VIDEO NOTEBOOK

ANDREW ROBERTS

Math Made Visible

ELEMENTARY ALGEBRA

FOURTH EDITION

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VIDEO NOTEBOOK

Elementary Algebra, Fourth Edition

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Instructor: Section:

Section 1.2 Video Guide

Fractions, Decimals, and Percents

Objectives:

1. Factor a Number as a Product of Prime Factors
2. Find the Least Common Multiple of Two or More Numbers
3. Write Equivalent Fractions
4. Write a Fraction in Lowest Terms
5. Round Decimals
6. Convert Between Fractions and Decimals
7. Convert Between Percents and Decimals

Section 1.2 – Objective 1: Factor a Number as a Product of Prime Factors
Video Length – 3:40

Definition
A natural number is _______________ if its only factors are __________ and _____________.

Natural numbers that are not prime are called _______________ . The number 1 is neither prime nor composite.

In this section, we will work on factoring composite numbers. For example, in $3 \cdot 5 = 15$, the 3 and the 5 are called _______________ and the 15 is called the_______________ .

Prime numbers: ____________________________

1. Example: Find the prime factorization of 80.

Final answer: $80 =$ ____________________

Note: The instructor writes $2 \cdot 2 \cdot 2 \cdot 2$ *as* 2^4. *If you're not familiar with this notation, don't worry about it yet. Exponential notation will be covered in a later section.*

Course: Name:
Instructor: Section:

Section 1.2 – Objective 2: Find the Least Common Multiple of Two or More Numbers
Video Length – 9:39

Before we talk about the definition of the least common multiple, let's just talk about what a multiple actually is.

Definition
A _______________ of a number is the _______________ of that number and any _______________ number.

Examples of multiples of 2:

Definition
The _______________ _______________ _______________ (_____) of two or more natural numbers is the _______________ number that is a _______________ of each of the numbers.

Let's say we want the least common multiple between 8 and 12:

2. Example: Find the LCM of the numbers 18 and 15.

Write the steps in words	*Show the steps with math*
Step 1	
Step 2	
Step 3	

Final answer: LCM = ____________________

3. Example: Find the LCM of 24 and 30.

Final answer: LCM = ____________________

Be sure to make an effort to be neat an organized when you do math! The more organized you are, the easier it is to keep track of your work and not make any BONEHEAD mistakes!!!

Course: Name:
Instructor: Section:

Section 1.2 – Objective 3: Write Equivalent Fractions

Video Length – 7:05

Consider the fraction

$$\frac{3}{4}$$

So how do we go about obtaining equivalent fractions?

Definition
The ________________ ________________ ________________ (_____) is the least common

multiple of the denominators of a group of fractions.

Note: Finding the least common denominator is the exact same thing as finding the least common multiple. Except that we are looking at the denominators of a group of fractions.

We are going to combine two ideas into one – we are going to combine the idea of the LCM with the idea of equivalent fractions.

4. Example: Write $\frac{5}{8}$ and $\frac{9}{20}$ as equivalent fractions with the least common denominator.

Write the steps in words	*Show the steps with math*
Step 1	
Step 2	

Final answer: LCD = ____________________

Course: Name:
Instructor: Section:

Section 1.2 – Objective 4: Write a Fraction in Lowest Terms
Video Length – 3:02

Definition
A fraction is written in _______________ _______________ if the numerator and the denominator share no common factor other than 1.

In order to write a fraction in lowest terms, use the "reverse" idea of what is used to create equivalent fractions.

When writing a fraction in lowest terms, we factor the numerator as primes, factor the denominator as primes and then divide out those common factors.

5. Example: Write $\frac{15}{55}$ in lowest terms.

Final answer: $\frac{15}{55} =$ ____________________

6. Example: Write $\frac{16}{84}$ in lowest terms.

Final answer: $\frac{16}{84} =$ ____________________

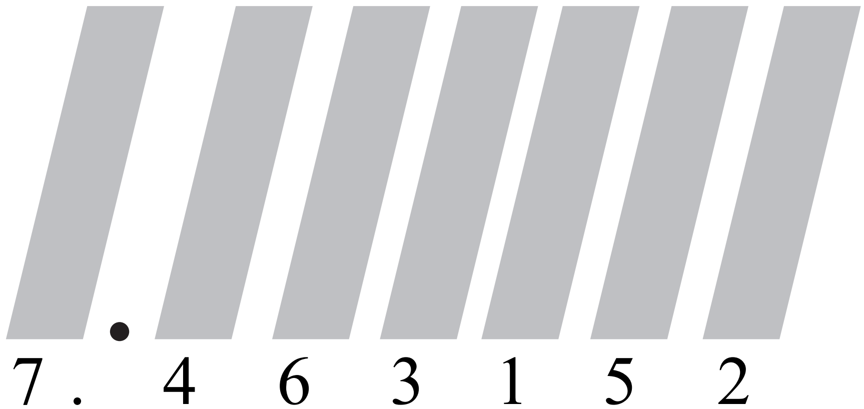
Course:
Instructor:

Name:
Section:

Section 1.2 – Objective 5: Round Decimals

Video Length – 3:37

We spent a lot of time talking about fractions, now we will spend a little a bit of time talking about decimals.



For example, 0.3 can be read as "point three" or "three-__________". This is the same as

0.3 = ______ . What does 0.28 mean? 0.28 = ______

Round Decimals
We round decimals in the same way we round whole numbers. First, identify the specified place value in the decimal. If the digit to the __________ is _____ or __________, add _____ to the digit; if the digit to the __________ is _____ or __________, leave the digit as it is. Then drop the digits to the right of the specified place value.

7. Example: Round 0.9451 to the nearest thousandth.

Final answer: ____________________

8. Example: Round 4.359 to the nearest hundredth.

Final answer: ____________________

Course: Name:
Instructor: Section:

Section 1.2 – Objective 6: Convert Between Fractions and Decimals
Part I – Convert a Decimal to a Fraction

Video Length – 2:13

Convert a Decimal to a Fraction
To convert a decimal to a fraction, identify the place value of the __________ digit in the decimal.

Write the decimal as a _______________ using the place value of the last digit as the

_______________, and write in lowest terms.

9. Example: Convert each decimal to a fraction and write in lowest terms, if possible.

(a) 0.4

(b) 0.531

Final answer: $0.4 =$ __________

Final answer: $0.531 =$ __________

Course: Name:
Instructor: Section:

Section 1.2 – Objective 6: Convert Between Fractions and Decimals
Part II – Convert a Fraction to a Decimal
Video Length – 4:38

Convert a Fraction to a Decimal
To convert a fraction to a decimal, _______________ the _______________ of the fraction by the _______________ of the fraction until the _______________ is _____ or the _______________ _______________.

10. Example: Convert $\frac{7}{25}$ to a decimal.

Note: Pay attention to what he says about "terminating".

Final answer: $\frac{7}{25} =$ ____________________

11. Example: Convert $\frac{7}{9}$ to a decimal.

Note: Pay attention to the notation that is used.

Final answer: $\frac{7}{9} =$ ____________________

Course: Name:
Instructor: Section:

Section 1.2 – Objective 7: Convert Between Percents and Decimals
Part I – Convert a Decimal to a Percent
Video Length – 1:27

Convert a Decimal to a Percent

Multiply the decimal by __________ .

For example, write 0.32 as a percent:

Shortcut: To convert a decimal to a percent, move the decimal _____ places to the __________ and add the percent symbol.

Now write 0.0625 as a percent:

Course: Name:
Instructor: Section:

Section 1.2 – Objective 7: Convert Between Percents and Decimals
Part II – Convert a Percent to a Decimal
Video Length – 3:02

Now we will convert from percents to decimals.

Definition
The word _______________ means __________ _____ __________ or __________ out of _____

_______________.

Convert a Decimal to a Percent

Multiply the percent by __________ .

For example, write 3% as a decimal:

Shortcut: To convert from a percent to a decimal, drop the percent and move the decimal _____ units

to the __________.

So 18% = ______ and 143% = ______ .

Course: Name:
Instructor: Section:

Section 1.3 Video Guide

The Number Systems and the Real Number Line

Objectives:

1. Classify Numbers
2. Plot Points on a Real Number Line
3. Use Inequalities to Order Real Numbers
4. Compute the Absolute Value of a Real Number

Section 1.3 – Introduction

Video Length – 1:56

Definition
A __________ is a collection of objects.

For example, the set of even numbers between 2 and 10, inclusive, can be represented by

$C =$ _______________

Definition
When a set has no elements in it, the set is an __________ _____ . Empty sets are denoted by _____

or _____ .

Course: Name:
Instructor: Section:

Section 1.3 – Objective 1: Classify Numbers

Video Length – 12:38

Definition
The _______________ numbers, or _______________ numbers, are the numbers in the set

_______________.

Definition
The _______________ numbers are the numbers in the set _______________.

Definition
The _______________ are the numbers in the set _______________.

Definition
A _______________ number is a number that can be expressed as a fraction (or quotient) of two

_______________ (*Note: The integer in the denominator cannot be zero*). A rational number can

be written in the form $\frac{p}{q}$, where *p* and *q* are integers (*Note:* $q \neq 0$).

Examples of rational numbers:

Additionally, it is important to recognize that

$$\frac{p}{1} = p$$

for any integer. This means that any integer can be written as a _______________ number.

However, any rational number is not necessarily an integer.

Definition
An _______________ number is a number that cannot be written as the quotient of two integers.

We learned in the last section that any fraction can be expressed as a decimal or we can convert decimals to fractions. Likewise, any rational number can also be represented as a decimal. A rational number will have a decimal representation that either _______________ (e.g. $\frac{1}{2} = 0.5$) or has a block of numbers that _______________ (e.g. $\frac{2}{3} = 0.66666666\ldots$).

With irrational numbers, the decimal representation _______________ _______________ _____

_______________.

Course: Name:
Instructor: Section:

Definition
The set of rational numbers combined with the set of irrational numbers is called the set of

________________ numbers.

The Real Numbers

Rational numbers = ________________________	**Irrational numbers** = ________________________
____	____
____	

1. Example: List the numbers in the set $\left\{7, -\frac{4}{9}, -2, 0, -5.131131113\ldots, 2.\overline{68}, 26.8686\ldots\right\}$ that are

(a) Counting numbers (a) **Final answer:** ____________________

(b) Whole numbers (b) **Final answer:** ____________________

(c) Integers (c) **Final answer:** ____________________

(d) Rational numbers (d) **Final answer:** ____________________

(e) Irrational numbers (e) **Final answer:** ____________________

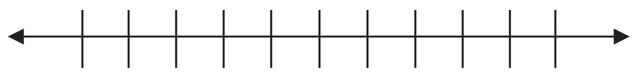
(f) Real numbers (f) **Final answer:** ____________________

Course: Name:
Instructor: Section:

Section 1.3 – Objective 2: Plot Points on a Real Number Line

Video Length – 5:32

Definition
The real numbers can be represented by points on a line called the __________ _______________ __________ .



Definition
The distance between 0 and 1 determines the __________ of the number line. The number associated with a point is called the _______________ of the point.

Note: Pay special attention to the subtle difference on how the word "point" and "coordinate" is used.

2. Example: On the real number line, label the points with the coordinates 0, 1.75, -2.5, 4.

Final answer:

Course: Name:
Instructor: Section:

Section 1.3 – Objective 3: Use Inequalities to Order Real Numbers
Video Length – 4:25

A real number line allows you to order, or rank, numbers.

3. Example: Replace the ? with <, >, or =.

(a) $3 \ ? \ -2$ (a) **Final answer:** ____________________

(b) $3 \ ? \ 5.6$ (b) **Final answer:** ____________________

(c) $-2 \ ? \ -\frac{8}{4}$ (c) **Final answer:** ____________________

(d) $\frac{7}{12} \ ? \ \frac{5}{8}$ (d) **Final answer:** ____________________

Course: Name:
Instructor: Section:

Section 1.3 – Objective 4: Compute the Absolute Value of a Real Number

Video Length – 1:29

Definition
The _______________ __________ of a number *a*, written _____ , is the _______________ from

0 to *a* on the real number line.

For example, $|5| =$ _____ :

Also, $|-2| =$ _____:

Course: Name:
Instructor: Section:

Section 1.4 Video Guide

Adding, Subtracting, Multiplying, and Dividing Integers

Objectives:

1. Add Integers
2. Determine the Additive Inverse of a Number
3. Subtract Integers
4. Multiply Integers
5. Divide Integers

Section 1.4 – Objective 1: Add Integers

Video Length – 8:35

This entire section is dedicated to adding, subtracting, multiplying, and dividing integers. In the next section, we will include rational numbers.

Operations on Signed Numbers

The symbols used in algebra for the operations of addition, subtraction, multiplication, and division are _____, _____, _____, and _____, respectively.

Note: Pay attention to what he says about the division symbol $\div$ *and mixed numbers.*

Operation	Symbols	Words
Addition		
Subtraction		
Multiplication		
Division		

1. Example: Add $-5+(-3)$

Final answer: $-5+(-3)=$ ____________________

Now add $-3+2$: ___ :

And add $5+(-2)=$ ___ :

Steps to Adding Two Nonzero Integers

To add integers with the same sign (both positive or both negative),
Step 1: Add the absolute value of the two integers.
Step 2: Attach the common sign, either positive or negative.

To add integers with different signs (one positive and one negative),
Step 1: Subtract the smaller absolute value from the larger absolute value.
Step 2: Attach the sign of the integer with the larger absolute value.

2. Example: Add $-12+(-42)$

Final answer: $-12+(-42)=$ ____________________

3. Example: Add $-63+18$

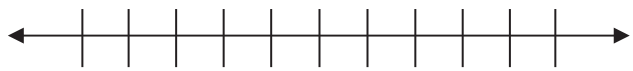
Final answer: $-63+18=$ ____________________

Course: Name:
Instructor: Section:

Section 1.4 – Objective 2: Determine the Additive Inverse of a Number
Video Length – 1:16

Additive Inverse Property
For any real number *a* other than 0, there is a real number_____, called the _______________

_______________ , or _______________ , of *a*, having the following property:



What is the additive inverse of 3? _____

What is the additive inverse of -15 ? _____

Course: Name:
Instructor: Section:

Section 1.4 – Objective 3: Subtract Integers

Video Length – 3:00

Definition
The ________________ $a-b$, read "*a* ___________ *b*" or "*a* _____ *b*," is defined as

In words, to subtract *b* from *a*, add the "________________ " of *b* to *a*.

4. Example: $-16-43$

Final answer: $-16-43=$ ______________________

5. Example: $17-(-13)$

Final answer: $17-(-13)=$ ______________________

6. Example: $35-81$

Final answer: $35-81=$ ______________________

Course: Name:
Instructor: Section:

Section 1.4 – Objective 4: Multiply Integers

Video Length – 5:55

If we multiply two positive numbers together, we get a _______________ number. If we multiply two negative numbers together, we get a _______________ number. Additionally, if we multiply a positive number and a negative number, we get a _______________ number. Why? Instead of just saying, "that's just the rules" or "that's just the way it is", let's provided some justification to those results.

If you're back in an arithmetic class and are trying to explain what $3 \cdot 6$ means, what would you say?

$$3 \cdot 6 =$$

What about $2 \cdot (-9)$?

$$2 \cdot (-9) =$$

But why does the product of two negative numbers give us a positive number? Let's deduce this result by establishing a pattern. For example,

___· ___ = ___

___· ___ = ___

___· ___ = ___

___· ___ = ___

___· ___ = ___

Now we have some justification for the rules that we already know.

Rules of Signs for Multiplying Two Integers

1. If we multiply two positive integers, the product is positive.
2. If we multiply one positive integer and one negative integer, the product is negative.
3. If we multiply two negative integers, the product is positive.

7. Example: Find the product: $-75 \cdot (-3)$

Final answer: $-75 \cdot (-3) =$ ____________________

8. Example: Find the product: $-18 \cdot 15$

Final answer: $-75 \cdot (-3) =$ ____________________

9. Example: Find the product: $2 \cdot (-10) \cdot 8$

When multiplying three or more numbers, multiply from __________ to __________ .

Final answer: $2 \cdot (-10) \cdot 8 =$ ____________________

Course: Name:
Instructor: Section:

Section 1.4 – Objective 5: Divide Integers

Video Length – 5:12

Multiplicative Inverse (Reciprocal) Property
For each *nonzero* real number *a*, there is a real number _____, called the **multiplicative inverse** or **reciprocal** of *a*, having the following property:

10. Example: Find the multiplicative inverse or reciprocal of the following.

(a) –9 (a) **Final answer:** ____________________

(b) $\frac{2}{5}$ (b) **Final answer:** ____________________

So why do we care so much about the reciprocal? Reciprocals will allow us to redefine __________

as __________ .

Definition
If *b* is a nonzero real number, the _______________ $\frac{a}{b}$, read as "*a* __________ by *b*" or "the __________ of *a* to *b*," is defined as

Now that we are able to rewrite division as multiplication, all the rules of signs that apply to multiplication also apply to division.

Rules of Signs for Dividing Two Real Numbers

1. If we divide two positive real numbers, the quotient is __________.
2. If we multiply one positive real number and one negative real number, the quotient is __________.
3. If we multiply two negative real numbers, the quotient is __________.

11. Example: Find the quotient: $\frac{-75}{15}$

Note: Pay careful attention to what he says about what remains in the denominator.

Final answer: $\frac{-75}{15}=$ ____________________

Course: Name:
Instructor: Section:

Section 1.5 Video Guide

Adding, Subtracting, Multiplying, and Dividing Rational Numbers

Objectives:

1. Multiply Rational Numbers in Fractional Form
2. Divide Rational Numbers in Fractional Form
3. Add and Subtract Rational Numbers in Fractional Form
4. Add, Subtract, Multiply, and Divide Rational Numbers in Decimal Form

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Section 1.5 – Objective 1: Multiply Rational Numbers in Fractional Form

Video Length – 6:23

Multiplying Fractions

$$\frac{\quad}{\quad} \cdot \frac{\quad}{\quad} = \frac{\qquad}{\qquad}$$, where b and $d \neq 0$.

Note: The approach used in this section will be utilized later on in the course when the numerator and denominator contain variables. So the techniques used here will also apply to future material.

1. Example: Find the product: $\left(-\frac{5}{12}\right)\left(-\frac{2}{3}\right)$

Final answer: $\left(-\frac{5}{12}\right)\left(-\frac{2}{3}\right) =$ ____________________

2. Example: Find the product: $\left(\frac{5}{8}\right)\left(-\frac{20}{7}\right)$

Final answer: $\left(\frac{5}{8}\right)\left(-\frac{20}{7}\right) =$ ____________________

Course: Name:
Instructor: Section:

Section 1.5 – Objective 2: Divide Rational Numbers in Fractional Form

Video Length – 6:29

Dividing Fractions

— ÷ — = — · — = ——— , where b, c and $d \neq 0$.

3. Example: Find the quotient: $\left(-\frac{4}{9}\right) \div \left(-\frac{5}{6}\right)$

Note: Pay attention to the instructor's "chess" suggestion.

Final answer: $\left(-\frac{4}{9}\right) \div \left(-\frac{5}{6}\right) =$ ____________________

4. Example: Find the quotient: $\left(\frac{8}{35}\right) \div \left(-\frac{1}{10}\right)$

Final answer: $\left(\frac{8}{35}\right) \div \left(-\frac{1}{10}\right) =$ ____________________

Course: Name:
Instructor: Section:

Section 1.5 – Objective 3: Add and Subtract Rational Numbers in Fractional Form Part I

Video Length – 2:43

Adding or Subtracting Fractions with the Same Denominator

$$\frac{}{} + \frac{}{} = \frac{}{}\text{, where } c \neq 0.$$

$$\frac{}{} - \frac{}{} = \frac{}{} = \frac{}{}\text{, where } c \neq 0.$$

5. **Example:** Find the sum and write in lowest terms: $-\frac{4}{9}+\frac{1}{9}$

Final answer: $-\frac{4}{9}+\frac{1}{9}=$ ____________________

Course: Name:
Instructor: Section:

Section 1.5 – Objective 3: Add and Subtract Rational Numbers in Fractional Form Part II

Video Length – 7:45

When adding or subtracting two rational number with different denominators, the least common denominator must be found.

Definition
The _______________ _______________ _______________ **(** _____ **)** is the _______________

number that each denominator has as a _______________ _______________.

We already know how to find the least common denominator of a fraction. The approach to finding the least common denominator of a rational number is identical.

6. Example: Find the LCD: $\frac{5}{6}$ and $\frac{3}{8}$

Final answer: LCD = ____________________

7. Example: Find the difference: $\frac{5}{12}-\frac{8}{30}$

Note: During Step 1, the instructor mentions a method that can be used to find the LCD for fractions with unlike denominators (e.g. using multiples of the larger denominator). However, he indicates that this particular method will not work well for algebra.

Write the steps in words	*Show the steps with math*
Step 1	
Step 2	
Step 3	
Step 4	

Final answer: $\frac{5}{12}-\frac{8}{30}=$ ____________________

Course: Name:
Instructor: Section:

Section 1.5 – Objective 4: Add, Subtract, Multiply, and Divide Rational Numbers in Decimal Form

Part I

Video Length – 2:47

Adding and Subtracting Decimals
To add or subtract decimals, arrange the numbers in a _______________ with the _______________ aligned. Then add or subtract the digits in the _______________ place values, and place the _______________ _______________ in the answer directly _______________ the decimal point in the problem.

8. Example: Find the sum: $718.97 + 496.5$

Final answer: $718.97 + 496.5 =$ ____________________

9. Example: Find the difference: $8 - 1.623$

Final answer: $8 - 1.623 =$ ____________________

Course: Name:
Instructor: Section:

Section 1.5 – Objective 4: Add, Subtract, Multiply, and Divide Rational Numbers in Decimal Form
Part II
Video Length – 3:38

Multiplying Decimals
The multiplication of decimals comes from the rules for multiplying numbers written as fractions.

$$\frac{3}{10}\times\frac{4}{100}=\frac{12}{1000} \longrightarrow \_\_\_\_\_ \times \_\_\_\_\_ = \_\_\_\_\_$$

10. Example: Find the product: 0.17×0.4

Final answer: $0.17\times 0.4=$ ____________________

11. Example: Find the product: -2.14×0.03

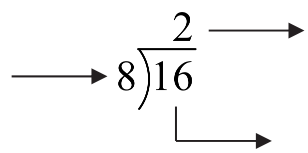
Final answer: $-2.14\times 0.03=$ ____________________

Course: Name:
Instructor: Section:

Section 1.5 – Objective 4: Add, Subtract, Multiply, and Divide Rational Numbers in Decimal Form
Part III

Video Length – 3:15

The number that is being divided into is called the _______________ . The number you are dividing by is called the _______________ and the result is called the _______________ .



Dividing Decimals
To divide decimals, we want the divisor to be a whole number, so we multiply the dividend and the divisor by a power of 10 that will make the divisor a whole number. Then divide as though we were working with whole numbers. The decimal point in the quotient lies directly above the decimal point in the dividend.

12. Example: Find the quotient: $\dfrac{17.68}{13.6}$

Final answer: $\dfrac{17.68}{13.6} =$ ____________________

Course: Name:
Instructor: Section:

Section 1.6 Video Guide

Properties of Real Numbers

Objectives:

1. Use the Identity Properties of Addition and Multiplication
2. Use the Commutative Properties of Addition and Multiplication
3. Use the Associative Properties of Addition and Multiplication
4. Understand the Multiplication and Division Properties of 0

Section 1.6 – Objective 1: Use the Identity Properties of Addition and Multiplication
Video Length – 4:31

Identity Property of Addition
For any real number *a*,

___+ ___ = ___+ ___ = ___

That is, the sum of any number and 0 is that number. We call 0 the _______________

_______________ .

Multiplicative Identity
For any real number *a*,

___· ___ = ___· ___ = ___

That is, the product of any number and 1 is that number. We call 1 the _______________

_______________ .

Definition

_______________ is changing the units of measure from one measure to a different measure.

1. **Example**: Convert 15 feet to inches.

Final answer: ____________________

2. **Example**: Convert 3 hours to seconds.

Final answer: ____________________

Course: Name:
Instructor: Section:

Section 1.6 – Objective 2: Use the Commutative Properties of Addition and Multiplication

Video Length – 10:34

Commutative Property of Addition
If *a* and *b* are real numbers, then

___+ ___ = ___+ ___

Commutative Property of Multiplication
If *a* and *b* are real numbers, then

___· ___ = ___· ___

3. Example: Evaluate the expression: $24+7+(-24)$

Final answer: $24+7+(-24)=$ ____________________

By the way, is subtraction commutative?

Is division commutative?

4. Example: Evaluate the expression: $\frac{2}{3}\cdot 5\cdot \frac{9}{16}$

Final answer: $\frac{2}{3}\cdot 5\cdot \frac{9}{16}=$ ____________________

5. Example: Evaluate the expression: $-15\cdot 9\cdot\left(-\frac{4}{5}\right)$

Final answer: $-15\cdot 9\cdot\left(-\frac{4}{5}\right)=$ ____________________

Course: Name:
Instructor: Section:

Section 1.6 – Objective 3: Use the Associative Properties of Addition and Multiplication
Video Length – 4:47

Associative Property of Addition and Multiplication
If *a*, *b*, and *c* are real numbers, then

$$\_\_\_ + (\_\_\_ + \_\_\_) = (\_\_\_ + \_\_\_) + \_\_\_ = \_\_\_ + \_\_\_ + \_\_\_$$

$$\_\_\_ \cdot (\_\_\_ \cdot \_\_\_) = (\_\_\_ \cdot \_\_\_) \cdot \_\_\_ = \_\_\_ \cdot \_\_\_ \cdot \_\_\_$$

6. **Example:** Evaluate the expression: $123 + 245 + (-245)$

Final answer: $123 + 245 + (-245) =$ ____________________

7. **Example:** Evaluate the expression: $-\frac{4}{13} \cdot \frac{5}{9} \cdot \frac{27}{10}$

Final answer: $-\frac{4}{13} \cdot \frac{5}{9} \cdot \frac{27}{10} =$ ____________________

"Working smart will save you a boatload of headaches."

Course: Name:
Instructor: Section:

Section 1.6 – Objective 4: Use the Multiplication and Division Properties of Zero
Video Length – 1:54

Multiplication Property of Zero
For any real number *a*, the product of *a* and 0 is always 0;

___· ___ = ___· ___ = ___

Division Properties of Zero
For any nonzero real number *a*,

1. The quotient of 0 and *a* is 0. That is, $\frac{0}{a}$ = ___ .
2. The quotient of *a* and 0 is ________________ . That is, $\frac{a}{0}$ is ________________.

8. Example: Find the quotient:

(a) $\frac{23}{0}$ (a) **Final answer:** _____________________

Note: The instructor says, "Hey Sullivan! Why the heck is 23 divided by 0 called 'undefined?' I don't understand." Listen carefully to the explanation.

(b) $\frac{0}{17}$ (b) **Final answer:** _____________________

Course: Name:
Instructor: Section:

Section 1.7 Video Guide

Exponents and Order of Operations

Objectives:

1. Evaluate Exponential Expressions
2. Apply the Rules for Order of Operations

Section 1.7 – Objective 1: Evaluate Exponential Expressions
Video Length – 11:51

Definition
Integer _______________ provide a shorthand notation device for representing repeated multiplications of a real number.

$$3 \times 3 \times 3 \times 3 = 3^4 = 81$$

3^4 is read as "__________ to the __________ __________." The 3 is called the _______________ and the 4 is called the _______________ or _______________ .

If n is a natural number and a is a real number, then

$$a^n = \underbrace{\rule{4cm}{0.4pt}}$$

The exponent tell the number of times the base is used as a factor.

Note: There is a ton of discussion on part (c) of the following example. Pay very close attention to the follow-up examples and explanations he provides. Also, he does not complete parts (d) and (e). You SHOULD do these on your own.

1. Example: Evaluate each expression.

(a) 2^4 — (a) **Final answer:** $2^4 =$ ________________

(b) 5^3 — (b) **Final answer:** $5^3 =$ ________________

(c) $(-3)^5$ — (c) **Final answer:** $(-3)^5 =$ _____________

(d) $-(12)^2$ — (d) **Final answer:** $-(12)^2 =$ ____________

(e) $\left(\frac{2}{3}\right)^3$ — (d) **Final answer:** $\left(\frac{2}{3}\right)^3 =$ ______________

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Section 1.7 – Objective 2: Apply the Rules for Order of Operations
Part I – Text Example 5
Video Length – 5:24

We will now look at the order of operations. Suppose you have an expression with multiplication and addition. Which operation do you do first, the multiplication or the addition?

_______________ . Why? Consider the example $3 \cdot 5 + 8$:

2. Example: Evaluate each expression.

(a) $12 \div 2 - 4 \cdot 2$

Final answer: $12 \div 2 - 4 \cdot 2 =$ ____________________

(b) $2 + 15 \div 5 \cdot 4$
Note: Remember, multiply/divide from left to right, then add/subtract.

Final answer: $2 + 15 \div 5 \cdot 4 =$ ____________________

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Section 1.7 – Objective 2: Apply the Rules for Order of Operations
Part II – Text Examples 6 and 7
Video Length – 7:36

We now understand that we multiply before we add, but what if we wanted to do the addition first? Is there any way that can be accomplished? Consider the expression

$$3+2\cdot 6$$

Now consider

$$\left(7+2\right)\cdot 4$$

Lastly, consider

$$\left(\frac{3}{4}-\frac{7}{4}\right)\left(\frac{13}{5}+\frac{2}{5}\right)$$

Note: In Example 3, he does not complete part (a). Make sure you do it. Also, pay attention to what he says about the division bar in part (b).

3. Example: Evaluate each expression.

(a) $12\div 2-4\cdot 2$

(a) **Final answer:** $12\div 2-4\cdot 2=$ ________

(b) $\dfrac{2+6}{16-4\cdot 3}$

(b) **Final answer:** $\dfrac{2+6}{16-4\cdot 3}=$ ___________

4. Example: Evaluate the expression: $\dfrac{2+3\div\frac{1}{4}}{-8\cdot 2+9}$

Final answer: $\dfrac{2+3\div\frac{1}{4}}{-8\cdot 2+9}=$ ____________________

Course: Name:
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Section 1.7 – Objective 2: Apply the Rules for Order of Operations
Part III – Text Example 8
Video Length – 4:53

When you have an expression with multiple grouping symbols, you work _______________

__________. Examples of grouping symbols are _______________, _______________, and

_______________.

5. Example: Evaluate the expression: $2\cdot\left[4\cdot(3+5)-7\right]$

Final answer: $2\cdot\left[4\cdot(3+5)-7\right]=$ ____________________

6. Example: Evaluate the expression: $\left[5\cdot\left(\frac{3}{4}\cdot(-8)+2\right)\right]+\frac{2}{3}$

Final answer: $\left[5\cdot\left(\frac{3}{4}\cdot(-8)+2\right)\right]+\frac{2}{3}=$ ____________________

Course: Name:
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Section 1.7 – Objective 2: Apply the Rules for Order of Operations
Part IV – Text Examples 9, 10, and 11
Video Length – 14:20

Now, you should ask yourself the following question, "When do we evaluate exponents in the order of operations?"

Consider the expression

$$2 \cdot 4^3$$

The order of operations can be summarized as follows:

1. ____________________________
2. ____________________________
3. ____________________________
4. ____________________________

7. Example: Evaluate the expression: $4+\left(4^2-13\right)^2-3$

Final answer: $4+\left(4^2-13\right)^2-3=$ ______________________

8. Example: Evaluate the expression: $\dfrac{3\cdot 4^2-10}{2\left(2-11\right)}$

Final answer: $\dfrac{3\cdot 4^2-10}{2\left(2-11\right)}=$ ______________________

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9. Example: Evaluate the expression: $\left(\dfrac{6-3^2}{12-2\cdot 4}\right)^2$

Final answer: $\left(\dfrac{6-3^2}{12-2\cdot 4}\right)^2 =$ ____________________

10. Example: Evaluate the expression: $\left(\dfrac{6-(-4)^3}{4^2-2\cdot 3}\right)^2$

Note: Think "bite-sized chunks".

Final answer: $\left(\dfrac{6-(-4)^3}{4^2-2\cdot 3}\right)^2 =$ ____________________

Course: Name:
Instructor: Section:

Section 1.8 Video Guide

Simplifying Algebraic Expressions

Objectives:

1. Evaluate Algebraic Expressions
2. Identify Like Terms and Unlike Terms
3. Use the Distributive Property
4. Simplify Algebraic Expressions by Combining Like Terms

Section 1.8 – Objective 1: Evaluate Algebraic Expressions

Video Length – 5:47

Definition

_______________ is a branch of mathematics in which symbols represent _______________ or

_______________ of a set.

Definition

A _______________is a letter used to represent *any* number.

Usually, the variable must come from a predetermined set of possible values. For example, we might say that the variable can be any real number or the variable can only be an integer.

Definition

A _______________is either a _______________ number or a letter that represents a fixed number.

Definition

An _______________ _______________ is any combination of _______________ ,

_______________, _______________ _______________, and mathematical _______________ .

Examples of algebraic expressions:

When you have a number and a variable next to each other without an operation between them, the

operation is understood to be _______________ .

Definition

To _______________ an _______________ _______________ , _______________ the

numerical value for each variable into the expression and simplify the result.

1. **Example**: Evaluate each expression for the given value.

(a) $5x-2$ for $x=8$ (a) **Final answer:** ____________________

(b) $3a^2+2a+4$ for $a=-4$ (b) **Final answer:** ____________________

Course: Name:
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Section 1.8 – Objective 2: Identify Like Terms and Unlike Terms

Video Length – 5:18

Definition
A _______________ is a constant or the product or quotient of a constant and one or more variables raised to powers.

Examples of terms:

The term is always going to be the expression separated by the _______________ sign.

Algebraic Expression	Terms

Definition
The _______________ of a term is the numerical factor of the term.

Definition
Terms that have the same _______________ _______________(s) with the same _______________(s) are called _______________ _______________.

2. Example: Are $4a^2$ and $-7a^2$ like terms? Why or why not? Explain.

3. Example: Are $3x^2$ and $-2x^3$ like terms? Why or why not? Explain.

4. Example: Are $2ab^2$ and $4a^2b$ like terms? Why or why not? Explain.

5. Example: Are 6 and -12 like terms? Why or why not? Explain.

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Section 1.8 – Objective 3: Use the Distributive Property
Video Length – 6:02

The Distributive Property
If *a*, *b*, and *c* are real numbers, then

$$\_\_\_\cdot(\_\_\_+\_\_\_)=\_\_\_\cdot\_\_\_+\_\_\_\cdot\_\_\_$$

$$(\_\_\_+\_\_\_)\cdot\_\_\_=\_\_\_\cdot\_\_\_+\_\_\_\cdot\_\_\_$$

That is, multiply each term inside the parentheses by the factor on the outside.

6. Example: Use the Distributive Property to remove the parentheses.

$7(4+2)$

Final answer: $7(4+2)=$ ____________________

7. Example: Use the Distributive Property to remove the parentheses.

$14(23)$

Final answer: $14(23)=$ ____________________

8. Example: Use the Distributive Property to remove the parentheses.

$2(a+7)$

Final answer: $2(a+7)=$ ____________________

9. Example: Use the Distributive Property to remove the parentheses.

$-\frac{1}{4}(12x-16)$

Final answer: $-\frac{1}{4}(12x-16)=$ ____________________

Course: Name:
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Section 1.8 – Objective 4: Simplify Algebraic Expressions by Combining Like Terms
Part I – Text Examples 7 and 8
Video Length – 5:21

We will now combine like terms by using the Distributive Property.

10. Example: Simplify each expression by combining like terms.

(a) $4x+3+8x$

Final answer: $4x+3+8x=$ ____________________

(b) $3a^2+2a-9a^2+10a$

Final answer: $3a^2+2a-9a^2+10a=$ ____________________

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Section 1.8 – Objective 4: Simplify Algebraic Expressions by Combining Like Terms Part II – Text Example 9

Video Length – 11:31

11. Example: Simplify each expression.

(a) $y+6+8(5-y)$

Final answer: $y+6+8(5-y)=$ ____________________

(b) $\frac{1}{4}\left(\frac{2}{3}x-\frac{1}{2}\right)+\frac{1}{10}\left(\frac{5}{2}x-\frac{15}{4}\right)$

Note: Be patient. This one takes a while. But you know you love fractions!!!

Final answer: $\frac{1}{4}\left(\frac{2}{3}x-\frac{1}{2}\right)+\frac{1}{10}\left(\frac{5}{2}x-\frac{15}{4}\right)=$ ____________________