Basic Operations with Real Numbers: Subtraction of Signed Numbers*

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Abstract

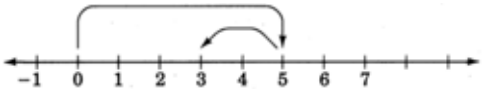
This module is from Elementary Algebra by Denny Burzynski and Wade Ellis, Jr. The basic operations with real numbers are presented in this chapter. The concept of absolute value is discussed both geometrically and symbolically. The geometric presentation offers a visual understanding of the meaning of |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. Objectives of this module: understand the definition of subtraction, be able to subtract signed numbers.

1 Overview

- Definition of Subtraction
- Subtraction of Signed Numbers

2 Definition of Subtraction

We know from our experience with arithmetic that the subtraction $5 - 2$ produces 3, that is, $5 - 2 = 3$. Illustrating this process on the number line suggests a rule for subtracting signed numbers.



We begin at 0, the origin.
Since 5 is positive, we move 5 units to the right.
Then, we move **2 units to the left** to get to 3. (This reminds us of addition with a negative number.)

This illustration suggests that $5 - 2$ is the same as $5 + (-2)$.
This leads us directly to the definition of subtraction.

Definition of Subtraction
If a and b are real numbers, $a - b$ is the same as $a + (-b)$, where $-b$ is the opposite of b.

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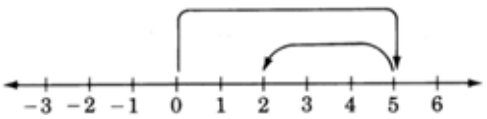
3 Subtraction of Signed Numbers

The preceding definition suggests the rule for subtracting signed numbers.
Subtraction of Signed Numbers
To perform the subtraction $a - b$, add the opposite of b to a, that is, change the sign of b and add.

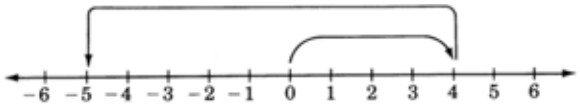
4 Sample Set A

Perform the subtractions.

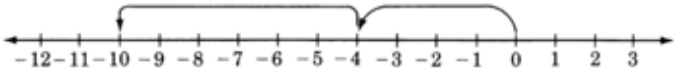
Example 1
$5 - 3 = 5 + (-3) = 2$



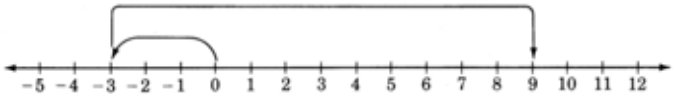
Example 2
$4 - 9 = 4 + (-9) = -5$



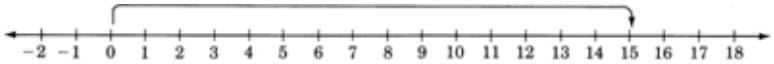
Example 3
$-4 - 6 = -4 + (-6) = -10$



Example 4
$-3 - (-12) = -3 + 12 = 9$



Example 5
$0 - (-15) = 0 + 15 = 15$



Example 6
The high temperature today in Lake Tahoe was 26°F. The low temperature tonight is expected to be −7°F. How many degrees is the temperature expected to drop?
We need to find the difference between 26 and −7.
$26 - (-7) = 26 + 7 = 33$
Thus, the expected temperature drop is 33°F.

Example 7

$$\begin{aligned} -6-(-5)-10 &= -6+5+(-10) \\ &= (-6+5)+(-10) \\ &= -1+(-10) \\ &= -11 \end{aligned}$$

5 Practice Set A

Perform the subtractions.

Exercise 1 *(Solution on p. 7.)*
$9-6$

Exercise 2 *(Solution on p. 7.)*
$6-9$

Exercise 3 *(Solution on p. 7.)*
$0-7$

Exercise 4 *(Solution on p. 7.)*
$1-14$

Exercise 5 *(Solution on p. 7.)*
$-8-12$

Exercise 6 *(Solution on p. 7.)*
$-21-6$

Exercise 7 *(Solution on p. 7.)*
$-6-(-4)$

Exercise 8 *(Solution on p. 7.)*
$8-(-10)$

Exercise 9 *(Solution on p. 7.)*
$1-(-12)$

Exercise 10 *(Solution on p. 7.)*
$86-(-32)$

Exercise 11 *(Solution on p. 7.)*
$0-16$

Exercise 12 *(Solution on p. 7.)*
$0-(-16)$

Exercise 13 *(Solution on p. 7.)*
$0-(8)$

Exercise 14 *(Solution on p. 7.)*
$5-(-5)$

Exercise 15 *(Solution on p. 7.)*
$24-(-(-24))$

6 Exercises

For the following exercises, perform the indicated operations.

Exercise 16 *(Solution on p. 7.)*
$8 - 3$

Exercise 17
$12 - 7$

Exercise 18 *(Solution on p. 7.)*
$5 - 6$

Exercise 19
$14 - 30$

Exercise 20 *(Solution on p. 7.)*
$2 - 15$

Exercise 21
$5 - 18$

Exercise 22 *(Solution on p. 7.)*
$1 - 7$

Exercise 23
$4 - 11$

Exercise 24 *(Solution on p. 7.)*
$-6 - 5$

Exercise 25
$-8 - 14$

Exercise 26 *(Solution on p. 7.)*
$-1 - 12$

Exercise 27
$-4 - 4$

Exercise 28 *(Solution on p. 7.)*
$-6 - 8$

Exercise 29
$-1 - 12$

Exercise 30 *(Solution on p. 7.)*
$-5 - (-3)$

Exercise 31
$-11 - (-8)$

Exercise 32 *(Solution on p. 7.)*
$-7 - (-12)$

Exercise 33
$-2 - (-10)$

Exercise 34 *(Solution on p. 7.)*
$-4 - (-15)$

Exercise 35
$-11 - (-16)$

Exercise 36 *(Solution on p. 8.)*
$-1 - (-6)$

Exercise 37
$-8-(-14)$

Exercise 38 *(Solution on p. 8.)*
$-15-(-10)$

Exercise 39
$-11-(-4)$

Exercise 40 *(Solution on p. 8.)*
$-16-(-8)$

Exercise 41
$-12-(-11)$

Exercise 42 *(Solution on p. 8.)*
$0-6$

Exercise 43
$0-15$

Exercise 44 *(Solution on p. 8.)*
$0-(-7)$

Exercise 45
$0-(-10)$

Exercise 46 *(Solution on p. 8.)*
$67-38$

Exercise 47
$142-85$

Exercise 48 *(Solution on p. 8.)*
$816-1140$

Exercise 49
$105-421$

Exercise 50 *(Solution on p. 8.)*
$-550-(-121)$

Exercise 51
$-15.016-(4.001)$

Exercise 52 *(Solution on p. 8.)*
$-26+7-52$

Exercise 53
$-15-21-(-2)$

Exercise 54 *(Solution on p. 8.)*
$-104-(-216)-(-52)$

Exercise 55
$-0.012-(-0.111)-(0.035)$

Exercise 56 *(Solution on p. 8.)*
$[5+(-6)]-[2+(-4)]$

Exercise 57
$[2+(-8)]-[5+(-7)]$

Exercise 58 *(Solution on p. 8.)*
$[4+(-11)]-[2+(-10)]$

Exercise 59
$[9+(-6)]-[4+(-12)]$

Exercise 60 *(Solution on p. 8.)*
$(11-8)-(1-6)$

Exercise 61
$(5-12)-(4-10)$

Exercise 62 *(Solution on p. 8.)*
$(1-10)-(2-15)$

Exercise 63
$(0-8)-(4-12)$

Exercise 64 *(Solution on p. 8.)*
$(-4+7)-(2-5)$

Exercise 65
$(-6+2)-(5-11)$

Exercise 66 *(Solution on p. 8.)*
$[-8+(-5+3)]-[9-(-3-5)]$

Exercise 67
$[-4+(-1+6)]-[7-(-6-1)]$

Exercise 68 *(Solution on p. 8.)*
$[2-(-6+10)]-[1-(2-11)]$

Exercise 69
$[5-(-2-5)]-[2-(-1-4)]$

Exercise 70 *(Solution on p. 8.)*
When a particular machine is operating properly, its meter will read 34. If a broken bearing in the machine causes the meter reading to drop by 45 units, what is the meter reading?

Exercise 71
The low temperature today in Denver was $-4°$F and the high was $42°$F. What is the temperature difference?

7 Exercises for Review

Exercise 72 *(Solution on p. 8.)*
(here[1]) Use the distributive property to expand $4x\,(5y+11)$.

Exercise 73
(here[2]) Simplify $\frac{2\left(3x^2y^2\right)^3\left(2x^4y^3\right)^0}{27x^4y^3}$. Assume $x\neq 0, y\neq 0$.

Exercise 74 *(Solution on p. 8.)*
(here[3]) Simplify $|-\left(4^2+2^2-3^2\right)|$.

Exercise 75
(here[4]) Find the sum. $-8+(-14)$.

Exercise 76 *(Solution on p. 8.)*
(here[5]) Find the sum. $3+(-6)$.

[1] "Basic Properties of Real Numbers: Properties of the Real Numbers" <http://cnx.org/content/m21894/latest/>
[2] "Basic Properties of Real Numbers: The Power Rules for Exponents" <http://cnx.org/content/m21897/latest/>
[3] "Basic Operations with Real Numbers: Absolute Value" <http://cnx.org/content/m21876/latest/>
[4] "Basic Operations with Real Numbers: AddItion of Signed Numbers" <http://cnx.org/content/m21991/latest/>
[5] "Basic Operations with Real Numbers: AddItion of Signed Numbers" <http://cnx.org/content/m21991/latest/>

Solutions to Exercises in this Module

Solution to Exercise 1 (p. 3)
3
Solution to Exercise 2 (p. 3)
-3
Solution to Exercise 3 (p. 3)
-7
Solution to Exercise 4 (p. 3)
-13
Solution to Exercise 5 (p. 3)
-20
Solution to Exercise 6 (p. 3)
-27
Solution to Exercise 7 (p. 3)
-2
Solution to Exercise 8 (p. 3)
18
Solution to Exercise 9 (p. 3)
13
Solution to Exercise 10 (p. 3)
118
Solution to Exercise 11 (p. 3)
-16
Solution to Exercise 12 (p. 3)
16
Solution to Exercise 13 (p. 3)
-8
Solution to Exercise 14 (p. 3)
10
Solution to Exercise 15 (p. 3)
0
Solution to Exercise 16 (p. 4)
5
Solution to Exercise 18 (p. 4)
-1
Solution to Exercise 20 (p. 4)
-13
Solution to Exercise 22 (p. 4)
-6
Solution to Exercise 24 (p. 4)
-11
Solution to Exercise 26 (p. 4)
-13
Solution to Exercise 28 (p. 4)
-14
Solution to Exercise 30 (p. 4)
-2
Solution to Exercise 32 (p. 4)
5

Solution to Exercise 34 (p. 4)
11
Solution to Exercise 36 (p. 4)
5
Solution to Exercise 38 (p. 5)
-5
Solution to Exercise 40 (p. 5)
-8
Solution to Exercise 42 (p. 5)
-6
Solution to Exercise 44 (p. 5)
7
Solution to Exercise 46 (p. 5)
29
Solution to Exercise 48 (p. 5)
-324
Solution to Exercise 50 (p. 5)
-429
Solution to Exercise 52 (p. 5)
-71
Solution to Exercise 54 (p. 5)
164
Solution to Exercise 56 (p. 5)
1
Solution to Exercise 58 (p. 5)
1
Solution to Exercise 60 (p. 6)
8
Solution to Exercise 62 (p. 6)
4
Solution to Exercise 64 (p. 6)
6
Solution to Exercise 66 (p. 6)
-27
Solution to Exercise 68 (p. 6)
-12
Solution to Exercise 70 (p. 6)
-11
Solution to Exercise 72 (p. 6)
$20xy + 44x$
Solution to Exercise 74 (p. 6)
11
Solution to Exercise 76 (p. 6)
-3