Graphing an Exponential Function

Graph $y = 2^x$.

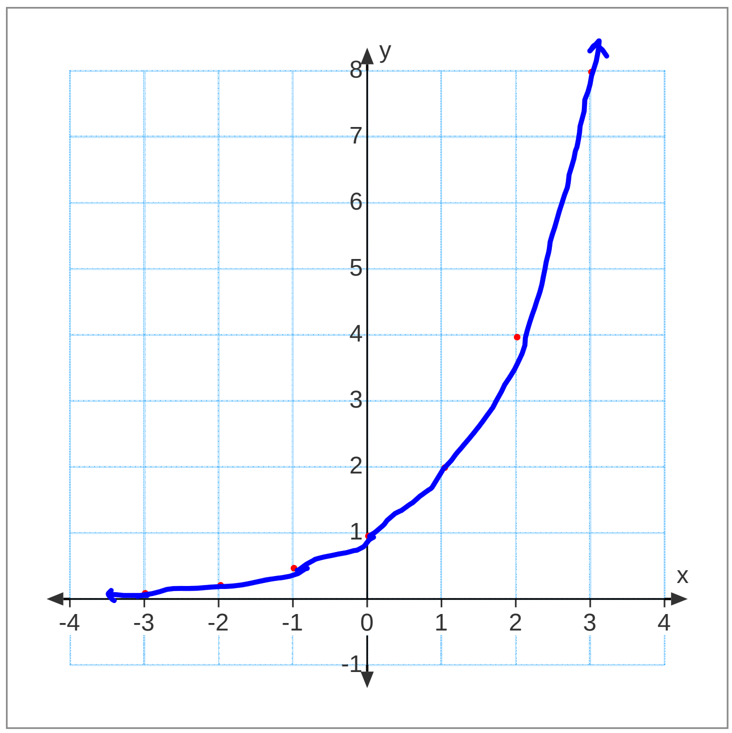
1) Make a table of values.

(You don't need a calc for this)

x	2^x
-3	2^{-3} $\frac{1}{2^3} = \frac{1}{8}$
-2	2^{-2} $\frac{1}{2^2} = \frac{1}{4}$
-1	2^{-1} $\frac{1}{2^1} = \frac{1}{2}$
0	$2^0 = 1$
1	$2^1 = 2$
2	$2^2 = 4$
3	$2^3 = 8$

What's the y-intercept? $(0,1)$

2) Plot and connect the points.

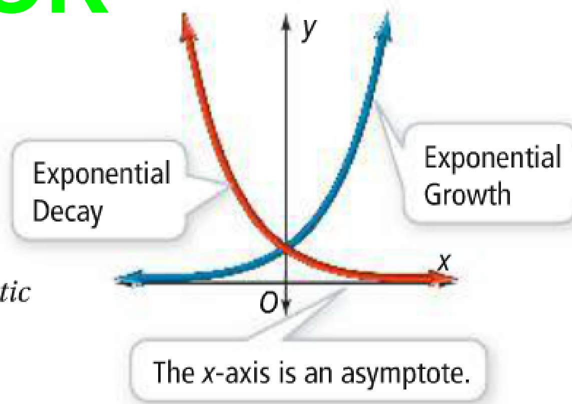


LOOK

Two types of exponential behavior are *exponential growth* and *exponential decay*.

For **exponential growth**, as the value of x increases, the value of y increases. For **exponential decay**, as the value of x increases, the value of y decreases, approaching zero.

The exponential functions shown here are *asymptotic* to the x-axis. An **asymptote** is a line that a graph approaches as x or y increases in absolute value.



take note

Concept Summary Exponential Functions

For the function $y = ab^x$,

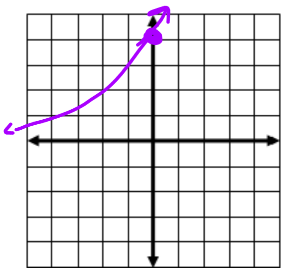
- if $a > 0$ and $b > 1$, the function represents exponential growth.
- if $a > 0$ and $0 < b < 1$, the function represents exponential decay.

In either case, the y-intercept is $(0, a)$, the domain is all real numbers, the asymptote is $y = 0$, and the range is $y > 0$.

Open your packet and use your calculator, make a quick sketch of each. Is it an exponential growth or exponential decay? What's the y-intercept?

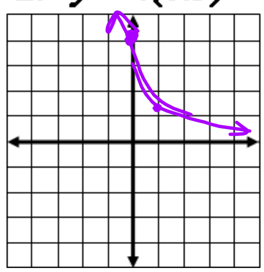
Show work for this!

1. $y = 4(2.3)^x$



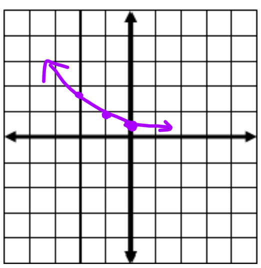
$y = 4(2.3)^0$
$= 4(1)$
$= 4$
$(0,4)$ y-intercept
exp. growth

2. $y = 4(0.3)^x$



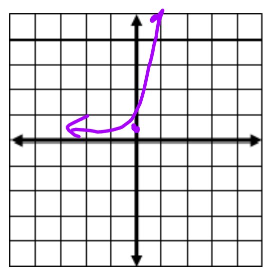
$y = 4(.3)^0$
$= 4(1) = 4$
$(0,4)$ y-int
exp. decay.

3. $y = \frac{2}{5}\left(\frac{1}{2}\right)^x$



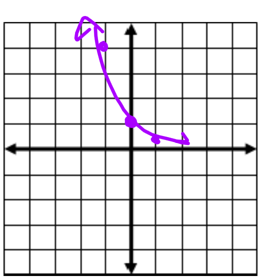
$y = \frac{2}{5}\left(\frac{1}{2}\right)^0$
$= \frac{2}{5}$
$(0, 2/5)$ yint
exp decay

4. $y = \frac{2}{5}\left(\frac{43}{2}\right)^x$



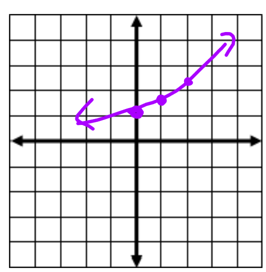
$y = \frac{2}{5}\left(\frac{43}{2}\right)^0$
$= 2/5$ $(0, 2/5)$
y-int
exp growth

5. $y = 4^{-x}$



$y = 4^{-0}$
$= 1$
$(0,1)$ yint
exp decay

6. $y = \left(\frac{2}{3}\right)^{-x}$



$y = \frac{2}{3}^{-0}$
$= 1$ $(0,1)$
y-int
exp growth

Copy these at the bottom of your note paper

~~Without graphing~~,determine whether the function represents exponential growth or exponential decay.
Then find the y-intercept.

1. $y = 120(.95)^x$

exp. decay

$y = 120(.95)^0$

$= 120$

$(0, 120)$ y-int

2. $y = .25(1.5)^x$

exp growth

$y = .25(1.5)^0$

$y = .25$

$(0, .25)$ y-int

3. $y = (3)^{-x}$

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

exp decay

$y = 3^{-0} = 1$

$(0, 1)$ y-int

7.1 Exponential Growth and Decay

Ex. 1 Find the multiplier for each rate of exponential growth or decay.

a) 15% growth $1+.15 = \boxed{1.15}$

b) 12% decay $1-.12 = \boxed{.88}$

c) 4.061% decay $1-.04061 = \boxed{.95939}$

d) 0.12% growth $1+.0012 = \boxed{1.0012}$

Ex. 2 You have a certain bacteria that quadruples every hour. If you start with 50 bacteria, how many will you have after:

4 times

4 is multiplier

a) 2 hours?

1 hour $50(4)=200$

$200(4)=$ $\boxed{800 \text{ bacteria}}$

b) 6 hours?

$50(4)^6 = \boxed{204{,}800 \text{ bacteria}}$

c) n hours?

$b=50(4)^n$

multiplier

initial value

Ex. 3 In 2010, the population of Sunnyplace was 14,126 and is projected to grow at a rate of 24% per decade. every 10 years

Predict the population:

mult $=1+.24=1.24$

a) in 2020

$14126(1.24)$

$= \boxed{17{,}516 \text{ people}}$

b) in 2035 how many decades? 2.5 decades

2035 − 2010 = 25 years

$P=14126(1.24)^{2.5}$

$= \boxed{24{,}186 \text{ people}}$

Ex. 4 The rate at which caffeine is eliminated from the bloodstream is about 15% per hour. After drinking a soda, the amount of caffeine reaches a peak level of 30 mg. decay $1-.15=.85$ multiplier

initial value

Predict the amount (nearest tenth) of caffeine remaining:

a) 1 hour after the peak level $30(.85) = \boxed{25.5 \text{ mg}}$

b) 4 hours after the peak level $30(.85)^4 = \boxed{15.7 \text{ mg}}$

c) n hours after the peak level

formula $c=30(.85)^n$