Warm-Up:

Solve.

1) $3x^2 - 7 = 0$

$\frac{3x^2}{3} = \frac{7}{3}$

$\sqrt{x^2} = \pm\sqrt{\frac{7}{3}}$

$x = \pm\frac{\sqrt{7}}{\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}}$

$x = \pm\frac{\sqrt{21}}{3}$

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

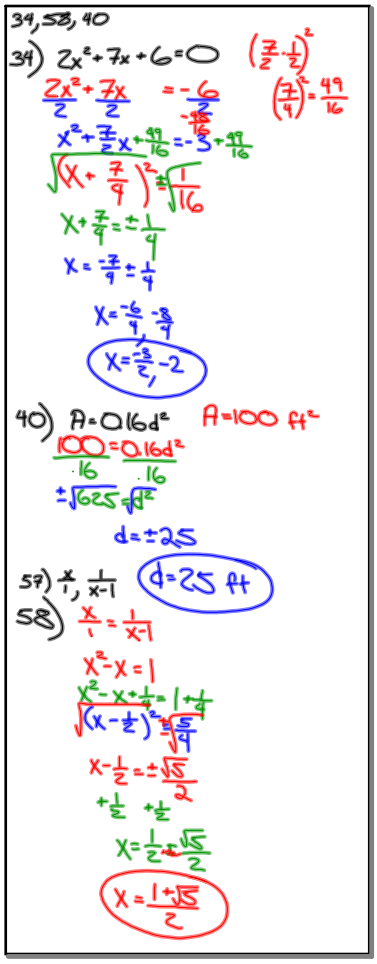
$x^2 + 6x + 9 = 1 + 9$

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

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

$-3 \quad -3$

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



Section 5-6: The Quadratic Formula

Solve for x by completing the square:

$ax^2 + bx + c = 0$

$$\left(\frac{b}{a}\cdot\frac{1}{2}\right)^2 \qquad \left(\frac{b}{2a}\right)^2 = \frac{b^2}{4a^2}$$

$$\frac{ax^2}{a} + \frac{bx}{a} = \frac{-c}{a}$$

$$x^2 + \frac{b}{a}x + \frac{b^2}{4a^2} \quad \frac{4}{4}\cdot\frac{-c}{a} + \frac{b^2}{4a^2} = \frac{-4ac}{4a^2} + \frac{b^2}{4a^2}$$

$$\sqrt{\left(x + \frac{b}{2a}\right)^2} = \pm\sqrt{\frac{b^2-4ac}{4a^2}}$$

$$x + \frac{b}{2a} = \frac{\pm\sqrt{b^2-4ac}}{2a}$$

$$\frac{-b}{2a} \qquad \frac{-b}{2a}$$

$$x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$$

The Quadratic Formula:

When $ax^2 + bx + c = 0$, then

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Examples:
Solve using the Quadratic Formula.

1) $5x^2 + 6x + 1 = 0$ $a=5\ b=6\ c=1$

$$x = \frac{-6 \pm \sqrt{6^2-4(5)(1)}}{2(5)}$$

$$x = \frac{-6 \pm \sqrt{36-20}}{10}$$

$$x = \frac{-6 \pm \sqrt{16}}{10}$$

$$x = \frac{-6 \pm 4}{10}$$

$$x = \frac{-2}{10} \quad \frac{-10}{10}$$

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

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

$a=5\ b=-6\ c=2$

$$x = \frac{6 \pm \sqrt{(-6)^2-4(5)(2)}}{2(5)}$$

$$x = \frac{6 \pm \sqrt{36-40}}{10}$$

$$x = \frac{6 \pm \sqrt{-4}}{10}$$

$$x = \frac{6 \pm 2i}{10}$$

$$x = \frac{3 \pm i}{5}$$

The expression under the square root of the quadratic formula $b^2 - 4ac$ is called the discriminant. Using this, we can determine the number and types of solutions we will get for a quadratic equation.

The Quadratic Formula:

When $ax^2 + bx + c = 0$, then

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

If $b^2 - 4ac > 0$ and is a perfect square then, 2 rational solutions

If $b^2 - 4ac > 0$ and is not a perfect square then, 2 irrational solutions

If $b^2 - 4ac = 0$, then 1 rational solution

If $b^2 - 4ac < 0$, then 2 complex solutions

Examples:
Find the value of the discriminant and describe the number and type of roots for the quadratic equation. Then solve using the Quadratic Formula.

3) $10x^2 + 8x + 1 = 0$ $a=10\ b=8\ c=1$

Discriminant: $8^2 - 4(10)(1)$

$64 - 40$

24

2 irrational

$x = \frac{-8 \pm \sqrt{24}}{2(10)}$ $\sqrt{24} = \sqrt{4}\sqrt{6}$

$x = \frac{-8 \pm 2\sqrt{6}}{20}$

$x = \frac{-4 \pm \sqrt{6}}{10}$

4) $9x^2 + 2x + 7 = 0$ $a=9\ b=2\ c=7$

Discriminant: $2^2 - 4(9)(7)$

$4 - 252$

-248

2 complex

$x = \frac{-2 \pm \sqrt{-248}}{2(9)}$

$x = \frac{-2 \pm \sqrt{4}\sqrt{4}\sqrt{62}}{18}$

$x = \frac{-2 \pm 2i\sqrt{62}}{18}$

$x = \frac{-1 \pm i\sqrt{62}}{9}$

Homework: pg 281 #16-30 even, 48, 54, 55

Section 5-6 Vocab