Problem Set 1

a. $\sqrt{20} = \sqrt{4 \cdot 5}$
$= \sqrt{4}\sqrt{5}$
$= 2\sqrt{5}$

b. $\sqrt{18} = \sqrt{9 \cdot 2}$
$= \sqrt{9}\sqrt{2}$
$= 3\sqrt{2}$

c. $\sqrt{48} = \sqrt{16 \cdot 3}$
$= \sqrt{16}\sqrt{3}$
$= 4\sqrt{3}$

d. $\sqrt{50} = \sqrt{25 \cdot 2}$
$= \sqrt{25}\sqrt{2}$
$= 5\sqrt{2}$

e. $\frac{3}{\sqrt{3}} = \frac{3}{\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}}$
$= \frac{3\sqrt{3}}{3}$
$= \sqrt{3}$

f. $\frac{1}{\sqrt{2}} = \frac{1}{\sqrt{2}} \cdot \frac{\sqrt{2}}{\sqrt{2}}$
$= \frac{\sqrt{2}}{2}$

g. $\sqrt{450} = \sqrt{9 \cdot 25 \cdot 2}$
$= \sqrt{9}\sqrt{25}\sqrt{2}$
$= 3 \cdot 5 \cdot \sqrt{2}$
$= 15\sqrt{2}$

h. $\sqrt{396} = \sqrt{4 \cdot 9 \cdot 11}$
$= \sqrt{4}\sqrt{9}\sqrt{11}$
$= 2 \cdot 3 \cdot \sqrt{11}$
$= 6\sqrt{11}$

i. $\frac{4}{\sqrt{32}} = \frac{4}{\sqrt{16 \cdot 2}}$
$= \frac{4}{\sqrt{16}\sqrt{2}}$
$= \frac{4}{4\sqrt{2}}$
$= \frac{1}{\sqrt{2}}$
$= \frac{1}{\sqrt{2}} \cdot \frac{\sqrt{2}}{\sqrt{2}}$
$= \frac{\sqrt{2}}{2}$

j. $\frac{7}{\sqrt{77}} = \frac{7}{\sqrt{77}} \cdot \frac{\sqrt{77}}{\sqrt{77}}$
$= \frac{7\sqrt{77}}{77}$
$= \frac{\cancel{7}\sqrt{77}}{\cancel{7} \cdot 11}$
$= \frac{\sqrt{77}}{11}$

k. $\dfrac{-8 \pm \sqrt{44}}{6} = \dfrac{-8 \pm \sqrt{4 \cdot 11}}{6}$

$= \dfrac{-8 \pm \sqrt{4}\sqrt{11}}{6}$

$= \dfrac{-8 + 2\sqrt{11}}{6}$

$= \dfrac{-4 \pm \sqrt{11}}{3}$

Scratch work – divide 2 out of **each** term.

$$\frac{-\overset{4}{\cancel{8}} + \overset{1}{\cancel{2}}\sqrt{11}}{\cancel{6}_{3}}$$

l. $\dfrac{10 \pm \sqrt{27}}{2} = \dfrac{10 \pm \sqrt{9 \cdot 3}}{2}$

$= \dfrac{10 \pm \sqrt{9}\sqrt{3}}{2}$

$= \dfrac{10 \pm 3\sqrt{3}}{2}$

m. $\dfrac{-12 \pm \sqrt{100}}{4} = \dfrac{-12 \pm 10}{4}$

$\dfrac{-12 + 10}{4} = -\dfrac{1}{2}$ and $\dfrac{-12 - 10}{4} = -\dfrac{11}{2}$

n. $\dfrac{6 \pm \sqrt{288}}{6} = \dfrac{6 \pm \sqrt{144 \cdot 2}}{6}$

$= \dfrac{6 \pm \sqrt{144}\sqrt{2}}{6}$

$= \dfrac{6 \pm 12\sqrt{2}}{6}$

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

Scratch work – divide 2 out of **each** term.

$$\frac{\overset{1}{\cancel{6}} \pm \overset{2}{\cancel{12}}\sqrt{2}}{\cancel{6}_{1}}$$

Problem 2

a. $(5w - 2)^2 = 88$

$5w - 2 = \pm\sqrt{88}$

$5w - 2 = \pm 2\sqrt{22}$

$5w = 2 \pm 2\sqrt{22}$

$w = \dfrac{2 \pm 2\sqrt{22}}{5}$

The solutions are $\dfrac{2 \pm 2\sqrt{22}}{5}$.

b. $(3x + 1)^2 + 4 = 0$

$(3x + 1)^2 = -4$

The equation has no real number solutions.

c. $(6t+10)^2 = 72$

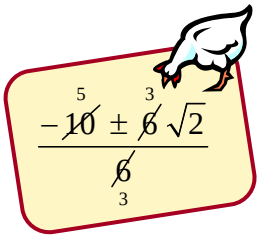
$6t+10 = \pm\sqrt{72}$

$6t+10 = \pm 6\sqrt{2}$

$6t = -10 \pm 6\sqrt{2}$

$t = \dfrac{-10 \pm 6\sqrt{2}}{6}$

$t = \dfrac{-5 \pm 3\sqrt{2}}{3}$



The solutions are $\dfrac{-5 \pm 3\sqrt{2}}{3}$.

Problem 3

a. $a = 2, \quad b = -4, \quad c = -3$

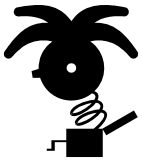
$$x = \frac{-(-4) \pm \sqrt{(-4)^2 - 4(2)(-3)}}{2(2)}$$

$$= \frac{4 \pm \sqrt{40}}{4}$$

$$= \frac{4 \pm 2\sqrt{10}}{4}$$

$$= \frac{2 \pm \sqrt{10}}{2}$$

The solutions are $\dfrac{2 \pm \sqrt{10}}{2}$.



Scratch work – divide 2 out of **each** term.

$$\frac{\cancel{4}^{2} \pm \cancel{2}^{1}\sqrt{10}}{\cancel{4}_{2}}$$

b. $-x^2 + 3x - 2 = 0 \Rightarrow 0 = x^2 - 3x + 2$

$a = 1, \quad b = -3, \quad c = 2$

$$x = \frac{-(-3) \pm \sqrt{(-3)^2 - 4(1)(2)}}{2(1)}$$

$$= \frac{3 \pm \sqrt{1}}{2}$$

$x = \dfrac{3+1}{2}$ or $x = \dfrac{3-1}{2}$

$x = 2$ or $x = 1$

The solutions are 1 and 2.

c. $(t+3)(t-7)=10$

$t^2-4t-21=10$

$t^2-4t-31=0$

$a=1, b=-4, c=-31$

Scratch work – divide 2 out of **each** term.

$$\frac{\cancel{4}^{2} \pm \cancel{2}^{1}\sqrt{35}}{\cancel{2}_{1}}$$

$$t=\frac{-(-4)\pm\sqrt{(-4)^2-4(1)(-31)}}{2(1)}$$

$$=\frac{4\pm\sqrt{140}}{2}$$

$$=\frac{4\pm\sqrt{4\cdot 35}}{2}$$

$$=\frac{4\pm 2\sqrt{35}}{2}$$

$$=2\pm\sqrt{35}$$

The solutions are $2\pm\sqrt{35}$.

d. $3x^2+5=x \Rightarrow 3x^2-x+5=0$

$a=3, b=-1, c=5$

The equation has no real number solutions.

$$x=\frac{-(-1)\pm\sqrt{(-1)^2-4(3)(5)}}{2(3)}$$

$$=\frac{1\pm\sqrt{1-60}}{6}$$

$$=\frac{1+\sqrt{-59}}{6}$$

Problem 4/5

a. Since the left side of the equation easily factors I'm going to go ahead and use the zero principle.

$x^2+5x-6=0$

$(x+6)(x-1)=0$

The solutions to the equation are 1 and -6.

$x+6=0$ **or** $x-1=0$

$x=-6$ **or** $x=1$

b. Since I have a factored expression equated to zero I'd be nutty to not just go ahead and use the zero principle,

$(x+2)(3x-8)=0$

The solutions to the equation are -2 and $8/3$.

$x+2=0$ **or** $3x-8=0$

$x=-2$ **or** $x=8/3$

c. There's no way to choose a method until I FOIL out the left side and see what I've got.

$$(x+2)(3x-8)=9$$
$$3x^2-2x-16=9$$
$$3x^2-2x-25=0$$

Hmm … maybe the left side factors, and maybe it doesn't … I think I'll just go ahead and use the quadratic formula.

$a=3$
$b=-2$
$c=-25$

$$x=\frac{-(-2)\pm\sqrt{(-2)^2-4(3)(-25)}}{2(3)}$$
$$=\frac{2\pm\sqrt{304}}{6}$$
$$=\frac{2\pm\sqrt{16\cdot 19}}{6}$$
$$=\frac{2\pm 4\sqrt{19}}{6}$$
$$=\frac{1\pm 2\sqrt{19}}{3}$$

The solutions to the equation are:

$\frac{1+2\sqrt{19}}{3}$ and $\frac{1-2\sqrt{19}}{3}$.

d. A perfect square equals a positive number … sounds like square root property material to me!

$$(x+2)^2=9$$
$$x+2=3 \text{ or } x+2=-3$$
$$x=1 \text{ or } x=-5$$

The solutions to the equation are 1 and -5.

e. The left side don't factor so it's time for the quadratic formula song (all over two a-ehhh)!

$a=1$
$b=-2$
$c=5$

$$x=\frac{-(-2)\pm\sqrt{(-2)^2-4(1)(5)}}{2(1)}$$
$$=\frac{2\pm\sqrt{-16}}{2}$$

This equation has no frickin real number solutions!

f. I need to expand things out before deciding on a solution method.

$$x(x-6) = -8$$
$$x^2 - 6x + 8 = 0$$
$$(x-2)(x-4) = 0$$

Since the left side of the equation factored so nice and tidyly I went ahead and used the zero principle. (Sorry for the lack of heads up!)

$$x - 2 = 0 \text{ or } x - 4 = 0$$
$$x = 2 \text{ or } x = 4$$

The solutions to the equation are 2 and 4.

g. You know what? $(x-6)(x-6)$ is just the long way of writing $(x-6)^2$. So methinks me best be using the square root property,

$$(x-6)(x-6) = -8$$
$$(x-6)^2 = -8$$

Gee golly, that was short and sweet. I could square real numbers from now until the cows come home and I ain't never gonna get -8. So I reckon this here little equation just doesn't have any real number solutions.

h. Since I'm not wanting to think about whether $2x^2 - x - 40$ factors or not I think I'll mosey on over to the quadratic formula.

$$2x^2 - x = 40$$
$$2x^2 - x - 40 = 0$$

$a = 2$
$b = -1$
$c = -40$

$$x = \frac{-(-1) \pm \sqrt{(-1)^2 - 4(2)(-40)}}{2(2)}$$
$$= \frac{1 \pm \sqrt{321}}{4}$$

The solutions to the equation are:

$$\frac{1+\sqrt{321}}{4} \text{ and } \frac{1-\sqrt{321}}{4}$$

i. A little zero principle action is called for here.

$$x^2 + 49x = 0$$
$$x(x+49) = 0$$
$$x = 0 \text{ or } x + 49 = 0$$
$$x = 0 \text{ or } x = -49$$

The solutions to the equation are 0 and -49.

j. Some preliminary algebraic intervention is definitely on the menu tonight.

$$(2x-1)(3x+2) = (6x+5)(x-4)$$
$$6x^2 + x - 2 = 6x^2 - 19x - 20$$
$$x - 2 = -19x - 20$$
$$20x = -18$$
$$x = -\frac{9}{10}$$

Aw man … we were punked; the equation wasn't even quadratic!

The only solution to this lowly linear equation is $-\frac{9}{10}$

Problem 6

a. $x^2 + 5x - 6 = 0$

$a = 1$
$b = 5$
$c = -6$

$$x = \frac{-5 \pm \sqrt{5^2 - 4(1)(-6)}}{2(1)}$$
$$= \frac{-5 \pm \sqrt{49}}{2}$$
$$x = \frac{-5+7}{2} \text{ or } x = \frac{-5-7}{2}$$
$$x = 1 \text{ or } x = -6$$

The solutions to the equation are:

1 and -6

b. $(x+2)(3x-8) = 0$
$3x^2 - 2x - 16 = 0$

$a = 3$
$b = -2$
$c = -16$

$$x = \frac{-(-2) \pm \sqrt{(-2)^2 - 4(3)(-16)}}{2(3)}$$
$$= \frac{2 \pm \sqrt{196}}{6}$$
$$= \frac{2 \pm 14}{6}$$
$$x = \frac{2+14}{6} \text{ or } x = \frac{2-14}{6}$$
$$x = \frac{8}{3} \text{ or } x = -2$$

The solutions to the equation are -2 and $\frac{8}{3}$.

d. $(x+2)^2 = 9$

$x^2 + 4x + 4 = 9$

$x^2 + 4x - 5 = 0$

$a = 1$

$b = 4$

$c = -5$

$$x = \frac{-4 \pm \sqrt{4^2 - 4(1)(-5)}}{2(1)}$$

$$= \frac{-4 \pm \sqrt{36}}{2}$$

$$x = \frac{-4+6}{2} \text{ or } x = \frac{-4-6}{2}$$

$$x = 1 \text{ or } x = -5$$

The solutions to the equation are:

1 and -5

f. $x(x-6) = -8$

$x^2 - 6x + 8 = 0$

$a = 1$

$b = -6$

$c = 8$

$$x = \frac{-(-6) \pm \sqrt{(-6)^2 - 4(1)(8)}}{2(1)}$$

$$= \frac{6 \pm \sqrt{4}}{2}$$

$$x = \frac{6+2}{2} \text{ or } x = \frac{6-2}{2}$$

$$x = 4 \text{ or } x = 2$$

The solutions to the equation are:

2 and 4

i. $x^2 + 49x = 0$

$a = 1$

$b = 49$

$c = 0$

$$x = \frac{-49 \pm \sqrt{49^2 - 4(1)(0)}}{2(1)}$$

$$= \frac{-49 \pm \sqrt{49^2}}{2}$$

$$= \frac{-49 \pm 49}{2}$$

$$x = \frac{-49+49}{2} \text{ or } x = \frac{-49-49}{2}$$

$$x = 0 \text{ or } x = -49$$

The solutions to the equation are :

0 and -49