COLLEGE ALGEBRA

2.2 SOLVING QUADRATIC EQUATIONS

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Class Time: 11:30-12:45   Date: 2-5-08

Useful Guidelines:

* Quadratic Equation: $f(x) = ax^2 + bx + c = 0 (a \neq 0)$, where a, b and c are real numbers.
* Square Root Property: If x and k are complex numbers and $x^2 = k$, then $x = \sqrt{k}$ or $x = -\sqrt{k}$.
* Completing the Square: To solve $ax^2 + bx + c = 0 (a \neq 0)$:

Step 1: If $a \neq 1$, divide each side by a.
Step 2: Write the equation with the variable terms on one side and the constant on the other.
Step 3: Take half the coefficient of x and square it.
Step 4: Add the square to both sides of the equation.
Step 5: Factor the perfect square of a trinomial, write it as the square of a binomial, and simplify.
Step 6: Use the square root property to complete the solution and write down the solution set.

Use the square root property to solve each equation and give the solution set.

1. a) $x^2 = 49$

$\sqrt{x^2} = \sqrt{49}$

$x = \pm 7$

solution set:

$\{7, -7\}$ or

$\{x \mid x = 7, -7\}$

b) $x^2 - 8 = 0$

$x^2 = -8$

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

solution set:

$\{x \mid x = \pm 2\sqrt{2}\}$ or

$\{-2\sqrt{2}, 2\sqrt{2}\}$

c) $(x-4)^2 = 25$

$\sqrt{(x-4)^2} = \sqrt{25}$

$= x - 4 = \pm 5$

$x = 9$

$x = -1$

solution set:

$\{x \mid x = 9, -1\}$

or

$\{9, -1\}$

d) $(2x-5)^2 = 12$

$2x - 5 = \pm 2\sqrt{3}$

$\dfrac{2x}{2} = \dfrac{5 \pm 2\sqrt{3}}{2}$

solution set:

$\{x \mid x = 2.5 \pm \sqrt{3}\}$

or

$\{2.5 - \sqrt{3}, 2.5 + \sqrt{3}\}$

Solve each equation by completing the square and give the solution set.

2. a) $\dfrac{2x^2}{2} + \dfrac{8x}{2} + \dfrac{2}{2} = \dfrac{0}{2}$ (make $a = 1$)

$= x^2 + 4x + 1 = 0$

$\quad\quad\quad -1 \; -1$

$= x^2 + 4x + 4 = -1$

(divide 4 by 2 and square it)

$x^2 + 4x + 4 = -1 + 4$

$(x+2)(x+2) = 3$

$(x+2)^2 = 3$

$= (x+2)^2 = 3$

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

$x + 2 = \pm\sqrt{3}$

$x = -2 \pm \sqrt{3}$

Solution set: $\{x \mid x = -2 \pm \sqrt{3}\}$

or

$\{-2 - \sqrt{3}, -2 + \sqrt{3}\}$

b) $z^2 - 10z + 15 = 0$

$z^2 = -10z \; (+25) = -15 + 25$

$(z-5)(z-5) = 10$

$(z-5)^2 = 10$

$\sqrt{(z-5)^2} = \sqrt{10}$

$z - 5 = \pm\sqrt{10}$

$z = 5 \pm \sqrt{10}$

Solution set:

$\{z \mid z = 5 \pm \sqrt{10}\}$

or

$\{5 + \sqrt{10}, 5 - \sqrt{10}\}$