Essential Question: How do we simplify fractional exponents?

DO NOW:

a) Simplify: $\left(x^{\frac{1}{2}}\right)\left(x^{\frac{1}{2}}\right) =$

X

b) Simplify: $\left(z^{\frac{1}{3}}\right)\left(z^{\frac{1}{3}}\right)\left(z^{\frac{1}{3}}\right) =$

Z

Apply "power over root". Calculators will not be permitted!

MAIN POINT: $x^{\frac{p}{r}}$ means take the rth root of x, and then raise that to the p power.

$\sqrt{81} \longrightarrow 81^{\frac{1}{2}}$ $\qquad$ $\sqrt[3]{27} \longrightarrow 27^{\frac{1}{3}}$ $\qquad$ $4^{\frac{5}{2}} \longrightarrow (\sqrt{4})^5$

Practice

1) Evaluate and simplify each of the following:

a) $64^{\frac{1}{3}}$

$\sqrt[3]{64}$

4

b) $125^{\frac{4}{3}}$

$\left(\sqrt[3]{125}\right)^4$

5^4

625

c) $27^{\frac{2}{3}}$

$\left(\sqrt[3]{27}\right)^2$

3^2

9

d) $4^{\frac{3}{2}}$

$(\sqrt{4})^3$

2^3

8

e) $\left(\frac{81}{9}\right)^{-\frac{1}{2}}$

$\left(\frac{9}{81}\right)^{\frac{1}{2}}$

$\left(\frac{1}{9}\right)^{\frac{1}{2}}$

$\sqrt{\frac{1}{9}}$

$\frac{1}{3}$

$(9)^{-\frac{1}{2}}$

$\left(\frac{1}{9}\right)^{\frac{1}{2}}$

$\frac{1}{3}$

f) $\left(\frac{a^2}{b^2}\right)^{-\frac{1}{2}}$

$\left(\frac{b^2}{a^2}\right)^{\frac{1}{2}}$

$\frac{\sqrt{b^2}}{a^2}$

$\frac{b}{a}$

2) Solve (only positive solutions will be accepted) each of the following equations for the indicated variable.

a) $x = 81^{\frac{1}{4}}$

$x = \sqrt[4]{81}$

$x = 3$

b) $x = \left(\dfrac{27}{8}\right)^{-\frac{1}{3}}$

$x = \left(\dfrac{8}{27}\right)^{\frac{1}{3}}$

$x = \dfrac{\sqrt[3]{8}}{\sqrt[3]{27}} \rightarrow \dfrac{2}{3}$

c) $x^2 = 49$

$(x^2)^{\frac{1}{2}} = 49^{\frac{1}{2}}$

$x = \sqrt{49}$

$x = 7$

d) $k^3 = 27$

$(k^3)^{\frac{1}{3}} = 27^{\frac{1}{3}}$

$k = \sqrt[3]{27}$

$k = 3$

e) $x^{\frac{1}{2}} = 8$

$\left(x^{\frac{1}{2}}\right)^2 = 8^2$

$x = 64$

f) $x^{\frac{1}{2}} = 7$

$\left(x^{\frac{1}{2}}\right)^2 = (7)^2$

$x = 49$

g) $\dfrac{4k^{\frac{1}{4}}}{4} = \dfrac{2}{4}$

$k^{\frac{1}{4}} = \dfrac{1}{2}$

$\left(k^{\frac{1}{4}}\right)^4 = \left(\dfrac{1}{2}\right)^4$

$k = \dfrac{1}{16}$

3) TRUE or FALSE : If $x \geq 0$, then $x^{\frac{a}{b}} = \left(\sqrt[b]{x}\right)^a = \sqrt[b]{x^a}$

$8^{\frac{2}{3}}$

$\left(\sqrt[3]{8}\right)^2$ or $\sqrt[3]{8^2}$

2^2 $\sqrt[3]{64}$

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