

## Lesson 29 – Simplifying Radical Expressions

Math 2 Honors - Santowski

### FAST FIVE

- ▶ Evaluate each expression if  $p = 4$  and  $q = -3$

$$A: \sqrt{36pq^2}$$

$$B: 6|q|\sqrt{p}$$

$$C: 6q\sqrt{p}$$

### Opening Investigation

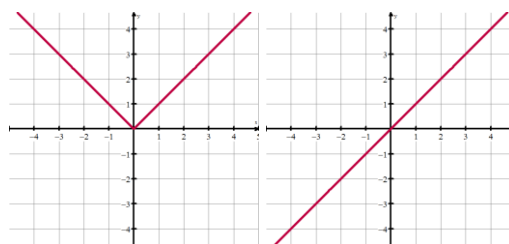
- ▶ Prepare a table of values and then graph the following "functions"

$$f(x) = \sqrt{x}$$

$$g(x) = \sqrt{x^2}$$

$$h(x) = \sqrt[3]{x^3}$$

### Opening Investigation



### Opening Investigation

- ▶ Prepare a table of values and then graph the following "functions"

$$f(x) = \sqrt{x}$$

$$g(x) = \sqrt{x^2} = |x|$$

$$h(x) = \sqrt[3]{x^3} = x$$

$$l(x) = \sqrt[4]{x^4} = \sqrt{(\sqrt{x^2})^2}$$

### Opening Investigation

- ▶ Given the functions you have investigated, what is true about the "algebraic operations" (THINK: input & output) defined by

$$f(x) = \sqrt{x}$$

$$g(x) = \sqrt{x^2}$$

$$h(x) = \sqrt[3]{x^3}$$

### Opening Investigation

- Simplify the following expressions:

$$\begin{array}{cccc} \sqrt{(5^2)} & \sqrt{(5^4)} & \sqrt[4]{625} & \sqrt[3]{125} \\ \sqrt{(-5)^2} & \sqrt{(-5)^4} & \sqrt[4]{(-5)^4} & \sqrt[3]{(-5)^3} \\ \sqrt{(x)^2} & \sqrt{(x)^4} & \sqrt[4]{x^4} & \sqrt[3]{x^3} \\ \sqrt{25x^2} & \sqrt{625x^4} & \sqrt[4]{625x^4} & \sqrt[3]{125x^3} \end{array}$$

►

### (A) Terminology Associated with Radicals

- Index of the radical
  - Radical sign
  - Radicand
- $$n\sqrt{x}$$
- Simplest form (radicand has no factors; radicand has no fractions, radicand has no negative exponents; index as low as possible)
  - Mixed radicals
  - Entire radicals

►

### (B) Simplest Form

- Simplify:

$$\begin{array}{cccc} \text{(a)} \sqrt{3} & \text{(b)} \sqrt{27} & \text{(c)} \sqrt[4]{48} & \text{(d)} \sqrt[3]{54} \\ \text{(e)} \sqrt{\frac{3}{5}} & \text{(f)} \sqrt{\frac{25}{2}} & \text{(g)} \sqrt[3]{\frac{7}{4}} & \text{(h)} \sqrt[4]{\frac{3}{2}} \\ \text{(i)} \sqrt{2a} & \text{(j)} \sqrt[3]{a^{-2}} & \text{(k)} \sqrt[4]{x^2y^{-3}} & \text{(l)} \sqrt[3]{x^2y} \\ \text{(m)} \sqrt[4]{2} & \text{(n)} \sqrt[4]{2^2} & \text{(o)} \sqrt[3]{y^2} & \text{(p)} \sqrt[4]{36x^6} \end{array}$$

►

### (C) Simplifying Radicals with Variables

- Simplify the following:

$$\begin{array}{ccc} \text{(a)} \sqrt{36x^2} & \text{(b)} \sqrt{36y^4} & \text{(c)} \sqrt{36y^6} \\ \text{(d)} \sqrt{36x^3y^2} & \text{(e)} \sqrt{49x^7y^5} & \text{(f)} \sqrt{81x^3y^5} \end{array}$$

- Simplify the following:

$$\begin{array}{ccc} \text{(a)} \sqrt[3]{-125x^5} & \text{(b)} \sqrt[3]{64y^3} & \text{(c)} \sqrt[6]{128x^7} \\ \text{(d)} \sqrt[4]{64y^{13}} & \text{(e)} \sqrt[4]{16p^8q^5} & \text{(f)} \sqrt[3]{-72x} \end{array}$$

►

### (D) Operations With Radicals – Add & Subtract

- In order to add and subtract with radicals, the (a) indices must be the same and (ii) the radicands must be “alike”

- Simplify the following:

$$\begin{array}{l} \text{(a)} 4\sqrt{3} - 2\sqrt{5} + 6\sqrt{3} + 5\sqrt{5} \\ \text{(b)} 2\sqrt{12} - \sqrt{18} - 5(3\sqrt{32} - \sqrt{27}) \\ \text{(c)} -2\sqrt[3]{40} - 3\sqrt[3]{135} + 5\sqrt[3]{320} + 8\sqrt[3]{5} \\ \text{(d)} 7\sqrt{b^3} + \sqrt{4a^2b} - \sqrt{4b^2} - \sqrt{4b} \end{array}$$

►

### (E) Operations with Radicals: Multiply and Divide

► T or F →  $\sqrt{a+b} \stackrel{?}{=} \sqrt{a} + \sqrt{b}$

► T or F →  $\sqrt{a} \times \sqrt{b} \stackrel{?}{=} \sqrt{ab}$

► T or F →  $\sqrt[3]{a} \times \sqrt[3]{b} \stackrel{?}{=} \sqrt[3]{ab}$

► T or F →  $\sqrt{a} \div \sqrt{b} \stackrel{?}{=} \sqrt{\frac{a}{b}}$

►

## (E) Operations with Radicals: Multiply and Divide

▶ Simplify the following:

(a)  $(3\sqrt{8})(2\sqrt{12})$

(b)  $(2\sqrt{5}-3)(3\sqrt{5}+2)$

(c)  $(-\sqrt{3}-5\sqrt{2})(5\sqrt{3}-\sqrt{2})$

(d)  $\sqrt[3]{16a^2} \times \sqrt{4a}$

(e)  $\sqrt[4]{8ab^4} \times \sqrt[3]{2a^3}$

(f)  $\frac{\sqrt[3]{-3a^7b^9}}{\sqrt[3]{81a}}$

(g)  $\frac{1}{\sqrt{2}+1}$

(h)  $\frac{3\sqrt{3}-2\sqrt{2}}{\sqrt{3}-\sqrt{2}}$



## (F) Homework

▶ p. 533 # 15-91 every other odd

