Exponents can be expressed as functions. The constant can be the base of an exponent and has special properties making it useful to calculus. This section defines exponential functions and their properties, and the constant .

# Exponents as a Function

****Exponential function (object) – a function in the form of , where a is a positive constant. See Figure 1.

Figure 1

**Remember**, in , is the base and is the exponent. Together they make a power.

## Positive, Negative, and Neutral Exponents

* If , and integer , then . ( times)
* If , then .
* If , and integer , then

## Rational and Irrational Exponents

* If the exponent is rational but not an integer, then , then .
* If the exponent is irrational, the value of can only be approximated by applying increasingly precise numbers to the exponent. [See 3.1 Works, A]

## Classes of Bases

Exponential functions can be classified into three categories, based on their constant .

|  |  |  |
| --- | --- | --- |
|  |  |  |
|  |  |  |

## Laws of Exponents

* If , then and .
* If , then and .

# The Constant

**** (constant) – the number defined by .

.

# The Natural Exponential Function

****Natural exponential function (object) – the exponential function with base . ()

Since ,

# Exercises

[See 3.1 Exercises]

# What Did You Learn?

* What is an exponent? How can it be a function?
* How can powers be classified by the base’s value? The base’s rationality? The exponent’s sign?
* What is ? How is it used in an exponent?