

Section 1.9: Operations with Fractions, Decimals and Percent
Chapter 1: Introduction to Algebra

Properties of real numbers

Property	Addition	Multiplication
Commutative Property	You can add in any order $a + b = b + a$ $2 + 4 = 4 + 2 = 6$	You can multiply in any order $a \times b = b \times a$ $3 \times 4 = 4 \times 3 = 12$
Associative Property	When you add, you can group the numbers in any combination $a + (b + c) = (a + b) + c$ $1 + (3 + 4) = (1 + 3) + 4$	When you multiply, you can group the numbers in any combination $a \times (b \times c) = (a \times b) \times c$ $2 \times (3 \times 5) = (2 \times 3) \times 5$
Identity Property	The sum of zero and any number is the number $a + 0 = a$ $4 + 0 = 4$	The product of 1 and any number is the number $a \times 1 = a$ $3 \times 1 = 3$

1) Rewrite using the associative property of addition: $(x + 2) + y$

2) Rewrite using the associative property of addition: $(y + 2) + x$

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Identity Property	The sum of zero and any number is the number $a + 0 = a$ $4 + 0 = 4$	The product of 1 and any number is the number $a \times 1 = a$ $3 \times 1 = 3$

3) Rewrite using the associative property of multiplication: $6(c \times d)$

4) Rewrite using the associative property of multiplication: $7(a \times b)$

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Identity Property	The sum of zero and any number is the number $a + 0 = a$ $4 + 0 = 4$	The product of 1 and any number is the number $a \times 1 = a$ $3 \times 1 = 3$

5) Rewrite using the commutative property of addition: $x + 5$

6) Rewrite using the commutative property of addition: $y + 9$

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7) Rewrite using the commutative property of multiplication: $x5$

8) Rewrite using the commutative property of multiplication: $y9$

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9) Rewrite using the commutative property of multiplication:

$$(x - 3)7$$

10) Rewrite using the commutative property of multiplication:

$$(x - 2)5$$

The Distributive Property

The ***distributive property*** enables us to simplify expressions that have an expression being multiplied by a single term.

General Algebra	Example
$a(b + c) = ab + ac$	$3(x + 3) = 3x + 9$
$(b + c)a = ba + ca$	$(4 + 2n)5 = 20 + 10n$
$a(b - c) = ab - ac$	$2(3b - 4c) = 6b - 8c$
$(b - c)a = ba - ca$	$(7 - 2x)3 = 21 - 6x$

The Distributive Property

The distributive property lets you multiply a sum by multiplying each addend separately and then add the products.

$$5(6 + 2) = 5 \cdot 6 + 5 \cdot 2$$

$$30 + 10$$

$$5(x + 2) = 5 \cdot x + 5 \cdot 2$$

$$5x + 10$$

$$(5x)(3x + 6) = 5x \cdot 3x + 5x \cdot 6$$

$$15x^2 + 30x$$

11) Rewrite using the distributive property, and simplify: $5(2 + 4)$

12) Rewrite using the distributive property, and simplify: $7(5 + 3)$

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$$15x^2 + 30x$$

13) Rewrite using the distributive property, and simplify: $(7 + 3)8$

14) Rewrite using the distributive property, and simplify: $(5 + 2)9$

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$$5(6 + 2) = 5 * 6 + 5 * 2$$

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$$5(x + 2) = 5 * x + 5 * 2$$

$$5x + 10$$

$$(5x)(3x + 6) = 5x * 3x + 5x * 6$$

$$15x^2 + 30x$$

15) Rewrite using the distributive property, and simplify: $5(10 - 4)$

16) Rewrite using the distributive property, and simplify: $7(5 - 3)$

The Distributive Property

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$a(b + c) = ab + ac$	$3(x + 3) = 3x + 9$
$(b + c)a = ba + ca$	$(4 + 2n)5 = 20 + 10n$
$a(b - c) = ab - ac$	$2(3b - 4c) = 6b - 8c$
$(b - c)a = ba - ca$	$(7 - 2x)3 = 21 - 6x$

The Distributive Property

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$$30 + 10$$

$$5(x + 2) = 5 * x + 5 * 2$$

$$5x + 10$$

$$(5x)(3x + 6) = 5x * 3x + 5x * 6$$

$$15x^2 + 30x$$

17) Rewrite using the distributive property, and simplify: $(2 - 3)8$

18) Rewrite using the distributive property, and simplify: $(1 - 2)9$

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$$5x + 10$$

$$(5x)(3x + 6) = 5x \cdot 3x + 5x \cdot 6$$

$$15x^2 + 30x$$

19) Rewrite using the distributive property: $5(x + y)$

20) Rewrite using the distributive property: $7(a + b)$

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The Distributive Property

The distributive property lets you multiply a sum by multiplying each addend separately and then add the products.

$$5(6 + 2) = 5 \cdot 6 + 5 \cdot 2$$

$$= 30 + 10$$

$$5(x + 2) = 5 \cdot x + 5 \cdot 2$$

$$= 5x + 10$$

$$(5x)(3x + 6) = 5x \cdot 3x + 5x \cdot 6$$

$$= 15x^2 + 30x$$

21) Rewrite using the distributive property: $(c + d)8$

22) Rewrite using the distributive property: $(x + y)9$

The Distributive Property

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$a(b + c) = ab + ac$	$3(x + 3) = 3x + 9$
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$$5(6 + 2) = 5 \cdot 6 + 5 \cdot 2$$

$$= 30 + 10$$

$$5(x + 2) = 5 \cdot x + 5 \cdot 2$$

$$= 5x + 10$$

$$(5x)(3x + 6) = 5x \cdot 3x + 5x \cdot 6$$

$$= 15x^2 + 30x$$

23) Rewrite using the distributive property, and simplify: $5(a - 4)$

24) Rewrite using the distributive property, and simplify: $7(c - 5)$

25) Rewrite using the distributive property, and simplify: $(x - 2)8$

26) Rewrite using the distributive property, and simplify: $(y - 2)9$

#27 – 38: Simplify

27) $-5(x - 2)$

28) $-3(y - 4)$

29) $-(3x - 2y)$

30) $-(5x - 4y)$

$$31) 8(3x^2 + 5x - 4)$$

$$32) 6(2y^2 + 3y - 9)$$

$$33) -2(4x^2 + 6x - 3)$$

$$34) -3(5y^3 - 6y + 1)$$

$$35) \frac{1}{2} \left(\frac{4}{5}x + \frac{9}{2} \right)$$

$$36) \frac{2}{3} \left(\frac{6}{9}x + \frac{15}{8} \right)$$

$$37) \frac{3}{4} \left(\frac{4}{9}x - \frac{6}{5} \right)$$

$$38) \frac{3}{5} \left(\frac{15}{9}x - \frac{7}{6} \right)$$

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Fractions in the form $\frac{0}{x}$ and division problems of the form $0 \div x$

Every fraction obeys the following rules

- $\frac{\text{numerator}}{\text{denominator}} = \text{answer}$
- $\text{answer} \times \text{denominator} = \text{numerator}$

For example: $\frac{6}{2} = 3$ and $3 \times 2 = 6$

What does the fraction $\frac{0}{6}$ reduce to?

I know that the above rule must apply to the answer:

$$\frac{0}{6} = \text{answer} \quad \text{and} \quad \text{answer} \times 6 = 0$$

I claim: $\frac{0}{6} = 0$

I will show you that it does.

we know that $\frac{0}{6} = \text{answer}$ and $\text{answer} \times 6 = 0$

- *change answer to 0*
- $\frac{0}{6} = 0$ Then: $0 \times 6 = 0$
- *since 0×6 does equal 0 I know my answer is correct*

Thus $\frac{0}{6} = 0$

Rule for fractions with 0 in the numerator

$$\frac{0}{x} = 0; \text{ provided } x \neq 0$$

and

$$0 \div x = 0; \text{ provided } x \neq 0 \text{ (since } \frac{0}{x} = 0 \div x)$$

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Fractions in the form $\frac{x}{0}$, ($x \neq 0$) and division problems in the form $x \div 0$, $x \neq 0$

What does the fraction $\frac{12}{0}$ reduce to?

I know that the above rule must apply to the answer:

$$\frac{12}{0} = \text{answer} \quad \text{and} \quad \text{answer} \times 0 = 12$$

This is a problem when we try to figure out how to solve this:

$$\text{answer} \times 0 = 12$$

- The left side will always reduce to zero, no matter what number I replace with the word answer. The times 0 on the left side forces the left side to always equal 0.
- There is no number to change the word answer to so that the left side will equal 12
- There is no way to reduce the fraction $\frac{12}{0}$

Thus, we say $\frac{12}{0} = \text{undefined}$

Rule for fractions with 0 in the denominator:

$$\frac{x}{0} = \text{undefined}; \text{ provided } x \neq 0 \text{ and}$$

$$x \div 0 = \text{undefined}; \text{ provided } x \neq 0 \text{ (since } \frac{x}{0} = x \div 0 \text{)}$$

Fractions

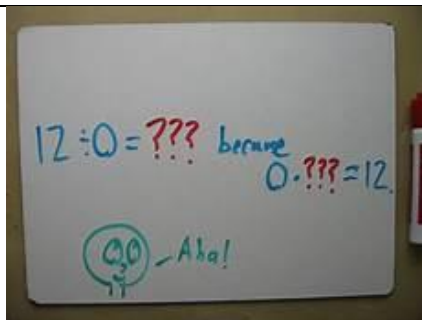
Tutor

- The denominator can never be equal to 0.

$$\frac{12}{0} = \text{Does not exist!}$$

- A fraction with a numerator of 0 equals 0.

$$\frac{0}{3} = 0 \quad \frac{0}{312} = 0$$



#39 – 46: Simplify

39) $\frac{5}{0}$

40) $\frac{2}{0}$

41) $12 \div 0$

42) $8 \div 0$

43) $\frac{0}{7}$

44) $\frac{0}{6}$

45) $0 \div 3$

46) $0 \div 9$