Completing the Square

2nd

$$x^2 + bx + \left(\frac{b}{2}\right)^2 = \left(x + \frac{b}{2}\right)^2$$

1st

Complete the square for each.

1. $x^2 + 14x \underline{+49} = (x \underline{+7})^2$
2. $x^2 - 24x \underline{+144} = (x \underline{-12})^2$
3. $x^2 + 56x \underline{+784} = (x \underline{+28})^2$
4. $2x^2 + 8x \underline{+16} = (x \underline{+4})^2$

Solve by completing the square.

$x^2 + 22x = 5$

$x^2 + 22x + 121 = 5 + 121$

$\sqrt{(x + 11)^2} = \sqrt{126}$

$14 \cdot 9$

Now solve using Square Roots

$x + 11 = \pm 3\sqrt{14}$

$x = -11 \pm 3\sqrt{14}$

$x^2 - 14x + 11 = 0$

Rewrite into: $ax^2 + bx = c$ Form

$x^2 - 14x = -11$

$x^2 - 14x + 49 = -11 + 49$

$x^2 - 14x + 49 = 38$

$\sqrt{(x - 7)^2} = \sqrt{38}$

Now solve using Square Roots

$x - 7 = \pm\sqrt{38} \rightarrow x = 7 \pm \sqrt{38}$

Solve by completing the square:

$x^2 - 10x + 7 = 0$

$x^2 - 10x + 25 = -7 + 25$

$\sqrt{(x-5)^2} = \sqrt{18}$

$x - 5 = \pm 3\sqrt{2}$

$x = 5 \pm 3\sqrt{2}$

Solve by completing the square:

$x^2 + 6x - 16 = 0$

$+16 \quad +16$

$x^2 + 6x = 16$

$x^2 + 6x + 9 = 16 + 9$

$(x+3)^2 = 16$

$\sqrt{(x+3)^2} = \sqrt{25}$

$x + 3 = \pm 5$

$-3 \quad -3$

$x = -3 + 5 \qquad x = -3 - 5$

$x = 2 \qquad x = -8$

Solve by completing the square:

$x^2 + 4x + 27 = 0$

$x^2 + 4x + 4 = -27 + 4$

$\sqrt{(x+2)^2} = \sqrt{-23}$

NO REAL SOL

Find the coordinates of the vertex of each quadratic.

Vertex Form

$y = (x + 3)^2 - 7$

$(-3, -7)$

Standard Form

$y = x^2 + 6x - 11$

$\frac{-6}{2} = -3$

$(-3)^2 + 6(-3) - 11$

$9 - 18 - 11$

$-9 - 11 = -20$

$(-3, -20)$

Completing the Square to write equation in Vertex Form.

$y = x^2 + 6x - 11$

Rearrange so that one side is only $x^2 + bx$

$y + 11 = x^2 + 6x$ $+9$

$+9$

Now complete the square

$y + 20 = (x+3)^2$

Move the 20 over to the right side.

$y = (x+3)^2 - 20$

Vertex $(-3, -20)$

Write each equation into Vertex Form

1. $y = x^2 + 8x + 3$

$y - 3 = x^2 + 8x + 16$

$+16$

$y + 13 = (x+4)^2$

$y = (x+4)^2 - 13$

2. $(-1)(y) = (-x^2 + 12x - 19)(-1)$

$-y = x^2 - 12x + 19$

$-19 \quad -19$

$-y - 19 = x^2 - 12x + 36$

$+36$

$-y + 17 = (x-6)^2$

$-1(-y) = ((x-6)^2 - 17) \cdot -1$

$y = -(x-6)^2 + 17$

Solve by completing the square:

$x^2 + 3x - 10 = 0$

$x^2 + 3x + \frac{9}{4} = 10 + \frac{9}{4}$

$\sqrt{\left(x+\frac{3}{2}\right)^2} = \sqrt{\frac{49}{4}}$

$x + \frac{3}{2} = \pm\frac{7}{2}$

$-\frac{3}{2} \quad -\frac{3}{2}$

$+\frac{7}{2} - \frac{3}{2} = \frac{4}{2} = 2$

$-\frac{7}{2} - \frac{3}{2} = -\frac{10}{2} = -5$

Why can't you solve this equation by completing the square, the way it's written.

$2x^2 + 16x - 26 = 0$

$ax^2 + bx + c$

a must be 1

Therefore, you would have to factor out the 5 or, if it's an equation, divide both sides by 5.

$\frac{2x^2 + 16x}{2} = \frac{26}{2}$

$x^2 + 8x = 13$

$x^2 + 8x + 16 = 13 + 16$

$\sqrt{(x+4)^2} = \sqrt{29}$

$x + 4 = \pm\sqrt{29}$

$\rightarrow x = -4 \pm \sqrt{29}$