Chapter 9 Quadratic Equations and Functions

A number made by squaring a whole number.

Section 9.1 Solving Quadratic Equations by Finding Square Roots

Assignment:

Part A: Evaluating Square Roots

*** If $b^2 = a$, then b is a square root of a. ***

perfect squares A number made by squaring a whole number.

irrational numbers A number that cannot be written as a simple fraction – the decimal goes on forever without repeating.

Example: Pi is an irrational number

Examples

1. Evaluate the expression.

a. $\sqrt{81}$ 9 b. $-\sqrt{81}$ -9 c. $\pm\sqrt{0}$ 0

d. $\pm\sqrt{0.0016}$ $\pm\sqrt{.4}$ e. $\sqrt{-9}$ No R

2. Evaluate the expression. Approximate to the nearest hundredth, if necessary.

a. $-\sqrt{36}$ -6 b. $\sqrt{1.21}$ $\sqrt{1.1}$

c. $-\sqrt{0.04}$ $-\sqrt{.2}$ d. $\sqrt{8}$ ≈ 2.83

3. Evaluate for $a = 7$, $b = 8$, and $c = 1$.

$\sqrt{b^2 - 4ac}$ $\sqrt{8^2 - 4(7)(1)}$

$\sqrt{64 - 28} = \sqrt{36} = 6$

4. Evaluate to the nearest hundredth.

$\frac{1 \pm 2\sqrt{6}}{4}$ $\frac{1 + 2\sqrt{6}}{4}$, $\frac{1 - 2\sqrt{6}}{4}$ ≈ 1.47 $\approx -.97$

Part B: Solving a Quadratic Equation

Standard form of a quadratic equation: $ax^2 + bx + c = 0,\ a \neq 0$

Falling Object Model:

When an object is dropped, the speed with which it falls continues to increase. Ignoring air resistance, its height h can be approximated by the falling object model:

$$h = -16t^2 + s$$

h = height (in feet)
t = time in motion (in seconds)
s = initial height (in feet)

Examples

1. Solve each equation.

a. $\sqrt{x^2} = \sqrt{16}$

$x = \pm 4$

b. $\sqrt{x^2} = \sqrt{11}$

$x \approx 3.32$

c. $\sqrt{x^2} = \sqrt{-11}$

$x = \text{No } \mathbb{R}$

d. $\sqrt{x^2} = \sqrt{100}$

$x = \pm 10$

2. Solve each equation.

a. $12x^2 - 60 = 0$

$\frac{\cancel{12}x^2}{\cancel{12}} = \frac{60}{12}$

$\sqrt{x^2} = \sqrt{5}$

$x = \pm 2.36$

b. $120 - 6x^2 = -30$

$-120 \qquad -120$

$\frac{-6x^2}{-6} = \frac{-150}{-6}$

$\sqrt{x^2} = \sqrt{25}$

$x = \pm 5$

3. Construction waste falls down a 25-foot chute into a bin. The height h of the waste after t seconds is modeled by $h = -16t^2 + s$, where s is the initial height. How long will it take the waste to reach the bin? Assume there is no air resistance.

$h = 0 \quad t = t$

$s = 25$

$0 = -16t^2 + 25$

$\frac{-25}{-16} = \frac{-16t^2}{-16}$

$\sqrt{t^2} = \sqrt{\frac{25}{16}}$

$t = 5/4$ sec

Section 9.2 Simplifying Radicals

Assignment:

Properties of Radicals

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

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

An expression with radicals is in simplest radical form if the following are true:

- No perfect square factors other than 1 are in the radicand.
- No fractions are in the radicand.
- No radicals appear in the denominator of a fraction.

Perfect Square List

$2^2=4$
$3^2=9$
$4^2=16$
$5^2=25$
$6^2=36$
$7^2=49$
$8^2=64$
$9^2=81$
$10^2=100$
$11^2=121$
$12^2=144$
$13^2=169$
$14^2=196$
$15^2=225$
$16^2=256$
$17^2=289$
$18^2=324$
$19^2=361$
$20^2=400$

Examples Break it down by factors! = perfect square

1. Simplify the expression.

a. $\sqrt{48}$

$\sqrt{16 \cdot 3}$

$\sqrt{16}\ \sqrt{3}$

$4\sqrt{3}$

b. $\sqrt{125}$

$\sqrt{25 \cdot 5}$

$\sqrt{25} \cdot \sqrt{5}$

$5\sqrt{5}$

c. $2\sqrt{98}$

$2\sqrt{49 \cdot 2}$

$2\sqrt{49}\ \sqrt{2} = 2 \cdot 7\sqrt{2}$

$14\sqrt{2}$

d. $\frac{1}{3}\sqrt{288}$

$\frac{1}{3}\sqrt{144}\ \sqrt{2}$

$\frac{1}{3}(12)\sqrt{2} = 4\sqrt{2}$

2. Simplify the expression.

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

a. $\sqrt{\frac{7}{16}}$ $\frac{\sqrt{7}}{\sqrt{16}} = \frac{\sqrt{7}}{4}$

b. $\frac{\sqrt{18}}{3}$ $\frac{\sqrt{9}\ \sqrt{2}}{3}$

$\frac{3\sqrt{2}}{3}$ $\sqrt{2}$

c. $\sqrt{\frac{80}{45}}$ $\sqrt{\frac{16}{9}} = \frac{4}{3}$

d. $\sqrt{\frac{40}{90}}$ $\sqrt{\frac{4}{9}} = \frac{2}{3}$

e. $3\sqrt{63}\sqrt{4}$ $3 \cdot 2\sqrt{63}$

$6\sqrt{9 \cdot 7} = 6 \cdot 3\sqrt{7}$

$18\sqrt{7}$

f. $\sqrt{32}\sqrt{2}$ $\sqrt{64} = 8$

3. The distance d you can see to the horizon depends on your height h. A model is $d^2 = 1.5h$, where d is measured in miles and h is measured in feet.

a. Find the distance you can see from the top of a 400-foot building.

$d^2 = 1.5(400)$ $\quad d = \sqrt{600}$ $\quad d = 10\sqrt{6}$

$\sqrt{d^2} = \sqrt{600}$ $\quad d = \sqrt{100 \cdot 6}$ $\quad d \approx 24.49$ ft

b. If you were 1200 feet up in a skyscraper, how far could you see to the nearest mile?

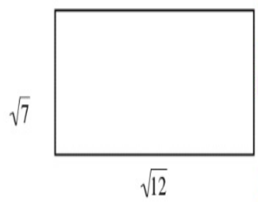
$d^2 = 1.5(1200)$

$\sqrt{d^2} = \sqrt{1800}$

$d \approx 42.43$

$d \approx 42$ mi

4. Find the area of the figure. Give both the exact answer in lowest radical form and the decimal approximation rounded to the nearest hundredth.



$A = bh$

$A = \sqrt{7}\sqrt{12}$

$A = \sqrt{7}\sqrt{4}\sqrt{3}$

$A = 2\sqrt{7}\sqrt{3}$

$A = 2\sqrt{21}$

$A \approx 4.58$ units