Exponential Functions

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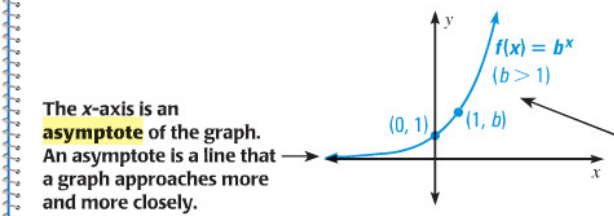
An **exponential function** has the form $y = ab^x$ where $a \neq 0$ and the base b is a positive number other than 1. If $a > 0$ and $b > 1$, then the function $y = ab^x$ is an **exponential growth function**, and b is called the **growth factor**. The simplest type of exponential growth function has the form $y = b^x$.

KEY CONCEPT *For Your Notebook*

Parent Function for Exponential Growth Functions

The function $f(x) = b^x$, where $b > 1$, is the parent function for the family of exponential growth functions with base b. The general shape of the graph of $f(x) = b^x$ is shown below.

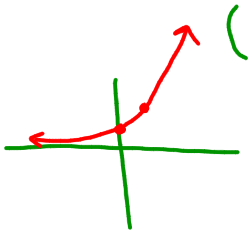


The x-axis is an **asymptote** of the graph. An asymptote is a line that a graph approaches more and more closely.

The graph rises from left to right, passing through the points (0,1) and (1,b).

The domain of $f(x) = b^x$ is all real numbers. The range is $y > 0$.

$y = 2^x$ (0, 1) (1, 2)



$y = 2^{x+3} - 7$

$x+3$: 3 left
-7: 7 down

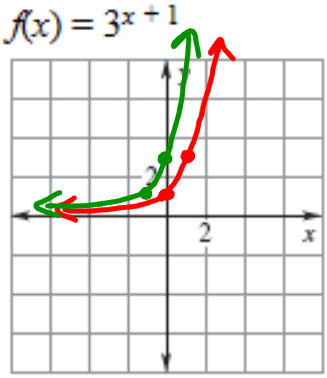
$y = 4 \cdot 3^{x-1} + 5$

4: Increase faster/steeper
$x-1$: 1 right
$+5$: 5 up

$y = -\frac{1}{2} \cdot 1.23^{x+1} - 2$

$-\frac{1}{2}$: Reflect in x-axis
Flatter than parent
$x+1$: left 1 unit
-2: down 2 units

5. $f(x) = 3^{x+1}$



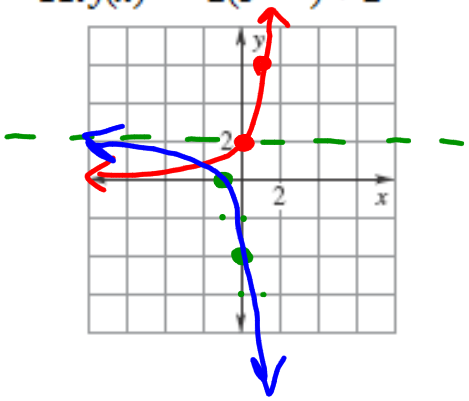
Parent: $f(x) = 3^x$

(0, 1) (1, 3)

1 unit left

D: Real R: $y > 0$

11. $f(x) = -2(3^{x+1}) + 2$



Parent: $f(x) = 2(3^x)$

(0, 2) (1, 6)

Reflect in x-axis

1 unit left, 2 units up

D: Real R: $y < 2$