

BASIC OPERATIONS WITH REAL NUMBERS: SUMMARY OF KEY CONCEPTS*

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Abstract

This module is from Elementary Algebra by Denny Burzynski and Wade Ellis, Jr. The basic operations with real numbers are presented in this chapter. The concept of absolute value is discussed both geometrically and symbolically. The geometric presentation offers a visual understanding of the meaning of $|x|$. The symbolic presentation includes a literal explanation of how to use the definition. Negative exponents are developed, using reciprocals and the rules of exponents the student has already learned. Scientific notation is also included, using unique and real-life examples. This module contains a summary of the key concepts in the chapter "Basic Operations with Real Numbers".

1 Summary of Key Concepts

Positive and Negative Numbers (here¹)

A number is denoted as **positive** if it is directly preceded by a "+" sign or no sign at all. A number is denoted as negative if it is directly preceded by a "-" sign.

Opposites (here²)

Opposites are numbers that are the same distance from zero on the number line but have opposite signs.

Double-Negative Property (here³)

$$-(-a) = a$$

Absolute Value (Geometric) (here⁴)

The absolute value of a number a , denoted $|a|$, is the distance from a to 0 on the number line.

Absolute Value (Algebraic) (here⁵)

$$|a| = \begin{cases} a & \text{if } a \geq 0 \\ -a & \text{if } a < 0 \end{cases}$$

Addition of Signed Numbers (here⁶)

To add two numbers with

like signs, add the absolute values of the numbers and associate the common sign with the sum.

*Version 1.4: May 28, 2009 4:43 pm GMT-5

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¹"Basic Operations with Real Numbers: Signed Numbers" <<http://cnx.org/content/m18874/latest/>>

²"Basic Operations with Real Numbers: Signed Numbers" <<http://cnx.org/content/m18874/latest/>>

³"Basic Operations with Real Numbers: Signed Numbers" <<http://cnx.org/content/m18874/latest/>>

⁴"Basic Operations with Real Numbers: Absolute Value" <<http://cnx.org/content/m21876/latest/>>

⁵"Basic Operations with Real Numbers: Absolute Value" <<http://cnx.org/content/m21876/latest/>>

⁶"Basic Operations with Real Numbers: Addition of Signed Numbers" <<http://cnx.org/content/m21991/latest/>>

unlike signs, subtract the smaller absolute value from the larger absolute value and associate the sign of the larger absolute value with the difference.

Addition with 0 (here⁷)

$0 + \text{any number} = \text{that particular number}$, that is, $0 + a = a$ for any real number a .

Additive Identity (here⁸)

Since adding 0 to a real number leaves that number unchanged, 0 is called the additive identity.

Definition of Subtraction (here⁹)

$$a - b = a + (-b)$$

Subtraction of Signed Numbers (here¹⁰)

To perform the subtraction $a - b$, add the opposite of b to a , that is, change the sign of b and add.

Multiplication and Division of Signed Numbers (here¹¹)

$$(+)(+) = + \quad \frac{(+)}{(+)} = + \quad \frac{(+)}{(-)} = -$$

$$(-)(-) = +$$

$$(+)(-) = -$$

$$(-)(+) = - \quad \frac{(-)}{(-)} = + \quad \frac{(-)}{(+)} = -$$

Reciprocals (here¹²)

Two numbers are reciprocals of each other if their product is 1. The numbers 4 and $\frac{1}{4}$ are reciprocals since $(4)\left(\frac{1}{4}\right) = 1$.

Negative Exponents (here¹³)

If n is any natural number and x is any nonzero real number, then $x^{-n} = \frac{1}{x^n}$.

Writing a Number in Scientific Notation (here¹⁴)

To write a number in scientific notation:

1. Move the decimal point so that there is one nonzero digit to its left.
2. Multiply the result by a power of 10 using an exponent whose absolute value is the number of places the decimal point was moved. Make the exponent positive if the decimal point was moved to the left and negative if the decimal point was moved to the right.

Converting from Scientific Notation:

positive exponent (here¹⁵)

To convert a number written in scientific notation to a number in standard form when there is a **positive** exponent as the power of 10, move the decimal point to the **right** the number of places prescribed by the exponent on the 10.

Negative Exponent (here¹⁶)

To convert a number written in scientific notation to a number in standard form when there is a **negative** exponent as the power of 10, move the decimal point to the **left** the number of places prescribed by the exponent on the 10.

⁷"Basic Operations with Real Numbers: Addition of Signed Numbers" <<http://cnx.org/content/m21991/latest/>>

⁸"Basic Operations with Real Numbers: Addition of Signed Numbers" <<http://cnx.org/content/m21991/latest/>>

⁹"Basic Operations with Real Numbers: Subtraction of Signed Numbers" <<http://cnx.org/content/m21877/latest/>>

¹⁰"Basic Operations with Real Numbers: Subtraction of Signed Numbers" <<http://cnx.org/content/m21877/latest/>>

¹¹"Basic Operations with Real Numbers: Multiplication and Division of Signed Numbers" <<http://cnx.org/content/m21872/latest/>>

¹²"Basic Operations with Real Numbers: Negative Exponents" <<http://cnx.org/content/m21882/latest/>>

¹³"Basic Operations with Real Numbers: Negative Exponents" <<http://cnx.org/content/m21882/latest/>>

¹⁴"Basic Operations with Real Numbers: Scientific Notation" <<http://cnx.org/content/m21879/latest/>>

¹⁵"Basic Operations with Real Numbers: Scientific Notation" <<http://cnx.org/content/m21879/latest/>>

¹⁶"Basic Operations with Real Numbers: Scientific Notation" <<http://cnx.org/content/m21879/latest/>>