

KEY POINTS

Section 2.1 Reordering & Regrouping

- You can make any change to an expression, providing you do not change its value. Such changes are:
 - Reordering
 - Regrouping
 - Rewriting subtraction as addition; rewriting division as multiplication
 - Combining like terms

Section 2.2 The Distributive Law

- The distributive law is fundamental to many algebraic transformations
- The distributive law allows us to multiply a sum by a single term
- Taking out a common factor is using the distributive law in reverse

Warm - Up

Section 2.1

Reordering &
Regrouping

Solve the following equations.

1. $-11 = \frac{1}{5}s$

$$\cdot 2 \quad \frac{1}{5}$$
$$-55 = 5$$

2. $\sqrt{m} = 16^2$

$$m = 256$$

$$\frac{1}{5} = .2$$

$$5 \cdot -11 = \frac{1s}{5} \cdot 5$$

$$-55 = 1s$$

$$(\sqrt{m})^2 = (16)^2$$

$$m = 256$$

Background

Section 2.1 Reordering & Regrouping

Since an expression represents a calculation with numbers, the rules about how we can manipulate expressions come from the rules of arithmetic.

One rule of addition says that we can add two numbers in any order:

$$x + 1 = 1 + x$$

$$x=2 \quad 2+1=1+2$$

However, we **cannot** replace $x - 1$ by $1 - x$, because they usually have different values.

$$5 - 1 = 4 \quad \text{but} \quad 1 - 5 = -4$$

$$x-1 \neq 1-x$$

Background

Section 2.1 Reordering & Regrouping

We can reorder and regroup addition, and reorder and regroup multiplication, without changing the value of a numerical expression.

Example of reordering:

$$3 * 5 = 5 * 3$$
$$15 = 15$$

and

$$3 + 5 = 5 + 3$$
$$8 = 8$$

Example of regrouping:

$$2 * (3 * 5) = (2 * 3) * 5$$
$$2 \cdot 15 = 6 \cdot 5$$
$$30 = 30$$

and $2 + (3 + 5) = (2 + 3) + 5$

$$2 + 8 = 5 + 5$$
$$10 = 10$$

General Rules

Section 2.1

Reordering &
Regrouping

$ab = ba$ and $a + b = b + a$;
for all values of a and b .

Reordering

$a(bc) = (ab)c$ and $a + (b + c) = (a + b) + c$;
for all values of a , b , and c .

Regrouping

Examples

Section 2.1 Reordering & Regrouping

In each of the following, an expression is changed into an equivalent expression by reordering addition, reordering multiplication, regrouping addition, regrouping multiplication, or a combination.

Which principles are used where?

a. $(x + 2)(3 + y) = (3 + y)(x + 2)$

Reordering Multiplication

b. $(2x)x = 2x^2$

Regrouping Multiplication

c. $(2c)d = c(2d)$

Reordering / Regrouping Multiplication

Examples

Section 2.1 Reordering & Regrouping

Consider a rectangle with length l and width w . It has area lw . Triple the length and take half the width to form a new rectangle.

How does the area of the new rectangle compare to the area of the original rectangle?

Original

$$A = lw$$

The new rectangle
is 1.5 times larger
than the original.

New

$$A = (3l)(w/2)$$

$$A = (3l)(\frac{1}{2}w)$$

$$= 3 \cdot \frac{1}{2} \cdot l \cdot w$$

$$= \frac{3}{2} lw \text{ or } 1.5lw$$

Examples

Section 2.1 Reordering & Regrouping

To reorder and regroup correctly with subtraction, we need to remember that subtraction can be rewritten as addition.

Example:

$$3 - 5 = 3 + (-5)$$

$-2 \quad -2$

If $x + y + z = 1$ find the value of $(x+10) + (y-8) + (z+3)$

$$(x) + 10 + (y) + (-8) + (z) + 3$$

$$x + y + z + 10 + (-8) + 3$$

$$\underline{x + y + z + 5}$$

$$1 + 5 = (6)$$

$$(x+10) + (y-8) + (z+3) =$$

Examples

Section 2.1
Reordering &
Regrouping

Combining Like Terms:

Combine like terms in each expression:

a. $3x^2 - 0.5x + 9x - x^2$

$$3x^2 - x^2 - 0.5x + 9x$$

$$2x^2 + 8.5x$$

b. $-z^3 + 5z^3 - 3$

$$4z^3 - 3$$

Practice

Section 2.1

Regrouping &
Reordering

Are the two expressions equivalent?

1. $(3x)(4y)(2x)$ and $24x^2y$

$$3 \cdot 4 \cdot 2 \cdot x \cdot x \cdot y$$
$$24x^2y$$

Practice

Section 2.1

Regrouping &
Reordering

Is the attempt to combine like terms correct?

2. $2x^2 + 3x^3 = 5x^5$

Exponents are not the same
Cannot combine like terms.

Practice

Section 2.1

Regrouping &
Reordering

Write the expression in a simpler form.

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

$$\begin{array}{c} 3x + 4x - 2 - 3 \\ \swarrow \quad \searrow \\ \text{---} 7x - 5 \text{---} \end{array}$$

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1-18, 19, 21
24, 25

Key Points

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Section 2.2 The Distributive Law

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Warm - Up

Section 2.2
The
Distributive
Law

Is $(5x)(4y)(2x)$ equivalent to $40x^2y$?

$$\begin{aligned} 5 \cdot 2 &= 10x^2 \cdot 4y \\ &\quad \underbrace{\hspace{1cm}}_{40x^2y} \\ 5 \cdot 4 \cdot 2 \cdot x \cdot x \cdot y \end{aligned}$$

$$d = rt$$
$$200 = rt$$

$$\frac{r}{2} \cdot 3t$$

$$\frac{1}{2}r \cdot 3t$$

$$3 \cdot \frac{1}{2} \cdot r \cdot t$$

$$\frac{3}{2}rt$$

$$\frac{3}{2} \cdot 200 = \frac{600}{2} = \textcircled{300}$$

Discussion

Section 2.2
The
Distributive
Law

Is $a(b+c)$ equivalent to $ab + ac$?

$$\begin{aligned} a &= 2 \\ b &= 3 \\ c &= 4 \end{aligned}$$

$$\begin{aligned} 2(3+4) &= 2(3) + 2(4) \\ 2(7) &= 6 + 8 \\ 14 &= 14 \end{aligned}$$

$$\begin{aligned} &a(b+c) \\ &ab + ac \end{aligned}$$

Examples

Section 2.2 The Distributive Law

Consider the sales tax formula $p + 0.056p$ derived in the previous chapter. Use the distributive law to express this as $p(1 + 0.056)$ or $1.056p$.

$$p + 0.056p$$

$$1(\cancel{p}) + 0.056(\cancel{p})$$

$$p(1 + 0.056)$$

$$p(1.056) = 1.056p$$

Examples

Section 2.2

The
Distributive
Law

Express $\ominus(c - d) - (d + c)$ in a simpler way.

$$-c + d \ominus (d + c)$$

$$-c + \cancel{d} - \cancel{d} - c$$

$$-c - c$$

$$\cancel{-c - d}$$

$$-1c - 1c$$

$$\boxed{-2c}$$

Examples

Section 2.2
The
Distributive
Law

Use the distributive law to rewrite each expression.

1. $6xy - 2xz$

$$2x(3y - 1z)$$

2. $12pq + 3p$

$$3p(4q + 1)$$

3. $t(\cancel{p+r}) - 7(\cancel{p+r})$

$$(p+r)(t-7)$$

4. $w^2(\cancel{a+2}) + w(\cancel{a+2}) - (\cancel{a+2})$

$$(a+2)(w^2 + w - 1)$$

Examples

Section 2.2 The Distributive Law

Are the two expression equivalent?

1. $10(x + y)$ and $10x + 10y$

$$10x + 10y$$

2. $2(xy)$ and $2x2y$

$$x=2$$

$$y=3$$

$$2(2 \cdot 3)$$

$$2(6)$$

$$(12)$$

$$2(2) \cdot 2(3)$$

$$4 \cdot 6$$

$$24$$

3. $\sqrt{s+t}$ and $\sqrt{s} + \sqrt{t}$

$$s=9$$

$$t=16$$

$$\sqrt{9+16}$$

$$\sqrt{25} = (5)$$

$$\sqrt{9} + \sqrt{16}$$

$$3 + 4 = (7)$$

Examples

Section 2.2

The
Distributive
Law

Use the distributive law to rewrite each expression

1. $-4xyz - 8xy$

2. $-ab + a^2b - ab^2$

Homework

Section 2.1
Regrouping &
Reordering

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Section 2.2
The
Distributive
Law

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