Key

4.5 Day 1 Notes

Objectives: Solve Quadratic equations using the Square Root Property and Completing the Square.

Warm-up: Factor the following quadratics

9: 1 | 9, 3 | 3, $+ = 6$

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

$(x+3)(x+3)$

$= (x+3)^2$

perfect square trinomial

2) $4x^2 - 20x + 25$

2: $\sqrt{4}$, 5: $\sqrt{25}$, $2 \cdot 5 = 10$, $\times 2$, 20 ✓

$(2x-5)(2x-5)$

$= (2x-5)^2$

perfect square trinomial

Solve $x^2 + 6x + 9 = 36$ by using the Square Root Property.

$(x+3)(x+3)$

$= (x+3)^2$

1) **Factor the perfect Square Trinomial**
2) **Use Square Root Property**
3) **Solve the equation**

$(x+3)^2 = 36$

$\sqrt{(x+3)^2} = \pm\sqrt{36}$

$x+3 = 6$ or $x+3 = -6$

$-3 \quad -3 \qquad -3 \quad -3$

$x = 3$ $\qquad$ $x = -9$

Solve the following equations using the Square Root Property.

3. $x^2 - 12x + 36 = 25$

$(x-6)^2 = 25$

$\sqrt{(x-6)^2} = \pm\sqrt{25}$

$x-6 = 5$ or $x-6 = -5$

$+6 \quad +6$

$x = 11$ $\qquad$ $x = 1$

4. $x^2 - 16x + 64 = 49$

$(x-8)^2 = 49$

$\sqrt{(x-8)^2} = \pm\sqrt{49}$

$x-8 = 7$ or $x-8 = -7$

$+8 \quad +8 \qquad +8 \quad +8$

$x = 15$ $\qquad$ $x = 1$

Roots that are irrational numbers can be written as exact answers in radical form.

Ex. $x^2 - 10x + 25 = 27$

$(x-5)^2 = 27$

$\sqrt{(x-5)^2} = \pm\sqrt{27}$

$x-5 = \pm\sqrt{9}\sqrt{3}$

$3\sqrt{3}$

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

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

$+5 \quad +5$

$x = 5 + 3\sqrt{3}$

or $x-5 = -3\sqrt{3}$

$+5 \quad +5$

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

5. $x^2 + 8x + 16 = 20$

$\sqrt{(x+4)^2} = \sqrt{20}$

$x+4 = \pm\sqrt{4}\sqrt{5}$

$x+4 = \pm 2\sqrt{5}$

$-4 \quad -4$

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

$x = -4 - 2\sqrt{5}$

6. $x^2 - 6x + 9 = 32$

$\sqrt{(x-3)^2} = \sqrt{32}$

$x-3 = \pm\sqrt{2 \cdot 16}$

$x-3 = \pm 4\sqrt{2}$

$+3 \quad +3$

$x = 3 + 4\sqrt{2}$

$x = 3 - 4\sqrt{2}$

7. $x^2 + 18x + 81 = 15$

$\sqrt{(x+9)^2} = \sqrt{15}$

$x+9 = \pm\sqrt{15}$

$-9 \quad -9$

$x = -9 + \sqrt{15}$

$x = -9 - \sqrt{15}$

To complete the square for any quadratic expression of the form $x^2 + bx$, follow the steps below.

Step 1: Find half of "b", the coefficient of x

Step 2: Square the result in Step 1

Step 3: Add the result of Step 2 to $x^2 + bx$

Ex. Find the value of "c" that makes $x^2 + 16x + c$ a perfect square. Then write the trinomial as a perfect square.

x^2+16x+ ____

step1: $\frac{16}{2} = 8$ step2: $8^2 = 64$ $\Rightarrow$ step3: $x^2+16x+64$

8) Find the value of "c" that makes $x^2 - 14x + c$ a perfect square. Then write the trinomial as a perfect square.

x^2-14x+ ____

step1: $\frac{14}{2} = 7$ step2: $7^2 = 49$ step3: $x^2-14x+49$

Completing the Square: All quadratic equations can be solved using the Square Root Property by manipulating the equation until one side is a perfect square. This method is called completing the square.

Consider $x^2 + 16x = 9$. Remember to perform each operation on each side of the equation.

$x^2 + 16x + \underline{64} = 9$ **1) What value is needed for the Perfect Square** $\frac{16}{2} = 8$ $8^2 = 64$

$x^2 + 16x + \underline{64} = 9 + \underline{64}$ **2) Add the number to both sides**

$x^2 + 16x + \underline{64} = \underline{73}$ **3) Simplify**

$(x + \underline{8})^2 = \underline{73}$ **4) Factor the Perfect Square Trinomial**

$\sqrt{(x+8)^2} = \pm\sqrt{73}$ **5) Use the Square Root Property**

$x+8 = \pm\sqrt{73}$

$-8 \quad -8$

$x = -8 + \sqrt{73}$ $x = -8 - \sqrt{73}$

Solve each equation by completing the square.

9) $x^2 - 10x + 24 = 0$

$\frac{10}{2} = 5$ $5^2 = 25$

$x^2-10x+\underline{25} = -24+\underline{25}$

$(x-5)^2 = 1$

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

$x-5 = 1$ or $x-5 = -1$

$+5 \quad +5$ $+5 \quad +5$

$x = 6$ or $x = 4$

10) $x^2 + 10x - 11 = 0$

$x^2+10x+\underline{25} = 11+\underline{25}$ $\frac{10}{2} = 5$ $5^2 = 25$

$(x+5)^2 = 36$

$\sqrt{(x+5)^2} = \pm\sqrt{36}$

$x+5 = \pm 6$

$x+5 = 6$ or $x+5 = -6$

$-5 \quad -5$ $-5 \quad -5$

$x = 1$ $x = -11$