Warm–Up

Directions: For Questions 1 – 4, write the algebraic expression for the given verbal expression. For Questions 5 – 8, evaluate the expression based on the given value of the variable(s).

1. Two multiplied by a number increased by seven	**2.** Nine less than six times a number
3. Four times the quantity of a number plus eight	**4.** The quotient of a number and five decreased by three times the same number
5. Evaluate $4x + 8y$ given $x = 2$ and $y = 4$.	**6.** Evaluate $^{-}6x + 5y$ given $x = 9$ and $y = {}^{-}7$.
7. Evaluate $3x^2 - 2x + 1$ given $x = {}^{-}2$.	**8.** Evaluate $5x^2 - \frac{36}{y} + 7$ given $x = 5$ and $y = 4$.

Directions: Complete the following SOLVE problem with your teacher. You will only complete the S step.

Mia is planting a garden with peppers and lettuce, her favorite vegetables. The width of the garden will be 6 feet, and the length of the garden will be $x + 2$ feet. Mia made sure to move the garden 14 feet away from her house so the garden has direct sunlight exposure. What is the area of the garden?

S Underline the question.
This problem is asking me to find _____.

Directions: Complete this page with your teacher and partner.

1. Look at the two expressions below in the chart.

Expression 1	Expression 2
8 + 7 =	2 + 4 + 2 + 5 + 2 =

2. Discuss with your partner the similarities and differences of the two expressions.

3. Explain how the two expressions are alike.

4. Explain how the two expressions are different.

5. How many terms does Expression 1 have? __ What are the terms in Expression 1? _____ How many terms does Expression 2 have? __ What are the terms in Expression 2? _____

6. What do you notice about the expressions?

7. Can you write two more expressions that are equal to 15?

Work with your partner to write one expression with 3 terms:_____

Work with your partner to write one expression with 6 terms:_____

8. What can you conclude about writing an expression to represent the value of 15?

Directions: Complete this page with your teacher and partner.

We can also use the properties of operations with algebraic expressions. Let's explore using the algebra tiles.

1. Place a yellow unit tile in the space below.

2. What is the value of the expression in the area above?

3. Add two more yellow unit tiles to the area. What is the value of the expression now?

4. Work with your partner to represent the value of 8 using the unit tiles. Create an expression with 3 terms and be prepared to model and explain your expression to the class.

5. Now place one long yellow algebra tile in the space below.

6. Do we know the how long the tile is? _____ Discuss with your partner and explain how to represent an unknown value.

7. What do we use to represent a variable? _____**.** Let's use the variable *x*. Place a unit tile at the end of the *x* tile. What is the width of the *x* tile? __

8. Explain how we can find the area of the long tile. _____ _____. What name can we use to represent the value of the long tile?

9. Add two more *x* tiles to the space under Question 5. What is the value of the expression now? ____ Explain.

LESSON 16: Properties of Operations with Expressions

Directions: Complete this page with your teacher and partner.

1. How can we represent the expression $x + 3$ using algebra tiles? Create a model and defend your answer.

2. How could we represent the expression $2x + 3$ using algebra tiles? Create a model and defend your answer.

3. Is it possible to represent the expression $2x + 3$ in a different way? Create a model and defend your answer.

4. How can we use variables and numbers to represent the expression in Problem 3?

5. Are the expressions we modeled in Question 2 and Question 3 equivalent? Explain your thinking.

6. Is the expression $3x + 2 = 2x + 3$? ___ Create a model and defend your answer.

Directions: Complete this page with your teacher and partner.

Expression	Equivalent Expression
1. $x + 2 - x + 2$	
Representation	Representation
2. $x + 2 + x - 3$	
Representation	Representation
3. $^{-}5x + 4 + 3x - 6$	
Representation	Representation
4. $2x - 8 - x + 1$	
Representation	Representation

LESSON 16: Properties of Operations with Expressions

Directions: Complete this page with your teacher and partner.

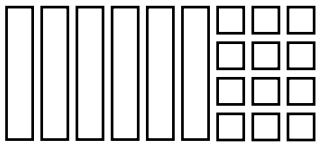
On S186, we proved that the expression 8 + 7 is equivalent to the expression 2 + 4 + 2 + 5 + 2. We can also write an equivalent expression for 6*x* + 12 in many different ways.

Create and explain how to model the expression 6*x* + 12 with algebra tiles. _____ _____ Now work with your partner to create an equivalent expression.

For Questions 1 and 2, use the algebra tiles to draw a picture to prove that the expression is equal to 6*x* + 12. For Questions 3 and 4, write the expression that is represented by the algebra tiles to determine if the two expressions are equal.

1. 2*x* + 12 + 4*x*

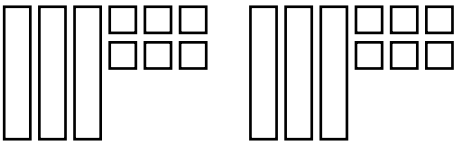
Which equals:



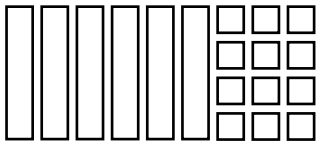
2. *x* + 5*x* + 11 + 1

Which equals:

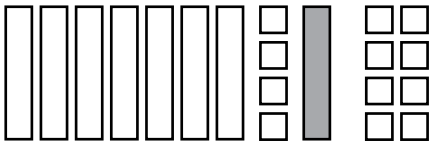
3. _____



Which equals:



4. _____



Which equals:

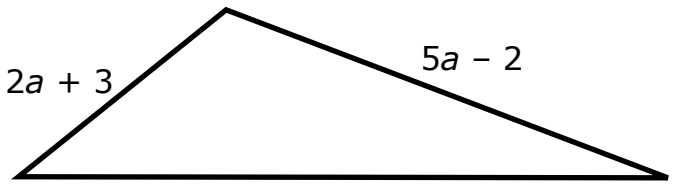
5. How is the representation for Problem 4 different than Problems 1 – 3?

6. How do we combine a negative *x* and a positive *x*?

LESSON 16: Properties of Operations with Expressions

Directions: Complete this page with your teacher and partner.
What is the value of the length of the rectangle?
What is the value of the width of the rectangle?
What does this mean?

1. What expression can we use to represent the width?	
2. What expression can we use to represent the length?	
3. How can we find the perimeter of the rectangle?	
4. What is the perimeter of the rectangle above?	
5. What is the simplified form of the expression that represents the perimeter of the rectangle?	
6. What is the relationship between the expressions in Question 4 and Question 5? Explain your thinking.	



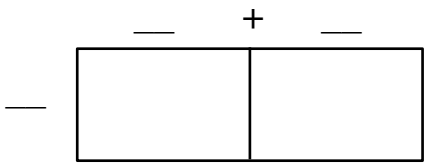
The dimensions for the sides of the triangle are shown above.

7. How can we find the perimeter of the triangle?	
8. What is the perimeter of the triangle above?	
9. What is the simplified form of the expression that represents the perimeter of the triangle?	
10. What is the relationship between the expressions in Question 8 and Question 9? Explain your thinking.	

Directions: Complete this page with your teacher and partner.

First Expression	Second Expression	Are the expressions equivalent?	Defend your answer
$3(3x + 2) - 3x$	$6x + 6$		
$2(-x + 1) + 5$	$^{-}2x + 3$		
$7x + 2(^{-}2x + 2)$	$3x + 4$		
$2(^{-}3x + 2) - 2$	$2x + 2 - 8x$		

Directions: Complete this page with your teacher and partner.

Expression: $15a + 25b$	
	
What is the prime factorization of the first term?	
What is the prime factorization of the second term?	
What factor(s) do they share?	
Place the factor(s) that both terms share on the left side, outside of the boxes.	
What factor(s) remains from $15a$?	
Place the remaining factors from 15a above its box.	
What factor(s) remains from $25b$?	
Place the remaining factors from 25b above its box.	
What operation sign should remain between the remaining factors?	
What two factors did we create?	

1. By completing the box method for factoring, what happened mathematically?

2. What is another way we can show that the 5 needs to be multiplied by both of the terms because it was factored out? _____ _____**.** What property does this remind you of?

3. How can we write the equivalent expression in its factored form?

4. When we distribute the 5 to each term, does the expression equal our original expression? Explain and defend your answer.

Directions: Complete this page with your teacher and partner.

$A = 18w + 3$

Example 1: What is the area of the rectangle?
How can we use the area to find the sides of the rectangle?

1. What is the prime factorization of the first term, $18w$?	
2. What is the prime factorization of the second term, 3?	
3. What factor(s) do the two terms share?	
4. If we remove the common factor from each term, what are we left with?	
5. What are the two factors that can be multiplied together to find the area of the rectangle?	

What are the measures of the length and width of the rectangle?
Explain what happened to the expression when the common factor was factored out?

$A = 24 + 16b$

Example 2: What is the area of the rectangle?
How can we use the area to find the sides of the rectangle?

6. What is the prime factorization of the first term, 24?	
7. What is the prime factorization of the second term, $16b$?	
8. What factor(s) do the two terms share?	
9. If we remove the common factor from each term, what are we left with?	
10. What are the two factors that can be multiplied together to get the original area?	

What are the measures of the length and width of the rectangle? _____.
Explain what happened to the expression when the common factor was factored out.

Directions: Complete this page with your teacher and partner.

Find an equivalent expression by combining like terms or expanding.

1. $4x + 5 - 3x + 6$	**2.** $2(b - 5) + 7b - 4$
3. $^{-}6(5c + 3c) + 1$	**4.** $8m + 9 - 7m + 2(6m - 1)$
5. $^{-}6(3k + 9) - 5(2k + 1)$	**6.** $6p + 5 - 7p + 9 + 2(p - 7)$

Factor the greatest common factor from the expressions below to find an equivalent expression.

7. $6x + 12$	**8.** $2j + 16$
9. $9a - 7 - 2a + 56$	**10.** $10p + 30p - 20$

Directions: Complete the following SOLVE problem with your teacher.

Mia is planting a garden with peppers and lettuce, her favorite vegetables. The width of the garden will be 6 feet, and the length of the garden will be $x + 2$ feet. Mia made sure to move the garden 14 feet away from her house so the garden has direct sunlight exposure. What is the area of the garden?

S Underline the question.

The problem is asking me to find _____.

O Identify the facts.

Eliminate the unnecessary facts.

List the necessary facts.

L Write in words what your plan of action will be.

Choose an operation or operations.

V Estimate your answer.

Carry out your plan.

E Does your answer make sense? (Compare your answer to the question.)

Is your answer reasonable? (Compare your answer to the estimate.)

Is your answer accurate? (Check your work.)

Write your answer in a complete sentence.

Directions: Complete the following SOLVE problem.

Leighann is helping her brother build a patio in his backyard. He tells her that the patio will be in the shape of a square. He also mentioned that the perimeter of the patio will be $64x + 16$ feet. He found a round table and 6 chairs to place on the patio, as well as an umbrella with an 8-foot diameter. What will be the length of each side of the patio?

S Underline the question.
The problem is asking me to find _____.

O Identify the facts.

Eliminate the unnecessary facts.

List the necessary facts.

L Write in words what your plan of action will be.

Choose an operation or operations.

V Estimate your answer.

Carry out your plan.

E Does your answer make sense? (Compare your answer to the question.)

Is your answer reasonable? (Compare your answer to the estimate.)

Is your answer accurate? (Check your work.)

Write your answer in a complete sentence.

Homework

Name _____ **Date** _____

Directions: Find an equivalent expression by combining like terms or expanding.

1. $-7x - 2 - 9x + 2$

2. $-(3b + 5) + 8b + 10$

3. $3(8c - 4c) - 2$

4. $5m + 1 + 3m + 6(2m + 4)$

5. $7(9k + 6) + 4(8k - 2)$

6. $5p - 2 - 6p + 4 + 4(2p + 1)$

Directions: Factor the greatest common factor from the expressions below to find an equivalent expression.

7. $25x + 40$

8. $18j - 27$

9. $7a - 3 + 15a + 58$

10. $12p - 8p + 32$