I can generate equivalent expressions using the properties of math

Operations Involving Rational Numbers

Addition

1. $2 + (-5) =$ _____
2. $-8 + (-3) =$ _____
3. $-12 + 4 =$ _____
4. $-9 + (-1) =$ _____
5. $7.6 + 9.5 =$ _____
6. $\frac{2}{7} + \frac{4}{7} =$ _____
7. $\frac{1}{2} + \frac{3}{8} =$ _____
8. $\frac{2}{3} + \frac{5}{9} =$ _____

Subtraction

1. $4 - 10 =$ _____
2. $6 - (-7) =$ _____
3. $-9 - 5 =$ _____
4. $-3 - (-1) =$ _____
5. $0.9 - 0.5 =$ _____
6. $\frac{5}{11} - \frac{2}{11} =$ _____
7. $\frac{7}{12} - \frac{1}{4} =$ _____
8. $\frac{9}{10} - \frac{3}{5} =$ _____

Multiplication

1. $-3 \cdot 5 =$ _____
2. $-13 \cdot -6 =$ _____
3. $12(-2) =$ _____
4. $-20(-4) =$ _____
5. $3 \cdot (-4)^3 =$ _____
6. $\frac{1}{4} \cdot \frac{3}{4} =$ _____
7. $\frac{2}{5} \cdot \frac{1}{3} =$ _____
8. $5 \cdot \frac{2}{3} =$ _____

Division

1. $121 \div (-11) =$ _____
2. $-36 \div (-9) =$ _____
3. $\frac{6}{-3} =$ _____
4. $\frac{-60}{-12} =$ _____
5. $-64/5 =$ _____
6. $\frac{3-17}{2} =$ _____
7. $\frac{2^3}{-8} =$ _____
8. $\frac{2}{9} \div \frac{1}{3} =$ _____

Properties of Numbers

Monomial	**Bi**nomial	**Tri**nomial	**Poly**nomial

Identity Properties	Inverse Properties
Additive Identity	Additive Inverse
Multiplicative Identity	Multiplicative Inverse (Reciprocal)

Distributive Property: $3(2x+6) =$

1. $2(-5x-1) =$

2. $-5(4x-2y) =$

3. $-(7x+3y-2z) =$

4. $\frac{1}{4}(-8r-12s+4t) =$

5. $4(3a+5b-c+2d-8e-4g) =$

Some Word Problems

1. Jennifer paid $39.75 for some packs of gum. If each pack of gum costs $1.59, how many packs of gum did Jennifer buy?

2. This month, Gerald deposited $12.50 into his bank account but then withdrew $8.75 a few days later. If Gerald started the month with $83.95, how much money does he have in his bank account now?

What can you do with these properties?

Commutative Property	Associative Property
Commutative Property of Addition	Associative Property of Addition
Commutative Property of Multiplication	Associative Property of Multiplication

Can we identify some of these properties?

Property Bank

Additive Identity	Multiplicative Inverse	Commutative Property	Distributive Property
Associative Property	Additive Inverse	Multiplicative Identity	

$3 + 7 = 7 + 3$	$6 \cdot 1 = 6$	$5(4 + 2) = 5 \cdot 4 + 5 \cdot 2$
$5 \cdot \frac{1}{5} = 1$	$-5 + 0 = -5$	$(6 + 4) + 5 = 6 + (4 + 5)$
$5(2x - 3y) = 10x - 15y$	$3 \cdot (-2) \cdot 7 = (-2) \cdot 7 \cdot 3$	$0 + a = a$
$-2(3 \cdot 6) = (-2 \cdot 3) \cdot 6$	$-\frac{6}{7} \cdot \left(-\frac{7}{6}\right) = 1$	$1 \cdot \frac{21}{23} = \frac{21}{23}$

Combining Like Terms

Let's take a look at some vocabulary before we begin.

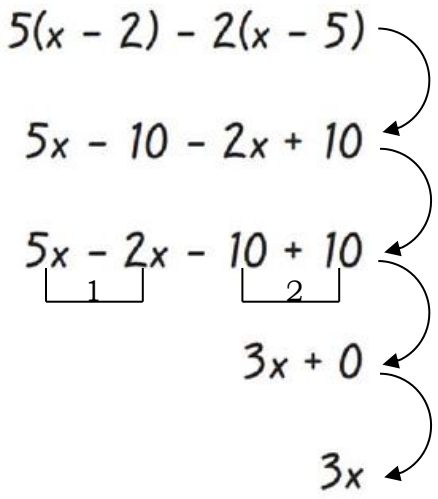
$$2x + 3$$

Like Terms	Unlike Terms

Simplify each Expression by Combining the Like Terms

1. $3x + 6x$
2. $-6y - 8y$
3. $3y - 8 + 6y$
4. $4x + 8y$
5. $4a + 6b - 3c + 7b - 2a - c$
6. $5x^2 - 3 - 6x - 3x^2 - 4x + 9$
7. $3(3x - 4) + 5$
8. $-2(x^2 + 6x) + 3(x - 4x^2)$
9. $3(2x - 5y) - (4x + 7y)$

10. Identify the Property Used to simplify the following Expression.



1. _____
2. _____

Some More to Practice:

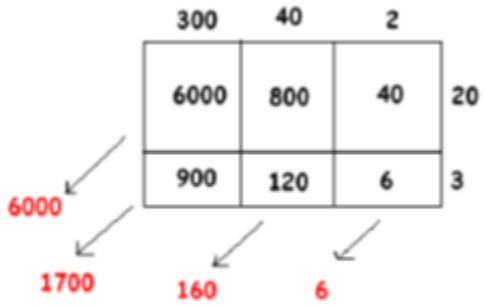
1. If $A=3x^2+5x-6$ and $B=-2x^2-6x+7$, find $A-B$

2. Subtract $5x^2+2x-11$ from $3x^2+8x-7$. Express the result as a trinomial.

3. If the difference $\left(3x^2-2x+5\right)-\left(x^2+3x-2\right)$ is multiplied by $\frac{1}{2}x^2$ what is the result written in standard form?

Multiplying Polynomials

Giselle computed 342 × 23 as follows:



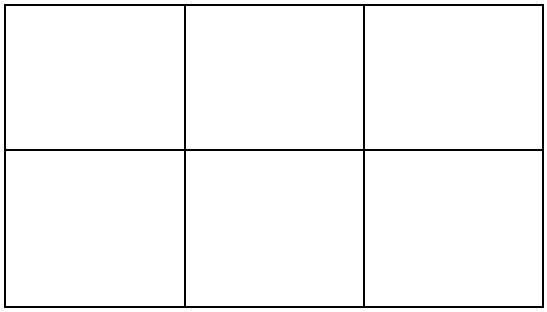
Can you explain what she is doing? What is her final answer?

Before we begin let's review basic exponent rules

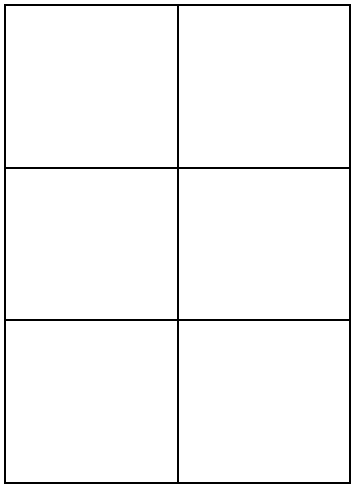
×	÷
$(12x^2)(4x^2)$	$12x^2 \div 4x^2$
$(4x^2y^5)(6x^3y^2)$	$\frac{-10x^5}{2x}$
Rule:	Rule:

Use a Geometric Model to compute the following products

$(3x^2+4x+2)(2x+3)$



$(x-1)(x^3+6x-5)$



Strategies for Simplifying Without the Geometric Model

$(3x^2+4x+2)(2x+3)$

Let's See What You Got!!

1. $(4x+3)(x^2+x^3)-(2x+2)(x^2+x^3)$

2. $3(x-2)^2-2(x-1)$

3. Fred is given a rectangular piece of paper. If the length of the piece of paper is represented by $2x-6$ and the width is represented by $3x-5$, find the perimeter and area of the piece of paper in terms of *x*.

4. When $(2x-3)^2$ is subtracted from $5x^2$, the result is…

I can generate equivalent expressions using the properties of math

Operations Involving Rational Numbers

Addition

1. $2 + (-5) =$ -3
2. $-8 + (-3) =$ -11
3. $-12 + 4 =$ -8
4. $-9 + (-1) =$ -10
5. $7.6 + 9.5 =$ 17.1
6. $\frac{2}{7} + \frac{4}{7} =$ $\frac{6}{7}$
7. $\frac{1}{2} + \frac{3}{8} =$ $\frac{7}{8}$
8. $\frac{2}{3} + \frac{5}{9} =$ $1\frac{2}{9}$

$\frac{4}{8} + \frac{3}{8} =$

$\frac{6}{9} + \frac{5}{9} = \frac{11}{9}$

Subtraction

1. $4 - 10 =$ -6
2. $6 - (-7) =$ 13
3. $-9 - 5 =$ -14
4. $-3 - (-1) =$ -2
5. $0.9 - 0.5 =$ 0.4
6. $\frac{5}{11} - \frac{2}{11} =$ $\frac{3}{11}$
7. $\frac{7}{12} - \frac{1}{4} =$ $\frac{1}{3}$
8. $\frac{9}{10} - \frac{3}{5} =$ $\frac{3}{10}$

$\frac{7}{12} - \frac{3}{12} = \frac{4}{12}$

$\frac{9}{10} - \frac{6}{10}$

Multiplication

1. $-3 \cdot 5 =$ -15
2. $-13 \cdot -6 =$ 78
3. $12(-2) =$ -24
4. $-20(-4) =$ 80
5. $3 \cdot (-4)^3 =$ 192

$3 \cdot -64$

6. $\frac{1}{4} \cdot \frac{3}{4} =$ $\frac{3}{16}$
7. $\frac{2}{5} \cdot \frac{1}{3} =$ $\frac{2}{15}$
8. $5 \cdot \frac{2}{3} =$ $\frac{10}{3} = 3\frac{1}{3}$

Division

1. $121 \div (-11) =$ -11
2. $-36 \div (-9) =$ 4
3. $\frac{6}{-3} =$ -2
4. $\frac{-60}{-12} =$ 5
5. $-64/5 =$ $-12\frac{4}{5}$
6. $\frac{3-17}{2} =$ -7

$\frac{-14}{2}$

7. $\frac{2^3}{-8} =$ -1

8

8. $\frac{2}{9} \div \frac{1}{3} =$ $\frac{2}{3}$

$3\frac{2}{9} \cdot \frac{3}{1}^{1}$

Properties of Numbers

1	2	3	Many
Monomial	**Bi**nomial	**Tri**nomial	**Poly**nomial
$5x$, $3x^2$	$3x+7$	x^5+5x+4	$2y+4x+7z-3c$

Identity Properties	Inverse Properties
Additive Identity $12+0=12$	Additive Inverse $12+-12=0$
Multiplicative Identity $6\cdot 1=6$	Multiplicative Inverse (Reciprocal) $6\cdot\frac{1}{6}=1$

Distributive Property: $3(2x+6)=$ $6x+18$

$2x+6$
$2x+6$
$+\ 2x+6$

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

2. $-5(4x-2y)=$ $-20x+10y$

3. $-1(7x+3y-2z)=$ $-7x-3y+2z$

4. $\frac{1}{4}(-8r-12s+4t)=$ $-2r-3s+t$

5. $4(3a+5b-c+2d-8e-4g)=$ $12a+20b-4c+8d-32e-16g$

Some Word Problems

1. Jennifer paid \$39.75 for some packs of gum. If each pack of gum costs \$1.59, how many packs of gum did Jennifer buy?

$x\cdot 1.59 = 39.75$

$\frac{x\cdot 1.59}{1.59} = \frac{39.75}{1.59}$

$x = 25$ packs of gum

2. This month, Gerald deposited \$12.50 into his bank account but then withdrew \$8.75 a few days later. If Gerald started the month with \$83.95, how much money does he have in his bank account now?

$\$83.95 + \$12.50 - \$8.75$

\$87.70

What can you do with these properties?

Commutative Property	Associative Property
+ , × switch order of terms	+, × switch grouping () of terms
Commutative Property of Addition $a+x+y = y+x+a$	Associative Property of Addition $(a+b)+c = a+(b+c)$
Commutative Property of Multiplication $4 \cdot 3 = 3 \cdot 4$	Associative Property of Multiplication $(2 \cdot 3) \cdot 4 = 2 \cdot (3 \cdot 4)$

Can we identify some of these properties?

Property Bank

Additive Identity	Multiplicative Inverse	Commutative Property	Distributive Property
Associative Property	Additive Inverse	Multiplicative Identity	

$3+7=7+3$ Commutative	$6 \cdot 1 = 6$ • Identity	$5(4+2) = 5 \cdot 4 + 5 \cdot 2$ Distributive
$5 \cdot \frac{1}{5} = 1$ • Inverse	$-5+0=-5$ + Identity	$(6+4)+5 = 6+(4+5)$ Associative
$5(2x-3y) = 10x-15y$ Distributive	$3 \cdot (-2) \cdot 7 = (-2) \cdot 7 \cdot 3$ Commutative	$0+a=a$ + Identity
$-2(3 \cdot 6) = (-2 \cdot 3) \cdot 6$ Associative	$-\frac{6}{7} \cdot \left(-\frac{7}{6}\right) = 1$ • Inverse	$1 \cdot \frac{21}{23} = \frac{21}{23}$ • Identity

Combining Like Terms

Let's take a look at some vocabulary before we begin.

$2x + 3$

coefficient — variable — constant

Like Terms	Unlike Terms
$4x$ and $-6x$	$2a$ and $3b$
$-7y^2$ and $-20y^2$	$9c^3$ and $10c^5$

Simplify each Expression by Combining the Like Terms

1. $3x + 6x$

$9x$

2. $-6y - 8y$

$-14y$

3. $3y - 8 + 6y$

$9y - 8$

4. $4x + 8y$

$4x + 8y$

5. $4a + 6b - 3c + 7b - 2a - 1c$

$2a + 13b - 4c$

6. $5x^2 - 3 - 6x - 3x^2 - 4x + 9$

$2x^2 - 10x + 6$

7. $3(3x - 4) + 5$

$9x - 12 + 5$

$9x - 7$

8. $-2(x^2 + 6x) + 3(x - 4x^2)$

$-2x^2 - 12x + 3x - 12x^2$

$-14x^2 - 9x$

9. $3(2x - 5y) - 1(4x + 7y)$

$6x - 15y - 4x - 7y$

$2x - 22y$

10. Identify the Property Used to simplify the following Expression.

$5(x - 2) - 2(x - 5)$

Distributive

$5x - 10 - 2x + 10$

Commutative prop +

$5x - 2x - 10 + 10$

1. Combining Like Terms

$3x + 0$

2. Inverse Prop of +

Identity Property +

$3x$

Some More to Practice:

1. If $A = 3x^2 + 5x - 6$ and $B = -2x^2 - 6x + 7$, find $A - B$

$3x^2 + 5x - 6 - (-2x^2 - 6x + 7)$

$3x^2 + 5x - 6 + 2x^2 + 6x - 7$

$5x^2 + 11x - 13$

2. Subtract $5x^2 + 2x - 11$ from $3x^2 + 8x - 7$. Express the result as a trinomial.

$3x^2 + 8x - 7 - (5x^2 + 2x - 11)$

$3x^2 + 8x - 7 - 5x^2 - 2x + 11$

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

3. If the difference $(3x^2 - 2x + 5) - (x^2 + 3x - 2)$ is multiplied by $\frac{1}{2}x^2$ what is the result written in standard form?

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

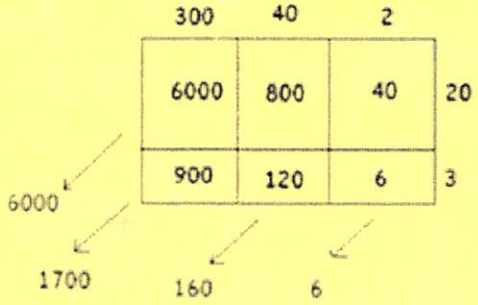
$3x^2 - 2x + 5 - x^2 - 3x + 2$

$\frac{1}{2}x^2(2x^2 - 5x + 7)$

$x^4 - \frac{5}{2}x^3 + \frac{7}{2}x^2$

Multiplying Polynomials

Giselle computed 342 × 23 as follows:



Can you explain what she is doing? What is her final answer?

She is adding up products of like place values

$342 \times 23 = 6000 + 1700 + 160 + 6$

$= 7866$

Before we begin let's review basic exponent rules

×	÷
$(12x^2)(4x^2)$ $48x^4$ $(4x^2y^5)(6x^3y^2)$ $24x^5y^7$	$12x^2 \div 4x^2$ $\frac{12 \cdot x \cdot x}{4 \cdot x \cdot x}$ (3) $\frac{-10x^5}{2x^1}$ $\frac{-10 \cdot x \cdot x \cdot x \cdot x \cdot x}{2 \cdot x}$ $-5x^4$
Rule: • Coefficients + exponents	Rule:

Use a Geometric Model to compute the following products

$(3x^2+4x+2)(2x+3)$

	$3x^2$	$+4x$	$+2$
$2x$	$6x^3$	$8x^2$	$4x$
$+3$	$9x^2$	$12x$	6

$6x^3 + 17x^2 + 16x + 6$

$(x-1)(x^3+6x-5)$

	x	-1
x^3	x^4	$-x^3$
$+6x$	$6x^3$	$-6x$
-5	$-5x$	6

$x^4 + 5x^3 - 11x + 6$

Strategies for Simplifying Without the Geometric Model

$(3x^2+4x+2)(2x+3)$

- Distribute each individual term to the individual terms of the other factor

Let's See What You Got!!

1. $(4x+3)(x^2+x^3)-(2x+2)(x^2+x^3)$

$4x^3 + 4x^4 + 3x^2 + 3x^3 - (2x^3 + 2x^4 + 2x^2 + 2x^3)$

$4x^3 + 4x^4 + 3x^2 + 3x^3 - 2x^3 - 2x^4 - 2x^2 - 2x^3$

$2x^4 + 3x^3 + x^2$

2. $3(x-2)^2 - 2(x-1)$

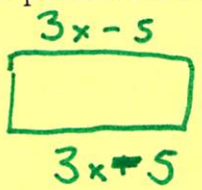
$3\cdot(x-2)(x-2) - 2(x-1)$

$3\cdot(x^2-2x-2x+4) - 2x + 2$

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

$3x^2 - 14x + 14$

3. Fred is given a rectangular piece of paper. If the length of the piece of paper is represented by $2x-6$ and the width is represented by $3x-5$, find the perimeter and area of the piece of paper in terms of x.



Area

$(2x-6)(3x-5)$

$6x^2 - 10x - 18x + 30$

$6x^2 - 28x + 30$

Perimeter

$2x + 3x + 2x + 3x = 10x$

$-5 - 6 - 5 - 6 = -22$

$10x - 22$

4. When $(2x-3)^2$ is subtracted from $5x^2$, the result is...

$5x^2 - [(2x-3)(2x-3)]$

$5x^2 - [4x^2 - 6x - 6x + 9]$

$5x^2 - 4x^2 + 6x + 6x - 9$

$x^2 + 12x - 9$