7 Dividing Polynomials

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Math 9 Date: ____________________

Section 5.5 Part 2 – Dividing Polynomials by a Constant Page 1 of 4

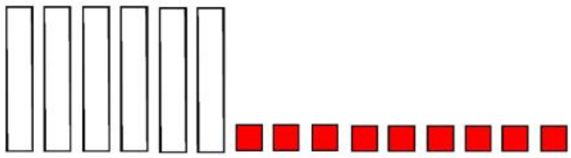
Learning Goal 5I: I can ~~multiply~~ divide a polynomial by a monomial.

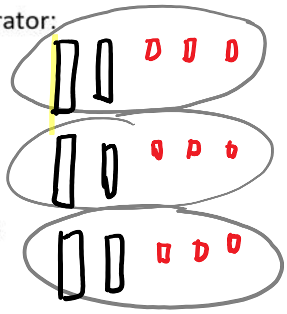
How do we "DIVIDE" polynomials?

When dividing a polynomial by a constant, we can split the polynomial into **groups** according to the constant in the denominator.

Example 1: Divide $\frac{6x-9}{3}$ using **algebra tiles**. $= 2x - 3$

Start with drawing out the tiles representing the numerator:

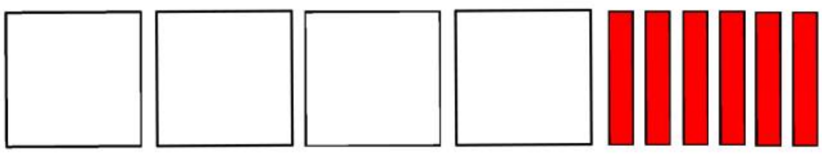


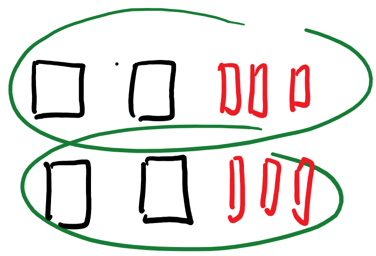


Then divide the algebra tiles into __3__ equal groups.

Example 2: Divide $\frac{4x^2-6x}{2}$ $= 2x^2 - 3x$

Start with drawing out the tiles representing the numerator:





Then split them up into __2__ equal groups.

How do you divide a polynomial algebraically? Split up into separate fractions!

To divide a polynomial by a constant, divide each term of the polynomial by the constant. That is:

$$\frac{a+b+c}{d} = \frac{a}{d} + \frac{b}{d} + \frac{c}{d}$$

Then simplify each term!

Example 3: Divide $\frac{9x^2+12x+6}{3}$ algebraically.

$\frac{\cancel{9}^{3}x^2}{\cancel{3}}+\frac{12x}{3}+\frac{6}{3}$

$=\boxed{3x^2+4x+2}$

Example 4: Divide $\frac{4m^2-2m+8}{-2}$ algebraically.

$=\frac{4m^2}{-2}-\frac{2m}{-2}+\frac{8}{-2}$

$=\boxed{-2m^2+m-4}$

Example 5: Divide each of the following:

a) $\frac{20x+15}{5}$

$\frac{20x}{5}+\frac{15}{5}$

$=4x+3$

b) $\frac{\cancel{36}^{4}x^2}{\cancel{9}}$

$=\boxed{4x^2}$

c) $\frac{-40x}{-10}$

$=\boxed{4x}$

d) $\frac{10x^2-8}{2}$

$\frac{10x^2}{2}-\frac{8}{2}$

$=\boxed{5x^2-4}$

e) $\frac{14p-21}{-7}$

$=\frac{14p}{-7}-\frac{21}{-7}$

$=-2p+3$

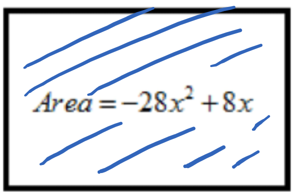
f) $\frac{16m^2-24m+12}{4}$

$\frac{16m^2}{4}+\frac{-24m}{4}+\frac{12}{4}$

$=4m^2-6m+3$

Example 6: The area of the following rectangle is $-28x^2+8x$. Determine the missing length if the width is 4.

$l=?$



$w=$ 4

$A=l\times w$

$l=\frac{A}{w}$

$l=\frac{-28x^2+8x}{4}$

$=\frac{-28x^2}{4}+\frac{8x}{4}$

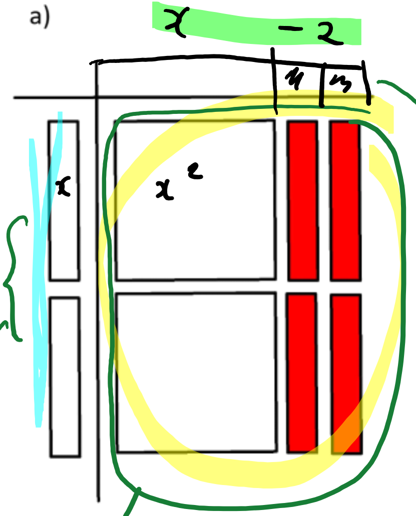
$=-7x^2+2x$

The missing length is $-7x^2+2x$.

When **dividing** a polynomial by a monomial **with algebra tiles**, we reverse the process of multiplication.
The **solution** will be the polynomial on the missing side of the multiplication chart.

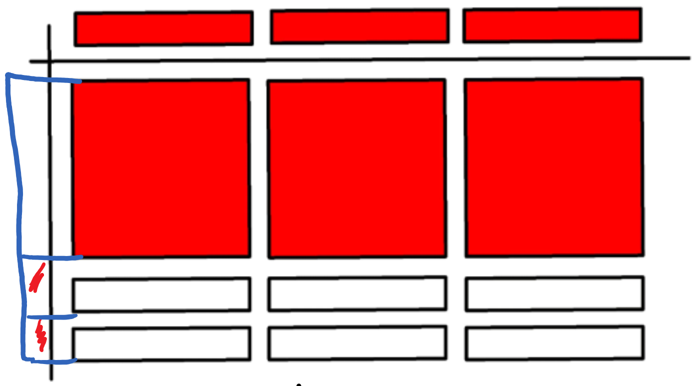
Example 7: Write a $\boxed{\text{division statement}}$ for each set of algebra tiles. Then find the solution.

a)



$$\frac{2x^2-4x}{2x} = \boxed{x-2}$$

b)



divisim statement:

$$\frac{-3x^2+6x}{-3x} = \boxed{x-2}$$

Quick Review of Exponent Laws!

$$\boxed{\frac{x^a}{x^b} = x^{a-b}}$$

Example 8: Write the following as a single power:

a) $\frac{4^5}{4^3} = 4^{5-3} = 4^2$ $= \frac{\cancel{4}\cdot\cancel{4}\cdot\cancel{4}\cdot 4\cdot 4}{\cancel{4}\cdot\cancel{4}\cdot\cancel{4}} = 4^2$ b) $\frac{5^9}{5^4} = 5^5$ c) $\frac{6^5}{6^1} = 6^{5-1} = 6^4$

The same exponent rule holds true for variables. We can simplify as follows:

a) $\frac{x^5}{x^3} = x^2$ b) $\frac{y^9}{y^4} = y^5$ c) $\frac{m^5}{m^1} = m^4$

If you have the same amount of the variable in the numerator as in the denominator, just cancel out the variable!

Example 9: Simplify the following

a) $\frac{5\cancel{x}}{\cancel{x}} = 5$ b) $\frac{-7m}{m} = -7$ c) $\frac{\cancel{r}}{\cancel{r}} = 1$

Example 10: Divide each of the following:

a) $\dfrac{6x^2+9x}{3x}$

$= \dfrac{6x^2}{3x} + \dfrac{9\cancel{x}}{3\cancel{x}}$

$= \boxed{2x+3}$

b) $\dfrac{9x^2+15xy}{3x}$

$\dfrac{9x^2}{3x} + \dfrac{15\cancel{x}y}{3\cancel{x}}$

$= 3x + 5y$

c) $\dfrac{4x^3+8x^2-6x}{2x}$

$\dfrac{4x^3}{2x} + \dfrac{8x^2}{2x} - \dfrac{6\cancel{x}}{2\cancel{x}}$

$2x^2+4x-3$

d) $\dfrac{-14x^3+21x^2-7x}{7x}$

$= \dfrac{-14x^3}{7x} + \dfrac{21x^2}{7x} - \dfrac{\cancel{7x}}{\cancel{7x}}$

$= \boxed{-2x^2+3x-1}$

e) $\dfrac{50a^5b^7 \quad + \quad 40a^3b^4 - 20a^2b^3}{10ab^2}$ (Extending)

$\dfrac{50a^5b^7}{10ab^2} + \dfrac{40a^3b^4}{10ab^2} - \dfrac{20a^2b^3}{10ab^2}$

$= \boxed{5a^4b^5 + 4a^2b^2 - 2ab}$