

## Lesson 31 – Simplifying Radical Expressions

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### FAST FIVE

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

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

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

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

► 2

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### Opening Investigation

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

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

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

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

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

► 3

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### Opening Investigation

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

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

▶ 4

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### Opening Investigation

- ▶ Simplify the following expressions:

$\sqrt{(5^2)}$

$\sqrt[4]{625}$

$\sqrt{(-5)^2}$

$\sqrt[4]{(-5)^4}$

$\sqrt{(x^2)}$

$\sqrt[4]{x^4}$

$\sqrt{25x^2}$

$\sqrt[4]{625x^4}$

$\sqrt{(5^4)}$

$\sqrt[3]{125}$

$\sqrt{(-5)^4}$

$\sqrt[3]{(-5)^3}$

$\sqrt{(x^4)}$

$\sqrt[3]{x^3}$

$\sqrt{625x^4}$

$\sqrt[3]{125x^3}$

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### (A) Terminology Associated with Radicals

- ▶ Index of the radical
- ▶ Radical sign
- ▶ Radicand
  
- ▶ Simplest form
  
- ▶ Mixed radicals
  
- ▶ Entire radicals

$$\sqrt[n]{x}$$

▶ 6

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**(B) Simplest Form**

▶ Simplify:

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

▶ 7

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**(C) Simplifying Radicals with Variables**

▶ Simplify the following:

- |                       |                       |                       |
|-----------------------|-----------------------|-----------------------|
| (a) $\sqrt{36x^2}$    | (b) $\sqrt{36y^4}$    | (c) $\sqrt{36y^6}$    |
| (d) $\sqrt{36x^5y^2}$ | (e) $\sqrt{49x^7y^5}$ | (f) $\sqrt{81x^3y^5}$ |

▶ Simplify the following:

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

▶ 8

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**(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:

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

▶ 9

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

▶ T or F →  $\sqrt{a+b} = \sqrt{a} + \sqrt{b}$

▶ T or F →  $\sqrt{a} \times \sqrt{b} = \sqrt{ab}$

▶ T or F →  $\sqrt[n]{a} \times \sqrt[n]{b} = \sqrt[n]{ab}$

▶ T or F →  $\sqrt{a} \div \sqrt{b} = \sqrt{\frac{a}{b}}$

▶ 10

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

▶ 11

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## (F) Homework

▶ p. 533 # 15-91 every other odd

▶ 12

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