

9-5 Factoring Trinomials of the Type $x^2 + bx + c$

Earlier we learned several methods to simplifying the following expressions. You may use FOIL, the Punnett Square, or the double distribution method.

1. $(x+6)(x+3)$

	x	$+3$
x	x^2	$3x$
$+6$	$6x$	18

$$x^2 + 3x + 6x + 18$$

$$\boxed{x^2 + 9x + 18}$$

2. $(x+2)(x-10)$

$$x^2 - 10x + 2x - 20$$

$$\boxed{x^2 - 8x - 20}$$

3. $(x-5)^2$

$$(x-5)(x-5)$$

F	x^2
O	$-5x$
I	$-5x$
L	$+25$

$$\boxed{x^2 - 10x + 25}$$

The most important part of this unit is going the reverse direction. Given a trinomial, we will want to factor it into a product of two binomials. Consider the product below:

$$(x+3)(x+5) = x^2 + 5x + 3x + (3 \cdot 5)$$

$$= x^2 + \underbrace{8x}_{\text{Add to}} + \underbrace{15}_{\text{Multiply to}}$$

Notice that the coefficient of the middle term $8x$ is the sum of 3 and 5. Also the constant term 15 is the product of 3 and 5. **To factor a trinomial of the form $x^2 + bx + c$, you must find two numbers that add to b and multiply to c .**

GCF

BUT WAIT!! ALWAYS LOOK FOR A GCF BEFORE FACTORING!

1. $x^2 + 12x + 20$

$$(x+2)(x+10)$$

Check

	x	10
x	x^2	$10x$
2	$2x$	20

$$x^2 + 2x + 10x + 20$$

$$x^2 + 12x + 20 \checkmark$$

2. $x^2 - 7x - 18$

$$(x-9)(x+2)$$

Check

$$x^2 + 2x - 9x - 18$$

$$x^2 - 7x - 18 \checkmark$$

	18
1	18
2	9
3	6

Factor

3. $x^2 + 6x + 6$

$$\begin{array}{r} 6 \\ 1, 6 \\ 3, 2 \end{array}$$

$(x)(x)$

Doesn't Factor

4. $x^2 - 5x - 24$

$$\begin{array}{r} 24 \\ 1, 24 \\ 2, 12 \\ 3, 8 \\ 4, 6 \end{array}$$

$(x - 8)(x + 3)$

6. $x^2 - 10x + 25$

$$\begin{array}{r} 25 \\ 1, 25 \\ 5, 5 \end{array}$$

$(x - 5)(x - 5)$

5. $x^2 + 1x - 30$

$$\begin{array}{r} 30 \\ 1, 30 \\ 2, 15 \\ 3, 10 \\ 5, 6 \end{array}$$

$(x - 5)(x + 6)$

8. $x^2 - 7x + 10$

$$\begin{array}{r} 10 \\ 1, 10 \\ 2, 5 \end{array}$$

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

7. $x^2 + 13x + 12$

$$\begin{array}{r} 12 \\ 1, 12 \\ 2, 6 \\ 3, 4 \end{array}$$

$(x + 1)(x + 12)$

10. $x^2 - 6x - 27$

$$\begin{array}{r} 27 \\ 1, 27 \\ 3, 9 \end{array}$$

$(x - 9)(x + 3)$

9. $x^2 + 14x - 32$

$$\begin{array}{r} 32 \\ 1, 32 \\ 2, 16 \\ 4, 8 \end{array}$$

$(x + 16)(x - 2)$

12. $x^2 + 2x + 1$

$$\begin{array}{r} 1 \\ 1, 1 \end{array}$$

$(x + 1)(x + 1)$
 $(x + 1)^2$

11. $x^2 + 4x - 45$

$$\begin{array}{r} 45 \\ 1, 45 \\ 3, 15 \\ 5, 9 \end{array}$$

$(x - 5)(x + 9)$

14. $x^2 - 4x - 21$

$$\begin{array}{r} 21 \\ 1, 21 \\ 3, 7 \end{array}$$

$(x + 3)(x - 7)$

13. $x^2 - 15x + 36$

$$\begin{array}{r} 36 \\ 1, 36 \\ 2, 18 \\ 3, 12 \\ 4, 9 \\ 6, 6 \end{array}$$

$(x - 3)(x - 12)$

Factor out the Greatest Common Factor

1. $24a^2b^5 - 18a^4b^3$

2. $15x^4 - 27x^2 + 3x$

Factor:

3. $x^2 - 4x - 45$

4. $x^2 + x - 42$

5. $x^2 + 17x + 30$

6. $x^2 + 2x - 24$

7. $x^2 - 10x + 21$

8. $x^2 - 5x - 6$

9. $x^2 + 20x + 100$

10. $x^2 + 8x - 33$