Unit 1:Relationships between Quantities and Expression

After completion of this unit, you will be able to…

Learning Target #1: Algebraic Expressions
- Review creating an expression from a verbal description
- Review interpreting parts of an Expression in terms of a context

Learning Target #2: Operations with Polynomials
- Classify polynomials by degree and terms
- Add polynomials
- Subtract polynomials
- Multiply polynomials
- Apply operations of polynomials to real world problems

Learning Target #3: Radical Expressions
- Simplify Radical Expressions
- Multiply Radical Expressions
- Add & Subtract Radical Expressions
- Rational & Irrational Numbers

Learning Target #4: Dimensional Analysis
- Convert units using dimensional analysis (Metric to Metric & customary to customary) without conversion factor provided
- Convert units using dimensional analysis (between customary & Metric) with conversion factor provided
- Define appropriate units for both metric and customary systems
- Apply dimensional analysis to rates

Timeline for Unit 1

Monday	Tuesday	Wednesday	Thursday	Friday
October 29th Day 1 – Review Creating Algebraic Expressions from a Context	**30th** Day 2 – Quick Check (Day 1) Classifying Polynomials/ Adding & Subtracting Polynomials	**31st** Day 3 – Adding & Subtracting Polynomials	**November 1st** Day 4 – Multiplying Polynomials (Area Model) Priority Standards Test	**2nd** **Quiz over Days 1 – 3** **Boot Camp**
5th Day 5 – More Practice Multiplying Polynomials/Real World Applications (Perimeter/Area)	**6th** Day 6 - Quick Check (Day 4 & 5) Real World Applications (Perimeter/Area)	**7th** Day 7 – Review Laws of Exponents/Perfect Squares/Simplifying Radical Expressions	**8th** Day 8 - Simplifying Radical Expressions Priority Standards Test	**9th** **Quiz over Days 4 – 7** **Boot Camp**
12th Day 9 - Multiplying & Simplifying Radical Expressions	**13th** **Teacher Work Day**	**14th** Day 10 – Practice Multiplying & Simplifying Radical Expressions	**15th** Day 11 – Adding & Subtracting Radicals Priority Standards Test	**16th** **Quiz over Days 8 – 11** **Boot Camp**
26th Day 12 – Metric Conversions & Appropriate Units	**27th** Day 13 – 1 & 2 Step Dimensional Analysis	**28th** Day 14 – Multi-Step Dimensional Analysis & Rate Conversions	**29th** Unit 1 Review	**30th** Unit 1 Test

Day 1 – Algebraic Expressions – Mixed Review

Standard(s): ____

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Evaluating Expressions

When you **evaluate** an expression, you are replacing the variable with what the variable equals:

Evaluate $4x - 5$ when $x = 6$

Practice: Evaluate the following expressions if $m = 7$, $r = 8$, and $t = -2$.

a. $5m - 6$

b. $\frac{r}{t}$

c. $3m - 5t$

d. $t^2 - 4r$

Application: Answer the following questions:

1. You earn 15n dollars for mowing n lawns.

   a. How much do you earn for mowing 1 lawn?

   b. How much do you earn for mowing 9 lawns?

2. After m months, the length of a fingernail is 10 + 3m millimeters.

a. How long is the fingernail, in centimeters, after 8 months?

b. How long is the fingernail after three years?

Creating Algebraic Expressions

Review: The Commutative and Associative Properties

Commutative Property of Addition (order doesn't matter) 5 + 6 can be written as 6 + 5 *Commutative Property of Multiplication* (order doesn't matter) 5 x 6 can be written as 6 x 5	*Associative Property of Addition* (grouping order doesn't matter) 2 + (5 + 6) can be written as (2 + 6) + 5 *Associative Property of Multiplication* (grouping order doesn't matter) (2 x 5) x 6 can be written as 2 x (6 x 5)

Addition	Subtraction	Multiplication	Division	Exponents
Sum	Difference	Of	Quotient	Power
Increased by	Decreased by	Product	Ratio of	Squared
More than	Minus	Times	Each	Cubed
Combined	Less	Multiplied by	Fraction of	
Together	Less than	Double, Triple	Out of	
Total of	Fewer than	Twice	Per	
Added to	How many more	As much	Divided by	
Gained	Left	Each	Split	
Raised	**Use Parenthesis:** The quantity of			
Plus				

Practice: Write the expression for each verbal description:

1. The difference of a number and 5

2. The quotient of 14 and 7

3. y decreased by 17

4. x increased by 6

5. The sum of a number and 8

6. 6 squared

7. Twice a number

8. 8 more than a third of a number

9. 6 less than twice k

Creating Expressions from a Context

Scenario A: A local restaurant is busiest on Saturday evenings. The restaurant has three cooks who work during this time. The cooks divide the incoming orders among themselves. So far, they have prepared 27 total.

a. If 15 additional orders come in, how many meals will each cook prepare?

b. If 42 additional orders come in, how many meals will each cook prepare?

c. Write an expression to represent the unknown number of meal each cooks prepare. Let m represent the number of additional orders.

Scenario B: Trey is selling candy bars to raise money for his basketball team. The team receives $1.25 for each candy bar sold. He has already sold 25 candy bars.

a. If Trey sells 10 more candy bars, how much money will he raise for the basketball team?

b. If Trey sells 45 more candy bars, how much money will he raise for the basketball team?

c. Write an expression to represent the unknown amount of money Trey will raise for the basketball team. Let c represent the additional candy bars sold.

Scenario C: Four friends decide to start a summer business of yardwork for their neighborhood. They will split all their earnings evenly. They have lawnmowers, but need to invest some money into rakes, trash bags, rakes, and hedge trimmers. They have to spend $75 on these supplies.

a. How much profit will each friend receive if they earn $350 the first week?

b. How much profit will each friend receive if they earn $475 the first week?

c. Write an expression that represents the unknown profit for each friend. Let d represent the amount of money earned.

Scenario D: Five friends (Jack, Jace, Kristian, Isreal, and Zach) have their own iPhones with songs downloaded to their phones from iTunes.

- Jace has five more songs than Jack.
- Kristian has half as many songs as Jace.
- Isreal has 3 more than twice the number of songs as Jack.
- Zach has three times as many songs as Kristian.

# of songs for Jack	# of songs for Jace	# of songs for Kristian	# of songs for Isreal	# of songs for Zach	Total # of Songs
11					
15					
25					
x					

Understanding Parts of an Expression

a. Hot dogs sell for $1.80 apiece and hamburgers sell for $3.90 apiece. This scenario can be represented by the expression 1.80x + 3.90y. Identify what the following parts of the expression represent.

1.80	
3.90	
x	
y	
1.80x	
3.90y	
1.80x + 3.90y	

b. Noah and his friends rent a sailboat for $15 per hour plus a basic fee of $50. This scenario can be represented by the expression 15h + 50.

15	
h	
15h	
50	
15h + 50	

c. A teacher has $600 to spend on supplies. They plan to spend $40 per week on supplies. This scenario can be represented by the expression 600 – 40w.

600	
-40	
w	
-40w	
600 – 40w	

Day 2 – Classifying & Adding/Subtracting Polynomials

Standard(s): ____

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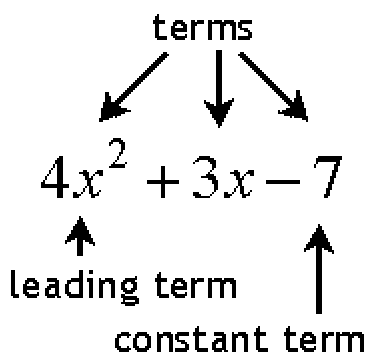
A **POLYNOMIAL** is a mathematical expression consisting of terms, which can include a constant, variable, or product of a constant and variable, that are connected together using addition or subtraction. Variables must have exponents raised to whole number exponents.



Number of Terms: ________________

Terms: ________________________

Coefficient(s): ________________

Constant(s): __________________

Polynomials CANNOT contain:

- Radicals
- Fractional exponents
- Negative exponents
- No variables in the denominator

Cross off all expressions that are NOT polynomials:

$-8x^5 + 2x - 7$ $\quad$ $3x^4 - \sqrt{x}$ $\quad$ $6x^{-2} - 3x$

$\frac{1}{x^3}$ $\quad$ $-9 + x$ $\quad$ $4x^2$

Polynomials are typically written in **STANDARD FORM**, which means the terms are arranged in decreasing order from the largest exponent to the smallest exponent. When you write polynomials in standard form, you can easily identify the degree. The **DEGREE** is the largest exponent of the variable in the polynomial.

Rewrite each polynomial in standard form. Then identify the degree of the polynomial:

a. $5x - 6x^2 - 4$	b. $-7x + 8x^2 - 2 - 8x^2$	c. $6(x - 1) - 4(3x^2) - x^2$
Standard Form:	Standard Form:	Standard Form:
Degree:	Degree:	Degree:

Classifying Polynomials

Polynomials are classified by **DEGREE** and **NUMBER OF TERMS:**

Degree	**Name**	**Example**

Terms	**Name**	**Example**

Complete the table below. Simplify the expressions or put in standard form if necessary.

Polynomial	**Degree**	**# of Terms**	**Classification**
$8x$			
$x^2 - 4$			
10			
$-24 + 3x - x^2$			
$5x^3 - 12 + 8$			
$7x - 9x + 1$			
$4x^2 - 5x^3 - 4 + 5x - 1$			
$2x + 3 - 7x^2 + 4x + 7x^2$			

Adding Polynomials

When adding, use the following steps to add polynomials:

- Line up like terms
- Add
- Make sure final answer is in standard form

a. $(4x^2 + 2x + 8) + (8x^2 + 3x + 1)$

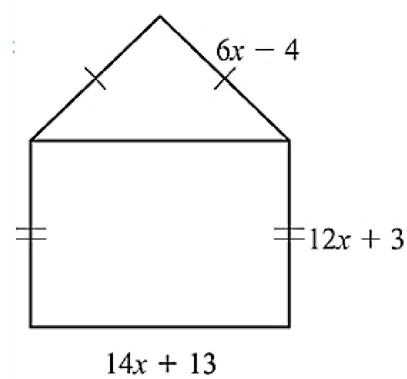
b. $(-2x + 5) + (-4x^2 + 6x + 9)$

c. $(5 - 2xy + x^2 + 7) + (3x^2 + 7 - 4xy)$

d. $(2x^3 + x^2 - 5) + (2x + x^3)$

Application: Find an expression that represents the perimeter of the house.

What does it mean to find the perimeter of an object?



Perimeter of the house:

Subtracting Polynomials

Subtracting polynomials is similar to adding polynomials except we have to take care of the minus sign first. Subtracting polynomials require the following steps:

- Change the subtraction sign to addition and distribute the negative sign to every term in the 2nd polynomial.
- Line up like terms
- Add (Make sure final answer is in standard form)
-

a. $(7x^2 - 2x + 1) - (-3x^2 + 4x - 7)$

b. $(3x^2 + 5x) - (4x^2 + 7x - 1)$

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

d. $(3 - 5x + 3x^2) - (-x + 2x^2 - 4)$

e. $(8xy + x^3 - 6) - (-10xy + 7 - 2x^3 + 5x^2)$

f. $(-7x^2 + 8x - 4) - (2 - 14x^2)$

Application: It costs Margo a processing fee of $3 to rent a storage unit, plus $17 per month to keep her belongings in the unit. Her friend Carissa wants to store a box of her belongings in Margo's storage unit and tells her that she will pay Margo $1 towards the processing fee and $3 for every month that she keeps the box in storage.

a. Write an expression in standard form that represents how much Margo will pay if Carissa contributes.

b. Determine how much Margo will pay if she uses the storage unit for 6 months.

Day 4 & 5 – Multiplying Polynomials

Standard(s): ____

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To multiply polynomials, we will use the **Area Model**.

Area Model

a. $4x(x + 3)$

b. $(x - 3)(x + 7)$

c. $(x + 5)^2$

d. $(x - 4)(x + 4)$

e. $(3x + 6)(2x - 7)$

f. $(x - 3)(2x^2 + 2)$

Practice Problems

Solve these problems using the Area Model.

1) $(x - 7)(x + 4)$

2) $(x - 9)^2$

3) $(x + 10)(x - 10)$

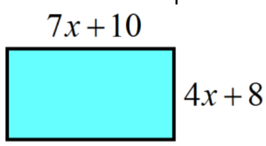
4) $x(x - 12)$

5) $(3x + 7)(2x + 1)$

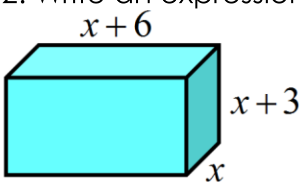
6) $(4x - 5)(3x - 6)$

Applications Using Polynomials

1. Write an expression that represents the area of this rectangle.

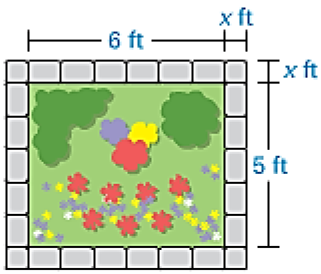


2. Write an expression that represents the volume of this rectangular prism. (V = *lwh*)



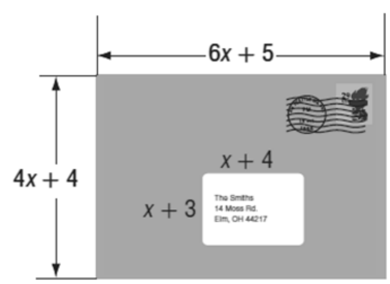
3. You are designing a rectangular flower bed that you will border using brick pavers. The width of the board around the bed will be the same on every side, as shown.

a. Write a polynomial that represents the total area of the flower bed and border.



b. Find the total area of the flower bed and border when the width of the border is 1.5 feet.

4. Find the expression that represents the area not covered by the mailing label.



Day 7 & 8: Multiplying & Simplifying Radical Expressions

Standard(s): ____

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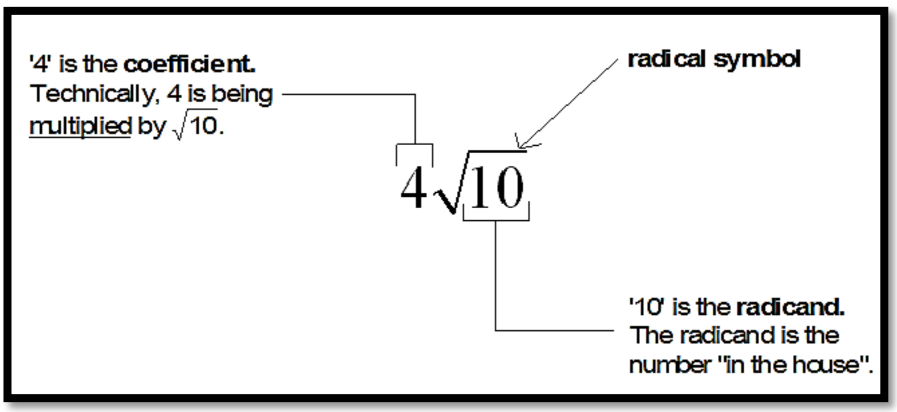
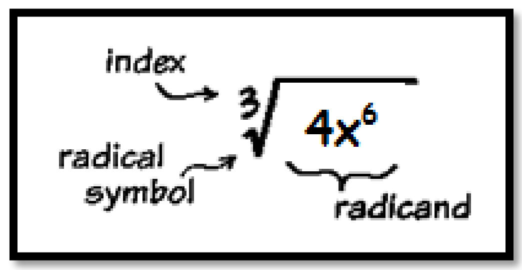
A **radical** is any number with a radical symbol ($\sqrt{\ }$).
A **radical expression** is an expression (coefficients and/or variables) with radical.





Square Root Table

Complete the table below.

	1	2	3	4	5	6	7	8	9	10	x
Square each of the following numbers. **Perfect Squares**											
Take the square root of each of your perfect squares. **Square Roots**	$\sqrt{\ }$	$\sqrt{\ }$	$\sqrt{\ }$	$\sqrt{\ }$	$\sqrt{\ }$	$\sqrt{\ }$	$\sqrt{\ }$	$\sqrt{\ }$	$\sqrt{\ }$	$\sqrt{\ }$	$\sqrt{\ }$

Perfect Squares are the product of a number multiplied by itself ($4 \cdot 4 = 16$; 16 is the perfect square).

Think about the process we just performed: **Number → Squared It → Took Square Root → Same Number**

A root and an exponent are **inverses** of each other (they undo each other). Therefore, square roots and squaring a number are **inverses** or they undo each other, just like adding and subtracting undo each other.

When are Radical Expressions in Simplest Form?

A ________________ expression is in **simplest form** if:

- No perfect square factors other than 1 are in the radicand (ex. $\sqrt{20} = \sqrt{4 \cdot 5}$)

Simplifying Radicals

Guided Example: Simplify $\sqrt{80}$.

Step 1: Find the prime factorization of the number inside the radical.	
Step 2: Determine the index of the radical. Since we are only talking about square roots, the index will be 2, which means we will circle all of our two of a kind.	
Step 3: Move each circled pair of numbers or variables from inside the radical to outside the radical. List your circled pair as just one factor outside the radical.	
Step 4: Simplify the expressions both inside and outside the radical by multiplying.	

Practice:

a. $\sqrt{25}$ b. $\sqrt{24}$ c. $5\sqrt{32}$ d. $-2\sqrt{63}$

Simplifying Radicals with Variables

When simplifying radical expressions, you simplify the variables using the same method as you did previously (Remember $\sqrt{x^2} = x$; square and square roots undo each other).

a. $\sqrt{x^8}$ b. $\sqrt{x^5}$ c. $\sqrt{y^4 z^3}$

Simplifying Radical Expressions with Square Roots

When simplifying radical expressions, you simplify both the coefficients and variables using the same method as you did previously (Remember $\sqrt{x^2}=x$; square and square roots undo each other). Remember, anything that is left over stays under the radical!

a. $\sqrt{9x^6}$

b. $\sqrt{4x^4}$

c. $\sqrt{32z^7}$

d. $\sqrt{45y^2}$

e. $\sqrt{108x^5y^9}$

f. $3\sqrt{12x^2}$

g. $3\sqrt{18a^4}$

h. $-2\sqrt{36f^3g^4}$

i. $5\sqrt{20x^{16}y^{10}}$

j. $2\sqrt{27a^4b}$

k. $-\sqrt{54m^4n^2}$

l. $-8\sqrt{48g^4h^7}$

Multiplying Radicals

The ________________ ________________ of ______________ states the square root of a product equals the product of the square roots of the factors.

$$\sqrt{ab} = \sqrt{a} \bullet \sqrt{b} \text{ where } a \geq 0 \text{ and } b \geq 0$$

When multiplying radicals, follow the following rules:

Multiplying Radicals – RULE

1. Multiply the ________________ together.
2. Multiply the ________________ together.
3. ______________ the radical.

Directions: Multiply the following radicals. Make sure they are in simplest form.

a. $\sqrt{2} \bullet \sqrt{18}$

b. $\sqrt{5} \bullet \sqrt{10}$

c. $-\sqrt{6} \bullet 3\sqrt{8}$

Multiplying Radicals with Variables

Recall: Do you remember what the rule is when you multiply two variables with exponents together? Work through the following examples to come up with the rule for multiplying exponents.

1. $x^2 \cdot x^5 =$

2. $a^3 \cdot a^4 =$

3. $y^2 \cdot y^5 \cdot z^2 =$

Law of Exponents: When multiplying expressions with the same bases, __________ the exponents.

$$x^m \cdot x^n =$$

Directions: Multiply the following radicals. Make sure they are in simplest form.

a. $\sqrt{a^3b} \bullet \sqrt{a \bullet b}$

b. $\sqrt{3x} \bullet \sqrt{15x}$

c. $5\sqrt{2y^3} \bullet \sqrt{32y}$

d. $-4\sqrt{2x^3} \bullet -\sqrt{8x}$

e. $5\sqrt{3z^3} \bullet 3\sqrt{3z^7}$

f. $-4\sqrt{10x^3} \bullet -4\sqrt{6x}$

g. $-3\sqrt{8x^4z} \bullet -7\sqrt{y^3z^5}$

h. $-4\sqrt{2a^4b^3} \bullet -2\sqrt{6a^3b^5}$

i. $3\sqrt{5c^3d^2} \bullet 2\sqrt{10c^3d}$

Day 9: Adding and Subtracting Radicals (Review)

Standard(s): ____

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To add and subtract radicals, you have to use the same concept of combining "like terms", in other words, your radicands must be the same before you can add or subtract.

Explore: Simplify the following expressions:

a. $4x + 6x$

b. $5x^2 - 2x^2$

c. $8x^2 + 3x - 4x^2$

Adding/Subtracting Radicals – RULE

1. ______________ all radicals
2. Then add/subtract the ________ radicals

Practice:

a. $2\sqrt{5}+6\sqrt{5}$

b. $6\sqrt{7}+8\sqrt{10}-3\sqrt{7}$

c. $4\sqrt{15}-6\sqrt{15}$

d. $11\sqrt{5}-2\sqrt{20}$

e. $3\sqrt{3}+6\sqrt{27}$

f. $3\sqrt{3}-2\sqrt{12}$

Putting It All Together: Simplify each expression.

a. $\sqrt{5}(\sqrt{10}-\sqrt{15})$

b. $-\sqrt{5}\left(\sqrt{10}+3\right)$

c. $-3\sqrt{3}\left(4\sqrt{6}-2\sqrt{2}\right)$

d. $\sqrt{14x}(3-\sqrt{2x})$

e. $\sqrt{6n}(7n^3+\sqrt{12n^4})$

f. $\sqrt{6x}(7x\sqrt{3x}+\sqrt{12x^5})$

Day 10: Classifying & Comparing Rational & Irrational Numbers

Standard(s): ____

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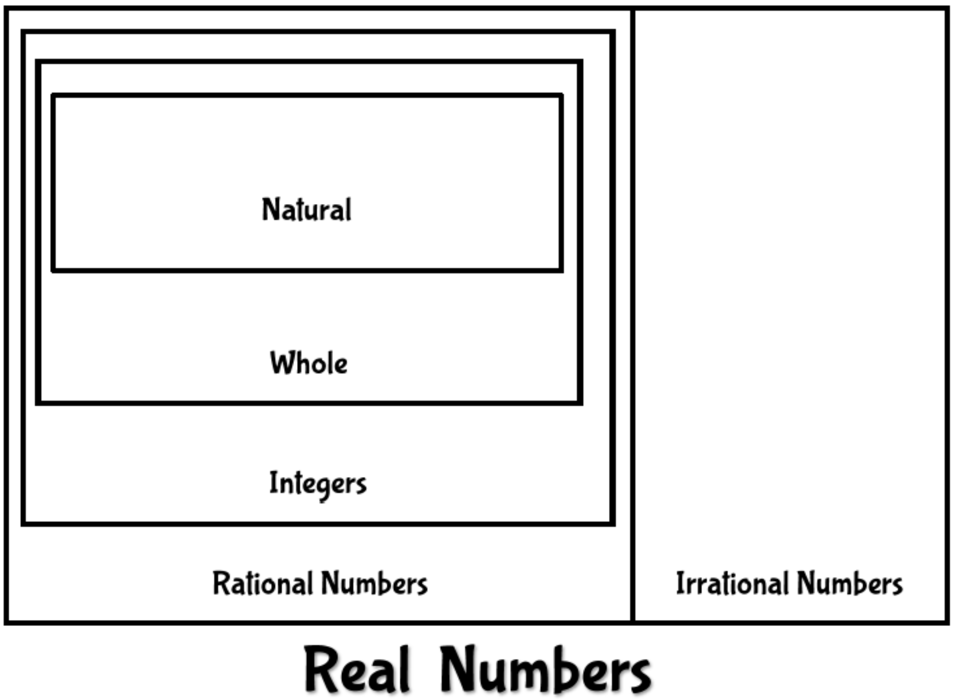

Rational Numbers:

- Can be expressed as the quotient of two integers (i.e. a fraction) with a denominator that is not zero.
- Counting/Natural, Integers, Fractions, and Terminating & Repeating decimals are rational numbers.
- Many people are surprised to know that a repeating decimal is a rational number.
- $\sqrt{9}$ is rational - you can simplify the square root to 3 which is the quotient of the integers 3 and 1.

Examples: -5, 0, 7, 3/2, $0.\overline{26}$

Irrational Numbers:

- Can't be expressed as the quotient of two integers (i.e. a fraction) such that the denominator is not zero.
- If your number contains π, a radical (not a perfect square), or a decimal that goes on forever (does not repeat), it is an irrational number.

Examples: $\sqrt{7}$, $\sqrt{5}$, π, 4.569284….

Adding Rational and Irrational Numbers

Directions: Perform the following operations and write your conclusions in each right box below.

		Rational		
	+	5	½	0
Rational	5			
	½			
	0			

Adding Two Rational Numbers

Conclusion:

The sum of two rational numbers is

____________________________________.

		Rational		
	+	5	½	0
Irrational	$\sqrt{2}$			
	$-\sqrt{2}$			
	π			

Adding Rational and Irrational Numbers

Conclusion:

The sum of a rational and irrational is

____

		Irrational		
	+	$\sqrt{2}$	$-\sqrt{2}$	π
Irrational	$\sqrt{2}$			
	$-\sqrt{2}$			
	π			

Adding Two Irrational Numbers

Conclusion:

The sum of two irrational numbers is

____

Except when:

____

Multiplying Rational and Irrational Numbers

		Rational		
	x	5	½	-1
Rational	5			
	½			
	-1			

Multiplying Two Rational Numbers

Conclusion:

The product of two rational numbers is

________________________________.

		Rational		
	x	5	½	-1
Irrational	$\sqrt{2}$			
	$-\sqrt{2}$			
	π			

Multiplying Rational and Irrational Numbers

Conclusion:

The product of a rational and irrational is

____

		Irrational		
	x	$\sqrt{2}$	$-\sqrt{2}$	π
Irrational	$\sqrt{2}$			
	$-\sqrt{2}$			
	π			

Multiplying Two Irrational Numbers

Conclusion:

The product of two irrational numbers is

____

Except when:

____

*If you ever multiply an irrational number by 0 (which is a rational number), your outcome will always be 0, which is a rational number. Most of the time, when multiplying, it will say a nonzero rational number, which means 0 is excluded from the rational number set.

Ex. $\sqrt{2} \cdot 0 = 0$ Ex. $\pi \cdot 0 = 0$

Practice: Classify each number as rational or irrational and explain why.

a. $\sqrt{15}$

b. ¼

c. $\sqrt{2} \cdot \sqrt{18}$

d. $\sqrt{25} + \sqrt{1}$

e. $\sqrt{7} + \sqrt{28}$

f. $\pi + (-\pi)$

Critical Thinking:

Let the following variables represent a certain type of number:

A: positive rational number

B: negative rational number

C: positive irrational number

D: negative irrational number

Determine if the following sums or products will result in a rational or irrational number or both. If a sum or product could result in both, give an example of when it results in a rational number and when it results in an irrational number.

a. A + B

b. A + C

c. C + D

d. C + C

e. A x B

f. B x C

g. C x D

h. C x C

Day 12: Metric Conversions & Defining Appropriate Units

Standard(s): ____

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The Metric System of Measurement is based on multiples of 10. The three base units are meters, liters, and grams. The 6 prefixes are kilo (1000), hector (100), deka (10), base unit (1), deci (.1), centi (.01), and milli (.001). A helpful way to remember the order of the prefixes is **King Henry Died Unusually Drinking Chocolate Milk**.

Metric Conversion

King	Henry	Died	Unusually	Drinking	Chocolate	Milk
Kilo **10 x 10 x 10 x LARGER than a unit** 1 kilo = 1,000 units	Hecto **10 x 10 x LARGER than a unit** 1 hecto = 100 units	Deca **10 x LARGER than a unit** 1 deca = 10 units	* Unit * ***Meter*** *(length)* ***Liter*** *(liquid volume)* ***Gram*** *(mass/weight)* **1 unit**	Deci **10 x SMALLER than a unit** 10 deci = 1 unit	Centi **10 x 10 x SMALLER than a unit** 100 centi = 1 unit	Milli **10 x 10 x 10 x SMALLER than a unit** 1,000 milli = 1 unit
km = kilometer kL = kiloliter kg = kilogram	hm = hectometer hL = hectoliter hg = hectogram	dam = decameter daL = decaliter dag = decagram	m = meter L = liter g = gram	dm = decimeter dL = deciliter dg = decigram	cm = centimeter cL = centiliter cg = centigram	mm = millimeter mL = milliliter mg = milligram
Example: 5 kilo	50 hecto	500 deca	5,000 units	50,000 deci	500,000 centi	5,000,000 milli

← DIVIDE numbers by 10 if you are getting bigger (same as moving decimal point one space to the left)

MULTIPLY numbers by 10 if you are getting smaller (same as moving decimal point one space to the right) →

Examples: Convert from one prefix to another

A. 2500 dL = __________ kL

B. 38.2 dkg = __________ cg

C. 5 dm = __________ m

D. 1000 mg = __________ g

E. 14 km = __________ m

F. 1 L = __________ mL

Examples: Compare measurements using <, >, or =.
(Hint: They have to be written in the same units of measure before you can compare.)

A. 502 mm ________ .502 m

B. 90,801 cg ________ 5 hg

C. 160 dL ________ 1.6 L

Defining Appropriate Units - Metric

Unit of Measure	Abbreviation	Estimate
Length		
Millimeter	mm	1 mm = thickness of a cd
Centimeter	cm	1 cm = width of computer keyboard key
Meter	m	1 m = length across a doorway
Kilometer	km	1 km = length of 11 football fields
Mass		
Milligram	mg	1 mg = mass of a strand of hair
Gram	g	1 g = mass of a dollar bill
Milligram	kg	1 kg = mass of a textbook
Capacity		
Milliliter	mL	1 mL = sip from a drink
Liter	L	1 L = amount of liquid in a bottle of water
Kiloliter	kL	1 kL = amount of water in two bathtubs

Practice: Choose the appropriate metric unit of measure to use when measuring the following:

a. The length of your pencil:

b. The amount of water to fill a swimming pool

c. Your height

d. The distance from New York to California

Defining Appropriate Units - Customary

Unit of Measure	Abbreviation	Estimate
Length		
Inch	in	1 in = length of small paper clip
Foot	ft	1 ft = length of a man's foot
Yard	yd	1 yd = length across a doorway
Mile	mi	1 mi = length of 4 football fields
Weight		
Ounce	oz	1 oz = weight of one slice of cheese
Pound	lb	1 lb = weight of one can of canned food
Ton	t	1 t = weight of small car
Capacity		
Fluid Ounce	fl oz	1 fl oz = sip from a drink
Cup	c	1 c = large scoop of ice cream
Pint	pt	1 pt = school lunch milk container
Quart	qt	1 qt = container of automobile oil
Gall	gal	1 gal = large can of paint

Practice: Choose the appropriate metric unit of measure to use when measuring the following:

a. The height of a building

b. The weight of your biology textbook

c. The weight of a semi truck

d. The amount of chicken noodle soup in a soup can

e. The amount of water that fills a bathtub

Defining Appropriate Units – Mixed Multiple Choice

1. Sandra collected data about the amount of rainfall a city received each week. Which value is MOST LIKELY part of Sandra's data?
   a) 3.5 feet
   b) 3.5 yards
   c) 3.5 inches
   d) 3.5 meters

2. What is a good unit to measure the area of a room in a house?
   a) Square feet
   b) Square miles
   c) Square inches
   d) Square millimeters

3. If you were to measure the volume of an ice cube in your freezer, what would be a reasonable unit to use?
   a) Cubic feet
   b) Cubic miles
   c) Square feet
   d) Cubic inches

4. Which unit is the most appropriate for measuring the amount of water you drink in a day?
   a) Kiloliters
   b) Liters
   c) Megaliters
   d) Milliliters

Day 13: One & Two Step Dimensional Analysis

Standard(s): ____

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There are many different units of measure specific to the U.S. Customary System that you will need to remember. The list below summarizes some of the most important.

Measurement	Time	Capacity	Weight
1 foot = ________ inches	1 minute = ________ seconds	1 cup = ________ fl. oz	1 ton = ________ lbs
1 yard = ________ feet	1 hour = ________ minutes	1 pint = ________ cups	1 lb = ________ oz
1 mile = ________ feet	1 day = ________ hours	1 quart = ________ pints	
1 mile = ________ yards	1 week = ________ days	1 gal = ________ quarts	
	1 year = ________ weeks		

In order to convert between units, you must use a conversion factor. A **conversion factor** is a fraction in which the numerator and denominator represent the same quantity, but in different units of measure.

Examples: 3 feet = 1 yard: $\frac{3\text{ feet}}{1\text{ yard}}$ OR $\frac{1\text{ yard}}{3\text{ feet}}$ | 100 centimeters = 1 meter: $\frac{100\text{ cm}}{1\text{m}}$ OR $\frac{1\text{m}}{100\text{ cm}}$

Multiplying a quantity by a unit conversion factor changes only its units, not its value. It is the same thing as multiplying by 1.

$$\frac{100\text{ cm}}{1\text{m}} = \frac{100\text{ cm}}{100\text{ cm}} = 1$$

The process of choosing an appropriate conversion factor is called **dimensional analysis.**

Understanding Dimensional Analysis

When setting up your conversion factors, don't worry about the actual numbers until the very end. The key to set up your conversion factors so that they cancel out the units you don't want until you end up with the units that you do want.

1. Convert from inches to miles

Possible Conversion Factors: $\frac{\text{yards}}{\text{miles}}$ **or** $\frac{\text{miles}}{\text{yard}}$ $\frac{\text{Inches}}{\text{feet}}$ **or** $\frac{\text{feet}}{\text{inches}}$ $\frac{\text{yard}}{\text{feet}}$ **or** $\frac{\text{feet}}{\text{yards}}$

2. Convert from gallons to cups

Possible Conversion Factors: $\frac{\text{cups}}{\text{pints}}$ **or** $\frac{\text{pints}}{\text{cups}}$ $\frac{\text{quarts}}{\text{pints}}$ **or** $\frac{\text{pints}}{\text{quarts}}$ $\frac{\text{gallons}}{\text{quarts}}$ **or** $\frac{\text{quarts}}{\text{gallons}}$

Practicing Dimensional Analysis

Scenario 1 : How many feet are in 72 inches?

Step 1: Write the given quantity with its unit of measure.	
Step 2: Set up a conversion factor. (Choose the conversion factor that cancels the units you have and replaced them with the units you want. $\frac{\text{what you want}}{\text{what you have}}$	
Step 3. Divide the units (only the desired unit should be left).	
Step 4: Solve the problem using multiplication and/or division.	

Scenario 2: How many cups are in 140 pints?

Possible Conversion Factors:

Scenario 3: How many feet are in 4.5 miles?

Possible Conversion Factors:

Scenario 4: Convert 408 hours to days.

Possible Conversion Factors:

Scenario 5: How many pounds are in 544 ounces?

Possible Conversion Factors:

Scenario 6: How many liters are in 4 quarts? (1.05 qt = 1 L)

Possible Conversion Factors:

Scenario 7: How many ounces are in 451 mL? (0.034 oz = 1 mL)

Possible Conversion Factors:

Video: Kendrick Farris clean and jerked 197 kg, 205 kg, and 211 kg at the 2013 Worlds Championships. How many pounds did he lift each time if 2.2 lbs = 1 kg?

Day 14: Multi-Step Dimensional Analysis

Standard(s): ____

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How many seconds are in a day?

Most of us do not know how many seconds are in a day or hours in a year. However, most of us know that there are 60 seconds in a minute, 60 minutes in an hour, and 24 hours in a day. Some problems with converting units require multiple steps. When solving a problem that requires multiple conversions, it is helpful to create a flowchart of conversions you already know, set up your conversion factors, and solve your problem.

Flowchart: Days→ Hours → Minutes → Seconds

Conversion Factors: 60 sec = 1 min, 60 min = 1 hr 24 hours = 1 day

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Scenario 1: How many inches are in 3 miles?

Flowchart:

Possible Conversions:

Scenario 2: How many centimeters are in 900 feet? (2.54 cm = 1 in)

Flowchart:

Possible Conversions:

Scenario 3: How many gallons are in 250 mL? (1 gal = 3.8 liters)

Flowchart:

Possible Conversions:

Scenario 4: How many feet are in 5000 centimeters? (1 in = 2.54 cm)

Flowchart:

Possible Conversions:

Real World Applications

Scenario 5: One cereal bar has a mass of 37 grams. What is the mass of 6 cereal bars? Is that more or less than 1 kilogram?

Scenario 6: A rectangle has a length of 5 cm and 100 mm. What is the perimeter of the rectangle in millimeters?

Scenario 7: You're throwing a pizza party for 15 people and figure that each person will eat 4 slices. Each pizza will cost $14.78 and will be cut up into 12 slices.

How many pizzas do you need for your party?

How much will this cost?

Scenario 8:

a. You find 13,406,190 pennies. How many dollars did you actually find?

b. If each penny weighs 4 grams, how much did all that loot weigh in lbs? (2.2 lbs = 1 kg)

c. Assume a movie ticket costs $9. How many movie tickets could you buy with the pennies you found in part a?

Scenario 9: Mrs. Wheaton is approximately 280,320 hours old. How many years old is she?

Rate Conversions

Standard(s): ____

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On Day 1, you learned what a rate is. Redefine what a rate is and then name a few examples.

Rate

Examples:

Most of the rates we are going to discuss today include both an amount and a time frame such as miles per hour or words per minute. When we convert our rates, we are going to change the units in **both** the numerator and denominator.

a. Ms. Howard can run about 2 miles in 16 minutes. How fast is she running in miles per hour?

b. Convert 36 inches per second to miles per hour.

c. Convert 45 miles per hour to feet per minute.

d. Convert 32 feet per second to meters per minute. (Use 1 in = 2.54 cm)

e. A soccer ball deflates by 1 cm every 3 days. What is the rate of deflation in inches per week? (Use 1 in = 2.54 cm)

f. The top speed of a coyote is 43 miles per hour. Find the approximate speed in kilometers per minute. (Use 1 mile = 1,610 meters)

g. The Washington family drinks 2 quarts of milk per day. How many gallons of milk do they drink in a week?