Sec. 4.6 Completing the Square

Problem 1: Solve

a. $3x^2 + 5 = 20$

$-5 \quad -5$

$\frac{3x^2}{3} = \frac{15}{3}$

$x^2 = 5$

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

$\boxed{x = \pm\sqrt{5}}$

$x^2 = 9$

$x = 3$

$x = -3$

$\boxed{x = \pm 3}$

b. $8x^2 - 3 = 29$

$+3 \quad +3$

$\frac{8x^2}{8} = \frac{32}{8}$

$x^2 = 4$

$\sqrt{x^2} = \pm\sqrt{4}$

$\boxed{x = \pm 2}$

Problem 2: Solve

$2ab$ ✓

$x^2+12x+36=9$

$(x+6)^2=9$

$\sqrt{(x+6)^2}=\pm\sqrt{9}$

$x+6=\pm 3$ $\quad +3-6=-3$ $\quad -3-6=-9$

$-6 \quad -6$

$x=-3,-9$

Problem 3:

Complete the square.

$2ab$

a. $x^2+14x+49$ $\quad +7x+7x$ $\quad a^2+2ab+b^2$

$(x+7)^2$ $\quad \left(\frac{b}{2}\right)^2=c$ $\quad (a+b)^2$

b. $x^2-18x+81$

$(x-9)^2$

c. x^2+2x+1

$(x+1)^2$

d. $x^2-8x+16$

$(x-4)^2$

e. $x^2+5x+\frac{25}{4}$ $\quad x^2+5x+6.25$

$\left(x+\frac{5}{2}\right)^2$ $\quad (x+2.5)^2$

Problem 4: Solve

a. $x^2 + 12 = 10x$

$-10x \quad -10x$

$x^2 - 10x + 12 = 0$

$-12 \quad -12$

$x^2 - 10x + 25 = -12 + 25$

$(x-5)^2 = 13$

$\sqrt{(x-5)^2} = \pm\sqrt{13}$

$x - 5 = \pm\sqrt{13}$

$+5 \quad +5$

$x = 5 \pm \sqrt{13}$

$5+\sqrt{13},\ 5-\sqrt{13}$

b. $\frac{3x^2}{3} + \frac{18x}{3} - \frac{3}{3} = \frac{0}{3}$

$x^2 + 6x - 1 = 0$

$+1 \quad +1$

$x^2 + 6x + 9 = 1 + 9$

$+3x \quad +3x$

$(x+3)^2 = 10$

$\sqrt{(x+3)^2} = \pm\sqrt{10}$

$(x+3)(x+3)$

$x^2 + 3x + 3x + 9$

$x + 3 = \pm\sqrt{10}$

$-3 \quad -3$

$x = -3 \pm \sqrt{10}$

Problem 5:

What is $y = x^2 - 10x + 4$ in vertex form? Name the vertex and y-intercept.

$y = x^2 - 10x + 4$

$y = (x^2 - 10x \underset{-5x-5x}{+25}) + 4 \underline{-25}$

$y = (x-5)^2 - 21$

v: $(5, -21)$ y-int: "c" = 4

$y - 4 \underline{+25} = x^2 - 10x \underline{+25}$

$y + 21 = (x-5)^2$

$-21 \quad -21$

$y = (x-5)^2 - 21$

b. $y = 2x^2 - 8x + 1$

$y = (2x^2 - 8x \underline{+8}) + 1 \underline{-8}$

$y = 2(x^2 - 4x \underline{+4}) + 1 \underline{-8}$

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

v: $(2, -7)$ y-int: 1

c. $y = \frac{1}{2}x^2 - 5x + 12$

$y = \left(\frac{1}{2}x^2 - 5x + \frac{25}{2}\right) + 12 \quad -\frac{25}{2}$

$y = \frac{1}{2}\left(x^2 - 10x + 25\right) + \frac{24}{2} \quad -\frac{25}{2}$

$-5 \div \frac{1}{2}$ $y = \frac{1}{2}(x-5)^2 - \frac{1}{2}$

$-5 \cdot \frac{2}{1}$

$V: \left(5, -\frac{1}{2}\right)$ y-int: 12