GRADE 7 · UNIT 9 · LESSON 5

Equivalent Numerical Expressions

MA.7.AR.1.2

I can use properties of operations to decide whether two numerical expressions are equivalent.

Warm-Up

1. Find the difference: $(2.5x - 4) - (x - 1.5)$
2. Find the sum: $(3m + 1) + (2m - 4)$
3. Find the value: -2×3.5
4. Name the property: $4 + 9 = 9 + 4$

Warm-Up

1. Find the difference: $(2.5x - 4) - (x - 1.5)$ $1.5x - 2.5$
2. Find the sum: $(3m + 1) + (2m - 4)$ $5m - 3$
3. Find the value: -2×3.5 **-7**
4. Name the property: $4 + 9 = 9 + 4$ **commutative**

Vocabulary

equivalent

two expressions that name the same value: 3(4 + ½) and 12 + 1½ are equivalent

commutative property

the order of adding, or of multiplying, does not matter: 4 + 9 = 9 + 4

associative property

the grouping of adding, or of multiplying, does not matter: (2 + 3) + 5 = 2 + (3 + 5)

distributive property

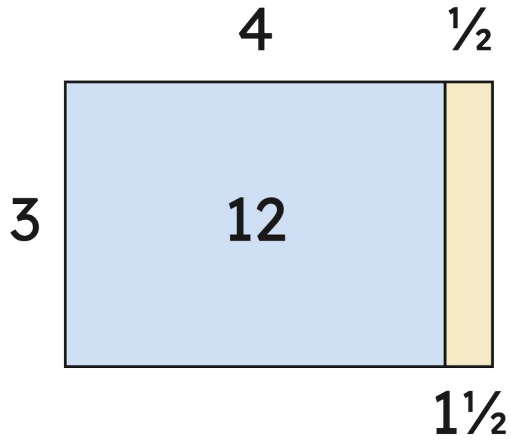
a factor outside a group reaches every term inside: 3(4 + ½) = 3 × 4 + 3 × ½

identity property

adding 0, or multiplying by 1, changes nothing: 2.5 + 0 = 2.5 and 2.5 × 1 = 2.5

Notes

I. The distributive property is a rectangle



$$3\left(4+\frac{1}{2}\right)=12+1\frac{1}{2}$$

One area, two ways: 3 × 4½, or 12 + 1½. The same area, so the two are equivalent.

Notes

II. The properties, named

Commutative (order): $2.5 + 6 = 6 + 2.5$ and $2.5 \times 6 = 6 \times 2.5$

Associative (grouping): $(0.4 + 1.6) + 3 = 0.4 + (1.6 + 3)$

Distributive (reach): $5\left(2 + \frac{1}{5}\right) = 10 + 1$

Identity (nothing changes): $2.5 + 0 = 2.5$ and $2.5 \times 1 = 2.5$

Notes

III. What is not commutative, and what a negative factor reaches

$7 - 2 = 5$ but $2 - 7 = -5$: subtraction is not commutative.

$7 + (-2) = (-2) + 7$: as addition, it does.

$-3\left(4 + \frac{1}{2}\right) = -12 - 1\frac{1}{2}$, not $-12 + \frac{1}{2}$: the negative reaches both.

Example 1

Are $-2\left(5-\frac{3}{4}\right)$ and $-10+1\frac{1}{2}$ equivalent?

Decide, and name the property.

Example 1

$$-2 \times 5 = -10$$

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

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

Answer: Yes — the distributive property

Your Turn

Are $-5\left(2-\frac{2}{5}\right)$ and $-10+2$ equivalent?

Decide, and name the property.

Your Turn

Are $-5\left(2-\frac{2}{5}\right)$ and $-10+2$ equivalent?

Decide, and name the property.

$-5 \times 2 = -10$ and $-5 \times \left(-\frac{2}{5}\right) = 2$

Yes: the distributive property. Both sides are $-10+2=-8$.

Answer: Yes — the distributive property

Example 2

Which properties turn $2.5 \times (-8) \times 4$ into $(2.5 \times 4) \times (-8)$?

Name them, then find the value.

Example 2

$$2.5 \times (-8) \times 4 = 2.5 \times 4 \times (-8)$$

$$= (2.5 \times 4) \times (-8)$$

$$= 10 \times (-8) = -80$$

Answer: Commutative, then associative; –80

Your Turn

Which properties turn $0.25 \times (-9) \times 8$ into $(0.25 \times 8) \times (-9)$?

Name them, then find the value.

Your Turn

Which properties turn $0.25 \times (-9) \times 8$ into $(0.25 \times 8) \times (-9)$?

Name them, then find the value.

Commutative, then associative.

$0.25 \times 8 = 2$

$2 \times (-9) = -18$

Answer: Commutative, then associative; –18

Whiteboards · Question 1 of 9

Are $3\left(5+\frac{1}{2}\right)$ and $15+1\frac{1}{2}$ equivalent?

Yes or no, and the property.

Answer it.

Whiteboards · Question 1 of 9

Are $3\left(5+\frac{1}{2}\right)$ and $15+1\frac{1}{2}$ equivalent?

Yes or no, and the property.

$3\times 5=15$ and $3\times\frac{1}{2}=1.5$

Yes: the distributive property. Both sides are $15+1.5=16.5$.

Answer: Yes — distributive

Whiteboards · Question 2 of 9

Are $3\left(5-\frac{1}{2}\right)$ and $15-1\frac{1}{2}$ equivalent?

Yes or no, and the property.

Answer it.

Whiteboards · Question 2 of 9

Are $3\left(5-\frac{1}{2}\right)$ and $15-1\frac{1}{2}$ equivalent?

Yes or no, and the property.

$3\times 5=15$ and $3\times\left(-\frac{1}{2}\right)=-1.5$

Yes: the distributive property. Both sides are $15-1.5=13.5$.

Answer: Yes — distributive

Whiteboards · Question 3 of 9

Are $-3\left(5-\frac{1}{2}\right)$ and $-15+1\frac{1}{2}$ equivalent?

Yes or no, and the property.

Answer it.

Whiteboards · Question 3 of 9

Are $-3\left(5-\frac{1}{2}\right)$ and $-15+1\frac{1}{2}$ equivalent?

Yes or no, and the property.

$-3\times 5=-15$ and $-3\times\left(-\frac{1}{2}\right)=1.5$

Yes: the distributive property. Both sides are $-15+1.5=-13.5$.

Answer: Yes — distributive

Whiteboards · Question 4 of 9

Which expression is equivalent to $-4\left(3-\frac{1}{2}\right)$**?**

A. $-12-2$

B. $-12+\frac{1}{2}$

C. $12-2$

D. $-12+2$

Answer it.

Whiteboards · Question 4 of 9

Which expression is equivalent to $-4\left(3-\frac{1}{2}\right)$**?**

$$-4 \times 3 = -12$$

$$-4 \times \left(-\frac{1}{2}\right) = +2$$

$$-12 + 2$$

Answer: D — −12 + 2

Whiteboards · Question 5 of 9

Are $7 - 2$ and $2 - 7$ equivalent?

Yes or no, and why.

Answer it.

Whiteboards · Question 5 of 9

Are $7 - 2$ and $2 - 7$ equivalent?

Yes or no, and why.

$7 - 2 = 5$ and $2 - 7 = -5$

No. Subtraction is not commutative.

Answer: No — subtraction is not commutative

Whiteboards · Question 6 of 9

Marco, who is 12, says $7 + (-2)$ and $(-2) + 7$ are equivalent.

Is he right, and why?

Answer it.

Whiteboards · Question 6 of 9

Marco, who is 12, says $7 + (-2)$ and $(-2) + 7$ are equivalent.

Is he right, and why?

$$7 + (-2) = 5 \text{ and } (-2) + 7 = 5$$

Yes. Addition is commutative.

Answer: Yes — commutative

Whiteboards · Question 7 of 9

Are $7 \div (-2)$ and $(-2) \div 7$ equivalent?

Yes or no, and why.

Answer it.

Whiteboards · Question 7 of 9

Are $7 \div (-2)$ and $(-2) \div 7$ equivalent?

Yes or no, and why.

$$7 \div (-2) = -3.5 \text{ and } (-2) \div 7 = -\frac{2}{7}$$

No. Division is not commutative.

Answer: No — division is not commutative

Whiteboards · Question 8 of 9

What is the value of $3 + 4(2 - 6)$**?**

A. -13

B. 19

C. -28

D. 5

Answer it.

Whiteboards · Question 8 of 9

What is the value of $3 + 4(2 - 6)$**?**

Inside first: $2 - 6 = -4$

Multiply before adding: $4(-4) = -16$

$3 - 16 = -13$

Answer: A — −13

Whiteboards · Question 9 of 9

$4 \times (2.5 + 0.3)$ and $10 + 1.2$

Show they are equivalent without finding either total. Name the property.

Write your answer in sentences.

Whiteboards · Question 9 of 9

$4 \times (2.5 + 0.3)$ and $10 + 1.2$

Show they are equivalent without finding either total. Name the property.

$4 \times 2.5 = 10$ and $4 \times 0.3 = 1.2$: the distributive property.

Answer: $4 \times 2.5 = 10$ and $4 \times 0.3 = 1.2$, so they are equivalent by the distributive property.

Independent Practice

1. Are $2\left(6+\frac{1}{2}\right)$ and $12+1$ equivalent? Name the property.
2. Are $-2\left(6-\frac{1}{2}\right)$ and $-12+1$ equivalent? Name the property.
3. Are $9-4$ and $4-9$ equivalent? Explain.
4. Are $\frac{3}{4}\times 8$ and $8\times\frac{3}{4}$ equivalent? Name the property.
5. Are $(4+6)+9$ and $4+(6+9)$ equivalent? Name the property.
6. Are $\frac{1}{2}(10-4)$ and $5-2$ equivalent? Name the property.

Before You Go

Equivalent: the same thing, written two ways.

Order, grouping, reach: commutative, associative, distributive.

Tomorrow: use the properties to make hard arithmetic easy.

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. No new skill today: the plan lists none for 9.05. Keep KCX and 6BT going to 60: every Unit 9 skill is due by the Unit 9 test.

Today's skills — all required

Subtract linear expressions (KCX)

Add and subtract linear expressions (6BT)