GRADE 7 · UNIT 9 · LESSON 8

Equivalent Expressions Using Properties of Operations

MA.7.AR.1.2

I can use the distributive property and combining like terms to decide whether two linear expressions are equivalent, and to write equivalent forms of an expression.

Warm-Up

1. Find the value of $-2m + 7$ when $m = -1.5$.
2. Find the difference: $(3.2x - 1) - (1.2x + 4)$
3. Find the value: $\frac{2}{3} \times (-9)$
4. Rewrite with the fewest terms: $5(x + 2)$

Warm-Up

1. Find the value of $-2m + 7$ when $m = -1.5$. **10**
2. Find the difference: $(3.2x - 1) - (1.2x + 4)$ $2x - 5$
3. Find the value: $\frac{2}{3} \times (-9)$ **−6**
4. Rewrite with the fewest terms: $5(x + 2)$ $5x + 10$

Vocabulary

distribute

multiply the factor outside by every term inside: $2(3x - 1)$ is $6x - 2$

fewest terms

like terms combined, nothing left to combine: $6x - 2 + x$ is $7x - 2$ with the fewest terms

equivalent

the same value for every x: $7x - 2$ and $2(3x - 1) + x$

simplify

IXL's and the state's word for rewriting with the fewest terms

Notes

I. Distribute a fraction, distribute a negative

$$\frac{1}{2}(4x - 6) = 2x - 3 \qquad -\frac{1}{2}(4x - 6) = -2x + 3$$

$$\frac{2}{3}(9 - 3x) = 6 - 2x$$

The factor reaches every term. A negative factor changes every sign.

Notes

II. Rewrite both until they match

$$4(2x + 3) = 8x + 12 \qquad 2(4x + 6) = 8x + 12$$

Both become 8x + 12: equivalent. Rewrite each with the fewest terms; the same expression means equivalent for every x.

Notes

III. Distribute, then combine — and compare every term

$$\frac{4}{3}(6 - x) - 3x = 8 - \frac{4}{3}x - 3x = 8 - \frac{13}{3}x$$

$$8 - \frac{13}{3}x \neq 8 - \frac{5}{3}x$$

Not equivalent to $8 - (5/3)x$: the x-terms differ. Distribute, combine, then compare the x-terms and the constants separately.

Notes

IV. One expression has many equivalent forms

$$\frac{3}{4}x - 1 = \frac{1}{2}x + \frac{1}{4}x - 1 = 0.75x - 1 = -1 + \frac{3}{4}x$$

Many forms, one expression. A form that is not the simplest is still equivalent.

Example 1

Is $-3(2y - 5) + 4y$ equivalent to $15 - 2y$?

Rewrite the first with the fewest terms, then decide.

Example 1

$$-3(2y - 5) + 4y = -6y + 15 + 4y$$

$$= -2y + 15$$

Yes: $-2y + 15 = 15 - 2y$

Answer: Yes — equivalent

Your Turn

Is $-2(3a - 4) + 5a$ equivalent to $8 - a$?

Rewrite the first with the fewest terms, then decide.

Your Turn

Is $-2(3a - 4) + 5a$ equivalent to $8 - a$?

Rewrite the first with the fewest terms, then decide.

$$-2(3a - 4) + 5a = -6a + 8 + 5a$$

$$= -a + 8. \text{ Yes.}$$

Answer: Yes — equivalent

Example 2

Match each expression to its equivalent form.

$2(3x - 1) + x$ $4x - (3 - x)$ $-(x - 4) + 3x$ $\frac{1}{2}(10x + 4) - 3$

$5x - 1$ $2x + 4$ $7x - 2$ $5x - 3$

Rewrite each with the fewest terms, then match.

Example 2

$$2(3x - 1) + x = 7x - 2$$

$$4x - (3 - x) = 5x - 3$$

$$-(x - 4) + 3x = 2x + 4$$

$$\frac{1}{2}(10x + 4) - 3 = 5x - 1$$

Answer: 7x – 2, 5x – 3, 2x + 4, 5x – 1 — the third, fourth, second and first

Your Turn

$3(2x + 1) - x$ $6x - (3 - x)$ $-(2x - 5) + 4x$ $\frac{1}{3}(15x + 6) - 1$

$2x + 5$ $5x + 1$ $5x + 3$ $7x - 3$

Match each to its equivalent form; rewrite first.

Your Turn

$3(2x + 1) - x$ $6x - (3 - x)$ $-(2x - 5) + 4x$ $\frac{1}{3}(15x + 6) - 1$

$2x + 5$ $5x + 1$ $5x + 3$ $7x - 3$

Match each to its equivalent form; rewrite first.

$5x + 3,\ 7x - 3,\ 2x + 5,\ 5x + 1$ — not in order

Answer: 5x + 3, 7x – 3, 2x + 5, 5x + 1 — the third, fourth, first and second

Whiteboards · Question 1 of 9

$\frac{1}{2}(6x + 4)$

Rewrite with the fewest terms.

Answer it.

Whiteboards · Question 1 of 9

$\frac{1}{2}(6x + 4)$

Rewrite with the fewest terms.

$\frac{1}{2}(6x) + \frac{1}{2}(4)$: two arrows

$= 3x + 2$

Answer: 3x + 2

Whiteboards · Question 2 of 9

$$-\frac{1}{2}(6x + 4)$$

Rewrite with the fewest terms.

Answer it.

Whiteboards · Question 2 of 9

$-\frac{1}{2}(6x + 4)$

Rewrite with the fewest terms.

$-\frac{1}{2}(6x) - \frac{1}{2}(4)$: both signs flip

$= -3x - 2$

Answer: $-3x - 2$

Whiteboards · Question 3 of 9

$$-\frac{1}{2}(6x - 4)$$

Rewrite with the fewest terms.

Answer it.

Whiteboards · Question 3 of 9

$-\frac{1}{2}(6x - 4)$

Rewrite with the fewest terms.

$-\frac{1}{2}(6x) + \frac{1}{2}(4)$: a negative times a negative

$= -3x + 2$

Answer: $-3x + 2$

Whiteboards · Question 4 of 9

$$-2(4x - 3)$$

A. $-8x + 6$

B. $-8x - 3$

C. $-8x - 6$

D. $8x - 6$

Answer it.

Whiteboards · Question 4 of 9

$$-2(4x - 3)$$

$-2(4x) = -8x$ and $-2(-3) = 6$

$-8x + 6$

Answer: A — $-8x + 6$

Whiteboards · Question 5 of 9

Jo, who is 12, says $3(x + 2)$ and $2(x + 3)$ are equivalent.

Is Jo right? Rewrite both.

Answer it.

Whiteboards · Question 5 of 9

Jo, who is 12, says $3(x + 2)$ and $2(x + 3)$ are equivalent.

Is Jo right? Rewrite both.

$3(x + 2) = 3x + 6$ and $2(x + 3) = 2x + 6$

No. The x-terms differ.

Answer: No — 3x + 6 and 2x + 6

Whiteboards · Question 6 of 9

Which are equivalent to $6x - 9$?

Select all that apply.

A. $3(2x + 3)$

B. $2(3x - 9)$

C. $-9 + 6x$

D. $3(2x - 3)$

E. $4x + 2x - 9$

Answer it.

Whiteboards · Question 6 of 9

Which are equivalent to $6x - 9$?

Select all that apply.

$3(2x - 3) = 6x - 9$; $-9 + 6x$ is commutative; $4x + 2x - 9 = 6x - 9$

$3(2x + 3) = 6x + 9$ and $2(3x - 9) = 6x - 18$: no

Answer: C, D and E

Whiteboards · Question 7 of 9

Rewrite $4y + (2y + 7) - 3$ using only the associative property.

Then using only the commutative property.

Answer it.

Whiteboards · Question 7 of 9

Rewrite $4y + (2y + 7) - 3$ using only the associative property.

Then using only the commutative property.

Associative: $(4y + 2y) + 7 - 3$ — the grouping moves

Commutative: $(2y + 7) + 4y - 3$ — the order moves

Answer: (4y + 2y) + 7 – 3; (2y + 7) + 4y – 3 (other orders count)

Whiteboards · Question 8 of 9

Nia's ribbon is $\left(2\frac{1}{2}r + 1\right)$ feet long and Owen's is $\left(\frac{3}{4}r + 2\frac{1}{2}\right)$ feet long.

How much longer is Nia's ribbon?

Answer it.

Whiteboards · Question 8 of 9

Nia's ribbon is $\left(2\frac{1}{2}r + 1\right)$ feet long and Owen's is $\left(\frac{3}{4}r + 2\frac{1}{2}\right)$ feet long.

How much longer is Nia's ribbon?

$$\left(\frac{5}{2}r + 1\right) - \left(\frac{3}{4}r + \frac{5}{2}\right) = \frac{5}{2}r - \frac{3}{4}r + 1 - \frac{5}{2}$$

$$= \frac{7}{4}r - \frac{3}{2}$$

Answer: 1¾r – 1½ feet

Whiteboards · Question 9 of 9

A rectangle has sides $x + 3$ and $2x$.

Ren writes its perimeter as $2(x + 3) + 2(2x)$. Sam writes $6x + 6$.

Are they equivalent? Show it.

Write your answer in sentences.

Whiteboards · Question 9 of 9

A rectangle has sides $x + 3$ and $2x$.

Ren writes its perimeter as $2(x + 3) + 2(2x)$. Sam writes $6x + 6$.

Are they equivalent? Show it.

$$2(x + 3) + 2(2x) = 2x + 6 + 4x$$

$$= 6x + 6.$$ Yes — the same expression.

Answer: Yes. $2(x + 3) + 2(2x) = 2x + 6 + 4x = 6x + 6$, Sam's expression exactly.

Independent Practice

1. Rewrite with the fewest terms: $\frac{1}{3}(9x + 6)$
2. Rewrite with the fewest terms: $-\frac{1}{3}(9x + 6)$
3. Rewrite with the fewest terms: $-2(3x - 5)$
4. Are $2(x + 4)$ and $4(x + 2)$ equivalent? Rewrite both.
5. Is $-2(y - 3) + 5y$ equivalent to $3y + 6$? Rewrite the first.
6. Rewrite $3y + (5y + 2) - 1$ using only the commutative property.

Before You Go

Distribute to every term. Combine like terms. Then compare the x-terms and the constants.

Two equivalent forms of $\frac{2}{3}x + 4$: $\frac{1}{3}x + \frac{1}{3}x + 4$, and $4 + \frac{2}{3}x$.

The practice test goes home today. Tomorrow is the spiral day; the test is Monday.

IXL

1. Open IXL and start today's skills.
2. Work on paper where the question needs work. The answer box does not show it.
3. Every skill listed is required, to a SmartScore of 60. Due by the Unit 9 test.

Today's skills — all required

Write equivalent expressions using properties (6XR)
Identify equivalent linear expressions I (DRB)
Identify equivalent linear expressions II (KAR)
Identify equivalent linear expressions using algebra tiles (38V)
Multiply using the distributive property (NUY)