Date: ________________

4.1 Common Factors in Polynomials

Bell Work: We are going to revisit elementary school to start today's learning. Please complete the following:

(Answers are posted with the complete note)

1. List all of the factors of 12.

1 and 12   3 and 4
2 and 6

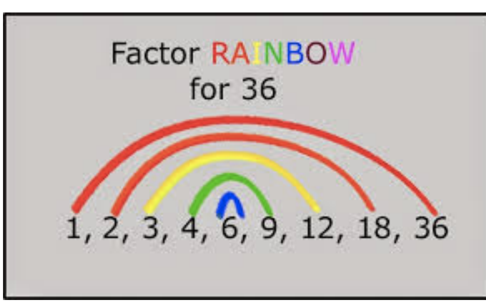
2. List all of the factors of 32.

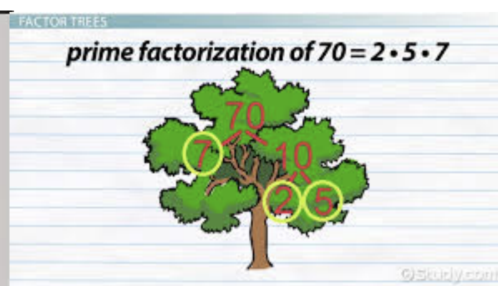
1 and 32   4 and 8
2 and 16

3. List the common factors of 12 and 32.

1, 2, 4

4. Identify the greatest common factor for 12 and 32. 4





4.1 Common Factors in Polynomials

Vocabulary:

factors - values or expressions that can be multiplied to produce a desired product. For example, when we multiply $(x + 4)(x - 2)$, the factors are $(x + 4)$ and $(x - 2)$.

common factors - factors that are common to two or more terms or expressions (common factors divide evenly into both terms). For example, $3x$ and $5x^2$ have a common factor of x.

greatest common factor (GCF) - the largest common factor for a set of terms. For example, if we have 12, 36, and 40, 4 is the GCF.

We can apply what we already knew about numbers to polynomial expressions.

Example: List all of the factors of $3x$ and $9x^2$. Identify common factors, and the greatest common factor. Remember to account for common variables too!

3 and x
-3 and -x ±9 and ±x² ±3 and 3x
3x and 1 ±9x and ±x

GCF = 3x

We can apply our understanding of finding greatest common factors to reverse the distributive property. This process is called **common factoring**.

$$\text{GCF} \rightarrow a(b + c) \underset{\text{common factoring}}{\overset{\text{distributive property}}{\rightleftarrows}} ab + ac$$

To common factor any polynomial expression:

- Identify the greatest common factor (GCF) for ALL terms in the expression.
- Write the GCF in front of a set of brackets.
- Divide all terms in the original expression by the GCF. Write each quotient in the brackets.
- Check your work by applying the distributive property to your final expression.

Example:

Common factor $6x^2 - 21x$.

$3x \rightarrow$ GCF

$6x^2 - 21x$

$= 3x\left(\frac{6x^2}{3x} - \frac{21x}{3x}\right)$

$= 3x(2x - 7)$

Check

$3x(2x - 7)$

$= 6x^2 - 21x$:)

More Practice: Common factor each of the following.

GCF $= -5$

1) $7x^3 - 14x^2 + 42x$ GCF $= 7x$

$= 7x(x^2 - 2x + 6)$

2) $5xy - 2x^2y^2 + 4x^2y$ GCF $= 1xy$

$= xy(5 - 2xy + 4x)$

3) $-15x^2 - 10x - 5$

$= -5(3x^2 + 2x + 1)$

opens down

Notes about common factoring expressions:

- You are not done factoring until the GCF has been removed. If you take out a smaller factor, you will end up with an expression that can be factored again!

ex/ $12x - 18x^2$

$= 3x(4 - 6x)$

still has a common factor of 2 !!

GCF $= 3x$ New GCF $= 2$

$= 3x[2(2 - 3x)]$

$= 6x(2 - 3x)$!!

- The number of terms in your bracket after you factor should match the number of terms that you started with. Remember, you have to be able to multiply it back out to get the original expression!
- Factoring is DIVISION! It "undoes" multiplication!

Common Factoring to Find the Zeros of a Quadratic Relation

A parabola is modelled by the relation $y = 4x^2 - 18x$.

a) Which way do you expect this parabola to open?

$a = 4$, so opens up.

b) Recall that the 'zeros' are the x - intercepts of the parabola. What do we do if we want to find x - intercepts? Apply your newly developed common factoring skills to find the zeros of this parabola.

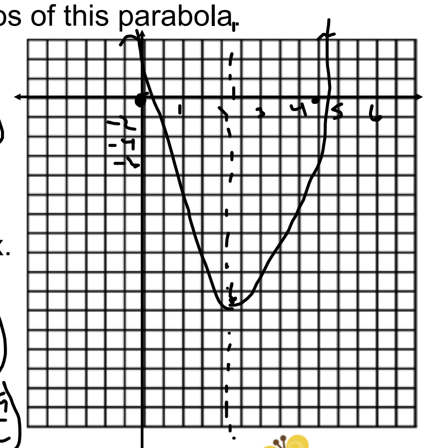
$y = 2x(2x - 9)$

Let $y = 0$

$2x = 0$
$x = 0$

$2x - 9 = 0$
$2x = 9$
$x = 4\frac{1}{2}$

$(0, 0)$
$(4\frac{1}{2}, 0)$



c) Determine the coordinates of the vertex.

x-coord

$x = \frac{0 + \frac{9}{2}}{2}$

$= \frac{9}{4}$ or $2\frac{1}{4}$

y-coord.

$y = 4\left(\frac{9}{4}\right)^2 - 18\left(\frac{9}{4}\right)$

$= 4\left(\frac{81}{16}\right) - 9\left(\frac{9}{2}\right)$

$= \frac{81}{4} - \frac{81}{2}$

$= -\frac{81}{4}$ or $-20\frac{1}{4}$

Vertex: $(2\frac{1}{4}, -20\frac{1}{4})$

d) Sketch the graph.