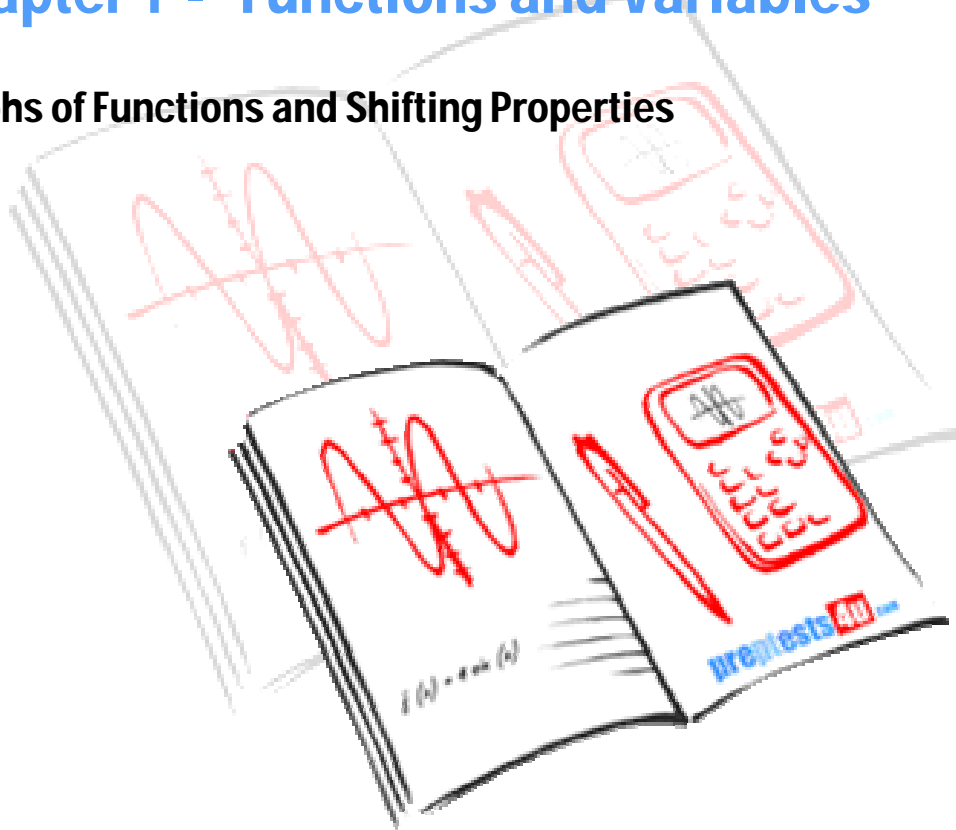


# Business Calculus I

## Chapter 1 - Functions and Variables

### Graphs of Functions and Shifting Properties



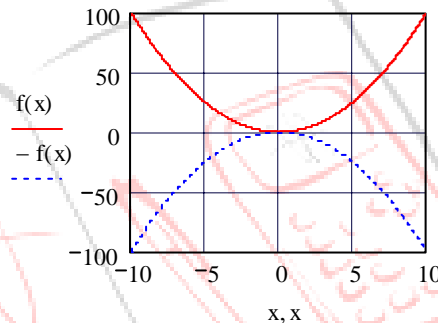
## Graphs of Functions and Shifting Properties

In this section, we outline the steps to graphing the functions by finding important points of the graph. In order to apply the shifting properties, one should become familiar with some of the most common graphs of equations as bases for such transformation. For instance, knowing the graphs of  $f(x) = x^2$  or  $f(x) = x^3$ , it is possible to graph any quadratic equation or polynomials of degree three, respectively.

The graphs of some of the commonly used functions are given as follow.

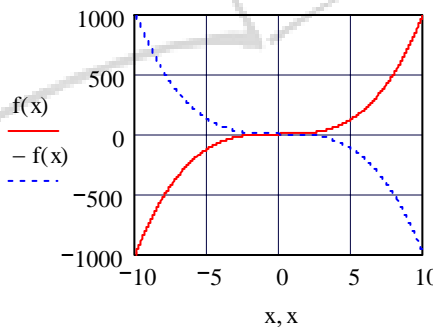
### Parabola

**Equation:**  $f(x) = x^2$



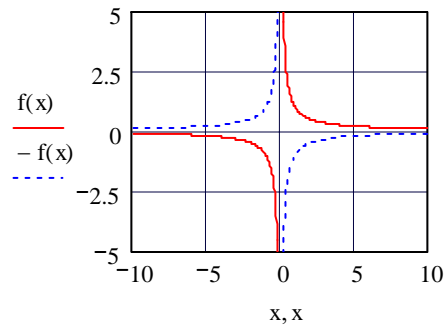
### Cubic Function

**Equation:**  $f(x) = x^3$



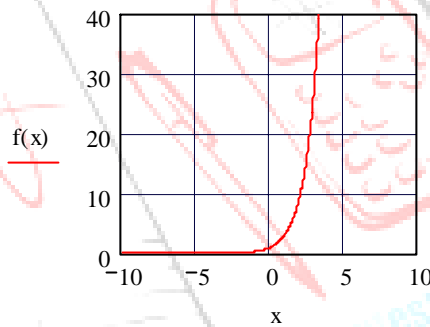
## Hyperbola

**Equation:**  $f(x) = \frac{1}{x}$



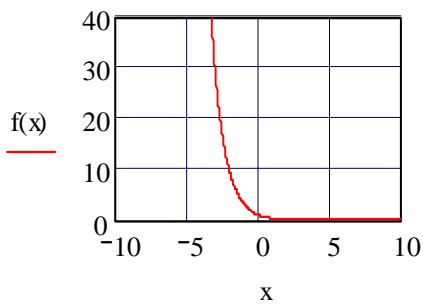
## Exponential Growth Function

**Equation:**  $f(x) = 3^x$

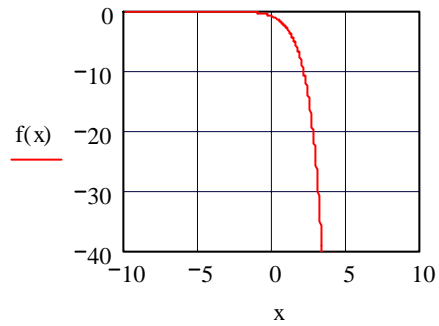


## Exponential Decay Functions

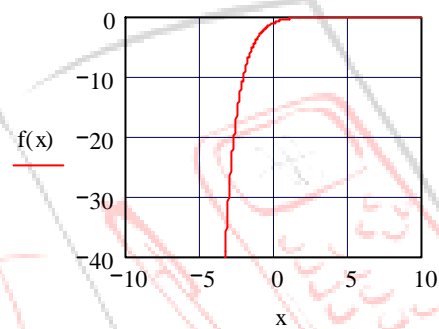
**Equation:**  $f(x) = 3^{-x}$



**Equation:**  $f(x) = -(3^x)$

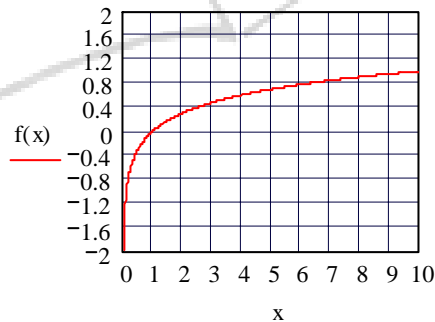


**Equation:**  $f(x) = -(3^{-x})$

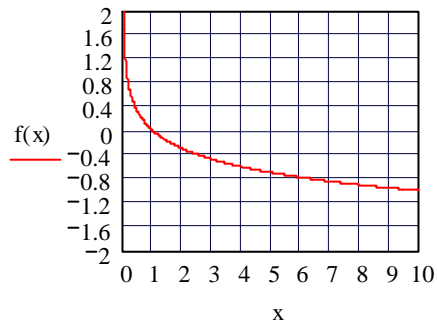


## Logarithmic Functions

**Equation:**  $f(x) = \log(x)$

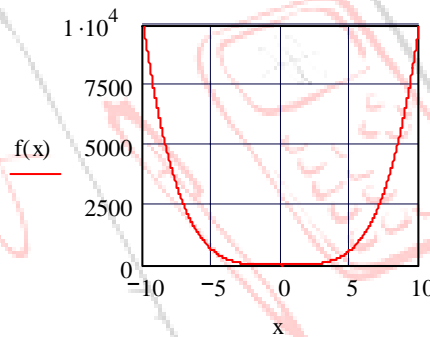


**Equation:**  $f(x) = -\log(x)$



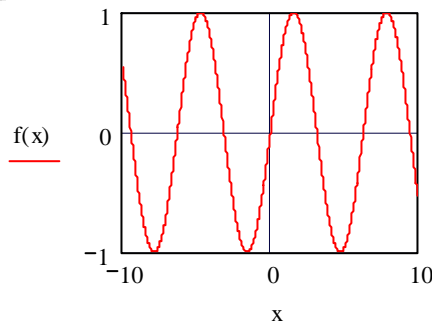
### 4<sup>th</sup> Degree Function

**Equation:**  $f(x) = x^4$

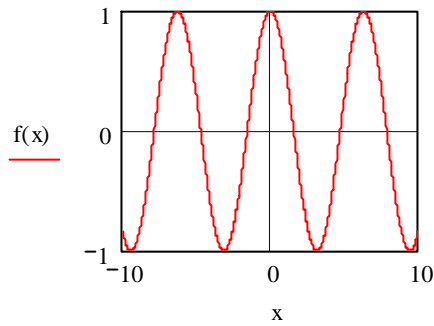


### Trigonometric Functions

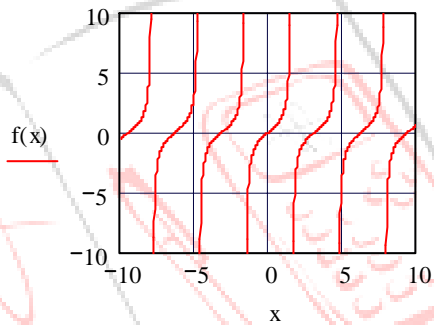
**Equation:**  $f(x) = \sin(x)$



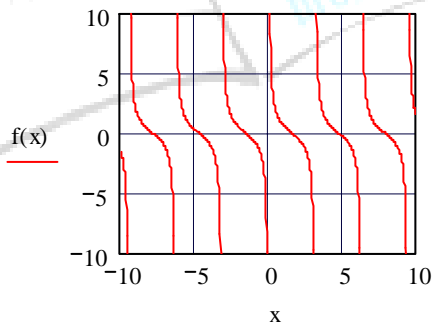
**Equation:**  $f(x) = \cos(x)$



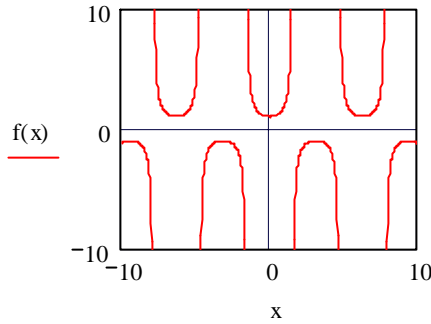
**Equation:**  $f(x) = \tan(x)$



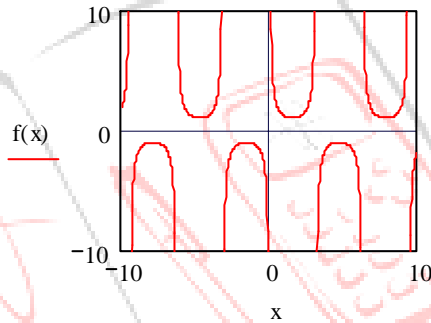
**Equation:**  $f(x) = \cot(x)$



**Equation:**  $f(x) = \sec(x)$



**Equation:**  $f(x) = \csc(x)$



### Shifting Properties for Graphing

Reference function	Given Function	Horizontal Shift		Vertical Shift	
		$a > 0$	$a < 0$	$b > 0$	$b < 0$
$f(x)$	$f(x+a)$	LEFT	RIGHT	XXX	XXX
$f(x)$	$f(x) + b$	XXX	XXX	UP	DOWN
$f(x)$	$f(x+a)+b$	LEFT	RIGHT	UP	DOWN
<b>a and b are constants</b>					