

1 4.1: Exponential Functions

An **exponential function** is a function of the form $f(x) = a^x$, $a > 0$.

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

Properties of Exponential Functions:

Using the limit definition of the derivative, we see that, if $f(x) = a^x$,

Definition: e is the number such that

Examples:

Compute $\lim_{x \rightarrow 2} e^{-x/(x-2)^2}$

Find the horizontal asymptotes of $f(x) = \frac{e^{3x} - e^{-3x}}{e^{3x} + e^{-3x}}$.

A **differential equation** is an equation involving an unknown function and its relationship to 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): Find the first and second derivatives of $f(x) = xe^{-2x}$.

$$(1 - 2x)e^{-2x}, (4x - 4)e^{-2x}$$