

Completing the Square } Look for a Pattern.

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

B) $(x-3)^2 = x^2 - 6x + 9$

C) $(2x+1)^2 = 4x^2 + 4x + 1$

D) $(3x-5)^2 = 9x^2 - 30x + 25$

E) $(4x+y)^2 = 16x^2 + 8xy + y^2$

F) $(a+b)^2 = a^2 + 2ab + b^2$

$x^2 + bx + c$
 $c = (b/2)^2$

* Note that $b/2$ is in the factor.

$ax^2 + bx$

$c = (b/2)^2 \div a$

Forms of a Quadratic Function

Standard Form: $f(x) = ax^2 + bx + c$ V: $(-\frac{b}{2a}, \text{plug in for } y)$

Vertex Form: $f(x) = a(x-h)^2 + k$ V: (h, k)

What value of c would complete the square?

1) $x^2 + 10x$ $b = 10 \rightarrow 5 \rightarrow 25$ $x^2 + 10x + 25 = (x+5)(x+5)$

2) $x^2 - 15x$ $b = -15 \rightarrow -\frac{15}{2} \rightarrow \frac{225}{4}$ $x^2 - 15x + \frac{225}{4} = (x - \frac{15}{2})(x - \frac{15}{2})$

3) $x^2 - 13/2 x$ $b = -\frac{13}{2} \rightarrow -\frac{13}{4} \rightarrow \frac{169}{16}$ $x^2 - \frac{13}{2}x + \frac{169}{16} = (x - \frac{13}{4})(x - \frac{13}{4})$

4) $2x^2 + 32x$

* $a \neq 1$

$b = 32 \rightarrow 16 \rightarrow 256 \rightarrow 128$

Half it Square it $\div a$

$2x^2 + 32x + 128$

$2(x^2 + 16x + 64)$

$2(x+8)(x+8)$

$2(x+8)^2$

$$1) \quad x^2 - 4x - 88 = 8$$

$$x^2 - 4x = 96$$

Make room for c
by moving constants
to the RHS.

$$b = -4 \rightarrow -a \rightarrow \boxed{4 = c}$$

Add c to both sides.

$$\underbrace{x^2 - 4x + 4}_{\text{FACTOR}} = \underbrace{96 + 4}_{\text{COMBINE}}$$

$$(x - 2)(x - 2) = 100$$

$$(x - 2)^2 = 100$$

$$x - 2 = \pm 10$$

$$x = 2 \pm 10$$

$$\begin{array}{l} \rightarrow 2 + 10 = \boxed{12} \\ \rightarrow 2 - 10 = \boxed{-8} \end{array}$$

$$2) \quad 7k^2 - 14k - 59 = -3$$

$$7k^2 - 14k = 56$$

$$k^2 - 2k = 8$$

$$b = -2 \rightarrow -1 \rightarrow 1 = c$$

$$k^2 - 2k + 1 = 8 + 1$$

$$(k - 1)(k - 1) = 9$$

$$(k - 1)^2 = 9$$

$$k - 1 = \pm 3$$

$$k = 1 \pm 3$$

$$k = 1 + 3 = \boxed{4}$$

$$k = 1 - 3 = \boxed{-2}$$

3) * a ≠ 1 *

$$3n^2 + 14n + 10 = -4n^2$$

Method 1 $7n^2 + 14n = -10$ * Factor a out

$$7(n^2 + 2n + 1) = -10 + 7$$

Factor Combine

Add c to LHS
Add ac to RHS

$b = a \rightarrow 1 \rightarrow 1 = c$

$$7(n+1)(n+1) = -3$$

$$7(n+1)^2 = -3$$

$$(n+1)^2 = \frac{-3}{7}$$

$$n+1 = \pm \sqrt{\frac{-3}{7}}$$

$$n = -1 \pm i \frac{\sqrt{3}}{\sqrt{7}}$$

Solve by $\sqrt{\quad}$ method

Method 2 $7n^2 + 14n = -10$

Add c to both sides

$b = 14 \rightarrow 7 \rightarrow 49 \rightarrow 7 = c$

Half it Square it \div by a

$7n^2 + 14n + 7 = -10 + 7$ Factor a out of LHS + Factor.

$$7(n^2 + 2n + 1) = -3$$

$$7(n+1)^2 = -3$$

$$n = -1 \pm i \frac{\sqrt{3}}{\sqrt{7}}$$

Solve by $\sqrt{\quad}$ method.