sName: Answer Key Date: _____ Period: _____

MODULE 11

Equivalent Algebraic Expressions

Standard 6.EE.2 Write, read, and evaluate numerical expressions in which letters stand for numbers.

Standard 6.EE.3 Apply the properties of operations to generate equivalent expressions.

Standard 6.EE.4 Identify when two expressions are equivalent.

In Module 11, you will learn how to...

- ___ **11-1** Model and Write Expressions. (**6.EE.2, 6.EE.4 and 6.EE.6**)
- ___ **11-2** Evaluate Expressions (**6.EE. 2**)
- ___ **11-3** Generate Equivalent Expressions (**6.EE.2, 6.EE.3, 6.EE.4**)

Your Grade Module 11...

The skills and concepts that you learn in this packet will appear as your grade for 6.NS.B Number Fluency.

A = 4 EXCEEDS	You exceed the learning targets in understanding or application.
B = 3 MEETS	You have met all the learning targets for this standard.
C = 2 DEVELOPING	You are approaching the standards or have only partial understanding.
D = 1 WELL BELOW	You have not yet met many of the standards.

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6.EE.2 Lesson 11-1

Modeling and Writing Expressions

Learning Target: I can write and model variables, constants and operations to represent each expression.

Evaluate the following expressions using the order of operation.

1. $7 + (12 - 3)^2$

$7 + 9^2$

$7 + 81$

88

2. $(3 + 5)^2 - 32 + 1$

$8^2 - 32 + 1$

$64 - 32 + 1$

$32 + 1$

33

Opening-

In an algebraic expression phrase there are key math vocabulary words that help us determine a certain operation to use. In the statements below underline the key words that would help you determine an operation.

a) The sum of twice b and 5.

b) The quotient of c and d.

c) a raised to the fifth power and then increased by the product of 5 and c.

d) The quantity of a plus b divided by 4.

e) 10 less than the product of 15 and c.

f) 5 times d and then increased by 8.

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Example 1- Writing Algebraic Expressions

An **Algebraic Expression** is an expression that contains one or more variables any may also contain operation symbols such as + or -.

Example: 150 + y

A **constant** is a specific number whose value does not change.

A **variable** is a letter or symbol used to represent an unknown number. The value of a variable *may change*.

Expression	Operation	Constant	Variable
52 - x	Subtraction	52	X
90 + y + x	Addition	90	y, x
r + 63 - 2	Addition/Subtrac.	63, 2	r

An **algebraic expression** must have a variable in it in order for the expression to be considered **algebraic.** Without a variable it is just an expression.

In **algebraic expressions**, multiplication and division are usually written without the symbols X and ÷

- **Multiplication** in an algebraic expression could be written in three different ways:
  Instead of *3 x n:*

3n	*3 • n*	*n • 3*

- **Division** in an algebraic expression is written without a ÷ sign.

  Instead of 3 ÷ n, it is written $\frac{3}{n}$

Rewrite the following multiplication and division algebraic expressions below:

Algebraic Expression	Rewrite
4 x j	4 • j OR 4j
108 ÷ n	$\frac{108}{n}$
n ÷ 80 x 4	$\frac{n}{80} \cdot 4$

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There are several different ways to describe expressions with words. You can write an expression from a description of words.

Operation	Addition	Subtraction	Multiplication	Division
Words	• added to • plus • sum • more than	• subtracted from • minus • difference • less than	• times • multiplied by • product • groups of	• divided by • divided into • quotient

Writing an algebraic expression as a phrase:

$\frac{20}{n}$ -------> ***this operation indicates division.***

Phrase: 20 divided by n ***or*** n divided into 20 ***or*** the quotient of 20 and n.

Expression	Phrase	Phrase
75 - n	Answers may vary. → 75 minus n	Difference between 75 and n.
n · 5.4	n multiplied by five and four tenths.	Product of n and five and four tenths.

Writing a phrase as an algebraic expression:

The <u>sum</u> of 7 and x -------> this operation indicates addition.

Expression: 7 + x OR x + 7

Phrase	Expression
The quotient of 45 and 5 subtracted from *x*	$x - \frac{45}{5}$
Six groups of *x* added to the sum of 1 and 5	$6x + (1+5)$

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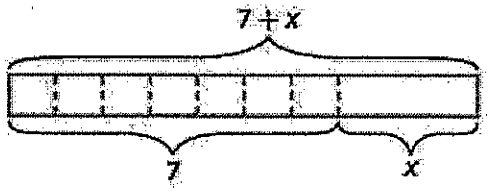
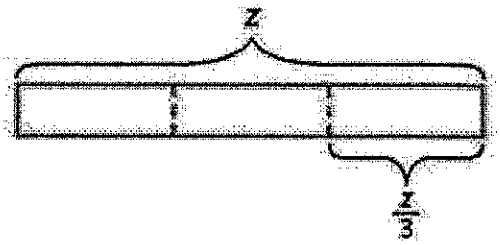
Exercise 1-Writing algebraic expressions and phrases

Directions: Fill in the table below with the missing information.

Expression	Operation	Phrase
$7n$	Multiplication	*n* times 7
$c + 3$	Addition	Sum of c and three
$4 - y$	Subtraction	4 minus *y*
$10y$	Multiplication	10 times y
$13 + x$	Addition	13 added to *x*

Example 2- Modeling Algebraic Expressions

Algebraic expressions can also be represented with models.

Algebraic expression	Bar Model
7 + x *Think in your head...Combine 7 and x*	 ***Combine 7 and x***
$\frac{z}{3}$ *Think in your head...Divide z into 3 equal parts*	 ***Divide z into 3 equal parts***

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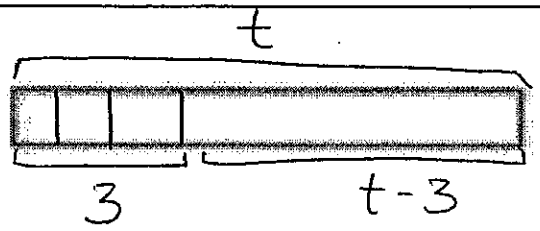
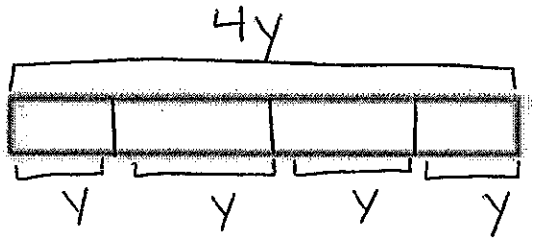
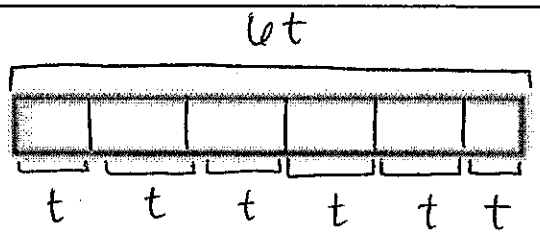
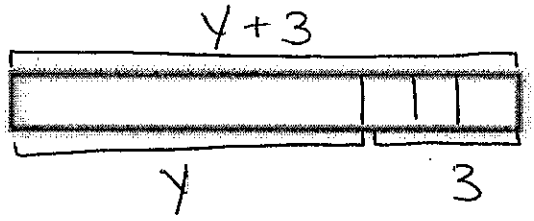
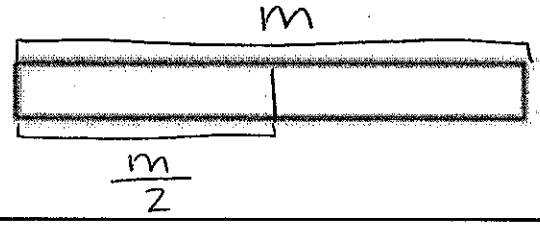
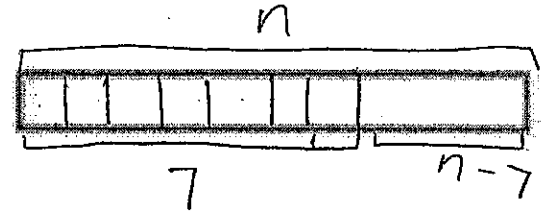
t - 3	
4y	

Exercise 2- Modeling Algebraic Expressions

Directions: Read each algebraic expression below. Then create a bar model that models the algebraic expression.

	Algebraic Expression	Bar Model
1)	**6*t***	
2)	**3 + *y***	
3)	$\frac{m}{2}$	
4)	***n* - 7**	

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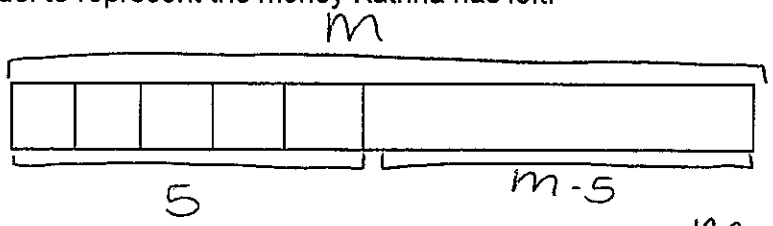
Example 3- Comparing Expressions using Models

Katrina and Andrew started the day with the same amount of money. Katrina spent 5 dollars on lunch. Andrew spent 3 dollars on lunch and 2 dollars on a snack after school. Do Katrina and Andrew have the same amount of money? Use the variable *m* for the unknown value.

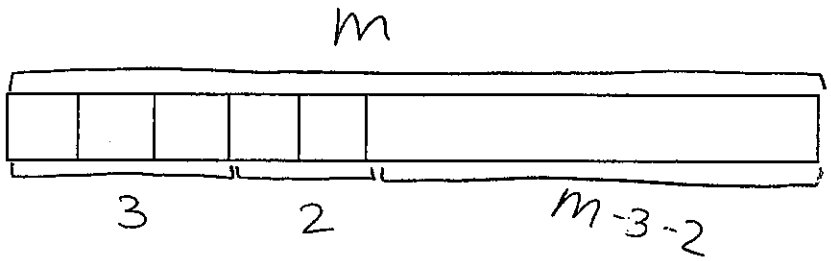
a) Write an algebraic expression to represent the money Katrina has left: $m - 5$

b) Label the bar model to represent the money Katrina has left:



c) Write an algebraic expression to represent the money Andrew has left: $m - 3 - 2$

d) Label the bar model to represent the money Andrew has left:



e) What do you notice about the bar models for Andrew and Katrina?

The bar models end up looking the same.

f) Are the expressions equivalent? Do Katrina and Andrew have the same amount of money left?

The expressions are equivalent because both Katrina and Andrew spent $5. They have the same money left over.

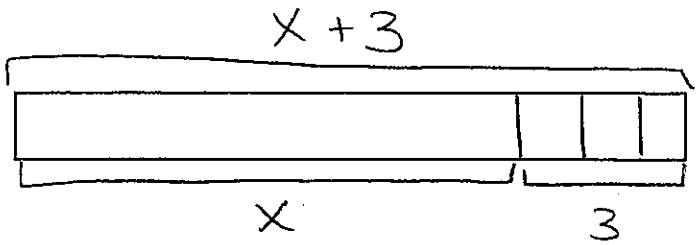
Exercise 3- Comparing Expressions using Models

On a math quiz, Tina scored 3 points more than Julia. Juan scored 2 points more than Julia and earned 2 points in extra credit. Write an expression and draw a bar model to represent Tina's score and Juan's score. Did Tina and Juan make the same grade on the quiz? Use the variable *x* for the unknown value.

a) Write an algebraic expression to represent Tina's score: $x + 3$

↑ Julia's score

b) Create a bar model to represent Tina's score:



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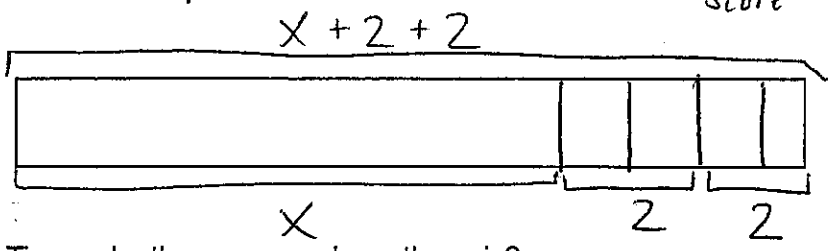
c) Write an algebraic expression to represent Juan's score: $x + 2 + 2$
(↑ Julia's score)

d) Create a bar model to represent Juan's score:



e) Did Juan and Tina make the same grade on the quiz?

No, Juan had a higher score because he earned a total of 4 points more than Julia whereas Tina only had 3 points more.

Example 4- Writing Expressions for Real-World Situations

You can use expressions to represent real-world situations. As you have practiced above, look for keywords in the real-world situation to help you understand the correct operation. Don't forget there will always be an unknown part of the word problem-use a variable!

1. **Tickets to the water park cost $53 per person. Write an expression to show the total cost of tickets for a *group* of people.**

a) *Group* is a keyword for Multiply

b) What is the constant? 53

c) What does the variable *p* represent? # of people

d) Algebraic expression for the total cost of the tickets: $53 \cdot p$ OR $53p$

2. **Genise has some savings in her bank. After babysitting, she *adds* $75 to her savings. How much money has Genise saved?**

a) *Adds* is a keyword for: addition

b) What is the constant? 75

c) What does the variable *s* represent? Savings

d) Algebraic expression for the ~~total cost of the tickets:~~ $s + 75$
$ in her savings:

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Exercise 4- Writing expressions for real-world situations

1. Helen divides up some money to give equally to her four nieces. If *t* represents the total amount, write an expression to represent how much money each niece receives.

a) Keyword: divides Operation: division

b) What is the constant?: 4

c) What does the variable *t* represent? total amount of $

d) Algebraic expression: $\frac{t}{4}$

2. Tickets to the aquarium cost $27 per person. Write an expression to represent the total cost of the tickets for a group of people.

a) Keyword: per person Operation: multiply

b) What is the constant?: 27

c) What does the variable *p* represent? # of people

d) Algebraic expression: $27 \cdot p$ OR $27p$

Problem Set

For problems 1-6, write an algebraic expression that represents the phrase.

1) 3 less than *y* $y - 3$	2) The product of 2 and *p* $2 \cdot p$ OR $2p$	3) *n* divided by 8 $\frac{n}{8}$
4) *p* multiplied by 4 $p \cdot 4$ OR $4p$	5) *b* plus 14 $b + 14$	6) 90 times *x* $90x$ OR $90 \cdot x$

For problems 1-4, write a phrase that matches each algebraic expression

Expression	Phrase
1. $y + 12$	Sum of y and twelve
2. $\frac{p}{10}$	P divided by ten.

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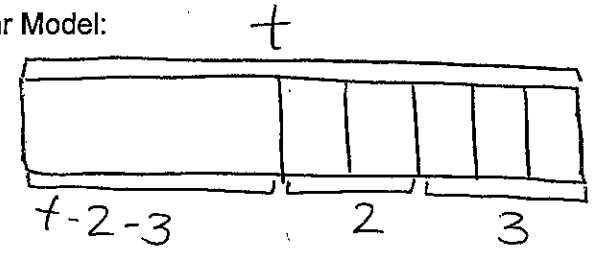
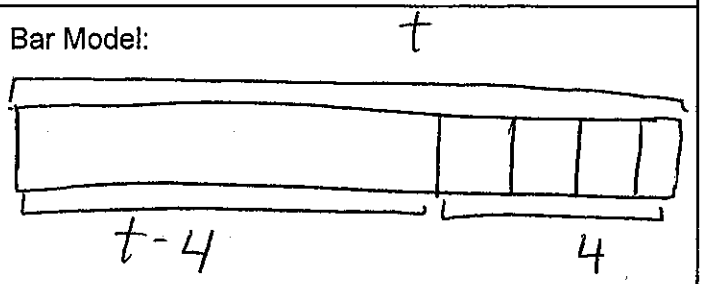
3. $42s$	Product of 42 and S
4. $5 - k$	K less than 5

Write an algebraic expression and draw a bar model to represent the scenario.

1. At 6 p.m. the temperature in Phoenix, AZ is the same as the temperature in Tucson, AZ. By 9 p.m. the temperature in Phoenix has dropped 2 degrees and in Tucson it has dropped 4 degrees. By 11 p.m. the temperature in Phoenix has dropped another 3 degrees.

Phoenix	**Tucson**
Expression: $t - 2 - 3$	Expression: $t - 4$
Bar Model: 	Bar Model: 

a) Are the expressions that represent the temperatures in the two cities equivalent? Justify your answer.
The expressions are not equivalent. Phoenix dropped 5 degrees and Tucson dropped 4 degrees.

For problems 1-4, write an algebraic expression.

1. Noelle bought some boxes of water bottles for a picnic. Each box contained 24 bottles of water. If c is the number of bottles, write an expression to show how many bottles of water Noelle brought. $24 \cdot c$, $24c$	2. Kelly has some savings. After mowing two lawns on Saturday, she adds \$40 to her savings. Write an expression to show how much money has Kelly saved. $S + 40$
3. Tyler has 3 dogs at home. If d is the amount of dog food left, write an expression to show how much dog food each dog would get. $\frac{d}{3}$	4. Tickets to the movie theatre are \$12.50 each. Write an expression to represent the total cost if Damarcus' entire family goes to see a movie. $12.50 \cdot f$ or $12.50f$

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6.EE.2 Lesson 11-2

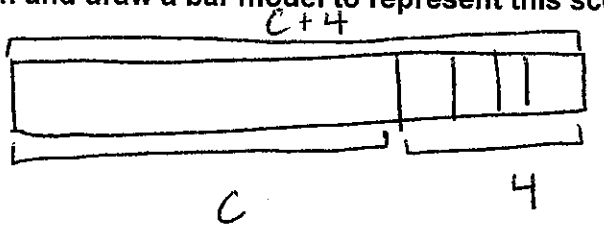
Evaluating Expressions

Learning Target: I can substitute specific values for a variable in order to evaluate expressions.

Do Now

Mr. Michay begins his morning with *c* cups of coffee. As the day goes on Mr. Michay drinks 4 more cups of coffee. Write and algebraic expression and draw a bar model to represent this scenario.

$C + 4$



Example 1- Evaluating Expressions

Remember that an algebraic expression contains one or more variables. You can substitute a number for that variable and then find the value of the expression. This is called *evaluating* the expression. We could substitute ANY number into an expression in order to solve the expression. Expressions can have multiple answers depending on what you substitute for the variable.

Substitution means replacing a variable with a given number in order to solve the problem completely.

What is x - 9 if x = 15?

a) **Substitute 15 for *x*.** What is the new expression? $15 - 9$

b) **Write as a sentence:** *When x = 15, x - 9 =* 6

What is $\frac{16}{n}$ if $n = 8$?

a) **Substitute 8 for *n*.** What is the new expression? $\frac{16}{8}$

b) **Write as a sentence:** *When n = 8,* $\frac{16}{n}$ = 2

What is $p + 17$ if $p = 14$?

b) **Substitute 14 for *p*.** What is the new expression? $14 + 17$

b) **Write as a sentence:** *When p = 14, p + 17 =* 31

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Substituting a variable in a multiplication expression:

Remember that when a variable and a number are next to each other, it signifies the multiplication operation. You may not see a multiplication sign, but you need to multiply! Substitution always involves an operation.

What is $5y$ when $y = 12$?

a) **Substitute 12 for *y*.** What is the new expression? $5 \cdot 12$

b) **Write as a sentence**: *When y = 12, 5y =* 60

Exercise 1- Evaluating Expressions

For Problems 1-6, substitute the given number for the variable to solve the problem completely.

1. What is $6k$ when $k = \frac{1}{2}$?

$6 \cdot \frac{1}{2} = 3$

Sentence: When $K = \frac{1}{2}$, $6K = 3$

2. What is $4x$ when $x = 8$?

$4 \cdot 8 = 32$

Sentence: When $x = 8$, $4x = 32$

3. What is $6.5 - n$ when $n = 1.8$?

$6.5 - 1.8 = 4.7$

Sentence: When $n = 1.8$, $6.5 - n = 4.7$

4. What is $\frac{m}{6}$ when $m = 18$?

$\frac{18}{6} = 3$

Sentence: When $m = 18$, $\frac{m}{6} = 3$

Example 2: Using the Order of Operations

Expressions may have more than one operation or more than one variable. To evaluate these expressions, substitute the given value for each variable and then use the order of operations.

Expression: $4(x - 4)$; $x = 7$

a) **Substitute 7 for *x*.** Write the new expression: $4(7 - 4)$

b) **Use order of operations to solve:**

$4(7 - 4)$

$4 \cdot 3 = 12$

c) **Write as a sentence:** When $x = 7$, $4(x - 4) =$ 12

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1. $10 + 2x$; $x = 11$

a) **Substitute 11 for x.** Write the new expression: $10 + 2 \cdot 11$

b) **Use order of operations to solve:**

$10 + 2 \cdot 11$

$10 + 22 = (32)$

c) **Write as a sentence:** When $x = 11$, $10+2x =$ 32

2. $w - x + y$; $w = 6, x = 5, y = 3$

a) **Substitute variables.** Write the new expressions: $6 - 5 + 3$

b) **Use order of operations to solve:**

$6 - 5 + 3$

$1 + 3 = (4)$

c) **Write as a sentence:** When $w = 6$, $x = 5$, $y = 3$, $w - x + y =$ 4

Exercise 2- Using Order of Operations

For problems 1- 4, evaluate each expression if *n = 5*

1. $3(n + 1)$

a) Substitute variable: $3(5+1)$

b) Solve using order of operations:

$3(5+1)$

$3 \cdot 6 = (18)$

c) Sentence:

When $n = 5$, $3(n+1) = 18$

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2. $4(n-4)$

a) Substitute variable: $4(5-4)$

b) Solve using order of operations:

$4(5-4)$

$4 \cdot 1 = 4$

c) Sentence:

When $n=5$, $4(n-4) = 4$

3. $6n + n^2$

a) Substitute variable: $6 \cdot 5 + 5^2$

b) Solve using order of operations:

$6 \cdot 5 + 5^2$

$30 + 25 = 55$

c) Sentence:

When $n=5$, $6n + n^2 = 55$

4. $\frac{n}{n} + 23n$

a) Substitute variable: $\frac{5}{5} + 23 \cdot 5$

b) Solve using order of operations:

$\frac{5}{5} + 23 \cdot 5$

$1 + 115 = 116$

c) Sentence:

When $n=5$, $\frac{n}{n} + 23n = 116$

Example 3- Evaluating Real-World Expressions

The expression $1.8c + 32$ gives the temperature in degrees Fahrenheit for a given temperature in degrees Celsius c. Find the temperature in degrees Farenheit that is equivalent to 30 °C.

a) What is the value of c? $c = 30$

b) Substitute the value into the expression: $1.8 \cdot 30 + 32$

c) Solve using order of operations:

$1.8 \cdot 30 + 32$

$54 + 32 = 86\,°F$

d) Write your answer a sentence: When $C = 30$, $1.8C + 32 = 86$

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The expression $6x^2$ gives the surface area of a cube, and the expression x^3 gives the volume of a cube where x is the length of one side of the cube. Find the surface area and the volume of a cube with a side length of 2 m.

Surface Area $x=2$	Volume $x=2$
$6x^2$ $6 \cdot 2^2$ $6 \cdot 4 = 24\ m^2$	x^3 2^3 $2 \times 2 \times 2 = 8\ m^3$

Exercise 3- Evaluating Real-World Expressions

For problems 1-4, substitute a given number for a variable and evaluate the expression completely.

1. The expression $60m$ gives the number of seconds in m minutes. How many seconds are there in 7 minutes?

$60m$
$60 \cdot 7$
420 seconds in 7 minutes

2. The expression $3.3m$ gives the number of feet in m (meters). Use the expression to find the number of feet that is equivalent to 400 meters.

$3.3m$
3.3×400
1,320 ft.

3. The kinetic energy (in joules) of a moving object can be calculated from the expression $\frac{1}{2}mv^2$ where m is the mass of the object in kilograms and v is its speed in meters per second. Find the kinetic energy of a 0.145-kg baseball that is thrown at a speed of 40 meters per second. → Mass, speed

$\frac{1}{2} \cdot 0.145 \cdot 40^2$
$\frac{1}{2} \cdot 0.145 \cdot 1600$
$.0725 \cdot 1600 = 116\ J$

4. The volume of a pyramid with a square base is given by the expression $\frac{1}{2}s^2h$ where s is the length of a side of the base and h is the height. Find the volume of a pyramid with a square base of side length 24 feet and height of 30 feet.

$\frac{1}{2} \cdot 24^2 \cdot 30$
$\frac{1}{2} \cdot 576 \cdot 30$
$288 \cdot 30 = 8{,}640\ ft^3$

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Problem Set

For problems 1-6, evaluate each expression for the given value of the variable.

1) $x - 7$; $x = 23$

$23 - 7 = 16$

2) $3a - b$; $a = 4$, $b = 6$

$3 \cdot 4 - 6$

$12 - 6 = 6$

3) $5(6.2 + z)$; $z = 3.8$

$5(6.2 + 3.8)$

$5 \cdot 10 = 50$

4) $9 + m$; $m = 1.5$

$9 + 1.5$

10.5

5) $\frac{1}{2}w + 2$; $w = \frac{1}{9}$

$\frac{1}{2} \cdot \frac{1}{9} + 2$

$\frac{1}{18} + 2 = 2\frac{1}{18}$

6) $\frac{8}{t}$; $t = 4$

$\frac{8}{4} = 2$

7) The table shows the prices for games in Bella's soccer league. Her parents and grandmother attended a soccer game. How much did they spend if they all went together in one car?

Women's Soccer Game Prices	
Student tickets	$6
Nonstudent tickets	$12
Parking	$5

a) Write an expression that represents the cost of one carful of nonstudent soccer fans who parked at the soccer game. Use x as the number of people who rode in the car and attended the game. $12x + 6$

b) Since there are three attendees, evaluate the expression when $x = 3$.

$12 \cdot 3 + 6$ ~~$= \$42$~~

c) How much did the family spend to attend the game?

$\$42$

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8) Stan wants to add trim all around the edge of a rectangular tablecloth that measures 5 feet long by 7 feet wide. The perimeter of the rectangular tablecloth is twice the length added to twice the width. How much trim does Stan need to buy?

a) Write an expression the represents the perimeter of the rectangular tablecloth. Let *l* represent the length and *w* represent its width. $2l + 2w$

b) Since the length is 5 ft long and the width is 7 ft wide, evaluate the expression above using substitution.

$2 \cdot 5 + 2 \cdot 7$

$10 + 14 = 24$ ft

c) How much trim did Stan have to buy to sew onto the tablecloth?

24 ft of trim.

9) Marjorie evaluated the expression $3x + 2$ for $x = 5$ as shown:

$3x + 2 = 35$

$3 \cdot 5 + 2$

$15 + 2 = 17$

a) Was Marjorie correct? What is the correct value of $3x + 2$?

No, Marjorie was not correct. The correct value of $3x+2$ when $x=5$, is 17.

10.

a) Evaluate the expressions below when $x = 2$.

$3x(x - 2) + 2$	$2x^2 + 3x - 12$
$3 \cdot 2 (2-2) + 2$ $3 \cdot 2 \cdot 0 + 2$ $6 \cdot 0 + 2$ $0 + 2 = 2$	$2 \cdot 2^2 + 3 \cdot 2 - 12$ $2 \cdot 4 + 3 \cdot 2 - 12$ $8 + 6 - 12$ $14 - 12 = 2$

b) Evaluate the same expressions below when $x = 7$

$3x(x - 2) + 2$	$2x^2 + 3x - 12$
$3 \cdot 7 (7-2) + 2$ $3 \cdot 7 \cdot 5 + 2$ $21 \cdot 5 + 2$ $105 + 2 = 107$	$2 \cdot 7^2 + 3 \cdot 7 - 12$ $2 \cdot 49 + 21 - 12$ $98 + 21 - 12 = 107$

c) Based on your results, do you know whether the two expressions are equivalent? Explain.

Yes, both expressions are equivalent. When substituting the same number in both expressions provide the same answer.

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6.EE.3, 6.EE.4 Lesson 11-3

Generating Equivalent Expressions

Learning Target: I can identify and write equivalent expressions.

Do Now

Evaluate the expressions below with the given number for *m* in the left hand column.

	7 (m - 6)
m = 9	$7(9-6)$ $7 \cdot 3 = 21$
m = 8	$7(8-6)$ $7 \cdot 2 = 14$
m = 12	$7(12-6)$ $7 \cdot 6 = 42$

Opening

One way to test whether two expressions might be equivalent is to evaluate them for the same value of the variable. Below are two algebraic expressions. To test to see if the expressions are equivalent, lets try substituting the number 3 (any #) in the place of "*x*."

why? 5 groups of x+1

5(x + 1)	**5x + 1**
$5(3+1)$ $5 \cdot 4$ 20	$5 \cdot 3 + 1$ $15 + 1$ 16

1) Are the two expressions above equivalent? How do you know?

No, the expressions are not equivalent because they do not provide the same ~~number~~ answer when substituting the same number.

2) How could you further test whether the expressions in each pair are equivalent?

Plug in a different number

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Example 1 - Equivalent Expressions Using the Distributive Property

When we used order of operations to solve numerical expressions, we always solved the operations in the parenthesis first. When we simplify algebraic expressions, there are times that we won't be able to solve what is in the parenthesis. In these situations we can use the distributive property.

The distributive property allows us to multiply a sum or difference by multiplying each addend separately.

$5(x + 3)$

Whenever you see a number or variable next to a set of parenthesis, that will signify that you need to simplify using the distributive property.

Simplify the expression above by multiplying the number on the outside of parentheses by the numbers or variables inside the parenthesis.

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

$5x + 15$

*** Because we were not given a value for *x*, this is the most simplified form of the expression.**

An algebraic expression can involve subtraction, exponents as well as the variable in either position inside the parenthesis. You can solve the same way that you did in the above example.

$3(4 - y^2)$

$(3 \cdot 4) - (3 \cdot y^2)$

$12 - 3y^2$

Exercise 1- Equivalent Expressions Using the Distributive Property

For problems 1-4, simplify the given expressions.

1. $10(m + 4)$

$(10 \cdot m) + (10 \cdot 4)$

$10m + 40$

2. $8(6 - y)$

$8 \cdot 6 - 8 \cdot y$

$48 - 8y$

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3. $3(x^3 - 6)$	4. $7(2 + b)$
$3 \cdot x^3 - 3 \cdot 6$ $3x^3 - 18$	$7 \cdot 2 + 7 \cdot b$ $14 + 7b$

Example 2- Identifying Equivalent Expressions Using the Distributive Property

When given two expressions that might look different, it is important that we remember to simplify using the distributive property to determine if the expressions are equivalent.

Circle which expression below can be simplified. Then simplify to determine if the expressions are equivalent.

$5x - 20$	**$5(x - 4)$**
$5x - 20$	$5x - 20$

Are the expressions equivalent? How do you know?

After simplifying, the expressions look the same (same operations) therefore they are equivalent.

Circle which expression below can be simplified. Then simplify to determine if the expressions are equivalent.

$6(m^2 + 4)$	**$6m + 4$**
$6m^2 + 24$	$6m + 4$

Are the expressions equivalent? How do you know?

The expressions are not equivalent because the ~~operation~~ expression on the left uses an exponent and adds 24. The expression on the right only adds 4.

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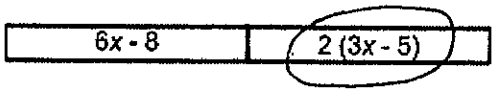
Exercise 2- Identifying Equivalent Expressions Using the Distributive Property

For problems 1-4 simplify the expressions below to determine whether or not the expressions are equivalent.

1. a) Circle the expression below that could be simplified.
   b) Simplify:



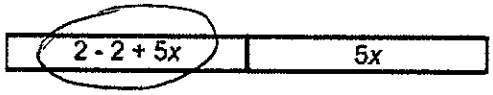
$6x - 10$

Are the expressions equivalent?

NO

Minus 8 } Minus 10

2. a) Circle the expression below that could be simplified.
   b) Simplify:



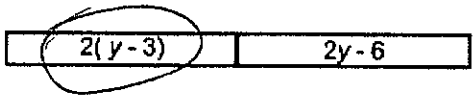
$0 + 5x$

$5x$

Are the expressions equivalent?

Yes

3. a) Circle the expression below that could be simplified.
   b) Simplify:

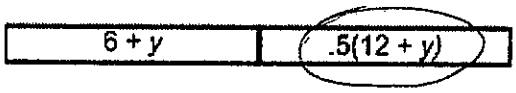


$2y - 6$

Are the expressions equivalent?

Yes

4) a) Circle the expression below that could be simplified.
   b) Simplify:



$6 + y$

Are the expressions equivalent?

Yes

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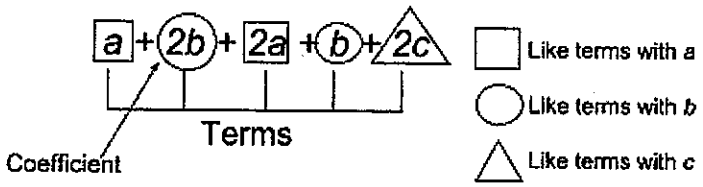
Example 3- Generating Equivalent Expressions

There are different parts of algebraic expressions that together make up a full expression. At times we may need to simplify an algebraic expression in order to make an equivalent expression.



Parts of an algebraic expression

Terms	**The parts of the expression that are separated by + or - signs.**	***Circle the terms below:*** $12 + 3y^2 + 4x + 2y^2 + 4$
Coefficients	**Numbers that are multiplied by at least one variable**	***Circle the coefficients below:*** $12 + 3y^2 + 4x + 2y^2 + 4$
Like Terms	**Terms with the <u>same variable</u> <u>and</u> raised to the <u>same power.</u>** *some terms won't have a like term	***Circle the like terms below:*** $12 + 3y^2 + 4x + 2y^2 + 4$

In the expressions below count the terms, underline the coefficients and box like terms with a square, circle or triangle.

a) $15 + 3a + 4c^2 + 2b + 6a + 3c^2$ **Number of terms:** 6

b) $5h + 11g + h - 8g$ **Number of terms:** 4

c) $4x^2 + 3y^2 - x^2 + 2y^2$ **Number of terms:** 4

d) $6y + 4x - 3y - 2x$ **Number of terms:** 4

Combining Like Terms

In order to create equivalent expressions, you need to combine like terms and simplify with the given operations.

$6x^2 - 4x^2$

a) Are $6x^2$ and $4x^2$ like terms? How do you know?

Yes. Both have same x variable with same exponent.

b) Since the terms are alike, you can subtract the coefficients. Write the equivalent expression below:

$6x^2 - 4x^2$

$2x^2$

*Keep the same variable and exponent!

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Combine like terms in the algebraic expression: $3a + 2(b + 5a)$

$3a + 2(b + 5a)$

$3a + 2b + 10a$ Distribute

$13a + 2b$ Combine "a" like terms

$13a + 2b$ * cannot combine "a" and "b", not like terms.

Combine like terms in the algebraic expression: $y + 11x + 7y - 7x$

$1y + 11x + 7y - 7x$

$8y + 11x - 7x$ Combine "y" terms

$8y + 3x$ Combine "x" terms

$8y + 3x$

Exercise 3

1. Combine like terms:

$8y - 3y$

$5y$

2. Combine like terms:

$6x^2 + 4(x^2 - 1)$

$6x^2 + 4x^2 - 4$

$10x^2 - 4$

3. Combine like terms:

$4a^5 - 2a^5 + 4b + b$

$2a^5 + 5b$

4. Combine like terms:

$8m + 14 - 12 + 4n$

$8m + 2 + 4n$

5. Combine like terms:

$12 + 3x - x - 12$

$12 + 2x - 12$

$0 + 2x$

$2x$

6. Write 2 terms that can be combined with $7y^4$

$3y^4$ $6y^4$

*Answers will vary

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Problem Set:

For problems 1-4 write an equivalent expression.

1. $5(3x - 2) =$ 15x - 10

15x - 10

2. $3(x^2 - 9) =$ $3x^2 - 27$

$3x^2 - 27$

3. $4(3 + 2b) =$ 12 + 8b

12 + 8b

4. $b(10 - 4) =$ 6b

10b - 4b

6b

For problems 5-10, combine like terms.

5. $7x^4 - 5x^4$

$2x^4$

6. $0.5(x^4 - 3) + 12$

$0.5x^4 - 1.5 + 12$

$0.5x^4 - 13.5$

7. $7a^2 - a^2 + 16$

$6a^2 + 16$

8. $3y^2 + 3(4y^2 - 2)$

$3y^2 + 12y^2 - 6$

$15y^2 - 6$

9. $6b + 7b - 10$

13b - 10

10. $z^2 + z + 4z^2 + 4z^2$

$9z^2 + z$

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11. $\frac{1}{2}(16 + 4p)$

$8 + 2p$

12. $y + 4 + 3(y + 2)$

$y + 4 + 12y + 6$

$13y + 4 + 6$

$13y + 10$

14. William earns $13 an hour working at a movie theater. Last week he worked *h* hours at the concession stand and three times as many hours at the ticket counter. Write and simplify an expression for the amount of money William earned last week.

$13h + 13h \cdot 3$

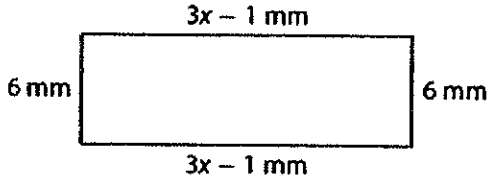
15. Write an example of an expression that cannot be simplified and explain how you know.

$3y + 2x + 3$

None of the terms above are alike, therefore it cannot be simplified any further.

16. Write an expression for the perimeters (distance around the outside of a shape) of the rectangle below. Simplify the expression.

a)



Expression: $6 + 6 + 3x - 1 + 3x - 1$

$12 + 3x - 1 + 3x - 1$

$12 + 6x - 1 - 1$

$11 + 6x - 1$

$10 + 6x$