19.1 Number Talk: Parentheses

5 mins

P
E
M
D
A
S

$2 + 3 \cdot 4$ (12) $= 14$

$(2+3)(4) = 20$ (5) "next to" means "multiply"

could be re-written $(2+3) \cdot 4$ → distribution $4(2+3)$

$2 - 3 \cdot 4 = -10$

$2 - (3+4) = -5$ or $2 - 3 - 4$

20.1 Why Is It True?

(Reasons may vary - one allowed)

5 mins.

1. $5 + 2 + 3 = 5 + (2+3)$ — Associative Property – mixing order of addition groupings produces the same result
2. $9a = 11a - 2a$ — Distributive Property: $a(11-2) = a(9)$
3. $7a + 4 - 2a = 7a + (-2a) + 4$ — additive inverse, Commutative property — order switched w.r.t. addition
4. $8a - (8a - 8) = 8$ — Additive inverse, distributive property

BARTLETT

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Unit 6, Lesson 19: Expanding and Factoring 15 mins.

19.2: Factoring and Expanding with Negative Numbers

In each row, write the equivalent expression. If you get stuck, use a diagram to organize your work. The first row is provided as an example. Diagrams are provided for the first three rows.

Take turns w/ partner or in trio → If you disagree, resolve before moving on

	5	-2y
-3	-15	6y

	a	-6
5	5a	-30

	3a	-b
2	6a	-2b

factored	expanded
$-3(5-2y)$	$-15+6y$
$5(a-6)$	$5a-30$
$2(3a-b)$	$6a-2b$
$-4(2w-5z)$	$-8w+20z$
* $-(2x-3y)$	$-2x+3y$
$5(4x-2y+3z)$	$20x-10y+15z$
$k(4-17)$	$4k-17k$ or $-13k$
$a(10-13)$	$10a-13a$ or $-3a$
$-2x(3y-z)$	$-6xy+2xz$
$b(a-c-3d)$	$ab-bc-3bd$
$-x(3y-z+4w)$	$-3xy+xz-4xw$

Re-write subtraction as addition using additive inverse if having trouble

* $-1\cdot(2x-3y)$

Note down/highlight which ones you & partner disagreed about

2/ What is a process/procedure for taking a factored expression & writing its corresponding expanded expression.

3/ & vice versa

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Unit 6, Lesson 20: Combining Like Terms (Part 1)

20.2: A's and B's 10 mins.

Compare Substitution w/ original

Diego and Jada are both trying to write an expression with fewer terms that is equivalent to

$$7a + 5b - 3a + 4b$$

Try: $a = 4$, $b = 3$ > both Jada & Diego = 43

- Jada thinks $10a + 1b$ is equivalent to the original expression.
- Diego thinks $4a + 9b$ is equivalent to the original expression.

Don't change value of the expression

1. We can show expressions are equivalent by writing out all the variables. Explain why the expression on each row (after the first row) is equivalent to the expression on the row before it.

$$7a + 5b - 3a + 4b$$

← Products as Sums: $(a+a+a+a+a+a+a) + (b+b+b+b+b) - (a+a+a) + (b+b+b+b)$

$(a+a+a+a) + (a+a+a) + (b+b+b+b+b) - (a+a+a) + (b+b+b+b)$ → associative: diff grouping of like terms

← commutation, 2nd & 3rd groups of like terms: $(a+a+a+a) + (b+b+b+b+b) + (a+a+a) - (a+a+a) + (b+b+b+b)$

$(a+a+a+a) + (b+b+b+b+b) + (b+b+b+b)$ → Subtraction added first itself to get 0 (zero pair)

← Associative: grouping all b's together: $(a+a+a+a) + (b+b+b+b+b+b+b+b+b)$

$4a + 9b$ → write sums as products (distribution)

2. Here is another way we can rewrite the expressions. Explain why the expression on each row (after the first row) is equivalent to the expression on the row before it.

$$7a + 5b - 3a + 4b$$

$7a + 5b + (-3a) + 4b$ → Additive Inverse: write subtraction as addition

← Commutation: Switch 2nd & 3rd terms: $7a + (-3a) + 5b + 4b$

$(7 + -3)a + (5 + 4)b$ → Distributive: write sums as products

← $4a + 9b$

Evaluate numerical expressions

Equivalent expressions must be equal for every possible value

Prefer to substitute or use the properties of operations?

not possible to check all values

20.3: Making Sides Equal 5-10 mins.

Replace each ? with an expression that will make the left side of the equation equivalent to the right side.

Set A Check your results with your partner and resolve any disagreements. Then move on to Set B.

1. $6x + ? = 10x$
   $4x$
2. $6x + ? = 2x$
   $-4x$
3. $6x + ? = -10x$
   $-16x$
4. $6x + ? = 0$
   $-6x$
5. $6x + ? = 10$
   $(10 - 6x)$

Q: Why not combine x terms & numbers?

Set B

1. $6x - ? = 2x$
   $4x$
2. $6x - ? = 10x$
   $-4x$
3. $6x - ? = x$
   $5x$
4. $6x - ? = 6$
   $(6x - 6)$
5. $6x - ? = 4x - 10$
   $(2x + 10)$

Lesson 20 Summary

There are many ways to write equivalent expressions that may look very different from each other. We have several tools to find out if two expressions are equivalent.

- Two expressions are definitely not equivalent if they have different values when we substitute the same number for the variable. For example, $2(-3 + x) + 8$ and $2x + 5$ are not equivalent because when x is 1, the first expression equals 4 and the second expression equals 7.
- If two expressions are equal for many different values we substitute for the variable, then the expressions *may* be equivalent, but we don't know for sure. It is impossible to compare the two expressions for all values. To know for sure, we use properties of operations. For example, $2(-3 + x) + 8$ is equivalent to $2x + 2$ because:

$$
\begin{aligned}
&2(-3 + x) + 8 \\
&-6 + 2x + 8 && \text{by the distributive property} \\
&2x + -6 + 8 && \text{by the commutative property} \\
&2x + (-6 + 8) && \text{by the associative property} \\
&2x + 2
\end{aligned}
$$

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Are you ready for more?

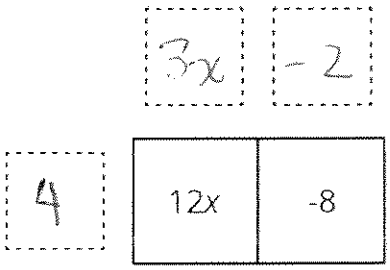
Expand to create an equivalent expression that uses the fewest number of terms: $\left(\left(\left(\left(x+1\right)\frac{1}{2}\right)+1\right)\frac{1}{2}\right)+1$. If we wrote a new expression following the same pattern so that there were 20 sets of parentheses, how could it be expanded into an equivalent expression that uses the fewest number of terms?

Lesson 19 Summary

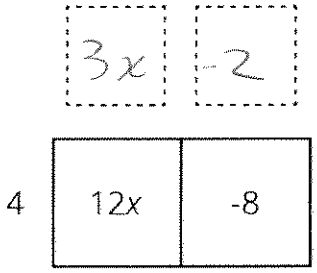
We can use properties of operations in different ways to rewrite expressions and create equivalent expressions. We have already seen that we can use the distributive property to expand an expression, for example $3(x+5) = 3x+15$. We can also use the distributive property in the other direction and factor an expression, for example $8x+12 = 4(2x+3)$.

We can organize the work of using distributive property to rewrite the expression $12x-8$. In this case we know the product and need to find the factors.

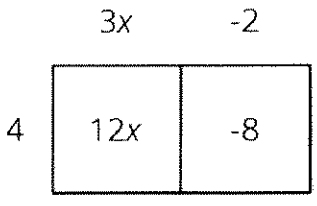
The terms of the product go inside:



We look at the expressions and think about a factor they have in common. $12x$ and -8 each have a factor of 4. We place the common factor on one side of the large rectangle:



Now we think: "4 times *what* is $12x$?" "4 times *what* is -8?" and write the other factors on the other side of the rectangle:



So, $12x-8$ is equivalent to $4(3x-2)$.

- To write an equivalent expression by factoring means to use the distributive property to write the sum as a product.
- To write an equivalent expression by

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