Unit 3A
Solving Quadratic Equations by Finding Square Roots

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- Sometimes a quadratic equation can be solved by taking square roots.
- It's OK to take the square root of an equation, as long as you do it to **BOTH SIDES.**
- Simple example: $x^2 = 25$

$$x = \pm 5$$

Use a $\pm$ when you have to insert it into the problem!!!

Vocabulary

- Radical sign

  $\sqrt{}$

- Radicand
  - Number under radical sign
- Radical
  - Expression itself is the radical

$\sqrt{16}$, 16 is radicand, $\sqrt{16}$ is radical

Properties of Square Roots

- Product Property

$$\sqrt{ab} = \sqrt{a} \cdot \sqrt{b}$$

$$\sqrt{9x^2} = \sqrt{9} \cdot \sqrt{x^2}$$

$$= 3x$$

- Quotient Property

$$\sqrt{\frac{a}{b}} = \frac{\sqrt{a}}{\sqrt{b}}$$

$$\sqrt{\frac{16}{25}} = \frac{\sqrt{16}}{\sqrt{25}} = \frac{4}{5}$$

Examples

- Find the largest factor of the radicand that is a perfect square
- Take square root of the perfect square factor
- Other factor stays under radical

a) $\sqrt{45} = \sqrt{9} \cdot \sqrt{5} = 3\sqrt{5}$

b) $\sqrt{8} \cdot \sqrt{15} = \sqrt{120} = \sqrt{4} \cdot \sqrt{30} = 2\sqrt{30}$

c) $\sqrt{\frac{2}{9}} = \frac{\sqrt{2}}{\sqrt{9}} = \frac{\sqrt{2}}{3}$

d. $3\sqrt{12}\cdot\sqrt{6}$

$3\sqrt{4}\sqrt{3}\cdot\sqrt{6}$

$3\cdot 2\sqrt{3}\cdot\sqrt{6}$

$6\sqrt{18}$

$6\sqrt{9}\sqrt{2}$

$6\cdot 3\sqrt{2}$

$\boxed{18\sqrt{2}}$

Method 2

$3\sqrt{72}$

$3\sqrt{36}\sqrt{2}$

$3\cdot 6\sqrt{2}$

$\boxed{18\sqrt{2}}$

Rationalizing Denominator

- **Cannot have radicals in denominator**
- To remove radicals from denominator:
  - Simplify all radicals
  - Multiply top and bottom by radical in denominator

$$\sqrt{\frac{3}{5}} = \frac{\sqrt{3}}{\sqrt{5}} \cdot \frac{\sqrt{5}}{\sqrt{5}} = \frac{\sqrt{15}}{\sqrt{25}} = \frac{\sqrt{15}}{5}$$

Rationalizing Denominator

- Simplify by rationalizing the denominator:

$$\sqrt{\frac{8x^2}{3}} = \frac{\sqrt{8x^2}}{\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}} = \frac{\sqrt{24x^2}}{\sqrt{9}}$$

$$= \frac{\sqrt{4x^2}\sqrt{6}}{3} = \frac{2x\sqrt{6}}{3}$$

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(Day 2)

- Review from last time!

Solving Quadratics (By Isolating)

- Get the term that is squared by itself
- Take square root of both sides (when you put in the square root)
  - Be sure to include positive and negative answers
- Get *x* by itself if necessary

Solving a Quadratic Equation

- Ex: $3x^2 - 5 = 7$

$3x^2 = 12$

$x^2 = 4$

$x = \pm 2$

- Ex: $\frac{1}{2}(x - 3)^2 = 8$

$(x - 3)^2 = 16$

$x - 3 = \pm 4$

$x = 3 \pm 4$

$x = 3 + 4$

$x = 7$

$x = 3 - 4$

$x = -1$

Solve

0011

5. $3-5x^2=-9$

$$-5x^2=-12$$

$$x^2=\frac{12}{5}$$

$$x=\pm\sqrt{\frac{12}{5}}=\pm\frac{\sqrt{12}}{\sqrt{5}}=\pm\frac{\sqrt{4}\cdot\sqrt{3}}{\sqrt{5}}=\pm\frac{2\sqrt{3}}{\sqrt{5}}$$

$$=\pm\frac{2\sqrt{3}}{\sqrt{5}}\cdot\frac{\sqrt{5}}{\sqrt{5}}\boxed{=\pm\frac{2\sqrt{15}}{5}}$$

Solve

0011

6. $3(x-2)^2 = 21$

$(x-2)^2 = 7$

$x-2 = \pm\sqrt{7}$

$\boxed{x = 2 \pm \sqrt{7}}$

Solve

0011

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

$(x-4)^2 = 30$

$x - 4 = \pm\sqrt{30}$

$\boxed{x = 4 \pm \sqrt{30}}$

Solving a Quadratic Equation

- Ex: $3(x-5)^2 = 81$

$(x-5)^2 = 27$

$x - 5 = \pm\sqrt{27}$

$x = 5 \pm\sqrt{27}$

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

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