

$$x^2 + 14x + 49$$
$$(x + 7)^2$$

$$x^2 - 10x + 25$$
$$(x - 5)^2$$

$$\frac{9x^2}{9} + \frac{12x}{3} + \frac{4}{1}$$
$$(3x + 2)^2$$

6x

$$\frac{12x}{2} = \frac{6x}{3} = 2$$

$$\underline{9x^2} + 42x \underline{+49}$$

$$\underbrace{(3x + 7)}_{2x}^2$$

$$\frac{42x}{2} = \frac{21x}{3x} = 7$$

$$\underline{16x^2} - 88x \underline{+121}$$

$$(4x - 11)^2$$

$$\begin{aligned} \frac{-88x}{2} &= \frac{-44x}{4x} \\ &= -11 \end{aligned}$$

Solve by CTS.

$$a. \quad x^2 - 16x + 7 = 0$$

$\begin{array}{cc} -7 & -7 \end{array}$

$$x^2 - 16x + \underline{64} = -7 + \underline{64}$$

$$(x - 8)^2 = 57$$

$$\sqrt{(x-8)^2} = \pm \sqrt{57}$$

$$x - 8 = \pm \sqrt{57}$$

$\begin{array}{cc} +8 & +8 \end{array}$

$$x = 8 \pm \sqrt{57}$$

$$b. \quad x^2 - 12x - 13 = 0$$

$\begin{array}{cc} +13 & +13 \end{array}$

$$x^2 - 12x + \underline{36} = 13 + \underline{36}$$

$$(x - 6)^2 = 49$$

$$\sqrt{(x-6)^2} = \pm \sqrt{49}$$

$$x - 6 = \pm 7$$

$\begin{array}{cc} +6 & +6 \end{array}$

$$x = 6 \pm 7$$

$$6 + 7 = 13$$

$$6 - 7 = -1$$

$$\begin{aligned}
 \text{c. } & 9x^2 + 30x + 12 = 0 \\
 & \quad \quad \quad -12 \quad +12 \\
 \hline
 & 9x^2 + 30x + 25 = -12 + 25 \\
 & \quad \quad \quad \underline{15x} \\
 & (3x+5)^2 = 13 \\
 & \sqrt{(3x+5)^2} = \pm\sqrt{13} \\
 & \quad \quad \quad \underline{-5} \quad \quad \underline{-5} \qquad x = \frac{-5 \pm \sqrt{13}}{3} \\
 & \quad \quad \quad \frac{3x}{3} = \frac{-5 \pm \sqrt{13}}{3}
 \end{aligned}$$

Change to vertex form. Vertex + y-int.

$$\begin{aligned}
 \text{a. } & y = x^2 - 6x + 13 \\
 & y = (x^2 - 6x + 9) + 13 - 9 \\
 & y = (x-3)^2 + 4 \\
 & v: (3, 4) \quad y\text{-int: } 13
 \end{aligned}$$

$$\begin{aligned}
 \text{b. } & y = x^2 - 18x + 52 \\
 & y = (x^2 - 18x + 81) + 52 - 81 \\
 & y = (x-9)^2 - 29 \\
 & v: (9, -29) \quad y\text{-int: } 52 \\
 & \qquad \qquad \qquad (0, 52)
 \end{aligned}$$

$$\frac{7x^2}{7} - \frac{28x}{7} + \frac{56}{7} = \frac{0}{7}$$

$$x^2 - 4x + 8 = 0$$

$$c. \quad y = 2x^2 - 20x + 17$$

$$y = (2x^2 - 20x + \underline{50}) + 17 - \underline{50}$$

$$y = 2(x^2 - 10x + \underline{25}) + 17 - \underline{50}$$

$$y = 2(x - 5)^2 - 33$$

$$v: (5, -33) \quad y\text{-int}: 17$$

$$d. \quad y = 4x^2 - 12x + 50$$

$$y = (4x^2 - 12x + \underline{9}) + 50 - \underline{9}$$

$$y = 4(x^2 - 3x + \underline{\frac{9}{4}}) + 50 - \underline{9}$$

$$y = 4(x - \frac{3}{2})^2 + 41$$