SKILL #21

CODE: FT.3

Completing the Square

When to use it?

GULDEN RULE

STEP 4: Rearrange the constants.

STEP 5: Factor the perfect square trinomial.

If $a \neq 1$, factor it out first!

When solving quadratics by factoring fails.

To find the vertex (highest / lowest point) of a parabola.

STEP 1: Make sure the x^2 coefficient is 1 (divide if needed).

STEP 2: Take half of the x-coefficient (b), then square it.

STEP 3: Add & subtract that square inside the expression.

Must have a = 1 before taking half of b.



S- Core Concept

A method that rewrites any quadratic expression $(ax^2 + bx + c)$ into the form $(x + k)^2 + constant$, so solving, graphing, or analyzing becomes easy.

Example

Complete the square: $x^2 + 6x + 2$

STEP 1: -->
$$a = 1$$
 , $b = 6$, $c = 2$

STEP 2:
$$\frac{b}{2} = \frac{6}{2} = 3 \implies 3^2 = 9$$

STEP 3: -->
$$x^2 + 6x + 2 + 9 - 9$$

STEP 4:
$$x^2 + 6x + 9 + 2 - 9$$

STEP 5:
$$(x^2 + 6x + 9) - 7 --> (x + 3)^2 - 7$$

X Forgetting to balance

Whatever you add inside the square, also subtract

X Leaving x² coefficient ≠ 1

Always factor it out first.

X Wrong Half-and-Square:

For $x^2 + 8x$, it's $\left(\frac{8}{2}\right)^2 = 16$, not $8^2 = 64$.

Additional Resources

Always halve first, then square.

Example 2: When $a \neq 1$

Complete the square: $2x^2 + 12x + 1$

STEP 1: --> a=2 , b=12 , c=1 factor 2 out

$$2(x^2 + 6x) + 1$$

STEP 2:
$$\frac{b}{2} = \frac{6}{2} = 3 \implies 3^2 = 9$$

STEP 3: -->
$$2(x^2 + 6x + 9 - 9) + 1$$

STEP 4:
$$2(x^2 + 6x + 9) - 18 + 1$$
 (take - 9 out)

STEP 5:
$$2(x+3)^2 - 17$$