21.2 Exponential Functions

Exponential Functions – Have the form $f(x) = a(b)^x$ where a & b are #s & x must be in the exponent. Also, $a \neq 0$, $b > 0$, and $b \neq 1$.

Exponential	NOT Exponential
$y = -1(3)^x$	$y = (-2)^x$
$y = 1(2)^{x+7}$	$y = x^2$
$y = -2(4)^{2x-3} + 5$	$y = 0(3)^x$
$y = (1.2)^x - 1$	$y = 3(-\frac{1}{2})^{x+1}$
$y = (\frac{1}{2})^x + 3$	$y = 4(1)^x$

Exponential Growth Factor – AKA constant multiplier, scale factor, or common ratio (when $b > 1$).

The following both have an exponential growth factor of 1.2.

①
x	0	1	2	3	4	5
y	4	4.8	5.76	6.912	8.2944	9.95328

② $f(x) = 2(1.2)^x$

Exponential Decay Factor – AKA constant multiplier, scale factor, or common ratio (when $b < 1$).

The following both have an exponential decay factor of 0.9.

①
x	0	1	2	3	4	5
y	6	5.4	4.86	4.374	3.9366	3.54294

② $f(x) = 3(0.9)^x$

Growth Rate – $|1 - b|$ & then turn it into a %.

Only use this for $b > 1$. AKA percent increase.

growth factor = 1.2

$|1 - 1.2| = |-0.2| = 0.2 \rightarrow$ growth rate = 20%

Decay Rate - $1-b$ & then turn into a percent.

AKA percent decrease.

decay factor $= 0.9$

$1 - 0.9 = 0.1 \longrightarrow$ decay rate $= 10\%$

Writing Exponential Equations

$$f(x) = a\,(b)^{x} \leftarrow \underline{NOT} \quad x-1$$

a, b → constant multiplier

→ initial value (when $x=0$)

EX#1 Write the exponential function for the table.

x	0	1	2	3	4
y	1	3	9	27	81

×3   ×3   ×3   ×3

$a = 1$
$b = 3$ $\boxed{f(x) = 1(3)^{x}}$

Ex#2 Complete the table if the exponential decay factor $= 0.8$.

x	0	1	2	3	4
y	64	51.2	40.96	32.768	26.2144

Ex#3 Write the equation for #2.

$a = 64$ $b = 0.8$ $\boxed{f(x) = 64(0.8)^{x}}$

Ex#4 What is the decay rate for #2 & #3?

$1 - 0.8 = 0.2 \Rightarrow \boxed{20\%}$

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