Multiply and Divide Integers

Getting the Idea

Use these rules to multiply two integers.

> **Rules for Multiplying Two Integers**
>
> Multiply the two integers as positive numbers.
>
> Then find the sign of the product using these rules.
>
> - If the signs of the two numbers are the same, the product is positive.
>
> - If the signs of the two numbers are different, the product is negative.

Example 1

Multiply.

$(-25) \cdot (-3) = \boxed{}$

Strategy   **Apply the rules for multiplying two integers.**

Step 1   Multiply the two integers as positive numbers.

$25 \cdot 3 = 75$

Step 2   Find the sign of the product.

The signs of the two numbers are the same, so the product is positive.

$(-) \cdot (-) = (+)$

The product is $+75$.

Solution $(-25) \cdot (-3) = 75$

Example 2

Marshall has $12 automatically deducted from his checking account each month as a charitable donation. What is the total amount deducted from his account after 1 year?

Strategy   **Write an expression for the problem. Then solve.**

Step 1   Write an expression to represent the problem.

The amount deducted each month can be represented by $-\$12$.

There are 12 months in 1 year.

So, find $-\$12 \cdot 12$.

Step 2   Multiply the two integers as positive numbers.

$12 \cdot 12 = 144$

Step 3   Find the sign of the product.

The signs of the two numbers are different, so the product is negative.

$(-) \cdot (+) = (-)$

The product is -144.

Solution   **The total amount deducted from Marshall's account is $144.**

The distributive property applies the rules for multiplying and adding signed numbers. The work below shows that $-(a + b) = -a - b$.

$-(a + b) = -1(a + b)$

$= -1 \cdot (a + b)$ Apply the distributive property.

$= -1 \cdot (a) + -1 \cdot (b)$ Multiply each addend by -1.

$= -a + (-b)$ Apply the rules for adding integers.

$= -a - b$

Example 3

Write $-(a - b)$ as a sum.

Strategy   **Use the distributive property.**

Step 1   Rewrite the expression to show the multiplication.

$-(a - b) = -1 \cdot (a - b)$

Step 2   Apply the distributive property.

$-1 \cdot (a - b) = -1 \cdot (a) - (-1) \cdot (b)$

Step 3   Multiply each addend by -1.

$-1 \cdot (a) - (-1) \cdot (b) = -a - (-b)$

Step 4   Apply the rules for subtracting two integers.

The additive inverse of $-b$ is b.

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

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

Use these rules to divide two integers.

> **Rules for Dividing Two Integers**
>
> Divide the two integers as positive numbers.
>
> Then find the sign of the quotient using these rules.
>
> - If the signs of the two numbers are the same, the quotient is positive.
>
> - If the signs of the two numbers are different, the quotient is negative.

All integers can be divided as long as the divisor is not zero.

Example 4

Divide.

$$(-32) \div (-8) = \boxed{}$$

Strategy   **Apply the rules for dividing two integers.**

Step 1   Divide the two integers as positive numbers.

$$32 \div 8 = 4$$

Step 2   Find the sign of the quotient.

The signs of the two numbers are the same, so the quotient is positive.

$$(-) \div (-) = (+)$$

The quotient is $+ 4$.

Solution   **$(-32) \div (-8) = 4$**

Example 5

The temperature fell 18°F in 3 hours. The temperature fell at the same rate every hour. How much did the temperature change each hour?

Strategy **Write an expression for the problem. Then solve.**

Step 1 Write an expression to represent the problem.

The temperature changed −18°F.

$\frac{(-18)}{3}$ or −18 ÷ 3 represents the temperature change per hour.

Step 2 Divide the two integers as positive numbers.

18 ÷ 3 = 6

Step 3 Find the sign of the product.

The signs of the two numbers are different, so the product is negative.

(−) ÷ (+) = (−)

The quotient is −6°.

Solution **The temperature changed −6°F each hour.**

Instead of using a multiplication sign, sometimes multiplication is shown by putting the factors in parentheses. For example, (−3)(2) = −3 × 2.

Coached Example

What is the value of (−5)(4)(−1)(−2)?

Will the product of the first two integers be positive or negative? _____

$-5 \cdot 4 =$ _____

When you multiply this product by the third integer, −1, will the product be positive or negative? _____

Multiply the product of the first two integers by the third integer, −1.

_____ · (−1) = _____

When you multiply this product by the fourth integer, −2, will the product be positive or negative? _____

_____ · (−2) = _____

The value of (−5)(4)(−1)(−2) is _____.

Lesson Practice

Choose the correct answer.

1. Multiply.

$$29 \cdot (-5) = \boxed{}$$

- **A.** -145
- **B.** -105
- **C.** 105
- **D.** 145

2. Divide.

$$378 \div (-7) = \boxed{}$$

- **A.** -54
- **B.** -45
- **C.** 45
- **D.** 54

3. Multiply.

$$-72 \cdot (-6) = \boxed{}$$

- **A.** -442
- **B.** -432
- **C.** 432
- **D.** 442

4. The temperature fell 36°F in 9 hours. If the temperature fell at the same rate every hour, which represents the change in temperature each hour?

- **A.** -324°F
- **B.** -27°F
- **C.** -4°F
- **D.** 45°F

5. Divide.

$$-385 \div 77 = \boxed{}$$

- **A.** -15
- **B.** -5
- **C.** 5
- **D.** 15

6. What is the value of $(-3)(5)(-4)$?

- **A.** -60
- **B.** -12
- **C.** 12
- **D.** 60

7. A shoreline is changing -3 centimeters each year due to erosion. What is the change in the shoreline over 6 years?

- **A.** -18 cm
- **B.** -9 cm
- **C.** -3 cm
- **D.** -2 cm

8. The price of a stock rose $2 yesterday. If the stock continues to change at the same rate each day, what will be the total change over 10 days?

- **A.** $-\$20$
- **B.** $-\$5$
- **C.** $\$5$
- **D.** $\$20$

9. Evan withdrew a total of $160 from an ATM machine over a 4-day period. He withdrew the same amount of money each day.

   A. Write an expression to represent the total amount that Evan's account changed each day.

   _____

   B. What integer represents the total amount that Evan's account changed each day? Show your work.

   _____

   _____

10. Draw a line from each expression to its equivalent value.

   A. -14×5 •   • -70

   B. $-7 \times (-10)$ •   • -27

   C. $-81 \div 3$ •   • 27

   D. $-162 \div (-6)$ •   • 70

11. Savannah's dog lost 2 pounds each week for 4 weeks. Circle the weight change after 4 weeks.

The dog's weight change after 4 weeks was

8
6
−6
−8

pounds.

12. Is each equation correct? Select True or False.

A. $15 \times (-6) = 90$ ○ True   ○ False

B. $-494 \div 26 = -19$ ○ True   ○ False

C. $(-2)(6)(-7) = 84$ ○ True   ○ False

D. $-63 \div (-9) = -7$ ○ True   ○ False

13. Evaluate each expression. Write each expression in the correct box.

-2×6	$-4 \times (-3)$	$-24 \div (-2)$	$48 \div (-4)$	-6×2

−12	12

14. Use numbers from the box to make each equation true.

$-2 \times 5 =$ _____

$6 \div (-2) =$ _____

$-2 \times$ _____ $= 14$

$80 \div (-8) =$ _____

$-28 \div 4 =$ _____

$\boxed{\begin{array}{c} -3 \\[6pt] -7 \\[6pt] -10 \end{array}}$

15. A plant grew 4 inches each month for a year. The rate of growth was constant. Circle the amount that the plant had grown after 7 months.

The growth of the plant after 7 months was $\boxed{\begin{array}{c} -28 \\[6pt] -11 \\[6pt] 28 \\[6pt] 11 \end{array}}$ inches.

16. Which expression is equivalent to -6? Circle all that apply.

A. $-18 \div 3$

B. -2×3

C. $-24 \div 4$

D. -6×-1

E. $36 \div (-6)$