

Sec. 3.4 Skills Refreshser: Completing the Square

Completing the Square

- Start with $x^2 + mx = \#$
- Add $(m/2)^2$ to both sides.
- Change the left side of the equation to $(x + m/2)^2$.
- Solve using the square root method.

Ex. Solve $x^2 + 5x + 4 = 0$

$$\begin{aligned} x^2 + 5x &= -4 \\ x^2 + 5x + \frac{25}{4} &= -4 + \frac{25}{4} \\ \left(x + \frac{5}{2}\right)^2 &= -\frac{16}{4} + \frac{25}{4} \end{aligned}$$

$$\sqrt{\left(x + \frac{5}{2}\right)^2} = \sqrt{\frac{9}{4}}$$

$$x + \frac{5}{2} = \frac{3}{2}$$

$$x = \frac{8}{2}$$

$$x = 4$$

$$x + \frac{5}{2} = -\frac{3}{2}$$

$$x = -\frac{8}{2}$$

$$x = -4$$

Solve $x^2 - 6x = 13$

$$\begin{aligned} x^2 - 6x + 9 &= 13 + 9 \\ (x - 3)^2 &= 22 \end{aligned}$$

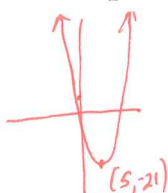
$$x - 3 = \sqrt{22}$$

$$x = 3 + \sqrt{22}$$

$$x - 3 = -\sqrt{22}$$

$$x = 3 - \sqrt{22}$$

Complete the square to rewrite $x^2 - 10x + 4$ in the form $a(x - h)^2 + k$.



$$\begin{aligned} x^2 - 10x + 4 \\ x^2 - 10x + 25 - 25 + 4 \\ (x - 5)^2 - 21 \end{aligned}$$

Now graph the equation. Sketch the graph below. What do each of the numbers tell you about the graph?

$$y = (x - 5)^2 - 21 \quad (5, -21) \text{ is vertex}$$

*** If a is not 1, you must first factor out before you complete the square!!!

Ex. Solve $h(x) = 5x^2 + 30x - 10$

$$\begin{aligned} &5(x^2 + 6x) - 10 \\ &5(x^2 + 6x + 9) - 10 - 45 \\ &h(x) = 5(x+3)^2 - 55 \end{aligned}$$

Ex. $2r^2 + 4r - 5 = 0$

$$\begin{aligned} &2(r^2 + 2r) = 5 \\ &2(r^2 + 2r + 1) = 5 + 2 \\ &2(r+1)^2 = 7 \\ &(r+1)^2 = \frac{7}{2} \end{aligned}$$

$$\begin{aligned} &\sqrt{(r+1)^2} = \sqrt{\frac{7}{2}} \\ &r+1 = \pm \sqrt{\frac{7}{2}} \\ &r = -1 \pm \sqrt{\frac{7}{2}} \end{aligned}$$

HW: pg 128 # 3-45 (m/3)