# 1-2 Writing Algebraic Expressions

Write algebraic expressions and one-step equations that represent a situation.



| | Word Phrases | Expression |
|---|---|---|
| + | • a number plus 5<br>• add 5 to a number<br>• sum of a number and 5<br>• 5 more than a number<br>• a number increased by 5 | $n + 5$ |
| – | •a number minus 11<br>• subtract 11 from a number<br>• difference of a number and 11<br>• 11 less than a number<br>• a number decreased by 11 | $x - 11$ |
| × | • 3 times a number<br>• 3 multiplied by a number<br>• product of 3 and a number | $3m$ |
| ÷ | • a number divided by 7<br>• 7 divided into a number<br>• quotient of a number and 7 | $\frac{a}{7}$ or $a \div 7$ |

## Additional Examples 1A and 1B: Translating Word Phrases into Math Expressions

**Write an algebraic expression for each word phrase.**

**A. the product of 8 and a number *n***

the product of 8 and *n*

8 • *n*

8*n*

**B. a number *w* decreased by 9**

*w* decreased by 9

*w* – 9

*w* – 9

## Additional Examples 1C and 1D: Translating Word Phrases into Math Expressions

**Write an algebraic expression for each word phrase.**

**C. 3 increased by the difference of *p* and 5**

3 increased by the difference of *p* and 5

3 + (*p* – 5)

3 + (*p* – 5)

**D. 24 decreased by the product of 6 and *q***

24 decreased by the product of 6 and *q*

24 – (6 • q)

24 – 6*q*

## Try This: Examples 1A and 1B

**Write an algebraic expression for each word phrase.**

**A. the sum of a number *h* and 88**

the sum of *h* and 88

h + 88

*h* + 88

**B. the quotient of a number *f* and 6**

quotient of *f* and 6

*f* ÷ 6

$\frac{f}{6}$

## Try This: Examples 1C and 1D

**Write an algebraic expression for each word phrase.**

**C. add 7 to 3 multiplied by *m***

add 7 to 3 multiplied by *m*

7 + (3 • *m*)

7 + 3*m*

**D. the difference of 5 and the product of 2 and *r***

the difference of 5 and the product of 2 and *r*

5 – (2 • r)

5 – 2*r*

To solve a word problem, you must first interpret the action you need to perform and then choose the correct operation for that action.

| Action | Operation | Possible Question Clues |
|---|---|---|
| Combine | Add | How many all together? |
| Combine equal groups | Multiply | How many all together? |
| Separate | Subtract | How many more? How many less? |
| Separate into equal groups | Divide | How many equal groups? |

## Additional Example 2: Interpreting Which Operation to Use in Word Problems

**A. Jared worked for *h* hours at the pay rate of $5 each hour. Write an expression to determine how much money Jared earned.**

5*h* *Multiply 5 by h hours.*

**B. How much money will he earn if he works a total of 18 hours?**

5 • 18 = 90 *Evaluate the expression for h = 18.*

Jared earned $90.

## Try This: Example 2

**A. A taxi-cab driver charges a base fee of $2, plus an additional $0.25 per mile. Write an expression to determine the fare.**

$2 + .25m$ *$2 plus .25 per mile.*

**B. If a passenger needs to travel 12 miles, how much money will they need to pay?**

$2 + .25(12) = \$5$ *Evaluate the expression for $m = 12$.*

It will cost $5 to travel 12 miles.

## Additional Example 3A: Writing and Evaluating Expressions in Word Problems

**Write an algebraic expression to evaluate each word problem.**

**A. Ahmed bought a new sweater for $27 plus sales tax *t*. If the tax was $1.76, what was the total cost of the sweater?**

$\$27.00 + t$ *Combine $27 with t.*

$\$27.00 + \$1.76 = \$28.76$ *Evaluate for $t = \$1.76$.*

The total cost of the sweater was $28.76.

## Additional Example 3B: Writing and Evaluating Expressions in Word Problems

**B. The cost to rent a banquet hall is $240. If the cost will be shared equally among all of the people who attend the event, how much will it cost each person if 12, 15, 16 or 20 people attend?**

$\$240 \div n$ *Separate the cost into n equal groups.*

$240 \div n$ *In dollars*

| $n$ | $240 \div n$ | Cost |
|---|---|---|
| 12 | $240 \div 12$ | $20 |
| 15 | $240 \div 15$ | $16 |
| 16 | $240 \div 16$ | $15 |
| 20 | $240 \div 40$ | $12 |

*Evaluate for n = 12, 15, 16, and 20.*

## Additional Example 3C: Writing and Evaluating Expressions in Word Problems

**C. An airplane was flying at an altitude of 20,000 feet when it began its descent at 9:00P.M. After ten minutes, it had descended *a* feet. If the plane descended 8500 feet during the ten minutes, what was its altitude at 9:10?**

$20{,}000 - f$ *Separate f feet from 20,000.*

$20{,}000 - 8500 = 11{,}500$ *Evaluate for f= 8500.*

The plane's altitude at 9:10 was 11,500 feet.

## Try This: Example 3A

**Write an algebraic expression and use it to evaluate each word problem.**

**A. Taylor orders one pizza for dinner. The 16 pieces are to be divided equally among *p* people. If she divides them equally among 4 people, how many pieces can each person get?**

$16 \div p$ *Separate the pieces into p equal groups.*

$16 \div 4 = 4$ *Evaluate for $p = 4$.*

Each person gets 4 pieces.

## Try This: Example 3B

**B. Gasoline costs $1.39 per *n* gallons. What will the cost be for 10, 12, 14, and 15 gallons?**

$\$1.39 \cdot n$ *Combine n equal amounts of $1.39.*

$\$1.39n$ *In dollars*

| *n* | $\$1.39 \cdot n$ | Cost |
|---|---|---|
| 10 | $\$1.39 \cdot 10$ | $13.90 |
| 12 | $\$1.39 \cdot 12$ | $16.68 |
| 14 | $\$1.39 \cdot 14$ | $19.46 |
| 15 | $\$1.39 \cdot 15$ | $20.85 |

*Evaluate for n = 10, 12, 14, and 15.*

## Try This: Example 3C

**C. After Kyle took his road trip, his car had 39,857 miles on the odometer. Before the trip, his odometer read *m* miles less than 39,857. If he traveled 739 miles on the trip, what was the mileage on his car before he started the trip?**

$39{,}857 - m$ *Subtract m miles from 39,857.*

$39{,}857 - 739 = 39{,}118$ *Evaluate for $m = 739$.*

The mileage on his car before he started the trip was 39,118 miles.

## Additional Example 3A

**A. Jan took a 34-mile trip in her car, and the odometer showed 16,550 miles at the end of the trip. What was the original odometer reading?**

| odometer reading at the beginning of the trip | + | miles traveled | = | odometer reading at the end of the trip |
|---|---|---|---|---|
| Solve: $x$ | + | 34 | = | 16,550 |

$x + 34 = 16{,}550$

$-34 \quad -34$ *Subtract 34 from both sides.*

$x + 0 = 16{,}516$

$x = 16{,}516$

The original odometer reading was 16,516 miles.

## Additional Example 3B

**B. From 1980 to 2000, the population of a town increased from 895 residents to 1125 residents. What was the increase in population during that 20-year period?**

| initial population | + | increase in population | = | population after increase |
|---|---|---|---|---|
| Solve: 895 | + | $n$ | = | 1125 |

$895 + n = 1125$

$-895 \quad -895$ *Subtract 895 from both sides.*

$0 + n = 230$

$n = 230$

The increase in population was 230.

## Try This: Example 3A

**A. Isabelle earned $27 interest and now has a balance of $535 in the bank. What was her balance before interest was added?**

| balance before interest | + | interest earned | = | balance after interest |
|---|---|---|---|---|
| Solve: $x$ | + | 27 | = | 535 |

$x + 27 = 535$

$-27 \quad -27$ *Subtract 27 from both sides.*

$x + 0 = 508$

$x = 508$

Isabelle had a balance of $508 before interest was added.

## Try This: Example 3B

**B. From June to July, the water level in a lake has increased from 472 feet to 502 feet. What was the increase in water level during that 1-month period?**

| initial water level | + | increase in water level | = | water level after increase |
|---|---|---|---|---|
| Solve: 472 | + | $n$ | = | 502 |

$472 + n = 502$

$-472 \quad -472$ *Subtract 472 from both sides.*

$0 + n = 30$

$n = 30$

The increase in water level was 30 feet.

## Additional Example 3: Food Application

Joe has enough flour to bake one sheet cake but would rather make cookies. How many dozen cookies can he make?

| Dessert | Cups of Flour |
|---|---|
| Apple crisp | 1.5 |
| Bread pudding | 4 |
| Cookies (1 doz.) | 2 |
| Pumpkin pie | 1 |
| Sheet cake | 8 |
| Tiramisu | 3 |

## Additional Example 3 Continued

| cups of flour for 1 dozen cookies | • | number of dozen cookies | = | cups of flour in 1 cake |
|---|---|---|---|---|
| 2 | • | $c$ | = | 8 |

$2c = 8$ *Write the equation.*

$\frac{2c}{2} = \frac{8}{2}$ *Divide both sides by 2.*

$c = 4$

Joe can make 4 dozen cookies with the same amount of flour that he would need for 1 sheet cake.

## Try This: Example 3

| cups of flour for bread pudding | • | number of bread pudding desserts | = | cups of flour in 1 cake |
|---|---|---|---|---|
| 4 | • | $b$ | = | 8 |

$4b = 8$ *Write the equation.*

$\frac{4b}{4} = \frac{8}{4}$ *Divide both sides by 4.*

$c = 2$

Joe can make 2 bread pudding desserts with the same amount of flour that he would need for 1 sheet cake.

## Additional Example 4: Money Application

**Meg has saved $50, which is one-fourth of the amount she needs for a school trip. What is the total amount she needs?**

| fraction of amount raised so far | • | total amount needed | = | amount raised so far |
|---|---|---|---|---|
| $\frac{1}{4}$ | • | $x$ | = | 50 |

$\frac{1}{4}x = 50$ *Write the equation.*

$4 \cdot \frac{1}{4}x = 4 \cdot 50$ *Multiply both sides by 4.*

$x = 200$

Meg needs $200 total.

## Try This: Example 4

**The school library needs money to complete a new collection. So far, the library has raised $750, which is only one-eighth of what they need. What is the total amount needed?**

| fraction of total amount raised so far | • | total amount needed | = | amount raised so far |
|---|---|---|---|---|
| $\frac{1}{8}$ | • | $x$ | = | 750 |

$\frac{1}{8}x = 750$ *Write the equation.*

$8 \cdot \frac{1}{8}x = 8 \cdot 750$ *Multiply both sides by 4.*

$x = 6000$

The library needs to raise a total of $6000.

## Additional Example 3: Problem Solving Application


Sarah heard on the morning news that the temperature had dropped 26 degrees since midnight. In the morning, the temperature was –8°F. What was the temperature at midnight?

## Additional Example 3 Continued

**1 Understand the Problem**

The **answer** is the temperature at midnight.

List the **important information:**

• The temperature dropped 26 degrees since midnight. In the morning it was –8°F.

Show the **relationship** or the information:

| temperature at midnight | – | degrees that temperature dropped | = | morning temperature |
|---|---|---|---|---|

## Additional Example 3 Continued

**2 Make a Plan**

**Write an equation** and solve it**.** Let $t$ represent the temperature at midnight and use the equation model. $t - 26 = -8$

**3 Solve**

$t - 26 = -8$

$+ 26 \quad + 26$ *Add 26 to both sides.*

$t = 18$

The temperature at midnight was 18° F.

## Additional Example 3 Continued

**4 Look Back**

The temperature at midnight was positive. Its value is less than the absolute value of the drop in temperature. This makes sense, since the morning temperature was negative.

## Try This: Example 3


Tim has two tug boats in a pulling contest. The boat on the left was pulling with a force of 23 tons. If the net force is 50 tons, what force is the boat on the right exerting on the rope?

## Try This: Example 3 Continued

**1 Understand the Problem**

The **answer** is the force that the right tug boat is exerting.

List the **important information:**

- The boat on the left pulls with a force of 23 tons.
- The net force is 50 tons.

Show the **relationship** of the information:

net force = left boat's force + right boat's force

## Try This: Example 3 Continued

**2 Make a Plan**

**Write an equation** and solve it. Let $f$ represent the force in tons.

$$50 = 23 + f$$

**3 Solve**

$$\begin{array}{rl} 50 = & 23 + f \\ \underline{-23} & \underline{-23} \\ 27 = & f \end{array}$$

*Add –23 to both sides.*

The right boat is exerting a force of 27 tons.

## Try This: Example 3 Continued

**4 Look Back**

The left tug boat was pulling at a force of 23 tons to the left. The total force on the tow rope was 50 tons. Since 23 tons is less than half the force, the tug boat on the right was advancing forward in a positive direction while the left tug boat was moving backward in a negative direction.