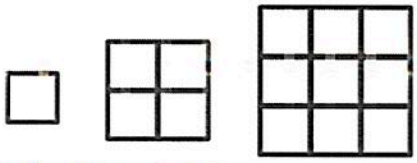
Algebra RH Note #2

Essential Question: How do we simplify square and cube root radicals?

Do Now:

a) List the set of perfect square numbers from 1 to 225.



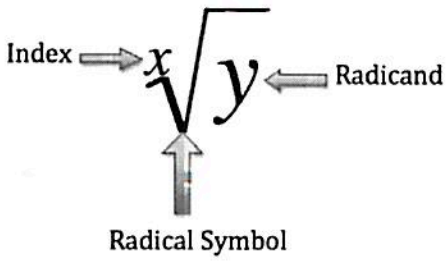
1, 4, 9, 16, 25, 36, 49, 64, 81, 100, 121, 144, 169, 196, 225

b) Which of the following expressions are perfect squares? x^2 x^5 x^8 x^9

c) Which of the following expressions are perfect cubes? x^2 x^3 x^6 x^9

Radical Expressions

An expression that uses a root, such as square root, cube root, etc...



Example:

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

If the index is not written, it is automatically a 2.

Simplifying Square Root Radicals

Question: What does it mean to **"simplify"**? carry out all operations

Think about the rational number $\frac{4}{8}$. Simplified, $\frac{4}{8}$ becomes $\frac{1}{2}$. $\frac{4}{8}$ and $\frac{1}{2}$ are equivalent

Question: Is there a way to **"simplify"** square root expressions that are irrational (non-perfect squares)? Yes! ↓ (equal in value)

- **Find two factors of the radicand, one of which is a *perfect square***
- **Express the square root of the product as the product of the square roots of the factors ($\sqrt{a \bullet b} = \sqrt{a} \bullet \sqrt{b}$)**
- **Find the square root of the factor that is the perfect square.**

Examples: (a) $\sqrt{27}$

$\sqrt{9}\sqrt{3}$

$3\sqrt{3}$

(b) $3\sqrt{75}$

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

$3 \cdot 5\sqrt{3}$

$15\sqrt{3}$

perfect cubes 1, 8, 27, 64, 125, 216, ... multiples of 3

What if we have a Cube Root Radical?

Examples: (c) $\sqrt[3]{27}$

3

(d) $\sqrt[3]{54}$

$\sqrt[3]{27}\ \sqrt[3]{2}$

$3\sqrt[3]{2}$

Let's try simplifying these radical expressions.

1. $\sqrt{8}$

$\sqrt{4}\sqrt{2}$

$2\sqrt{2}$

2. $\sqrt{54}$

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

$3\sqrt{6}$

3. $\sqrt[3]{24}$

$\sqrt[3]{8}\ \sqrt[3]{3}$

$2\sqrt[3]{3}$

4. $\sqrt{\frac{16}{49}}$

$\frac{4}{7}$

5. $\sqrt{300}$

$\sqrt{100}\sqrt{3}$

$10\sqrt{3}$

6. $2\sqrt{20}$

$2\sqrt{4}\sqrt{5}$

$2 \cdot 2\sqrt{5}$

$4\sqrt{5}$

7. $2\sqrt{3}$

already simplified

8. $\frac{1}{4}\sqrt{96}$

$\frac{1}{4}\sqrt{16}\sqrt{6}$

$\frac{1}{4}(4)\sqrt{6}$

$\sqrt{6}$

9. $\sqrt{49x^4}$

$7x^2$

10. $\sqrt{8x^9}$

$\sqrt{4}\sqrt{2}\sqrt{x^8}\sqrt{x}$

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

11. $2\sqrt{3x^3y^7}$

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

$2xy^3\sqrt{3xy}$

12. $-2\sqrt{36x^2y}$

$-2\sqrt{36x^2}\sqrt{y}$

$-2 \cdot 6x\sqrt{y}$

$-12x\sqrt{y}$

13. $\sqrt{\frac{18}{81}}$

$\frac{\sqrt{18}}{\sqrt{81}} \rightarrow \frac{\sqrt{9}\sqrt{2}}{9}$

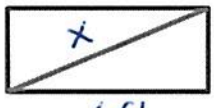
$\frac{3\sqrt{2}}{9} \rightarrow \frac{\sqrt{2}}{3}$

14. $\sqrt[3]{250w^7}$

$\sqrt[3]{125w^6}\ \sqrt[3]{2w}$

$5w^2\sqrt[3]{2w}$

15. A rectangle has dimensions of 6 feet by 36 inches. What is the length of the diagonal of the rectangle? Express your answer in simplest radical form.



36 in
3ft

$a^2 + b^2 = c^2$

$6^2 + 3^2 = x^2$

$36 + 9 = x^2$

$\sqrt{45} = \sqrt{x^2}$

$x = \sqrt{45}$

$x = \sqrt{9}\sqrt{5}$

$x = 3\sqrt{5}$

TAKE AWAY

Some irrational numbers are expressed in radical form. These radical expressions can be simplified if the radicand can be factored into two numbers, one of which is a perfect square or non-perfect square.