• The positive square root of any positive real number, \( x \), is \( \sqrt{x} \)
• The negative square root of any positive real number, \( x \), is \( -\sqrt{x} \)
• Notation: The whole thing is called the radical

```
\[ y \sqrt{x} \]
```

- **Radical Sign**
- **Radicand**
- **Index**

- **Properties of Radicals:** (These work for all indexes)
  1. \( \sqrt{ab} = \sqrt{a} \sqrt{b} \)
  2. \( \frac{\sqrt{a}}{\sqrt{b}} = \frac{\sqrt{a}}{\sqrt{b}} \)
  3. \( \sqrt{a} \sqrt{a} = a \)

- **Simplified form for radicals Rules:**
  1. No perfect squares or factors that are perfect squares under the radical sign
  2. No fractions under the radical sign
  3. No radicals in the denominator of a fraction

- **How to deal with radicals:**
  o To add/subtract, simplify each radical and treat the radical like a variable (you can only add like radicals)
    \[
    \sqrt{18} - \sqrt{50} = \sqrt{9 \cdot 2} - \sqrt{25 \cdot 2}
    \]
    Example:
    \[
    = 3\sqrt{2} - 5\sqrt{2} = -2\sqrt{2}
    \]
  o To multiply, use the distributive property or FOIL
    \[
    \left(\sqrt{2x} - \sqrt{3}\right)\left(\sqrt{8x} + \sqrt{3}\right)
    \]
    \[
    = \sqrt{2x} \cdot \sqrt{8x} + \sqrt{2x} \cdot \sqrt{3} - \sqrt{3} \cdot \sqrt{8x} - \sqrt{3} \cdot \sqrt{3}
    \]
    Example:
    \[
    = \sqrt{6x^2} + \sqrt{3x^2} = x\sqrt{6} + x\sqrt{3}
    \]
    Example 2:
    \[
    = \sqrt{16x^2} + \sqrt{6x} - \sqrt{24x} - \sqrt{3^2}
    \]
    \[
    = 4x + \sqrt{6x} - 2\sqrt{6x} - 3
    \]
    \[
    = 4x - \sqrt{6x} - 3
    \]
  o To divide, rationalize the denominator (get the radicals out of the denominator, by multiplying the top and bottom of the fraction by a number that will make the radical in the denominator go away).
  o Conjugates multiply to be the difference of 2 squares (this is one way to get rid of radicals in the denominator): \( \left(\sqrt{x} + \sqrt{y}\right)\left(\sqrt{x} - \sqrt{y}\right) = x - y \)