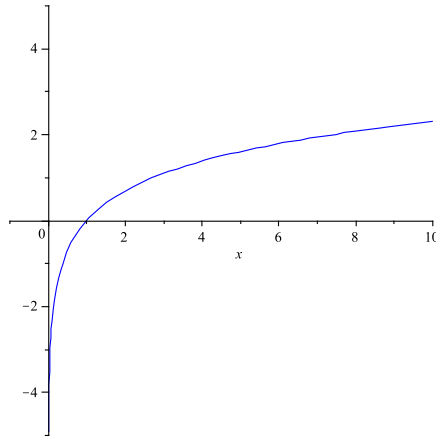

Exponential Functions

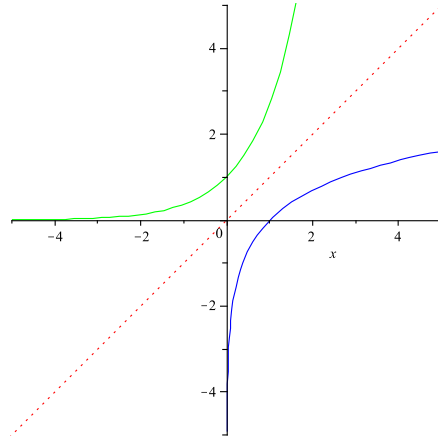
Notice: $f(x) = \ln(x)$ is a one-to-one function (this means $\ln(x)$ has an inverse)



Definition: The inverse function for $\ln(x)$ is $f^{-1}(x) = e^x$

* e is a real number (≈ 2.718)

Graph of $f(x) = e^x$



Properties of the Natural Exponential Function

1. The domain of $f(x) = e^x$ is $(-\infty, \infty)$, and the range is $(0, \infty)$
2. The function $f(x) = e^x$ is continuous, increasing, and one-to-one on its entire domain
3. The graph of $f(x) = e^x$ is concave upward on its entire domain
4. $\lim_{x \rightarrow -\infty} e^x = 0$ and $\lim_{x \rightarrow \infty} e^x = \infty$

Note: Since $\ln(x)$ and e^x are inverses:

$$e^{\ln(x)} = \ln(e^x) = x$$

*Use this to solve equations

Derivation Rules:

$$\frac{d}{dx}[e^x] = e^x$$

$$\frac{d}{dx}[e^u] = e^u \frac{du}{dx}$$

Integration Rules:

$$\int e^x dx = e^x + C$$

$$\int e^u du = e^u + C$$