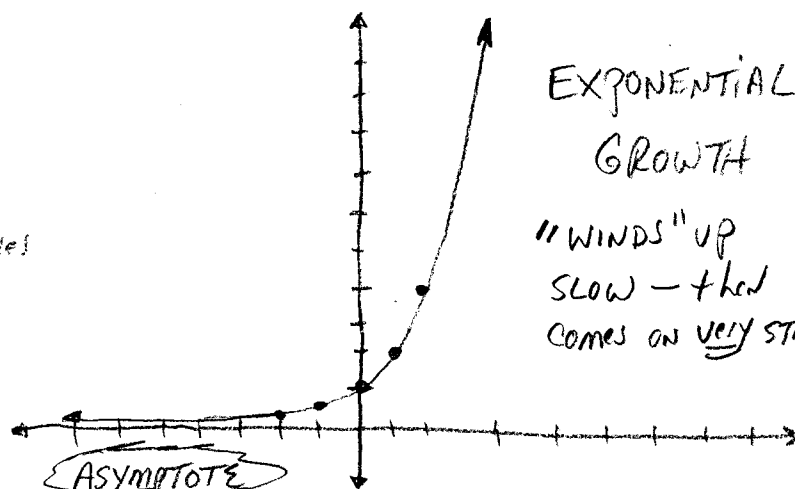
y-intercept

↑ ↑
domain range
{all TR} {>0}



WHAT HAPPENS AS $x \rightarrow +\infty$?
AS $x \rightarrow -\infty$?

X	2^x
-5	$2^{-5} = \frac{1}{2^5} = \frac{1}{32}$
-Big Number	$\frac{1}{\text{Big Number}} \Rightarrow \text{Approaches zero}$
5	$2^5 = 32$
+ Big Number	$2^{\text{Big Number}} \Rightarrow \text{Approaches } \infty$
	$2^{64} = 1.8 \times 10^{19} \Rightarrow \text{KING w/ GRAIN OF RICE}$

EXPONENTIAL
GROWTH

"WINDS" UP
SLOW - then
comes on very STRONG

In the exponential function, if the base $y = (\text{base})^x$ is < 0 (negative), then the function is "misbehaved" since the sign of y will "flip flop" depending on whether or not x is even ($+y$) or x is odd ($-y$). So the base must be > 0 .

Two other "restrictions" on base:

① What if base is 1 $\Rightarrow y = f(x) = 1^x$

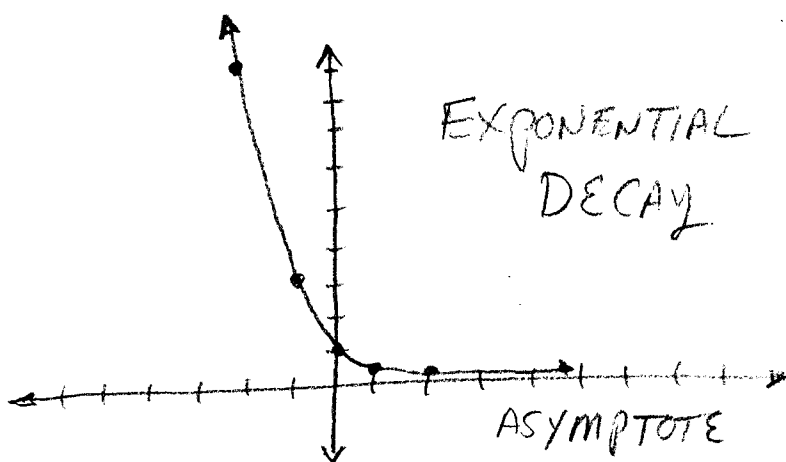
$\therefore y$ is always 1 $\Rightarrow$ horizontal line at $y=1$.

② What if $0 < \text{base} < 1$

i.e., what if the base is a $\oplus$ fraction < 1 ?

③ $y = f(x) = \left(\frac{1}{3}\right)^x$

x	$\left(\frac{1}{3}\right)^x$
-2	$\frac{1}{\left(\frac{1}{3}\right)^2} = \frac{1}{\frac{1}{9}} = 9$
-1	3
0	1
1	$\frac{1}{3}$
2	$\frac{1}{9}$



GENERAL EXPONENTIAL FUNCTION

$$y = b(1 \pm r)^x$$

independent variable
 $\Rightarrow$ Number of changes

$\uparrow$ $\uparrow$
 Y-intercept, RATE OF
 the change } % as a decimal or fraction
 starting value when $x=0$
 (0, b)

Exponential
 NOTE: $+$ $\Rightarrow$ growth (>1)
 $-$ $\Rightarrow$ decay (<1)

EX) $y = 2^x$

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

$\uparrow$ $\uparrow$
 $b=1$ $\hookleftarrow 100\% \uparrow = 1.00$ EACH change

$$y = \left(\frac{1}{3}\right)^x$$

$$y = 1\left(1 - \frac{2}{3}\right)^x \quad \text{or} \quad 1(1 - .\bar{6})^x$$

$\hookrightarrow$ if you are multiplying by $\frac{1}{3}$
 Each change, you are "losing" $\frac{2}{3}$
 each change.

The y and b terms ARE NOT common.

Since y is the "amount" of something you have after " x " changes, A is often used as in $A = b(1 \pm r)^x$

To be consistent, A_0 , read "A sub zero" or more often "A naught" is used for the starting (y-intercept) value (when $x = 0$)

$$A = A_0(1 \pm r)^x$$

$\uparrow$ $\uparrow$
 ENDING STARTING
 VALUE VALUE

EX) The school population increases 2% per year AT SUSAN MOORE — WRITE THE EXPONENTIAL GROWTH function ASSUMING 2009 IS YEAR ZERO AND 600 STUDENTS.

$$A = 600(1.03)^t$$

$A \Rightarrow$ number of students
 $t \Rightarrow$ years, 2009 = 0

5

Money has its own language and conventions,
The interest rate is always per year and
is expressed as 2%, 5%, etc. The per year
is understood!

To find the "x" or number of changes, you
have to know how many times per year
the interest is paid, this is called how
many times it is compounded

Semi-ANNUAL $\Rightarrow$ 2 per year

quarterly $\Rightarrow$ 4 per year

daily $\Rightarrow$ 365 per year

MONTHLY $\Rightarrow$ 12 per year ... ETC

ⓔ Find amount you have if you invest \$5000 for
2 years at 3% compounded quarterly.

RATE $r = \frac{3\%}{4} = \frac{.03}{4} = .0075$ r is $\oplus$ for INVESTMENT

Number of changes $X = t = (4 \text{ quarters})(2 \text{ years}) = 8 \text{ "changes"}$

$$A = 5000(1.0075)^8 = 5000(1.0615988)$$

$$\boxed{A = 5307.99}$$

Money $\Rightarrow$ Round to hundredths. Why?
 $A_0 = P = \text{PRINCIPAL}$

