

# Writing Linear Expressions

Name: \_\_\_\_\_

## Prerequisite: Identify Equivalent Expressions

**Study the example problem showing how to write equivalent linear expressions. Then solve problems 1–8.**

### Example

Mia babysits some children after school. For each child, she charges  $x + 2$  dollars per hour. One day she cared for 2 children for 3 hours each. She paid \$4 per child for materials for activities. Two students wrote expressions for the amount of money Mia earned. Are their expressions equivalent?

Paolo wrote the expression  $3(x + 2) + 3(x + 2) - 8$ .

Carla wrote the expression  $(3x + 6) - 4 + (3x + 6) - 4$ .

Simplify the expressions to see whether they are equivalent.

#### Paolo's Expression

$$\begin{aligned} 3(x + 2) + 3(x + 2) - 8 \\ = 3x + 6 + 3x + 6 - 8 \\ = 6x + 4 \end{aligned}$$

#### Carla's Expression

$$\begin{aligned} (3x + 6) - 4 + (3x + 6) - 4 \\ = 3x + 3x + 6 + 6 - 4 - 4 \\ = 6x + 4 \end{aligned}$$

The expressions are equivalent.

- 1** Why did Paolo add  $3(x + 2)$  to itself and subtract 8?

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- 2** What is the meaning of each part of Carla's expression?

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- 3** How do you know that Paolo's and Carla's expressions are equivalent?

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### Vocabulary

#### equivalent expressions

expressions that have the same value for every value of the variable.

$2(x + 1)$  and  $2 + 2x$  are equivalent expressions.



**Solve.**

- 4 Is the expression  $3\left(x + 1\frac{1}{2}\right) - 3$  equivalent to  $3x + 1\frac{1}{2}$ ? Explain.

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- 5 Is  $-\frac{1}{2}n + 1\frac{1}{2}n + 3 - n$  equivalent to 3? Explain.

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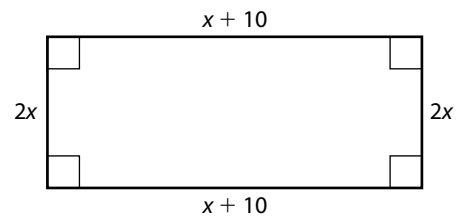
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- 6 Brady said that the expression  $2.6x - (1.3x - 4.5)$  is equivalent to  $1.3x - 4.5$ . Is he correct? If not, explain his error.

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- 7 Faye says that the perimeter of the rectangle shown is  $2x + (x + 10) + 2x + (x + 10)$ . Khai says that the perimeter is  $2(2x) + 2(x + 10)$ . Jesse says that the perimeter is  $4x + 20$ . Who is correct? Explain.



**Show your work.**

*Solution:* \_\_\_\_\_

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- 8 If  $a$ ,  $b$ , and  $c$  are constants, is  $a(x - b) - c = ax - (ab + c)$ ? Explain.

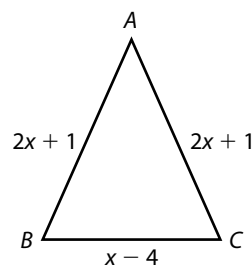
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## Writing Equivalent Expressions

**Study the example showing different ways to write an expression for a problem. Then solve problems 1–7.**

### Example

The distance from Ari's house,  $A$ , to Ben's house,  $B$ , is equal to the distance from Ari's house to Cal's house,  $C$ . One day the boys all met at Ari's house, and then they went to Ben's house and from there to Cal's house. Then Ari and Ben went home. Ari and Cal each wrote expressions for the distance they walked.



$$\text{Ari's travel distance} = (2x + 1) + (x - 4) + (2x + 1)$$

$$\text{Cal's travel distance} = 2(2x + 1) + (x - 4)$$

- 1** Did Ari and Cal walk the same distance? Explain.

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- 2** In the expression for Cal's distance, why is  $(2x + 1)$  multiplied by 2?

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- 3** Cindy wrote the expression  $2x + 2x + x + 1 + 1 - 4$  to represent Ari's distance. Is her expression correct? Explain.

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- 4** Did Ben walk the same distance as the other two boys? Use an expression to explain your answer.

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**Solve.**

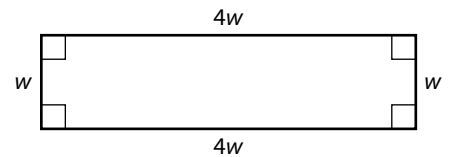
- 5 The perimeter of a square is given as  $8x + 20$ . Write two different expressions for the perimeter. Use factoring to write one of the expressions.

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- 6 The length of a rectangle is 4 times its width. Write three different expressions to describe its perimeter. Explain how you wrote each expression.



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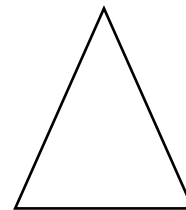
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- 7 Each of the two congruent sides of an isosceles triangle has length  $2x - 1.5$ , and the third side has length  $x + 3$ . Label the sides of the triangle. Then write two equivalent expressions for its perimeter.



**Show your work.**

*Solution:* \_\_\_\_\_

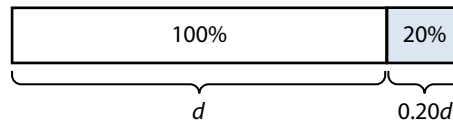
## Equivalent Expressions with Percents

**Study the example showing how to write equivalent expressions with percents. Then solve problems 1–6.**

### Example

The number of blood donors at an annual drive increased this year by 20% from last year. If there were  $d$  donors last year, write two different expressions for the number of donors this year.

First you can draw a bar model to help you understand the problem. Then write the expressions.



$$\begin{aligned} \text{Number this year} &= 120\% \text{ of number last year} \\ &= 1.20d \end{aligned}$$

$$\begin{aligned} \text{Number this year} &= 100\% \text{ of number last year} + 20\% \text{ of number last year} \\ &= d + 0.20d \end{aligned}$$

- 1** Show that the expressions in the example are equivalent.

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- 2** There were 165 donors last year. Find the number of donors this year using each of the expressions. Do you get the same number with each of the expressions?

**Show your work.**

*Solution:* \_\_\_\_\_

- 3** Write an expression to represent the number of donors this year if the number of donors this year is 20% less than last year.

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**Solve.**

**4** The price of a set of headphones that regularly sells for \$99 increases by 30%.

**a.** What is the sum  $100\% + 30\%$ ? How can you use that sum to write an expression for the new price?

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**b.** Write two different expressions that you can use to find the new price. Show that they are equivalent.

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**5** The triangle shown is reduced to form a similar triangle that is 40% smaller than its current size. Write two equivalent expressions for each new length.

**a.**  $AB$  \_\_\_\_\_

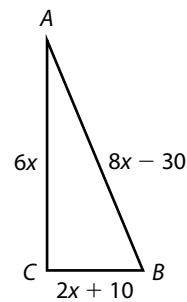
**b.**  $AC$  \_\_\_\_\_

**c.**  $BC$  \_\_\_\_\_

**d.** Write an expression in simplified form for the perimeter of the reduced triangle.

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**6** A camcorder with a price of \$300 is discounted 25%. Later, the same camcorder is discounted again by another 15%.

**a.** What is the price after the second discount? Explain.

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**b.** Chris says that the two discounts are equivalent to a single discount of  $25\% + 15\%$ , or 40%. Do you agree? Explain.

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## Writing Linear Expressions

Solve the problems.

- 1 A store owner who bought comforters for  $x$  dollars is marking them up 60%. Write two expressions that represent the selling price and show that they are equivalent.

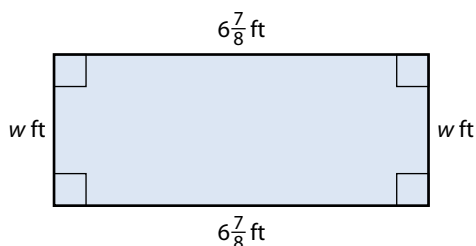
**Show your work.**

To mark something up means to increase the price.



Solution: \_\_\_\_\_

- 2 A rug is  $6\frac{7}{8}$  feet long and  $w$  feet wide. Which expression does NOT represent the perimeter of the rug in feet? Circle the correct answer.



- A  $2\left(6\frac{7}{8} + w\right)$       C  $2\left(6\frac{7}{8}\right) + w$   
 B  $2w + 13\frac{6}{8}$       D  $6\frac{7}{8} + w + 6\frac{7}{8} + w$

How do you find the perimeter of a rectangle?



- 3 Which of the following expressions are equivalent to  $4x - 8$ ? Select all that apply.

- A  $2(2x - 8)$   
 B  $(2x - 4) + (2x - 4)$   
 C  $x + x + x + x + 2 + 2 + 2 + 2$   
 D  $4(x - 2)$

Jesse chose **A** as his answer. How did he get that answer?

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What makes two expressions equivalent?



**Solve.**

**4** For each expression, select Yes or No to indicate whether the expression could be used to represent a 30% discount. Let  $x$  represent the original amount.

- |                 |                              |                             |
|-----------------|------------------------------|-----------------------------|
| a. $x - 0.7$    | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| b. $0.3(x - 1)$ | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| c. $0.7x$       | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| d. $x - (0.3x)$ | <input type="checkbox"/> Yes | <input type="checkbox"/> No |

What does a discount do to the original price?



**5** Six bakers use a total of  $12x - 3.6$  pounds of flour each hour. If each baker uses the same amount of flour, find an expression for the number of pounds each baker uses in an hour. Then write an expression equivalent to  $12x - 3.6$  to represent the total flour used in an hour.

**Show your work.**

Is the fact that they use the same amount important?



Solution: \_\_\_\_\_  
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**6** Alice is paying her bill at a restaurant. The tax on the cost of her meal is 5%. She decides to leave a tip of 20% of the cost of the meal plus the tax. Write an expression for her total bill if the cost of her meal is  $m$  dollars. Write your answer in simplified form.

**Show your work.**

How can you write a percent as a decimal?



Solution: \_\_\_\_\_