

9/15/17

Essential Question: How do we determine if algebraic expressions are equivalent?

Do Now: Evaluate the algebraic expressions.

a)  $(5p + 2) - p^2$  when  $p = -3$

$$(5(-3) + 2) - (-3)^2$$

$$(-15 + 2) - (9)$$

$$-13 - 9$$

$$-22$$

b)  $-9bc^2$  when  $b = 10$  and  $c = -2$

$$-9(10)(-2)^2$$

$$-9(10)(4)$$

$$-90(4)$$

$$-360$$



Think about this...

Are  $2x + y$  and  $y + 2x$  equivalent? In what ways can we prove it?

<p>1<sup>st</sup> proof: use properties to show identical expressions</p> <p><math>2x + y</math> ↙ <math>y + 2x</math> commutative property of addition</p>	<p>2<sup>nd</sup> proof: evaluate to show the same value</p> <p>ex. <math>x = 3, y = 5</math></p> <table style="width: 100%; border: none;"> <tr> <td style="text-align: center;"><math>2x + y</math></td> <td style="text-align: center;"><math>y + 2x</math></td> </tr> <tr> <td style="text-align: center;"><math>2(3) + 5</math></td> <td style="text-align: center;"><math>5 + 2(3)</math></td> </tr> <tr> <td style="text-align: center;"><math>6 + 5</math></td> <td style="text-align: center;"><math>5 + 6</math></td> </tr> <tr> <td style="text-align: center;">(11)</td> <td style="text-align: center;">(11)</td> </tr> </table> <p style="text-align: center;">← same sum →</p>	$2x + y$	$y + 2x$	$2(3) + 5$	$5 + 2(3)$	$6 + 5$	$5 + 6$	(11)	(11)
$2x + y$	$y + 2x$								
$2(3) + 5$	$5 + 2(3)$								
$6 + 5$	$5 + 6$								
(11)	(11)								

Equivalent expressions...

- represent the same value for any value(s) substituted for the variables that they contain.
- look exactly the same when simplified.

## Let's Review...



How do we simplify algebraic expressions?

1) **Like terms** of an expression are terms that contain the same variable(s) raised to the same power.

Ex:  $2x$  and  $3x$  are like terms      Ex:  $2x$  and  $3y$  are not like terms

2) **Only** like terms can be combined.

Ex:  $2x + 3y - 5x + y$   
 $2x - 5x + 3y + y$   
 $-3x + 4y$        $2x + 3y - 5x + y$  is equivalent to  $-3x + 4y$

3) When simplifying expressions with parentheses ( ), first use the distributive property and then combine like terms.

Ex:  $2(4x - 5y) + 7x$   
 $8x - 10y + 7x$   
 $8x + 7x - 10y$   
 $15x - 10y$        $2(4x - 5y) + 7x$  is equivalent to  $15x - 10y$

## Justifying Equivalence Using the Properties of Real Numbers

Is  $6 + 3(5y)$  equivalent to  $3(4y + 2) + 3y$ ? Simplify the expressions to find out.

Expression	Property/Process
$3(4y + 2) + 3y$	GIVEN EXPRESSION
$12y + 6 + 3y$	distributive property
$12y + 3y + 6$	commutative prop. of +
$15y + 6$	combine like terms

Expression	Property/Process
$6 + 3(5y)$	GIVEN EXPRESSION
$6 + (3 \cdot 5)(y)$	associative property of multiplication
$6 + 15y$	multiply
$15y + 6$	commutative property of addition

Prove that  $6 + 3(5y)$  is equivalent to  $3(4y + 2) + 3y$  in another way.

When  $y = 2$

$$\begin{aligned}
 &6 + 3(5y) \\
 &6 + 3(5(\underline{\quad})) \\
 &6 + 3(5(\underline{2})) \\
 &6 + 3(10) \\
 &6 + 30 \\
 &36
 \end{aligned}$$

$$\begin{aligned}
 &3(4y + 2) + 3y \\
 &3(4(\underline{\quad}) + 2) + 3(\underline{\quad}) \\
 &3(4(\underline{2}) + 2) + 3(\underline{2}) \\
 &3(8 + 2) + 3(2) \\
 &3(10) + 3(2) \\
 &30 + 6 \\
 &36
 \end{aligned}$$

same result  
 equivalent value

1) Jack took the steps below to simplify an expression.

$$4x + 3x \rightarrow x(4 + 3) \rightarrow x(7) \rightarrow 7x$$

a) What properties did he use?

distributive, commutative

b) Prove that  $4x + 3x$  is equivalent to  $7x$  in another way.

algebraic equivalence

when  $x = 5$

$4(5) + 3(5)$	$7(5)$	the results
$20 + 15$	$35$	are the same
$35$	$35$	

2) Determine which of the following algebraic expressions are equivalent. Justify your response.

A.  $3(n - 4)$

B.  $3n - 4$

C.  $3n - 12$

D.  $4n - 12 - n$

$3n - 12$

$4n - n - 12$

$3n - 12$

E.  $12 + n$

F.  $3(n + 4)$

G.  $-12 + 3n$

H.  $2n + 4 + n$

$3n + 12$

$3n - 12$

$2n + n + 4$

$3n + 4$

Equivalent Expressions A, C, D, G

Justification: using properties/processes  
 distributive property (A)  
 commutative property (G)  
 combining like terms (D)  
 these expressions are all equivalent  
 to  $3n - 12$

The **TAKEAWAY**

evaluating expressions  
 when  $n = 5$

(A) $3(5 - 4)$	(D) $4(5) - 12 - 5$
$3(1)$	$20 - 12 - 5$
$3$	$8 - 5$
(C) $3(5) - 12$	(G) $-12 + 3(5)$
$15 - 12$	$-12 + 15$
$3$	$3$

1) Algebraic expressions are equivalent when they represent the same value.

2) We can prove algebraic expressions are equivalent by either creating identical expressions using properties of real numbers or by substituting values for the variable(s) in each expression and evaluating to see if the result is the same.