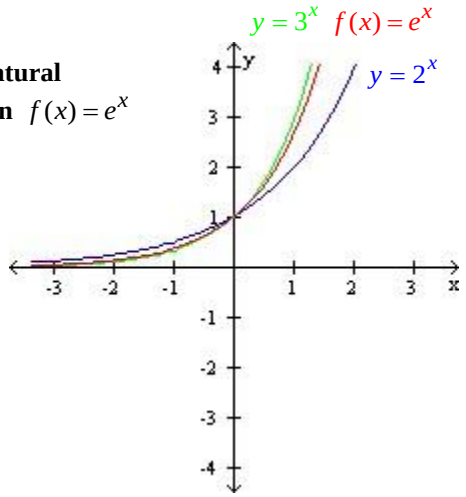
Section 5.1 Continued The Natural Exponential Function

Objective 1: Understanding the Characteristics of the Natural Exponential Function

The number *e* is an irrational number that is defined as the value of the expression $\left(1+\frac{1}{n}\right)^n$ as *n* approaches infinity. The table below shows the values of the expression $\left(1+\frac{1}{n}\right)^n$ for increasingly large values of *n*.

As the values of *n* get large, the value *e* (rounded to 6 decimal places) is 2.718281. The function $f(x)=e^x$ is called the **natural exponential function.**

The graph of the natural exponential function $f(x)=e^x$



n	$\left(1+\frac{1}{n}\right)^n$
1	2
2	2.25
10	2.5937424601
100	2.7048138294
1000	2.7169239322
10,000	2.7181459268
100,000	2.7182682372
1,000,000	2.7182804693
10,000,000	2.7182816925
100,000,000	2.7182818149

Characteristics of the Natural Exponential Function

The Natural Exponential Function is the exponential function with base *e* and is defined as $f(x)=e^x$.

The domain of $f(x)=e^x$ is $(-\infty,\infty)$ and the range is $(0,\infty)$.

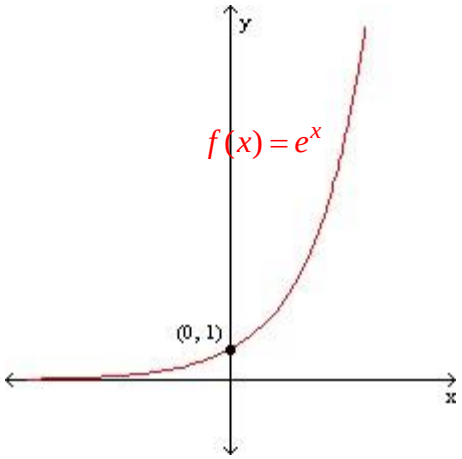
The graph of $f(x)=e^x$ intersects the *y*-axis at $(0,1)$.

$e^x \to \infty$ as $x \to \infty$

$e^x \to 0$ as $x \to -\infty$

The line $y=0$ is a horizontal asymptote.

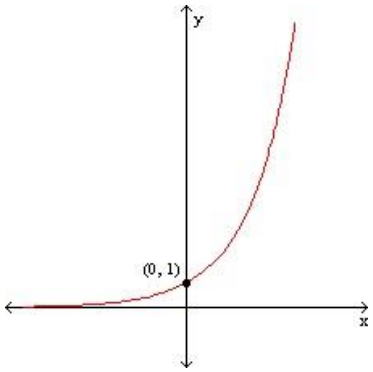
The function $f(x)=e^x$ is one-to-one.



NOTE: The important thing to keep in mind for graphing $f(x)=e^x$ is that $e>1$. Then all lessons from 5.1 apply.

Objective 2: Sketching the Graphs of Natural Exponential Functions

$f(x) = e^x$



5.2.9

Use the graph of $f(x) = e^x$ and transformations to sketch the exponential functions. Determine the domain and range. Also, determine the y-intercept and find the equation of the horizontal asymptote.

$f(x) = -e^{x+1} - 1$

Objective 3: Solving Natural Exponential Equations by Relating the Bases

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 $u = v$.

5.2.12

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

$e^{5x+2} = \sqrt[3]{e}$