# 11-1a Simplifying Radicals

Radical symbol $\sqrt{\ }$ indicates a square root. The expression under the radical sign is the radicand. **If the radicand is a perfect square, the result will be an integer (Ex. $\sqrt{16}=4$).** You will need to memorize the perfect squares in order to simplify radicals that are not perfect squares.

The number 50 is not a perfect square, so if you evaluate $\sqrt{50}$ you get 7.071067812.

The important thing to remember is that each of these radicals will have a decimal equal to it. Considering this fact, answer the following multiple choice Regents Question.

**Example**

1. What is $2\sqrt{45}$ expressed in simplest radical form?

$2 \cdot 3 \cdot \sqrt{5}$

$6\sqrt{5}$

(1) $3\sqrt{5}$ (2) $5\sqrt{5}$ (3) $6\sqrt{5}$ (4) $18\sqrt{5}$

The reason we want to Simplify Radicals is the same reason why we reduce fractions into their lowest terms. You can simplify a radical expression by removing the perfect-square factors from the radicand. To do this we use:

**Multiplication Property of Square Roots**

For every number, $a \geq 0$, and $b \geq 0$,

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

1. Start by dividing the radicand by 2. Continue with 3, 4, etc. until a perfect square appears.
2. Split the Square Root into two separate square roots, with the first being the perfect square.
3. Simplify the Perfect Square root.

$\sqrt{54}$

$\sqrt{9} \bullet \sqrt{6}$

$3\sqrt{6}$

## Perfect Squares

$\sqrt{1} = 1$

$\sqrt{4} = 2$

$\sqrt{9} = 3$

$\sqrt{16} = 4$

$\sqrt{25} = 5$

$\sqrt{36} = 6$

$\sqrt{49} = 7$

$\sqrt{64} = 8$

$\sqrt{81} = 9$

$\sqrt{100} = 10$

$\sqrt{121} = 11$

$\sqrt{144} = 12$

$\sqrt{169} = 13$

$\sqrt{196} = 14$

$\sqrt{225} = 15$

$\sqrt{256} = 16$

## Variable Square Roots

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

$\sqrt{x^2} = x^1$

$\sqrt{x^3} = x^{1.5} = x\sqrt{x}$

$\sqrt{x^4} = x^2$

$\sqrt{x^5} = x^{2.5} = x^2\sqrt{x}$

$\sqrt{x^6} = x^3$

$\sqrt{x^7} = x^{3.5} = x^3\sqrt{x}$

$\sqrt{x^8} = x^4$

$\sqrt{x^9} = x^{4.5} = x^4\sqrt{x}$

$\sqrt{x^{10}} = x^5$

## Practice:

1. $\sqrt{192}$

$\sqrt{64}\sqrt{3}$

$8\sqrt{3}$

2. $\sqrt{98}$

$\sqrt{49}\sqrt{2}$

$7\sqrt{2}$

3. $\sqrt{15}$

$\sqrt{15}$

4. $\sqrt{75}$

$\sqrt{25}\sqrt{3}$

$5\sqrt{3}$

5. $\sqrt{108b^4}$

$\sqrt{36}\sqrt{3}\sqrt{b^4}$

$6\sqrt{3}\ b^2$

$6b^2\sqrt{3}$

6. $3\sqrt{12x^5}$

$3\sqrt{12}\sqrt{x^5}$

$\sqrt{4}\sqrt{3}\ x^2\sqrt{x}$

$2\sqrt{3}$

$6x^2\sqrt{3x}$

Practice 11-1 Name _____

1. What is $3\sqrt{250}$ expressed in simplest radical form?

(1) $5\sqrt{10}$ (2) $8\sqrt{10}$ (3) $15\sqrt{10}$ (4) $75\sqrt{10}$

2. What is $\sqrt{72}$ expressed in simplest radical form?

(1) $2\sqrt{18}$ (2) $3\sqrt{8}$ (3) $6\sqrt{2}$ (4) $8\sqrt{3}$

**Simplify each Radical.**

3. $\sqrt{200}$

4. $\sqrt{28}$

5. $\sqrt{147}$

6. $\sqrt{320}$

7. $\sqrt{20a^5}$

8. $\sqrt{96x^8y^3}$