11.8 Applications of Quadratic Equations

7. **Road Design.** A triangular traffic island has a base half as long as its height. The island has an area of 64 m². Find the base and the height.

![Image of a triangular traffic island]

\[
A = \frac{1}{2} \cdot b \cdot h \\
6 = \frac{1}{2} \cdot h \\
A = \frac{1}{2} \left( \frac{1}{2} h \right) h \\
4 \cdot 64 = \frac{1}{2} h^2 \cdot 4 \\
256 = h^2 \\
\sqrt{256} = h \\
h = 16, b = 8 \text{ (meters)}
\]

In general, when you're solving a quadratic equation, you want to get everything on one side (w/ 0 on the other side) first.

32. **Guy Wire.** The guy wire on a TV antenna is 1 m longer than the height of the antenna. If the guy wire is anchored 3 m from the foot of the antenna, how tall is the antenna?

![Image of a TV antenna with a guy wire]

\[
x^2 + 3^2 = (x + 1)^2 \\
9 + x^2 = x^2 + 2x + 1 \\
9 + x^2 = x^2 + 2x + 1 \\
-x^2 = 2x + 1 \\
x = 4
\]

By the Pythagorean theorem, \(a^2 + b^2 = c^2\)

Long side

\[
9 = 2x + 1 \\
-1 \\
\frac{8}{2} = \frac{dx}{2} \\
4 \text{ meters}
\]
For what values of $x$ is $f(x) = \frac{3}{(x+1)(x-3)}$ not defined?

$$x = -1 \text{ or } x = 3$$

For what values of $x$ is $g(x) = \frac{x}{2x^2 - 9x - 5}$ not defined?

Solve

$0 = 2x^2 - 9x - 5$

$2(-5) = -10$

$0 = 2x^2 + x - 10x - 5$

$0 = x(2x + 1) - 5(2x + 1)$

$0 = (x - 5)(2x + 1)$

$x = 5$

$x = \frac{-1}{2}$

$x = 2x + 1$

$x = -\frac{1}{2}$
\[
\frac{15}{65} = \frac{3 \cdot 5}{13 \cdot 5} = \frac{3}{13} \quad \frac{x(x-1)^3}{x^4(x-1)} = \frac{(x-1)^2}{x^2}
\]

You can only cancel factors, not terms

\[
\frac{8x^2}{10x} = \frac{4x}{5} \quad \frac{(x+1)(x-2)}{(x+1)x} = \frac{x-2}{x}
\]

\[
\left[ \frac{7}{5} = \frac{4}{y} + 3 \right] \text{ anti-example } \quad \frac{16x^5}{y^3x^3} = \frac{8 \cdot 2 \cdot x^3 \cdot x^2}{y} = \frac{d^2x^2}{d^2x^2}
\]

\[
\frac{2}{3} \cdot \frac{2}{5} = \frac{4}{15}
\]

\[
\frac{x-1}{3x} \cdot \frac{x}{14+x} = \frac{(x-1)x}{3x(14+x)} = \frac{x-1}{3(14+x)}
\]

\[
\frac{2-x}{x^2-4x+3} \cdot \frac{x^2-1}{x-2} = \frac{2-x}{x-1}(x-3) \cdot \frac{(x+1)(x-7)}{x-2}
\]

\[
15 = 3 \cdot 5 \\
-15 = (-1) \cdot 3 \cdot 5
\]

\[
\left[ x^2 - 3x - 7 \\
\quad 7 + 3x - x^2 \right]
\]
12.2 Division and Reciprocals

OBJECTIVES

a. Find the reciprocal of a rational expression.

b. Divide rational expressions and simplify.

\[
\frac{4}{19} \cdot \frac{3}{2} = \frac{4}{19} \cdot \frac{3}{2} = \frac{57}{5}
\]

\[
\left(\frac{4/19}{3/2}\right) = \frac{4}{19} \cdot \frac{2}{3} = \frac{8}{57}
\]

\[
\frac{x^2 - 4}{x + 1} \div \frac{x + 2}{x} = \frac{x^2 - 4}{x + 1} \cdot \frac{x}{x + 2}
\]

\[
= \frac{(x + 2)(x - 2)}{x + 1} \cdot \frac{x}{x + 2}
\]

\[
= \frac{(x - 2)x}{x + 1}
\]
Quiz 3 10/24/13

1. Multiply: $(2x - 3)(x^2 + x + 1)$ (and combine like terms)

2. Divide: $(2x^3 + 3x - 4) \div (x+2)$