Factoring $y = x^2 + bx + c$ when both factors are the same

Perfect Square Trinomials

If we factor $\boldsymbol{y = x^2 + bx + c}$, and figure out that both factors are the same, we have a **perfect square trinomial**.

In these cases, we can factor a little further.

Remember, $(x + 1)(x + 1)$ is the same as $(x + 1)^2$.

Factor $\boldsymbol{y = x^2 + 6x + 9}$ *Find two numbers that add to 6 and multiply to 9* **Factors are +3 and +3** $\boldsymbol{y = (x + 3)(x + 3)}$ $\boldsymbol{y = (x + 3)^2}$	Factor $\boldsymbol{y = x^2 - 8x + 16}$ *Find two numbers that add to -8 and multiply to 16* **Factors are -4 and -4** $\boldsymbol{y = (x - 4)(x - 4)}$ $\boldsymbol{y = (x - 4)^2}$
Factor $\boldsymbol{y = x^2 + 10x + 25}$	Factor $\boldsymbol{y = x^2 - 10x + 25}$

Factor $\boldsymbol{y = x^2 + 2x + 1}$	Factor $\boldsymbol{y = x^2 - 2x + 1}$
Factor $\boldsymbol{y = x^2 + 12x + 36}$	Factor $\boldsymbol{y = x^2 - 18x + 81}$
Factor $\boldsymbol{y = x^2 - 4x + 4}$	Factor $\boldsymbol{y = x^2 + 20x + 100}$

Factoring $y = x^2 + bx + c$
Simple Trinomials

When factoring $\boldsymbol{y = x^2 + bx + c}$, we have what is called a **simple trinomial**.

We need to find two numbers that **add to b** and **multiply to c**. These are our factors!

If c is positive, we either need 2 positive factors **or** 2 negative factors (the sign of b tells us which!)

If c is negative, we need 1 positive and 1 negative factor (the sign of b tells us the sign of the LARGER factor)

Factor $\boldsymbol{y = x^2 + 5x + 6}$ *Find two numbers that add to 5 and multiply to 6* **Factors are +2 and +3** $\boldsymbol{y = (x + 2)(x + 3)}$	Factor $\boldsymbol{y = x^2 - 5x - 14}$ *Find two numbers that add to -5 and multiply to -14* **Factors are +2 and -7** $\boldsymbol{y = (x + 2)(x - 7)}$
Factor $\boldsymbol{y = x^2 + 10x + 9}$	Factor $\boldsymbol{y = x^2 - 3x - 18}$

Factor $\boldsymbol{y = x^2 + 3x - 10}$	Factor $\boldsymbol{y = x^2 - 7x + 12}$
Factor $\boldsymbol{y = x^2 - 9x + 8}$	Factor $\boldsymbol{y = x^2 + x - 6}$
Factor $\boldsymbol{y = x^2 - x - 2}$	Factor $\boldsymbol{y = x^2 - 2x - 48}$

Factoring when b = 0
Difference of Squares

When b = 0, as in $y = x^2 - 25$, we have what is called a **difference of squares**.

We need to find two numbers that **add to 0** and **multiply to -25**.

*Take the square root of 25!

Factor $y = x^2 - 25$ *Square root of 25 is 5* **Factors are +5 and -5** $y = (x + 5)(x - 5)$	Factor $y = x^2 - 9$
Factor $y = x^2 - 1$	Factor $y = x^2 - 4$

Factor $\boldsymbol{y = x^2 - 100}$	Factor $\boldsymbol{y = x^2 - 121}$
Factor $\boldsymbol{y = x^2 - 16}$	Factor $\boldsymbol{y = x^2 - 144}$
Factor $\boldsymbol{y = x^2 - 36}$	Factor $\boldsymbol{y = x^2 - 49}$

Factoring when c = 0
Common Factoring

When c = 0, as in $\boldsymbol{y = x^2 + 4x}$, all we can do is **common factor**.

We need to determine what both terms have in common, in this case x.

To factor, **divide both terms by the common factor**.

Factor $\boldsymbol{y = x^2 + 4x}$ **Common Factor: x** *Divide x^2 and $4x$ by x* $\boldsymbol{y = x(x + 4)}$	Factor $\boldsymbol{y = -3x^2 + 9x}$ **Common Factor: -3x** *Divide $-3x^2$ and $9x$ by -3x* $\boldsymbol{y = -3x(x - 3)}$
Factor $\boldsymbol{y = x^2 + 9x}$ **Common Factor:**	Factor $\boldsymbol{y = -4x^2 + 8x}$ **Common Factor:**

Factor $\boldsymbol{y = x^2 - 5x}$ **Common Factor:**	Factor $\boldsymbol{y = -5x^2 - 10x}$ **Common Factor:**
Factor $\boldsymbol{y = 2x^2 + 8x}$ **Common Factor:**	Factor $\boldsymbol{y = 5x^2 - 20x}$ **Common Factor:**
Factor $\boldsymbol{y = -x^2 + 11x}$ **Common Factor:**	Factor $\boldsymbol{y = 0.5x^2 + 6}$ **Common Factor:**