9.3

1) $x^2 - 30x + \_\_\_$

$\left(-30 \cdot \frac{1}{2}\right)^2$

$(-15)^2 = 225$

$x^2 - 30x + 225$

$(x - 15)^2$

3) $m^2 - 36m + \_\_\_$

$\left(-36 \cdot \frac{1}{2}\right)^2$

$(-18)^2 = 324$

$m^2 - 36m + 324$

$(m - 18)^2$

5) $x^2 - 15x + \_\_$

$\left(-15 \cdot \frac{1}{2}\right)^2$

$\left(-\frac{15}{2}\right)^2 = \frac{225}{4}$

$x^2 - 15x + \frac{225}{4}$

$\left(x - \frac{15}{2}\right)^2$

7) $y^2 - y + \_\_$

$\left(-1 \cdot \frac{1}{2}\right)^2$

$\left(-\frac{1}{2}\right)^2 = \frac{1}{4}$

$y^2 - y + \frac{1}{4}$

$\left(y - \frac{1}{2}\right)^2$

9) $x^2 - 16x + 55 = 0$

$\underline{\quad -55 \quad -55}$

$x^2 - 16x \quad = -55$

$\left(-16 \cdot \frac{1}{2}\right)^2$

$(-8)^2 = 64$

$x^2 - 16x + 64 = -55 + 64f$

$\sqrt{(x-8)^2} = \sqrt{9}$

$x - 8 = \pm 3$

$\underline{\quad +8 \quad +8}$

$x = 8 \pm 3$

$x = 11, 5$

11) $v^2 - 8v + 45 = 0$

$\underline{\quad -45 \quad -45}$

$v^2 - 8v \quad = -45$

$\left(-8 \cdot \frac{1}{2}\right)^2$

$(-4)^2 = 16$

$v^2 - 8v + 16 = -45 + 16$

$\sqrt{(v-4)^2} = \sqrt{-29}$

$v - 4 = \pm i\sqrt{29}$

$\underline{\quad +4 \quad +4}$

$v = 4 \pm i\sqrt{29}$

13) $6x^2 + 12x + 63 = 0$

$\quad -63 \quad \underline{-63}$

$\frac{6x^2}{6} + \frac{12x}{6} \quad = -\frac{63}{6}$

$x^2 + 2x \quad = -\frac{21}{2}$

$\left(2 \cdot \frac{1}{2}\right)^2$

$(1)^2 = 1$

$x^2 + 2x + 1 = -\frac{21}{2} + 1$

$\sqrt{(x+1)^2} = \sqrt{-\frac{19}{2}} \left(\frac{\sqrt{2}}{\sqrt{2}}\right)$

$x + 1 = \pm \frac{i\sqrt{38}}{2}$

$\underline{\quad -1 \quad -1}$

$x = \frac{-2 \pm i\sqrt{38}}{2}$

15) $5k^2 - 10k + 48 = 0$

$\underline{\quad -48 \quad -48}$

$\frac{5k^2}{5} - \frac{10k}{5} = \frac{-48}{5}$

$k^2 - 2k = \frac{-48}{5}$

$\left(-2 \cdot \frac{1}{2}\right)^2$

$(-1)^2 = 1$

$k^2 - 2k + 1 = -\frac{48}{5} + 1$

$\sqrt{(k-1)^2} = \sqrt{-\frac{48}{5}} \left(\frac{\sqrt{5}}{\sqrt{5}}\right)$

$k - 1 = \pm\frac{i\sqrt{215}}{5}$

$\underline{\quad +1 \quad +1}$

$k = \frac{5 \pm i\sqrt{215}}{5}$

17) $x^2 + 10x - 57 = 4$

$\underline{\quad +57 \quad +57}$

$x^2 + 10x = 61$

$\left(10 \cdot \frac{1}{2}\right)^2$

$(5)^2 = 25$

$x^2 + 10x + 25 = 61 + 25$

$\sqrt{(x+5)^2} = \sqrt{86}$

$x + 5 = \pm\sqrt{86}$

$\underline{\quad -5 \quad -5}$

$x = -5 \pm \sqrt{86}$

19) $n^2 - 16n + 67 = 4$

$\underline{\quad -67 \quad -67}$

$n^2 - 16n = -63$

$\left(-16 \cdot \frac{1}{2}\right)^2 = (-8)^2 = 64$

$n^2 - 16n + 64 = 63 + 64$

$\sqrt{(n-8)^2} = \sqrt{1}$

$n - 8 = \pm 1$

$\underline{\quad +8 \quad +8}$

$n = 9, 7$

21) $2x^2 + 4x + 38 = -6$

$\underline{\quad -38 \quad -38}$

$\frac{2x^2}{2} + \frac{4x}{2} = \frac{-44}{2}$

$x^2 + 2x = -22$

$\left(2 \cdot \frac{1}{2}\right)^2 = 1^1 = 1$

$x^2 + 2x + 1 = -22 + 1$

$\sqrt{(x+1)^2} = \sqrt{-21}$

$x + 1 = \pm i\sqrt{21}$

$\underline{\quad -1 \quad -1}$

$x = -1 \pm i\sqrt{21}$

23) $8b^2 + 16b - 37 = 5$

$\underline{\quad +37 \quad +37}$

$\frac{8b^2}{8} + \frac{16b}{8} = \frac{42}{8}$

$b^2 + 2b = \frac{21}{4}$

$\left(2 \cdot \frac{1}{2}\right)^2 = 1^1 = 1$

$b^2 + 2b + 1 = \frac{21}{4} + 1$

$\sqrt{(b+1)^2} = \sqrt{\frac{25}{4}}$

$b + 1 = \pm\frac{5}{2}$

$\underline{\quad -1 \quad -1}$

$b = -1 \pm \frac{5}{2}$

$b = \frac{3}{2}, -\frac{7}{2}$

25) $x^2 = -10x - 29$

$\underline{\quad +10x \quad +10x}$

$x^2 + 10x = -29$

$\left(10 \cdot \frac{1}{2}\right)^2 = (5)^2 = 25$

$x^2 + 10x + 25 = -29 + 25$

$\sqrt{(x+5)^2} = \sqrt{-4}$

$x + 5 = \pm 2i$

$\underline{\quad -5 \quad -5}$

$x = -5 \pm 2i$

27) $n^2 = -21 + 10n$

$-10n \quad -10n$

$n^2 - 10n = -21$

$\left(-10 \cdot \frac{1}{2}\right)^2 = (-5)^2 = 25$

$n^2 - 10n + 25 = -21 + 25$

$\sqrt{(n-5)^2} = \sqrt{4}$

$n - 5 = \pm 2$

$+5 \quad +5$

$n = 5 \pm 2$

$n = 7, 3$

29) $3k^2 + 9 = 6k$

$-6k - 9 \quad -6k - 9$

$\frac{3k^2}{3} - \frac{6k}{3} = \frac{-9}{3}$

$k^2 - 2k = -3$

$\left(-2 \cdot \frac{1}{2}\right)^2 = (-1)^2 = 1$

$k^2 - 2k + 1 = -3 + 1$

$\sqrt{(k-1)^2} = \sqrt{-2}$

$k - 1 = \pm i\sqrt{2}$

$+1 \quad +1$

$k = 1 \pm i\sqrt{2}$

31) $2x^2 + 63 = 8x$

$-8x - 63 \quad -8x - 63$

$\frac{2x^2}{2} - \frac{8x}{2} = -\frac{63}{2}$

$x^2 - 4x = -\frac{63}{2}$

$\left(-4 \cdot \frac{1}{2}\right)^2 = (-2)^2 = 4$

$x^2 - 4x + 4 = -\frac{63}{2} + 4$

$\sqrt{(x-2)^2} = \sqrt{-\frac{55}{2}} \left(\frac{\sqrt{2}}{\sqrt{2}}\right)$

$x - 2 = \pm \frac{i\sqrt{110}}{2}$

$+2 \quad +2$

$x = \frac{4 \pm i\sqrt{110}}{2}$

33) $p^2 - 8p = -55$

$\left(-8 \cdot \frac{1}{2}\right)^2 = (-4)^2 = 16$

$p^2 - 8p + 16 = -55 + 16$

$\sqrt{(p-4)^2} = \sqrt{-39}$

$p - 4 = \pm i\sqrt{39}$

$+4 \quad +4$

$p = 4 \pm i\sqrt{39}$

35) $7n^2 - n + 7 = 7n + 6n^2$

$-6n^2 - 7n - 7 \quad -6n^2 - 7n - 7$

$n^2 - 8n = -7$

$\left(-8 \cdot \frac{1}{2}\right)^2 = (-4)^2 = 16$

$n^2 - 8n + 16 = -7 + 16$

$\sqrt{(n-4)^2} = \sqrt{9}$

$n - 4 = \pm 3$

$+4 \quad +4$

$n = 4 \pm 3$

$n = 7, 1$

37) $13b^2 + 15b + 44 = -5 + 7b^2 + 3b$

$-7b^2 - 3b - 44 \quad -44 - 7b^2 - 3b$

$\frac{6b^2}{6} + \frac{12b}{6} = -\frac{49}{6}$

$b^2 + 2b = -\frac{49}{6}$

$\left(2 \cdot \frac{1}{2}\right)^2 = 1^2 = 1$

$b^2 + 2b + 1 = -\frac{49}{6} + 1$

$\sqrt{(b+1)^2} = \sqrt{-\frac{43}{6}} \left(\frac{\sqrt{6}}{\sqrt{6}}\right)$

$b + 1 = \pm \frac{i\sqrt{256}}{6}$

$-1 \quad -1$

$b = \frac{-6 \pm i\sqrt{256}}{6}$

39) $5x^2 + 5x = -31 - 5x$

$+5x \quad +5x$

$\frac{5x^2}{5} + \frac{10x}{5} = -\frac{31}{5}$

$x^2 + 2x = -\frac{31}{5}$

$\left(2 \cdot \frac{1}{2}\right)^2 = 1^2 = 1$

$$x^2 + 2x + 1 = -\frac{31}{5} + 1$$
$$\sqrt{(x+1)^2} = \sqrt{-\frac{26}{5}\left(\frac{\sqrt{5}}{\sqrt{5}}\right)}$$
$$x + 1 = \pm\frac{i\sqrt{130}}{5}$$
$$\underline{-1 \quad -1}$$
$$x = \frac{-5 \pm i\sqrt{130}}{5}$$

41) $v^2 + 5v + 28 = 0$

$$\underline{-28 \quad -28}$$
$$v^2 + 5v = -28$$
$$\left(5 \cdot \frac{1}{2}\right)^2 = \left(\frac{5}{2}\right)^2 = \frac{25}{4}$$
$$v^2 + 5v + \frac{25}{4} = -28 + \frac{25}{4}$$
$$\sqrt{\left(v + \frac{5}{2}\right)^2} = \sqrt{-\frac{87}{4}}$$
$$v + \frac{5}{2} = \pm\frac{i\sqrt{87}}{2}$$
$$\underline{-\frac{5}{2} \quad -\frac{5}{2}}$$
$$v = \frac{-5 \pm i\sqrt{87}}{2}$$

43) $7x^2 - 6x + 40 = 0$

$$\underline{-40 \quad -40}$$
$$\frac{7x^2}{7} - \frac{6x}{7} = -\frac{40}{7}$$
$$x^2 - \frac{6}{7}x = -\frac{40}{7}$$
$$\left(-\frac{6}{7} \cdot \frac{1}{2}\right)^2 = \left(-\frac{3}{7}\right)^2 = \frac{9}{49}$$
$$x^2 - \frac{6}{7}x + \frac{9}{49} = -\frac{40}{7} + \frac{9}{49}$$
$$\sqrt{\left(x - \frac{3}{7}\right)^2} = \sqrt{-\frac{271}{49}}$$
$$x - \frac{3}{7} = \pm\frac{i\sqrt{271}}{7}$$
$$\underline{+\frac{3}{7} \quad +\frac{3}{7}}$$
$$x = \frac{3 \pm i\sqrt{271}}{7}$$

45) $k^2 - 7k + 50 = 3$

$$\underline{-50 \quad -50}$$
$$k^2 - 7k = -47$$
$$\left(-7 \cdot \frac{1}{2}\right)^2 = \left(-\frac{7}{2}\right)^2 = \frac{49}{4}$$
$$k^2 - 7k + \frac{49}{4} = -47 + \frac{49}{4}$$
$$\sqrt{\left(k - \frac{7}{2}\right)^2} = \sqrt{-\frac{139}{4}}$$
$$k - \frac{7}{2} = \pm\frac{i\sqrt{139}}{2}$$
$$\underline{+\frac{7}{2} \quad +\frac{7}{2}}$$
$$k = \frac{7 \pm i\sqrt{139}}{2}$$

47) $5x^2 + 8x - 40 = 8$

$$\underline{+40 \quad +40}$$
$$\frac{5x^2}{5} + \frac{8x}{5} = \frac{48}{5}$$
$$x^2 + \frac{8}{5}x = \frac{48}{5}$$
$$\left(\frac{8}{5} \cdot \frac{1}{2}\right)^2 = \left(\frac{4}{5}\right)^2 = \frac{16}{25}$$
$$x^2 + \frac{8}{5}x + \frac{16}{25} = \frac{48}{5} + \frac{16}{25}$$
$$\sqrt{\left(x + \frac{4}{5}\right)^2} = \sqrt{\frac{256}{25}}$$
$$x + \frac{4}{5} = \pm\frac{16}{5}$$
$$\underline{-\frac{4}{5} \quad -\frac{4}{5}}$$
$$x = \frac{-4 \pm 16}{5}$$

49) $m^2 = -15 + 9m$

$$\underline{-9m \quad -9m}$$
$$m^2 - 9m = -15$$
$$\left(-9 \cdot \frac{1}{2}\right)^2 = \left(-\frac{9}{2}\right)^2 = \frac{81}{4}$$
$$m^2 - 9m + \frac{81}{4} = -15 + \frac{81}{4}$$
$$\sqrt{\left(m - \frac{9}{2}\right)^2} = \sqrt{\frac{21}{4}}$$
$$m - \frac{9}{2} = \pm\frac{\sqrt{21}}{2}$$
$$\underline{+\frac{9}{2} \quad +\frac{9}{2}}$$
$$m = \frac{9 \pm \sqrt{21}}{2}$$

51) $\frac{8r^2}{8} + \frac{10r}{8} = -\frac{55}{8}$

$$r^2 + \frac{5}{4}r = -\frac{55}{8}$$
$$\left(\frac{5}{4} \cdot \frac{1}{2}\right)^2 = \left(\frac{5}{8}\right)^2 = \frac{25}{64}$$
$$r^2 + \frac{5}{4}r + \frac{25}{64} = -\frac{55}{8} + \frac{25}{64}$$

$$\sqrt{\left(r+\frac{5}{8}\right)^2}=\sqrt{\frac{-415}{64}}$$

$$r+\frac{5}{8}=\pm\frac{i\sqrt{416}}{8}$$

$$-\frac{5}{8}\quad -\frac{5}{8}$$

$$r=\frac{-5\pm i\sqrt{415}}{8}$$

53) $5n^2-8n+60=-3n-6+4n^2$

$$-4n^2+3n-60\ \ +3n-60-4n^2$$

$$n^2+5n\quad =-54$$

$$\left(5\cdot\frac{1}{2}\right)^2=\left(\frac{5}{2}\right)^2=\frac{25}{4}$$

$$n^2+5n+\frac{25}{4}=-54+\frac{25}{4}$$

$$\sqrt{\left(n+\frac{5}{2}\right)^2}=\sqrt{-\frac{191}{4}}$$

$$n+\frac{5}{2}=\pm\frac{i\sqrt{191}}{2}$$

$$-\frac{5}{2}\quad -\frac{5}{2}$$

$$n=\frac{-5\pm i\sqrt{191}}{2}$$

55) $2x^2+3x-5=-4x^2$

$$+4x^2\quad +5\quad +4x^2+5$$

$$\frac{6x^2}{6}+\frac{3x}{6}\quad =\frac{5}{6}$$

$$x^2+\frac{1}{2}x\quad =\frac{5}{6}$$

$$\left(\frac{1}{2}\cdot\frac{1}{2}\right)^2=\left(\frac{1}{4}\right)^2=\frac{1}{16}$$

$$x^2+\frac{1}{2}x+\frac{1}{16}=\frac{5}{6}+\frac{1}{16}$$

$$\sqrt{\left(x+\frac{1}{4}\right)^2}=\sqrt{\frac{43}{48}}=\frac{\sqrt{43}}{4\sqrt{3}}\left(\frac{\sqrt{3}}{\sqrt{3}}\right)$$

$$x+\frac{1}{4}=\pm\frac{\sqrt{129}}{12}$$

$$-\frac{1}{4}\quad -\frac{1}{4}$$

$$x=\frac{\left(-3\pm\sqrt{129}\right)}{12}$$

57) $-2x^2+3x-5=-4x^2$

$$+4x^2\quad +5\quad +4x^2+5$$

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

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

$$\left(\frac{3}{2}\cdot\frac{1}{2}\right)^2=\left(\frac{3}{4}\right)^2=\frac{9}{16}$$

$$x^2+\frac{3}{2}x+\frac{9}{16}=\frac{5}{2}+\frac{9}{16}$$

$$\sqrt{\left(x+\frac{3}{4}\right)^2}=\sqrt{\frac{49}{16}}$$

$$x+\frac{3}{4}=\pm\frac{7}{4}$$

$$-\frac{3}{4}\quad -\frac{3}{4}$$

$$x=-\frac{3}{4}\pm\frac{7}{4}$$

$$x=1,-\frac{5}{2}$$