

Trinomial Factoring

Pre-Practice: Multiply the following pairs of binomials using the FOIL rule.

Factoring

$$\begin{aligned} \text{a) } & (x+2)(x+5) \\ & = x^2 + 5x + 2x + 10 \\ & = x^2 + \underline{7x} + \underline{10} \end{aligned}$$

$$\begin{aligned} \text{b) } & (x+5)(x-4) \\ & = x^2 - 4x + 5x - 20 \\ & = x^2 + \underline{1x} - \underline{20} \end{aligned}$$

$$\begin{aligned} \text{c) } & (x-3)(x+6) \\ & = x^2 + 6x - 3x - 18 \\ & = x^2 + \underline{3x} - \underline{18} \end{aligned}$$

The answers above take the form of: $x^2 + bx + c$

Look at answer a)...

How were the numbers 2 and 5 used to make the 7? → they were added

How were the numbers 2 and 5 used to make the 10? → they were multiplied

When factoring a trinomial, we are doing the opposite of FOIL/expanding. We are looking for two binomials that multiply to make the trinomial.

Example

Factor the following:

$$\begin{aligned} \text{a) } & x^2 + 6x + 8 \\ & = (x+4)(x+2) \end{aligned}$$

$$\begin{aligned} \text{b) } & x^2 + 9x + 18 \\ & = (x+6)(x+3) \end{aligned}$$

$$\begin{aligned} \text{c) } & x^2 + 2x - 24 \\ & = (x+6)(x-4) \end{aligned}$$

$$\begin{aligned} \text{d) } & x^2 - 4x - 21 \\ & = (x-7)(x+3) \end{aligned}$$

$$\begin{aligned} \text{e) } & x^2 - 8x + 15 \\ & = (x-5)(x-3) \end{aligned}$$

$$\begin{aligned} \text{f) } & x^2 + 10x + 25 \\ & = (x+5)(x+5) \\ & = (x+5)^2 \end{aligned}$$

$$\begin{aligned} \text{g) } & 2x^2 + 8x + 6 \\ & = 2(x^2 + 4x + 3) \\ & = 2(x+3)(x+1) \end{aligned}$$

$$\begin{aligned} \text{h) } & -3x^2 - 6x + 45 \\ & = -3(x^2 + 2x - 15) \\ & = -3(x+5)(x-3) \end{aligned}$$

$$\begin{aligned} \text{i) } & x^2 + 11x + 18 \\ & = (x+9)(x+2) \end{aligned}$$

Check

$$\begin{aligned} & (x+9)(x+2) \\ & = x^2 + 2x + 9x + 18 \\ & = x^2 + 11x + 18 \end{aligned}$$

$$\begin{aligned} & (5) + (-3) \\ & = 5 - 3 \\ & = 2 \end{aligned}$$

Practice – Common Factoring and Trinomial Factoring

1. Common factor the following:

$$\begin{aligned} \text{a) } 12x - 8 \\ = 4(3x - 2) \end{aligned}$$

$$\begin{aligned} \text{b) } -3x^2 + 9x \\ = -3x(x - 3) \end{aligned}$$

$$\begin{aligned} \text{c) } 4x^2 - 12x + 24 \\ = 4(x^2 - 3x + 6) \end{aligned}$$

$$\begin{aligned} \text{d) } 13x - 7x^2 \\ = x(13 - 7x) \end{aligned}$$

$$\begin{aligned} \text{e) } 3xy - 6x \\ = 3x(y - 2) \end{aligned}$$

$$\begin{aligned} \text{f) } 15x^2 - 10x + 13 \\ = \text{can't be} \\ \text{common factored} \end{aligned}$$

2. Trinomial factor the following:

$$\begin{aligned} \text{a) } x^2 + 9x + 20 \\ = (x + 4)(x + 5) \end{aligned}$$

$$\begin{aligned} \text{b) } x^2 - 7x + 12 \\ = (x - 3)(x - 4) \end{aligned}$$

$$\begin{aligned} \text{c) } x^2 - 3x - 54 \\ = (x - 9)(x + 6) \end{aligned}$$

$$\begin{aligned} \text{d) } x^2 + x - 12 \\ = (x + 4)(x - 3) \end{aligned}$$

$$\begin{aligned} \text{e) } x^2 + 2x - 48 \\ = (x + 8)(x - 6) \end{aligned}$$

$$\begin{aligned} \text{f) } x^2 - 5x - 6 \\ = (x - 6)(x + 1) \end{aligned}$$

3. Common factor then trinomial factor.

$$\begin{aligned} \text{a) } 2x^2 + 12x + 16 \\ = 2(x^2 + 6x + 8) \\ = 2(x + 2)(x + 4) \end{aligned}$$

$$\begin{aligned} \text{b) } 3x^2 - 15x + 12 \\ = 3(x^2 - 5x + 4) \\ = 3(x - 1)(x - 4) \end{aligned}$$

$$\begin{aligned} \text{c) } -2x^2 - 20x - 32 \\ = -2(x^2 + 10x + 16) \\ = -2(x + 2)(x + 8) \end{aligned}$$