4-3 Rational Exponents Notes

When simplifying with rational exponents, the Laws of Exponents still apply.

<table>
<thead>
<tr>
<th>Rule</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>$x^a \cdot x^b = x^{a+b}$</td>
<td>$\sqrt[3]{x^5} \cdot \sqrt[3]{x^4} = x^{\frac{5}{3}} \cdot x^{\frac{4}{3}} = x^{\frac{5}{3} + \frac{4}{3}} = x^{\frac{9}{3}} = x^3$</td>
</tr>
<tr>
<td>$\frac{x^a}{x^b} = x^{a-b}$</td>
<td>$\frac{\sqrt{a}}{\sqrt{b}} = \frac{\sqrt{a}}{\sqrt{b}} = \frac{\sqrt{a}}{\sqrt{b}} = \frac{a^{\frac{1}{2}}}{b^{\frac{1}{2}}} = \frac{\frac{1}{2}}{\frac{1}{2}} = \frac{2}{2} = 1$</td>
</tr>
<tr>
<td>$(x^a)^b = x^{ab}$</td>
<td>$(\sqrt{x})^4 = (x^{\frac{1}{2}})^4 = x^{\frac{4}{2}} = x^{2}$</td>
</tr>
<tr>
<td>$x^{-a} = \frac{1}{x^a}$</td>
<td>$x^{\frac{1}{3}} \cdot x^{-\frac{1}{3}} = x^{\frac{1}{3} + \frac{1}{3}} = x^{\frac{2}{3}}$</td>
</tr>
</tbody>
</table>

When simplifying: If the answer is yes to all - you are done
- All perfect root factors have been removed from the radical (radical is simplified completely)
- There are no negative exponents
- There aren't any rational exponents/radicals in the denominator
- The index of any radical is the least number possible
- All possible laws of exponents have been used

$\sqrt[3]{x} = \frac{\sqrt[3]{x}}{\sqrt[3]{x}} = \frac{\sqrt[3]{x}}{\sqrt[3]{x}} = \frac{\sqrt[3]{x}}{\sqrt[3]{x}} = \frac{\sqrt[3]{x}}{\sqrt[3]{x}} = \frac{\sqrt[3]{x}}{\sqrt[3]{x}} = \frac{\sqrt[3]{x}}{\sqrt[3]{x}}$
Now you try!

Write the following in Radical Form:

1. \(4^{1/5} = \sqrt[5]{4}\)
2. \(16^{5/3} = \sqrt[3]{16^5} = \sqrt[3]{(2^4)^5} = 2^{10}\)
3. \(x^{1/2} \sqrt{x}\)
4. \((5xy^2)^{3/4}\)
   \[\sqrt[4]{(5xy^2)^3} = \sqrt[4]{125x^3y^6} = (\sqrt[4]{125}x^{3/4}y^{3})\]

Write the following in Rational Form:

5. \(\sqrt{51} = 5\frac{2}{2}\)
6. \(\sqrt{8} = 8^{1/2}\)
7. \(\sqrt[3]{8} = 2^{\frac{3}{3}}\)
8. \(\sqrt[4]{27x^2} = (3^{\frac{2}{4}}x^{\frac{4}{4}})^3 = 3^{\frac{3}{4}}x^{\frac{3}{4}}\) or \((3x)^{\frac{2}{4}}\)

Simplify:

9. \((4)^{\frac{3}{2}} = 2^{\frac{3}{2}}\)
10. \(9^{-1} = \frac{1}{9}\)
11. \(b^{2/3} \cdot b^{1/3} = b\)
12. \((z^3)^{\frac{2}{3}} = z^{\frac{2}{3}} = z^2\)