# The Next Step

## Mathematics Applications for Adults
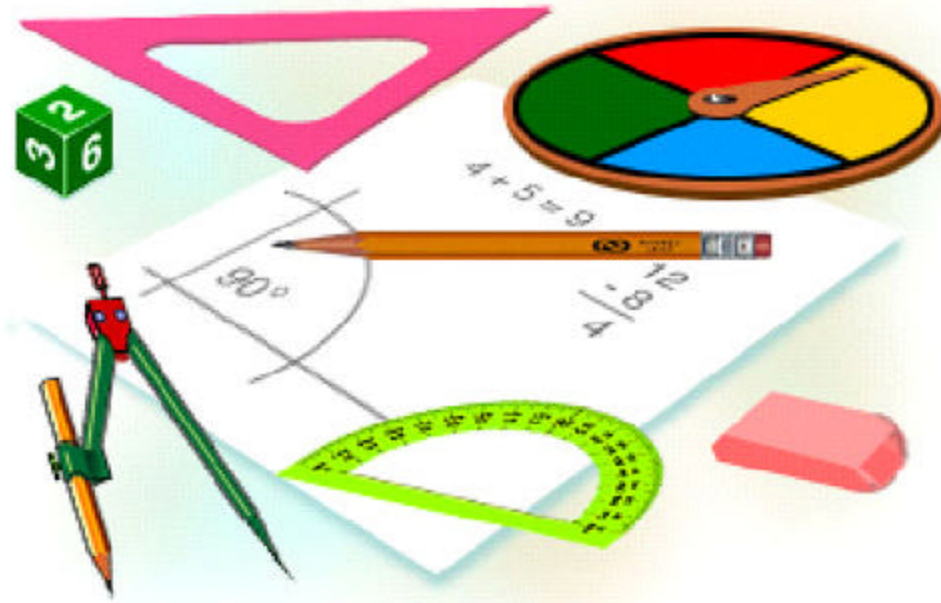
**Book 14019 – Integers**

# OUTLINE

## Mathematics - Book 14019

| Integers |
| --- |
| **Introduction to Integers** |
|      perform mathematical operations using integers. |
|      explain the difference between signs of operations and signs of quantity. |

# THE NEXT STEP

## Book 14019

## Integers

### Introduction to Integers

The set of *integers* includes *0*, all of the counting numbers (called *positive* whole numbers), and the whole numbers less than *0* (called *negative* numbers). Integers are shown below on a number line.

$\Longrightarrow$ *All counting numbers and whole numbers are integers.*

Negative Numbers          Positive Numbers
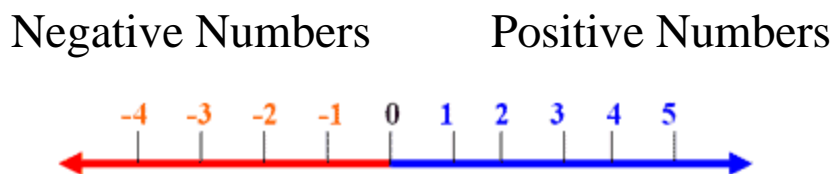


**Numbers less than 0 are negative numbers.   Numbers greater than 0 are positive.**

*Number lines* show numbers in order. If you follow the number line to the right, the numbers get larger and larger. If you follow the number line to the left, the numbers get smaller and smaller.

$\implies$ *To remember the order of negative and positive numbers on a number line, think of the alphabet (n,o,p = negative, zero, positive).*

It's important to understand the number line because it shows you that every number has an opposite. The famous German mathematician Leopold Kronecker once said: "God made the positive integers; everything else is the work of man." Why, then, did we confuse things with negative numbers? As it turns out, there are many, many everyday problems where negative numbers are useful. For example, we can both gain and lose weight.

The temperature can rise or fall. Locations on the earth can be above sea level, or below sea level.

Integers can be understood both as signs of operation and signs of quantity.

**Examples**  +5 stands for $0 + 5$ (operation), but it can also stand for a positive amount or a gain as in measurements such as temperature or weight (quantity).

-5 stands for 0 – 5 (operation), but it can also stand for a negative amount or a drop as in measurements such as temperature or weight (quantity).

# Practice Exercise

Write an integer for each description.
(Hint: include a negative sign for a description that is below zero)

1. **7**   10 units to the right of -3 on a number line

2. _____ A deposit of $271

3. _____ The opposite of -12

4. _____ Withdraw $287 from an ATM machine

5. _____ A loss of 10 pounds

6. _____ An altitude of 4000 ft

7. _____ 8 inches taller

8. _____ A gain of 4 pounds

9. _____ The stock market went up 394 points today

10. _____ 13 degrees below zero

11. _____ 284 ft below sea level

12. _____ 12 units to the left of 11 on a number line

13. _____ 8 yards short for first down

14. _____ The opposite of 12

15. _____ A gain of 20 yards

16. _____ 6 units to the right of 4 on a number line

17. _____ A profit of $158 dollars

18. _____ The temperature dropped 7 degrees overnight

**Compare the given integers using "<", ">", or "=".**

| | | | | | |
|---|---|---|---|---|---|
| (1) | 23 | -26 | (2) | 72 | 42 |
| (3) | -23 | -23 | (4) | -23 | -20 |
| (5) | -3 | -50 | (6) | 20 | -1 |
| (7) | 17 | -53 | (8) | 19 | -58 |
| (9) | -39 | 13 | (10) | 28 | 58 |
| (11) | 60 | -60 | (12) | 4 | 23 |
| (13) | -80 | 37 | (14) | -39 | 20 |
| (15) | 11 | -220 | (16) | -26 | 9 |
| (17) | -32 | -14 | (18) | -29 | -10 |
| (19) | 38 | -38 | (20) | -37 | -41 |
| (21) | 20 | -8 | (22) | -13 | -13 |
| (23) | 10 | -9 | (24) | -16 | -37 |

## Adding and Subtracting Integers

Adding and subtracting positive integers works the same way as adding and subtracting whole numbers. Adding and subtracting negative numbers works differently.

When you add a negative integer to a positive integer, you are actually subtracting the value of the negative integer from the positive integer.

**4 + -2 = 4 – 2 = 2**
**7 + 3 + -2 = 7 + 3 – 2 = 8**
**11 + -6 + 4 + -2 = 11 – 6 + 4 – 2 = 7**

When you add a negative integer to another negative integer, you add the values of the integers and then add a negative sign in front of them.

$\implies$ *Adding a negative number to another negative number results in a sum less than either negative addend.*

**-4 + -2 = - (4 + 2) = -6**
**-7 + -3 = - (7 + 3) = -10**
**-11 + -6 + -4 + -2 = - (11 + 6 + 4 + 2) = -23**

$\implies$ *Adding a positive number to a positive number always results in a sum greater than either addend.*

**2 + 3 = 5**

# Addition Property of Opposites

The property which states that the <u>sum</u> of a number and its <u>opposite</u> is zero

*Examples*:

$$5 + {}^-5 = 0 \qquad {}^-15 + 15 = 0$$

When you subtract a negative number from a negative integer, you are actually adding a positive integer to the negative integer.

**-4 - -2 = -4 + 2 = -2**

**-7 - -3 - -2 = -7 + 3 + 2 = -2**

**-11 - -6 - -4 - - 2 = -11 + 6 + 4 + 2 = 1**

When you subtract a positive integer of greater value from another positive integer, the difference will be a negative integer.

**2 – 4 = -2**

**3 – 7 – 2 = -6**

**11 – 6 – 4 – 2 = -1**

## Practice Exercise

| | | | |
|---|---|---|---|
| **1.** | **15 – 38 =** | **2.** | **-6 + 35 =** |
| **3.** | **51 – 92 =** | **4.** | **-21 + 17 =** |
| **5.** | **-34 - (-21) =** | **6.** | **35 – 5 =** |

7.  84 + (-73) =                    8.   -91 – 77 =
9.  -74 + (-76) =                   10.  -61 + (-93) =
11. -4 - (-4) + -8 =                12.  -26 + 2 –11 =
13. -0.4+ (-1) + (-2.4) =   14.  (+7) - (-10) =
15. -3 + (-4) =                     16.  8 + (+11) - (-14) =
17. 7 + 7 =                          18.  6 + (-4) - (0.4) + (2.4) =
19. -6 – 4 =                         20.  -3 - (-8) + -1 =
21. -0.2+ (-1) + (-2.2) =   22.  1 + (-8) - (1) + (5) =
23. 9 + (+3) - (-7) =            24.  (+2) - (-11) =

## Multiplying Integers

Multiplying integers works the same way as multiplying whole numbers, unless one or more of the integers is a negative number.

The product of a positive integer multiplied by another positive integer will always be a positive integer.  Positive integers may or may not be written with a positive sign:  +8 = 8.

$$4 \times 2 = 8$$

$$\begin{array}{r} 3 \\ \underline{\times 2} \\ 6 \end{array} \qquad \begin{array}{r} 7 \\ \underline{\times 1} \\ 7 \end{array}$$

The product of a positive integer multiplied by a negative integer will always be a negative integer.

$$4 \times -2 = -8$$

$$\begin{array}{r} 3 \\ \underline{\times -2} \\ -6 \end{array}$$

$$\begin{array}{r} 7 \\ \underline{\times -1} \\ -7 \end{array}$$

The product of a negative integer multiplied by a positive integer will always be a negative integer.

$$-4 \times 2 = -8$$

$$\begin{array}{r} -3 \\ \underline{\times 2} \\ -6 \end{array}$$

$$\begin{array}{r} -7 \\ \underline{\times 1} \\ -7 \end{array}$$

The product of a negative integer multiplied by a negative integer will always be a positive integer.

$$-4 \times -2 = 8$$

$$\begin{array}{r} -3 \\ \underline{\times -2} \\ 6 \end{array}$$

$$\begin{array}{r} -7 \\ \underline{\times -1} \\ 7 \end{array}$$

⟹ *Remember:*
*positive x positive = positive*
*positive x negative = negative*
*negative x positive = negative*
*negative x negative = positive*

# Practice Exercise

1. $8 \div 2 =$        2.  $40 \div 10 =$
3. $-46 \times 31 =$        4.  $80 \div 10 =$
5. $93 \div 31 =$        6.  $-60 \times (-2) =$
7. $28 \div 2 =$        8.  $56 \div 8 =$
9. $-42 \times 45 =$        10.  $40 \div 20 =$
11. $-9 \times (-6) =$        12.  $-462 \div 77 =$
13. $-8 \times -4 =$        14.  $(-4) \times (10) \times (-8) =$
15. $-7 \times 2 =$        16.  $(1) \times (-1.2) =$
17. $-33 \div 3 =$        18.  $(+8) \times (-8) =$
19. $(9) \times (-1.2) =$        20.  $-10 \div -5 =$
21. $-5 \times (-8) =$        22.  $(+3) \times (-9) =$
23. $-1260 \div 105 =$        24.  $-3 \times 4 =$

## Book 14019 - Integers

**Page 5**    **2.** 271   **3.** 12   **4.** –287   **5.** –10
**6.** 4000   **7.** 8   **8.** 4   **9.** 394   **10.** –13
**11.** –284   **12.** –1   **13.** –8   **14.** –12
**15.** 20   **16.** 10   **17.** 158   **18.** –7

**Page 6**    **1.** >   **2.** >   **3.** =   **4.** <   **5.** >   **6.** >
**7.** >   **8.** >   **9.** <   **10.** <   **11.** >   **12.** <
**13.** <   **14.** <   **15.** >   **16.** <   **17.** <
**18.** <   **19.** >   **20.** >   **21.** >   **22.** =
**23.** >   **24.** >

**Page 8**    **1.** –23   **2.** 29   **3.** –41   **4.** –4   **5.** –13
**6.** 30   **7.** 11   **8.** –168   **9.** –150
**10.** –154   **11.** –8   **12.** –35   **13.** –3.8
**14.** 17   **15.** –7   **16.** 33   **17.** 14   **18.** 4
**19.** –10   **20.** 4   **21.** –3.4   **22.** –3   **23.** 19
**24.** 13

**Page 11**    **1.** 4   **2.** 4   **3.** –1426   **4.** 8   **5.** 3
**6.** 120   **7.** 14   **8.** 7   **9.** –1890   **10.** 2
**11.** 54   **12.** –6   **13.** 32   **14.** 320
**15.** –14   **16.** –1.2   **17.** –11   **18.** –64
**19.** –10.8   **20.** 2   **21.** 40   **22.** –27
**23.** –12   **24.** –12