

## 4.1: Exponential Functions

**Definition:** An *exponential function* is a function of the form  $f(x) = a^x$ ,  $a \neq 1$ .

**Graph and Graphical Properties of  $f(x) = a^x$ :**

Properties of exponential functions:

Using the definition of the derivative, we see that

$$f'(x) =$$

**Definition:**  $e$  is the number such that

*Examples:*

Compute the following limits:

$$\lim_{x \rightarrow 0^-} e^{\frac{1}{x}}$$

$$\lim_{x \rightarrow -\infty} \frac{e^{3x} - e^{-3x}}{e^{3x} + e^{-3x}}$$

$$\lim_{x \rightarrow 2} 3^{-\frac{x}{(x-2)^2}}$$

Differentiate  $f(x) = e^{ax} \cos(bx)$ , where  $a$  and  $b$  are constants.

Find  $y'$  given  $e^y - e^{-y} = x$ .

A *differential equation* is an equation involving an unknown function and one or more of its derivatives. Show that the function  $y = 2e^{-3x}$  is a solution to the differential equation  $y' = -3y$

**On Your Own:** 4.1 #3,5,6,9,17,18,28,30,39,44,47-50,58,61