Section 5.1 Exponential Functions

Objective 1: Understanding the Characteristics of Exponential Functions

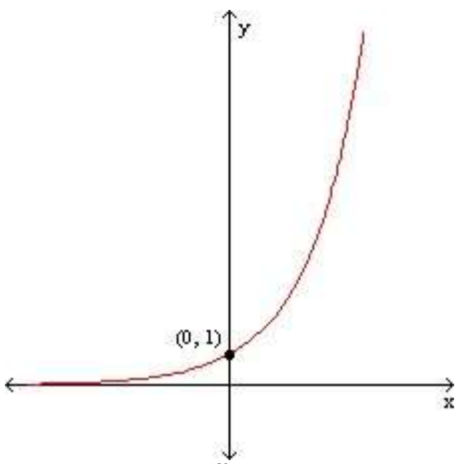
Definition of an Exponential Function

An **exponential function** is a function of the form $f(x) = b^x$ where x is any real number and $b > 0$ such that $b \neq 1$. The constant, b, is called the base of the exponential function.

Characteristics of Exponential Functions

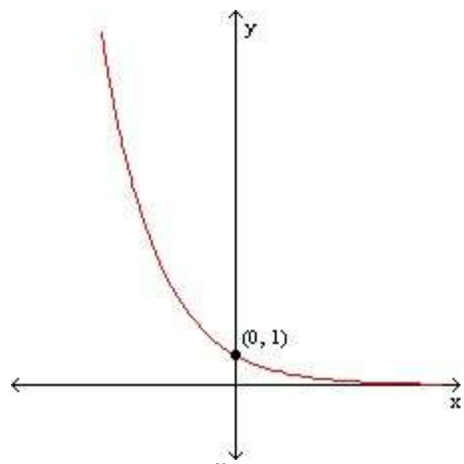
For $b > 0$, $b \neq 1$ the exponential function with base b is defined by $f(x) = b^x$.

The domain of $f(x) = b^x$ is $(-\infty, \infty)$ and the range is $(0, \infty)$. The graph of $f(x) = b^x$ has one of the following two shapes



$f(x) = b^x$, $b > 1$

The graph intersects the y-axis at $(0,1)$.
The line $y = 0$ is a horizontal asymptote.



$f(x) = b^x$, $0 < b < 1$

The graph intersects the y-axis at $(0,1)$.
The line $y = 0$ is a horizontal asymptote.

5.1.1
Sketch the graph of the exponential function

$f(x)$ = ______.

5.1.2
Sketch the graph of the exponential function

$f(x)$ = ______.

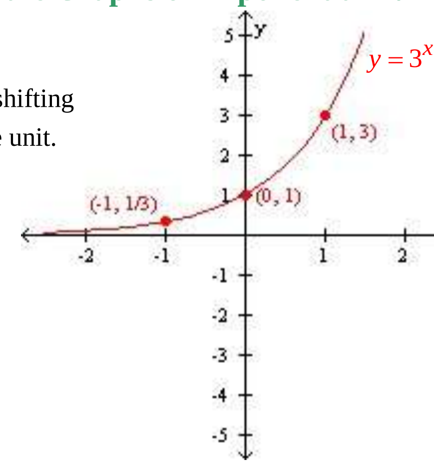
5.1.6

Determine the correct exponential function of the form $f(x) = b^x$ whose graph is given.

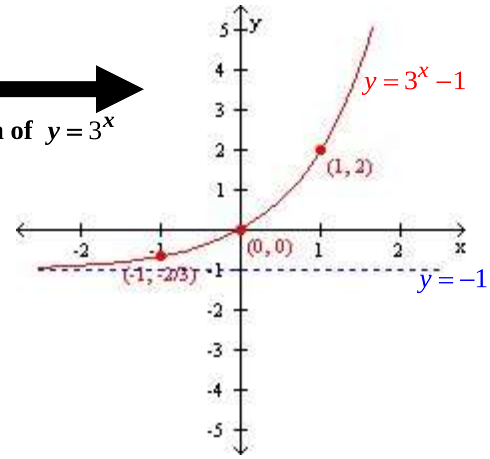
f(x) = ___________________________

Objective 2: Sketching the Graphs of Exponential Functions Using Transformations

The graph of $f(x) = 3^x - 1$ can be obtained by vertically shifting the graph of $y = 3^x$ down one unit.



Shift the graph of $y = 3^x$ down one unit.



5.1.15 and 18

Use the graph of $y = 3^x$ and transforms to sketch the exponential functions. Determine the domain and range. Also, determine the y-intercept and find the equation of the horizontal asymptote.

Objective 3: Solving Exponential Equations by Relating the Bases

The function $f(x) = b^x$ is one-to-one because the graph of f passes the horizontal line test.
If the bases of an exponential equation of the form $b^u = b^v$ are the same, then the exponents must be the same.

> **The Method of Relating the Bases for Solving Exponential Equations**
>
> If an exponential equation can be written in the form $b^u = b^v$, then $u = v$.

5.1.21, 22, and 24
Solve the exponential equation using the method of "relating the bases" by first rewriting the equation in the form $b^u = b^v$.