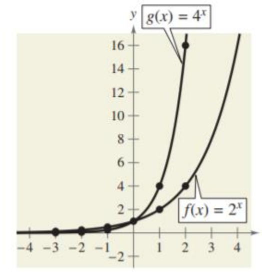
3.1 Exponential Functions and Their Graphs --- Part 1: Exponential Graphs

Exponential Functions

Parent exponential function:

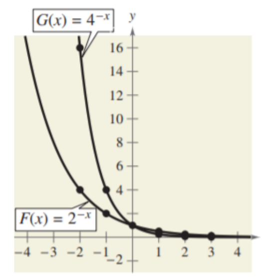
Ex) Evaluate, using your calculator: $f(x) =$

Graphs of Exponential Functions



Ex 1) (from page 219)

- Both functions have positive exponents
- The graphs of both functions increase (for exponential functions, this means that from left to right, the y values are getting larger)
- The graph of $g(x) = 4^x$ increases more rapidly than the graph of $f(x) = 2^x$



Ex 2) (from page 219)

- Both functions have negative exponents
- The graphs of both functions decrease (for exponential functions, this means that from left to right, the y values are getting smaller)
- The graph of $\mathrm{G}(x) = 4^{-x}$ decreases more rapidly than the graph of $\mathrm{F}(x) = 2^{-x}$

Characteristics of Exponential Graphs

Transformations:

Horizontal Shifts:

Vertical Shifts:

Axis Flips:

Range:

<u>Range:</u>

<u>Range of an exponential functions graph:</u>

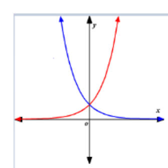
<u>Find the range of the following functions:</u>

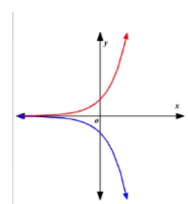
Ex 3)

Ex 4)

Ex 5)

Domain:





<u>Domain:</u>

<u>Domain of an exponential functions graph:</u>

X-Intercepts:

<u>x-intercepts:</u>

<u>Finding x-intercepts:</u>

<u>x-intercepts of an exponential functions graph:</u>

Find the x-intercepts of each, if they exist:

Ex 6)

Ex 7)

Ex 8)

Ex 9)

Ex 10)

y-Intercepts:

y-intercepts:

Finding y-intercepts:

y-intercepts of an exponential functions graph:

Find the y-intercepts of each:

Ex 11)

Ex 12)

Ex 13)

Ex 14)

Horizontal Asymptotes:

<u>Horizontal asymptotes of exponential functions:</u>

$y = 2^x$

x	y
2	4
1	2
0	1
-1	½
-2	¼
-3	1/8
-4	1/16

<u>Find the horizontal asymptotes of each:</u>

Ex 16)

Ex 17)

Ex 18)

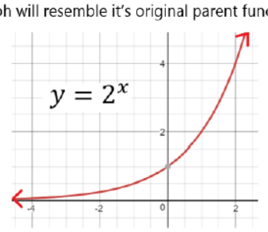
Vertical Asymptotes:

Exponential functions **<u>never have vertical asymptotes</u>**! (Vertical asyms. are found by finding what numbers, when plugged in for x, make the function not exist. Since x is in the exponent, it can be anything – positive, negative, fraction…. Any real number!

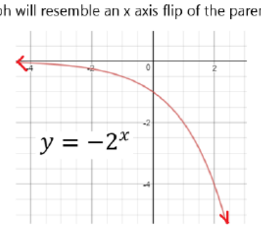
The breakdown: Steps to graph exponential functions:

These graphs below are examples, using $y = 2^x$ as the parent function. Remember that there could easily be many more translations within the 2 functions that involve a flip upon an axis

When there is **NO FLIP over the x or y axis**, the graph will resemble it's original parent function.



When there is a **flip over the x axis** (the entire function is negated, denoted with a negative in front of the entire function) the graph will resemble an x axis flip of the parent function



When there is a **flip over the y axis** (the x value is negated) the graph will resemble an y axis flip of the parent function