Unit 1 Algebraic Foundations

Target 1.1: Using the order of operations to simplify numerical expressions
    1.1a – Apply the order of operations (by hand)
    1.1b – Apply the order of operations using the calculator

Target 1.2: Simplify radicals, including perfect square functions and rationalizing the denominator
    1.2a – Simplifying radicals using the product properties of radicals
    1.2b – Simplifying radicals using the quotient properties of radicals

Target 1.3: Apply the Properties of Exponents involving Products and Quotients
    1.3a – Multiplication properties of exponents
    1.3b – Division properties of exponents
    1.3c – Rewrite radicals in rational exponential form

Target 1.4: Translate verbal models to algebraic expressions and equations
    1.4a – Write expressions
    1.4b – Write equations and inequalities

Name: _____

1.1a – Apply Order of Operations (by hand)
Target 1: Use order of operations to simplify numerical expressions

Vocabulary:

Order of Operations: _____

_____

	Order of Operations G – E – M- D – A - S		
G GROUPING SYMBOLS	EVALUATE EXPRESSIONS INSIDE _____	Example: $(9 + 33 - 6) \div 6 - 3^2$	
E EXPONENTS (POWERS)	EVALUATE _____		
M MULTIPICATION **D** DIVISION	SIMPLIFY _____ TO _____		
A ADDITION **S** SUBTRACTION	SIMPLIFY _____ TO _____		

YOU TRY NOW!
Evaluate the expression

1) $10 + 3^2$

2) $28 \div 2^2 + 1$

3) $2[(10 - 4) \div 3]$

4) Evaluate $\frac{12k}{3(k^2+4)}$ when k = 2

YOUTRYNOW Answers: 1) 19   2) 8   3) 4   4) 1

Annotate Here

1.1b – Apply Order of Operations (using the TI-84)
Target 1: Use order of operations to simplify numerical expressions

	Annotate Here

Example 1: Using grouping symbols
Simplify the expression

$$\frac{[-7+2(3+9\cdot(2\div4))-4)]}{-8-6}$$

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Example 2: Entering fractions in the TI-84
Simplify the expression

$$-7+\left\{5-14\cdot\left(\frac{11}{3}\div\frac{22}{9}\right)\right\}\div17$$

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Example 3: Entering exponents in the TI-84
Simplify the expression. Round your answer to the nearest thounsandths.

$$3-\left(-\frac{3}{4}+\frac{5}{9}\right)^2-\left(\frac{(-10)\cdot3(-2)}{\frac{7}{11}}\right)+1$$

Answers: 1) 1/4   2) -135/17   3) -90.324

1.2a – Simplifying Radicals Using the Product Property of Radicals
Target 2: Simplify radicals, including perfect square functions and rationalizing the denominator

Vocabulary:

$$\sqrt{}$$

"Simplest Form of a Radical Expression"

_____

_____

_____

_____

Examples of Perfect Squares

Product Property of Radicals

The square root of a product equals the product of the
_____ of the _____.

Example:

Example 1: Use the product property of radicals to <u>simplify</u> each expression

a) $\sqrt{12}$

b) $\sqrt{24p^2}$

c) $\sqrt{56r^4}$

d) $\sqrt{32m^5}$

1.2b – Simplifying Radicals Using the Quotient Property of Radicals
Target 2: Simplify radicals, including perfect square functions and rationalizing the denominator

Quotient Property of Radicals

The square root of a quotient equals the _____ of the _____ of the _____ and_____

Example:

Example 1: Use the quotient property of radicals

a) $\sqrt{\dfrac{11}{29}}$

b) $\sqrt{\dfrac{t^2}{49}}$

Example 2: Rationalize the denominator

a) $\dfrac{\sqrt{2}}{\sqrt{5}}$

b) $\dfrac{1}{\sqrt{7r}}$

🏁 YOU TRY NOW! Simplify the expression

1) $\sqrt{\dfrac{15}{25}}$

2) $\dfrac{2}{\sqrt{5y}}$

YOUTRYNOW Answers: 1) $\dfrac{\sqrt{15}}{5}$ *2)* $\dfrac{2\sqrt{5y}}{5y}$

ANNOTATE HERE

Define the phrase
"Rationalizing the Denominator"

When you rationalize the denominator, what are you REALLY multiplying the fraction by?

1.3a - Apply Exponent Properties Involving Products
Target 3 – Apply the Properties of Exponents involving Products and Quotients

Product of Power Property

Let a be a real number, and let m and n be a <u>positive</u> integers.

If the powers have the <u>same</u> base, _____ the exponents

ALGEBRA: $a^m \cdot a^n =$ _____

Example 1: Simplify the expression

$$5^6 \cdot 5^3 =$$

Power of a Power Property

Let a be a real number, and let m and n be a <u>positive</u> integers.

If a <u>power</u> is being RAISED to another <u>power</u>, _____ the exponents.

ALGEBRA: $(a^m)^n =$ _____

Example 2: Simplify the expression

$$(3^4)^2 =$$

Power of a Product Property

Let a and b be real numbers, and let m <u>positive</u> integers.

If the product <u>two</u> or <u>MORE</u> bases are all being RAISED to the same exponent, _____ the exponent to <u>*EVERY*</u> base.

ALGEBRA: $(ab)^n =$ _____

Example 3: Simplify the expression

$$(23 \cdot 17)^5 =$$

⚑ *YOU TRY NOW! Simplify the expression*

Product of Power Property: Simplify the expression.

a) $2^2 \cdot 2^3$

b) $4^4 \cdot 4$

c) $w^9 \cdot w^2$

d) $(-6)(-6)^6$

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Power of a Power Property: Simplify the expression.

a) $(5^2)^3$

b) $[(-3)^5]^3$

c) $(n^7)^2$

d) $[(z-4)^2]^5$

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Power of a Product Property: Simplify the expression

a) $(4 \cdot 16)^7$

b) $(-3rs)^2$

c) $-(3rs)^2$

1.3b - Apply Exponent Properties Involving Quotients
Target 3 – Apply the Properties of Exponents involving Products and Quotients

Quotient of Powers Property

Let a be a nonzero real number, and let m and n be positive integers such that m > n.

Whenever a power is moved from the numerator to the denominator or vice versa, the _____ of the _____ changes.

ALGEBRA:
$$\frac{a^m}{a^n} =$$

Example 1: Simplify the expression

$$\frac{4^7}{4^2} =$$

Power of a Quotient Property

Let a and b be a real number, with $b \neq 0$, and let m be a _positive_ integer.

If quotient of two numbers are _____ being RAISED to a power, then the exponent is _____ to EACH base.

ALGEBRA:
$$\left(\frac{a}{b}\right)^m =$$

Example 2: Simplify the expression
$$\left(\frac{4}{3}\right)^3 =$$

⚑ YOU TRY NOW! Simplify the expression

Quotient of Powers Property: Simplify the expression

a) $\dfrac{6^{12}}{6^5}$

b) $\dfrac{(-2)^4}{(-2)^7}$

c) $\dfrac{4^2 \cdot 4^8}{4^4}$

d) $\dfrac{1}{y^9} \cdot y^{12}$

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Power of a Quotient Property: Simplify the expression

a) $\left(\dfrac{r}{s}\right)^5$

b) $\left(-\dfrac{4}{w}\right)^3$

c) $\dfrac{3^5 \cdot 3^4}{3^3}$

d) $\dfrac{(-8)^8}{(-8)^5}$

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CHALLENGE PRACTICE! Simplify the expression

a) $\left(\dfrac{2y^7}{y^5}\right)^3 =$

b) $\left(\dfrac{4a}{b^2}\right)\left(\dfrac{2a^2b^3}{a}\right)^4 =$

c) $\left(\dfrac{7y^3z}{y}\right)^2$

d) $\left(\dfrac{6m^3n^2}{3mn}\right)^3$

1.3c – Rewrite Radicals in Rational Exponential Form
Target 3 – Apply the Properties of Exponents involving Products and Quotients

Vocabulary: <u>*LABEL*</u>

$$\sqrt{}$$

Writing Radicals in Rational Exponential Form

Example 1: Write each radical expression using rational exponents

a) $\sqrt{5}$

b) $\sqrt[3]{7}$

c) $\sqrt[5]{x^2}$

d) $\sqrt[3]{x^6 y^8}$

📎 <u>YOU TRY NOW!</u> *Write each radical expression using rational exponents*

a) $\sqrt[3]{7^2}$

b) $\sqrt[3]{x^3}$

c) $\sqrt[3]{8^2 y^5}$

d) $\sqrt[5]{x^3 y^6 z^8}$

YOUTRYNOW Answers: a) $7^{\frac{2}{3}}$　　**b)** x　　**c)** $8^{\frac{2}{3}} y^{\frac{5}{3}}$　　**d)** $x^{\frac{3}{5}} y^{\frac{5}{3}} 8^{\frac{2}{3}}$

1.4a – Write Expressions
Target 4: Translate verbal models to algebraic expressions and equations

Vocabulary:

Verbal Model: _____

_____

Rate: _____

_____

Unit Rate: _____

_____

Translating Verbal Phrases		
Operation	_Verbal Phrase_	_Expression_
Addition	• The _____ of 3 and a number n • A number x _____ 10	
Subtraction	• The _____ of 7 and a number a • Twelve _____ a number x.	
Multiplication	• Five _____ a number y • The _____ of 2 and a number n	
Division	• The _____ of a number a and 6. • Eight _____ into a number y	

Example 1: Translate verbal phrases

Verbal Phrase   _Expression_

a)   _6 less than the quantity 8 times a number x_

b)   _2 times the sum of 5 and a number a_

c)   _The difference of 17 and the cube of a number n_

Annotate Here

What do you need to put in your expression when you see "quantity?"

When you see "LESS THAN" The order _____.

"3 less than x" means

_____

Example 2: Use a verbal model to write an expression

You and three friends are collecting canned food for a food drive. You each collect the same number of cans. Write an expression for the total.

Example 3: Find a unit rate

Three gallons of milk cost $9.15. Find the unit rate.

✎ YOU TRY NOW!
Translate the verbal phrase into an expression.

1) *The product of 5 and the quantity 12 plus a number n*

- -

2) *The quotient of 10 and the quantity a number x minus 3*

- -

3) *You and three friends are collecting canned food for a food drive. You each collect the same number of cans. Then, the total numbers of cans collected were evenly distributed to 2 food banks. Write an expression that represents the number of cans each food bank receives.*

Find the unit rate.

4)
$$\frac{420\ miles}{3\ hours}$$

5)
$$\frac{\$12}{3\ ft^2}$$

6)
$$\frac{20\ cups}{8\ people}$$

YOUTRYNOW Answers: 1) $5(12+n)$ **2)** $\frac{10}{x-3}$ **3)** $\frac{c\times 4}{2}$ **4)** $\frac{140\ miles}{1\ hour}$ **5)** $\frac{\$4}{1\ ft^2}$

6) $\frac{2.5\ cups}{1\ person}$

You always have to make sure that denominator is equal to _____ when you find the unit rate.

1.4b – Write Equations and Inequalities
Target 4: Translate verbal models to algebraic expressions and equations

Annotate Here

Vocabulary:

Open sentence: _____

Expressing Open Sentences		
Symbol	**Meaning**	**Associated Words**
$a = b$	a Is _____ to b	a is the _____ as b
$a < b$	a Is _____ b	a is _____ than b
$a \leq b$	a Is _____ or _____to b	• a is _____ b • a is _____than b
$a > b$	a Is _____ b	a is _____ than b
$a \geq b$	a Is _____ or _____to b	• a is _____ b • a is _____than b

Example 1: Write equation and inequalities

Verbal Sentence	**Equation or Inequality**
a) The sum of three times a number a and 4 is 25.	_____
b) The quotient of a number x and 4 is fewer than 10.	_____
c) A number n is greater than 6 and less than 12.	_____

Example 2: Check possible solution
Check whether "2" is a solution of the equation or inequality

   a) $7x - 8 = 9$ b) $4 + 5y < 18$

✎ YOU TRY NOW!

Translate the verbal phrase into an equation or inequality

1) The sum of 6 times a number and 1 is 25.

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2) 5 less than the square of a number x is greater than 10.

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3) the product of 7 and a number a is at least to 21.

YOUTRYNOW Answers: 1) $6r + 1 = 25$ **2)** $x^2 - 5 > 10$ **3)** $7a \leq 21$

Annotate Here