

## 5.2 Factoring Quadratics, Part 1 $a=1$

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GCF Factoring, Difference of Squares & Factoring Trinomials

Standards:

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A.SSE.2

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A.SSE.3

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# Old Multiplying Polynomials

Expand the product.

Distribution Property or First Outer Inner Last

①  $(x+3)(x-4)$

$$= x^2 - 4x + 3x - 12$$
$$= x^2 - x - 12$$

②  $(x-5)(x+5)$

$$= x^2 + 5x - 5x - 25$$
$$= x^2 - 25$$

③  $x(7x+6)$

$$= 7x^2 + 6x$$

④  $4x(3+7x^2)$

$$= 12x + 28x^3$$

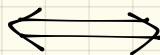
# new Factoring Part 1

Case 1 GCF Factoring - finding the **greatest common factor (GCF)** of a sum of terms. Use the **GCF** to create a product.

Let's consider the expression  $2x^2(7x+3)$ . Expand the expression.

~~Before~~ **FORWARDS** (Expand)

$$2x^2(7x+3)$$
$$= 14x^3 + 6x^2$$



**Now** **BACKWARDS** (Factor) GCF for #'s

$$14x^3 + 6x^2$$
$$2x^2(7x+3)$$

14 6  
1·14 1·6  
② 7 ② 3

GCF for variable

$x^3$

$x^2$

$x \cdot x \cdot x$

$x \cdot x$

# [More Examples] Factor the problems.

①  $5x^2 + 15x$   
 $5x(1x + 3)$

GCF for #'s  
 15      5  
 1·15    1·5  
 3·5

GCF for variable  
 $x^2$        $x$   
 $\cancel{x} \cdot x$      $\cancel{x}$

②  $2x^3 - 8x^2$   
 $2x^2(x - 8)$

GCF for #'s  
 2      8  
 1·2    1·8  
 ②·4

GCF for variable  
 $x^3$        $x^2$   
 $\cancel{x} \cdot \cancel{x} \cdot x$      $\cancel{x} \cdot \cancel{x}$

③  $2x^2 - 4x$   
 $2x(x - 2)$

GCF for #'s  
 2      4  
 1·2    1·4  
 2·2

GCF for variable  
 $x^2$        $x$   
 $\cancel{x} \cdot x$      $\cancel{x}$

④  $15x^2 - 5x + 30$   
 $5(3x^2 - x + 6)$

GCF for #'s  
 15      5      30  
 1·15    1·5    1·30  
 3·5      2·15  
 3·10  
 5·6

GCF for variable  
 $x^2$        $x$       1  
 $x \cdot x$      $x$       1

## Case B Factoring Trinomials — factor the sum of 3 terms (trinomial) into a product of 2 binomials.

Let's consider the expression  $(x+3)(x+2)$ . Expand the expression.

$$\begin{aligned} (x+3)(x+2) &= x^2 + 2x + 3x + 6 \\ &= x^2 + 5x + 6 \end{aligned}$$

Standard Form for Trinomials  $\Rightarrow ax^2 + bx + c$

$$ax^2 + \underbrace{bx + c}_{\text{sum}} \rightarrow \text{product}$$

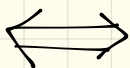
## Guess & Check Method

To factor the trinomial: Find 2 numbers that multiplies to get the "product" (c) & adds up to get the "sum" (b).

~~Before~~ (Expand)  
FORWARDS

$$(x+3)(x+2)$$

$$= x^2 + 2x + 3x + 6$$
$$= x^2 + 5x + 6$$



~~Now~~ (Factor)  
BACKWARDS

$$x^2 + 5x + 6$$

Factors of "c"  
 $\begin{matrix} 1 \cdot 6 \\ 2 \cdot 3 \end{matrix}$  - multiplies to 6 & adds to 5.

$$= (x+2)(x+3)$$

[Examples] Factor the trinomial.

$$\textcircled{1} x^2 + 9x + 14 \begin{matrix} 1 \cdot 14 \\ 2 \cdot 7 \end{matrix}$$
$$= (x+2)(x+7)$$

$$\textcircled{2} n^2 - 11n + 10 \begin{matrix} 1 \cdot 10 \\ 2 \cdot 5 \end{matrix}$$
$$= (n-1)(n-10)$$

$$\textcircled{3} n^2 + 4n - 12 \begin{matrix} 1 \cdot 12 \\ 2 \cdot 6 \\ 4 \cdot 3 \end{matrix}$$
$$= (n-2)(n+6)$$

$$\textcircled{4} m^2 + 2m - 24 \begin{matrix} 1 \cdot 24 \\ 2 \cdot 12 \\ 3 \cdot 8 \\ 4 \cdot 6 \end{matrix}$$
$$= (m-4)(m+6)$$

$$\textcircled{5} k^2 - 13k + 40 \begin{matrix} 1 \cdot 40 \\ 2 \cdot 20 \\ 4 \cdot 10 \\ 5 \cdot 8 \end{matrix}$$
$$= (k-5)(k-8)$$

$$\textcircled{6} 4v^2 - 4v - 8 \begin{matrix} 1 \cdot 2 \end{matrix}$$
$$= 4(v^2 - v - 2)$$
$$= 4(v-2)(v+1)$$

# Case C Difference of Squares

Let's consider the expression  $(x-5)(x+5)$ . Expand the expression.

$$\begin{aligned}(x+5)(x-5) &= x^2 - 5x + 5x - 25 \\ &= x^2 - 25\end{aligned}$$

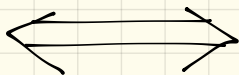
the middle term (linear term) was eliminated because "5x" and "-5x" are additive inverses.

Difference of Squares Mean:

"perfect square" minus "perfect square"  $a^2 - b^2 = (\sqrt{a^2} - \sqrt{b^2})(\sqrt{a^2} + \sqrt{b^2})$

**Before** FORWARD (Expand)

$$\begin{aligned}(x+5)(x-5) \\ = x^2 - 5x + 5x - 25 \\ = x^2 - 25\end{aligned}$$



**Now** BACKWARD (Factor)

$$\begin{aligned}x^2 - 25 \\ = x^2 + 0x - 25 \quad \frac{1 \cdot 25}{5 \cdot 5} \\ = (x-5)(x+5)\end{aligned}$$

[Examples]

①  $x^2 - 36$   
 $(x+6)(x-6)$

②  $x^2 - 4$   
 $(x+2)(x-2)$

③  $4w^2 - 16$   
 $4(w^2 - 4)$   
 $4(w+2)(w-2)$