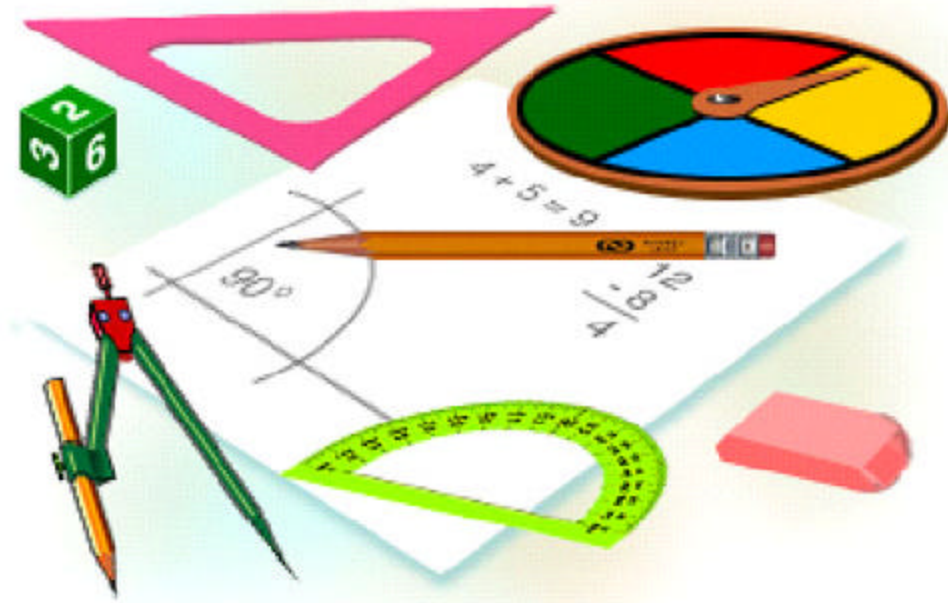


The Next Step

Mathematics Applications for Adults



Book 14018 - Integers

OUTLINE

Mathematics - Book 14018

Integers
<u>Introduction To Integers</u>
perform mathematical operations using integers.
explain the difference between signs of operations and signs of quantity.

THE NEXT STEP

Book 14018

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.

P *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.

⇒ *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. **137** A deposit of \$137
2. _____ 17 units to the left of 1 on a number line
3. _____ 19 units to the right of -5 on a number line
4. _____ Withdraw \$268 from an ATM machine
5. _____ The opposite of -16
6. _____ 10 units to the right of 4 on a number line
7. _____ A loss of 19 pounds
8. _____ 42 degrees below zero
9. _____ A profit of \$210 dollars
10. _____ An altitude of 9000 ft
11. _____ 8 yards short for first down
12. _____ The stock market went up 291 points today
13. _____ A gain of 18 yards

14. _____ 582 ft below sea level
15. _____ The temperature dropped
20 degrees overnight
16. _____ A gain of 20 pounds
17. _____ The opposite of 17
18. _____ 4 inches taller

1.	4	<	6	2.	2	_____	-4
3.	-4	_____	-4	4.	1	_____	0
5.	-5	_____	7	6.	20	_____	-10
7.	-35	_____	-35	8.	42	_____	-42
9.	22	_____	11	10.	22	_____	-21
11.	22	_____	-99	12.	12	_____	44
13.	-15	_____	-32	14.	33	_____	17
15.	-66	_____	32	16.	-14	_____	-26
17.	-78	_____	-78	18.	-14	_____	-11
19.	-5	_____	5	20.	24	_____	-6
21.	73	_____	-86	22.	15	_____	-15
23.	-17	_____	-39	24.	-50	_____	11

25.	2	_____	-11	26.	-81	_____	-81
27.	-61	_____	59	28.	47	_____	54
29.	23	_____	25	30.	-44	_____	-17
31.	-13	_____	11	32.	-88	_____	18
33.	-3	_____	10	34.	17	_____	-78
35.	-68	_____	-68	36.	-45	_____	45

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.

⇒ *Adding a negative number to another negative number results in a sum less than either negative addend.*

$$-4 + -2 = -(4 + 2) = -6$$

$$-7 + -3 = -(7 + 3) = -10$$

$$-11 + -6 + -4 + -2 = -(11 + 6 + 4 + 2) = -23$$

⇒ *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 sum of a number and its opposite is zero

Examples:

$$5 + -5 = 0 \quad -15 + 15 = 0$$

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. | $-13 - 4 =$ | -17 | 2. | $3 + -7 =$ | _____ |
| 3. | $7 + -5 =$ | _____ | 4. | $3 - (-4) =$ | _____ |
| 5. | $11 + 5 =$ | _____ | 6. | $18 - (-8) =$ | _____ |
| 7. | $-17 + 8 =$ | _____ | 8. | $16 + -1 =$ | _____ |
| 9. | $-9 - (-8) =$ | _____ | 10. | $12 - 11 =$ | _____ |
| 11. | $6 + -2 =$ | _____ | 12. | $-6 - (-5) =$ | _____ |
| 13. | $15 + 7 =$ | _____ | 14. | $-4 - (-1) =$ | _____ |
| 15. | $17 + -11 =$ | _____ | 16. | $4 + -10 =$ | _____ |
| 17. | $-15 + -12 =$ | _____ | 18. | $-11 - 4 =$ | _____ |
| 19. | $-15 + 12 =$ | _____ | 20. | $6 - (-13) =$ | _____ |
| 21. | $13 - 13 =$ | _____ | 22. | $19 + -4 =$ | _____ |
| 23. | $-19 - 9 =$ | _____ | 24. | $-47 + -7 =$ | _____ |
| 25. | $26 - 49 =$ | _____ | 26. | $18 + -13 =$ | _____ |
| 27. | $-46 - (-9) =$ | _____ | 28. | $-21 + 9 =$ | _____ |
| 29. | $36 + -13 =$ | _____ | 30. | $15 - (-11) =$ | _____ |
| 31. | $1 - 22 =$ | _____ | 32. | $-27 + 15 =$ | _____ |
| 33. | $19 + -9 =$ | _____ | 34. | $500 - 130 =$ | _____ |
| 35. | $8 + -1 =$ | _____ | 36. | $-250 - (-313) =$ | _____ |

Multiplying and Dividing Integers

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

The product or quotient of a positive integer multiplied or divided by another positive integer will always be a positive integer. Positive integers may or may not be written with a positive sign: $+8 = 8$. Negative integers are *always* written with the minus sign.

$$4 \times 2 = 8$$
$$24 \div 6 = 4$$

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

$$4 \times -2 = -8$$
$$24 \div -6 = -4$$

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

$$-4 \times 2 = -8$$
$$-24 \div 6 = -4$$

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

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

$$-24 \div -6 = 4$$

The rule for multiplying or dividing integers is if the signs are the same, the answer is positive. If the signs are different, the answer is negative.

⇒ Remember:

positive x positive or positive , positive = positive
positive x negative or positive , negative = negative
negative x positive or negative , positive = negative
negative x negative or negative , negative = positive

Practice Exercise

- | | |
|----------------------------|-----------------------------|
| 1. $-21 \div -3 = 7$ | 2. $11 \times -11 =$ _____ |
| 3. $72 \div -8 =$ _____ | 4. $-72 \div -9 =$ _____ |
| 5. $-9 \times -10 =$ _____ | 6. $12 \times -4 =$ _____ |
| 7. $40 \div -4 =$ _____ | 8. $7 \times -10 =$ _____ |
| 9. $28 \div -4 =$ _____ | 10. $-3 \times 10 =$ _____ |
| 11. $-20 \div 4 =$ _____ | 12. $-4 \times -9 =$ _____ |
| 13. $-66 \div 11 =$ _____ | 14. $-12 \times -9 =$ _____ |
| 15. $-6 \times -5 =$ _____ | 16. $5 \times -11 =$ _____ |
| 17. $162 \div 9 =$ _____ | 18. $-24 \div 2 =$ _____ |
| 19. $14 \times 6 =$ _____ | 20. $63 \div -7 =$ _____ |
| 21. $-33 \div -11 =$ _____ | 22. $-6 \times 3 =$ _____ |
| 23. $-4 \times -2 =$ _____ | 24. $-48 \div -8 =$ _____ |
| 25. $-133 \div 19 =$ _____ | 26. $11 \times -20 =$ _____ |

27. $69 \div 23 =$ _____

29. $1222 \div 26 =$ _____

31. $-10 \times -6 =$ _____

33. $-22 \times -9 =$ _____

35. $39 \times 5 =$ _____

28. $-5 \times -13 =$ _____

30. $-3 \times -13 =$ _____

32. $6 \times -18 =$ _____

34. $45 \div -15 =$ _____

36. $100 \div -10 =$ _____

Answer Key

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2. -16 3. 14 4. -268 5. 16 6. 14
7. -19 8. -42 9. 210 10. 9000
11. -8 12. 291 13. 18 14. -582
15. -20 16. 20 17. -17 18. 4

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2. > 3. = 4. > 5. < 6. > 7. =
8. > 9. > 10. > 11. > 12. <
13. > 14. > 15. < 16. > 17. =
18. < 19. < 20. > 21. > 22. >
23. > 24. < 25. > 26. = 27. <
28. < 29. < 30. < 31. < 32. <
33. < 34. > 35. = 36. <

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2. -4 3. 2 4. 7 5. 16 6. 26 7. -9
8. 15 9. -1 10. 1 11. 4 12. -1
13. 22 14. -3 15. 6 16. -6 17. -27
18. -15 19. -3 20. 19 21. 0 22. 15
23. -28 24. -54 25. -23 26. 5
27. -37 28. -12 29. 23 30. 26
31. -21 32. -12 33. 10 34. 370
35. 7 36. 63

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2. -121 3. -9 4. 8 5. 90 6. -48
7. -10 8. -70 9. -7 10. -30 11. -5
12. 36 13. -6 14. 108 15. 30
16. -55 17. 18 18. -12 19. 84

20. -9 **21.** 3 **22.** -18 **23.** 8 **24.** 6
25. -7 **26.** -220 **27.** 3 **28.** 65 **29.** 47
30. 39 **31.** 60 **32.** -108 **33.** 198
34. -3 **35.** 195 **36.** -10