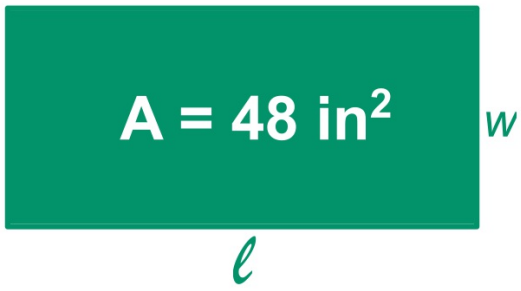
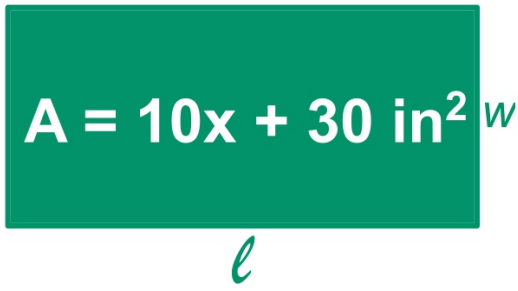
Factoring Polynomials
Day 1

If the area of the following rectangle is 48 in^2, what are some possibilities for the lenght and width?



Can you use the same concept with an area of 10x + 30?



Concept Summary — Factoring Techniques

Number of Terms	Factoring Technique	General Case
any number	Greatest Common Factor (GCF)	$a^3b^2 + 2a^2b - 4ab^2 = ab(a^2b + 2a - 4b)$
two	Difference of Two Squares Sum of Two Cubes Difference of Two Cubes	$a^2 - b^2 = (a + b)(a - b)$ $a^3 + b^3 = (a + b)(a^2 - ab + b^2)$ $a^3 - b^3 = (a - b)(a^2 + ab + b^2)$
three (STAR Method)	Perfect Square Trinomials	$a^2 + 2ab + b^2 = (a + b)^2$ $a^2 - 2ab + b^2 = (a - b)^2$
	General Trinomials	$acx^2 + (ad + bc)x + bd = (ax + b)(cx + d)$
four or more	Grouping	$ax + bx + ay + by = x(a + b) + y(a + b)$ $= (a + b)(x + y)$

Example 1 GCF (Un-distribute)

Factor $6x^2y^2 - 2xy^2 + 6x^3y$.

$6x^2y^2 - 2xy^2 + 6x^3y = (2 \cdot 3 \cdot x \cdot x \cdot y \cdot y) - (2 \cdot x \cdot y \cdot y) + (2 \cdot 3 \cdot x \cdot x \cdot x \cdot y)$

$2xy(\ \_\_\_\_\ \ \_\_\_\_\ \ \_\_\_\_\_)$

$\frac{6x^2y^2}{2xy} \quad -\frac{2xy^2}{2xy} \quad +\frac{6x^3y}{2xy}$

$2xy(\ 3xy \ \ -\ y \ \ +\ 3x\ )$

-The GCF (2xy) goes outside ( )

-Divide each term by the GCF to get values left in the ( )

-check answer by distributing

Example 2 **Grouping**

Factor $a^3 - 4a^2 + 3a - 12$.

$$a^3 - 4a^2 + 3a - 12 = (a^3 - 4a^2) + (3a - 12) \quad \text{Group to find a GCF.}$$
$$= a^2(a - 4) + 3(a - 4) \quad \text{Factor the GCF of each binomial.}$$
$$= (a - 4)(a^2 + 3) \quad \text{Distributive Property}$$

Examples:

1) $x^3 + x^2 + 2x + 2$

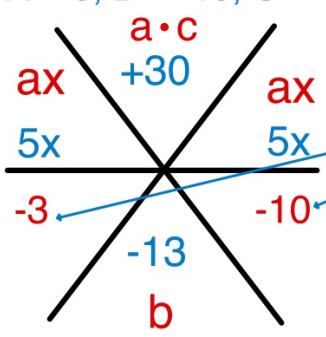
2) $21 - 7y + 3x - xy$

Factoring: Day 2

Example 3 Trinomials

Factor: $5x^2 - 13x + 6$

A = 5, B = -13, C = 6

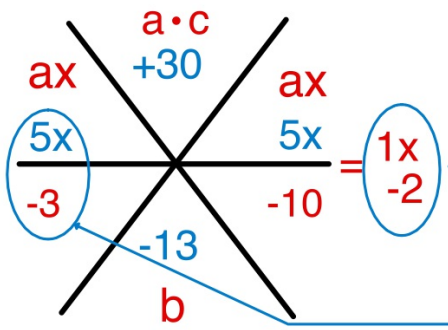


Find two factors of +30 that will add to = -13

1 x 30
2 x 15
3 x 10
5 x 6

Both neg — Signs will be the same

Hint $5x^2 - 13x \oplus 6$



Simplify if needed.

1x
-2

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

Examples:

1) $x^2 + 12x + 36$

2) $3x^2 + 11x - 20$

3) $x^2 - 16$

Always look for GCF 1st!!

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

5) $4x^2 + 14x + 6$

6) $3x^3 - 9x^2 - 84x$

The area of a rectangle is represented by the expression $2x^2 + x - 10$. Find the length and width in terms of x.

Factoring Day 3

Example 4 Binomials

Factor Each polynomial

a. $4x^2 - 16$

$4(x^2 - 4)$

$\boxed{4(x + 2)(x - 2)}$

Factor out the GCF.

$(x^2 - 4)$ is the difference of two squares $a^2 - b^2 = (a + b)(a - b)$

1) Recognize both terms are perfect squares
2) Take the square root of both values
3) Fill into the rule for difference of squares

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b. $y^3 + 27$

$(y + 3)(y^2 - y \cdot 3 + 3^2)$

$\boxed{(y + 3)(y^2 - 3y + 9)}$

Sum of cubes: $a^3 + b^3 = (a + b)(a^2 - ab + b^2)$

1) recognize both terms are perfect cubes
2)Take the cube root of both values
3) Fill into the rule for sum of cubes

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c. $2y^3 - 250$

$2(y^3 - 125)$

$2(y - 5)(y^2 + y \cdot 5 + 5^2)$

$\boxed{2(y - 5)(y^2 + 5y + 25)}$

Factor out the GCF.

Difference of cubes: $a^3 - b^3 = (a - b)(a^2 + ab + b^2)$

1) Recognize both terms are perfect cubes
2)Take the cube root of both values
3) Fill into the rule for difference of cubes

Factor:

1) $16x^2 - 25y^2$

2) $a^6 + 64$

3) $z^3 - 1$

4) $4x^5 + 4x^2$

5) $x^4 - y^4$

6) $z^6 - 64$