Objective: Know and use the rules of exponents to simplify radicals

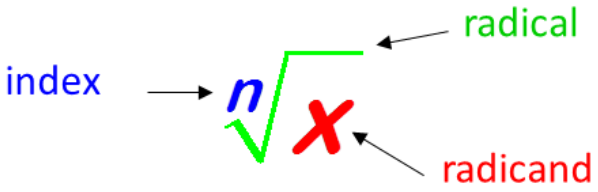
Concept

Rational and irrational numbers expressed in radical form can also be expressed with fractional exponents. When the number has a fractional exponent, it is said to be in rational exponent form.

$$\sqrt[n]{b} = b^{\frac{1}{n}}$$

and

$$\sqrt[n]{b^p} = b^{\frac{p}{n}} \text{ or } \left(\sqrt[n]{b}\right)^p = b^{\frac{p}{n}}$$



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Ex) Write the expression in radical form.

$5^{\frac{2}{3}}$ ← exponential form

exponent

index

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

$= \sqrt[3]{25}$

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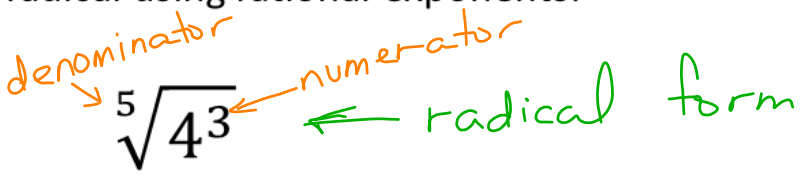
Ex) Write the radical using rational exponents.



$= 4^{\frac{3}{5}}$ exponent form

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Concept

Negative Exponent Rule: $x^{-n} = \frac{1}{x^n}$ or $\frac{1}{x^{-n}} = x^n$

Product of Powers: $\left(x^n\right) \cdot \left(x^m\right) = x^{n+m}$

Power of a Power: $\left(x^n\right)^m = x^{n \cdot m}$

Quotient of Powers: $\frac{x^n}{x^m} = \frac{x^{n-m}}{1} = x^{n-m}$ or $\frac{x^n}{x^m} = \frac{1}{x^{m-n}}$

Zero Exponent Rule: $x^0 = 1$

Objective: Know and use the rules of exponents to simplify radicals

Ex) Evaluate each expression. Show your work.

$32^{-\frac{2}{5}}$ ← index, exponent

① $\left(\sqrt[5]{32}\right)^{-2}$

$(2)^{-2}$ ★

$= \frac{1}{2^2}$

$= \boxed{\frac{1}{4}}$

★ use negative exponent rule

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Ex) Evaluate each expression. Show your work.

$$125^{-\frac{1}{3}} \cdot 125^{\frac{2}{3}}$$

① $= 125^{-\frac{1}{3}+\frac{2}{3}}$

$= 125^{\frac{1}{3}}$ exp. / index

② $\sqrt[3]{125^1} = \sqrt[3]{125} = \boxed{5}$

$\star \left(x^n\right) \cdot \left(x^m\right) = x^{n+m}$

$\left(x^n\right)^m = x^{n \cdot m}$

$\frac{x^n}{x^m} = \frac{x^{n-m}}{1} = x^{n-m}$

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Ex) Evaluate each expression. Show your work.

$$\left(32^{\frac{4}{3}}\right)^{\frac{3}{5}}$$

① $32^{\frac{4}{3}\cdot\frac{3}{5}}$

$32^{\frac{12}{15}}$ reduce

$= 32^{\frac{4}{5}}$

$= 32^{\frac{4}{5}}$

② $\left(\sqrt[5]{32}\right)^4 = 2^4 = \boxed{16}$

$$\left(x^n\right)\cdot\left(x^m\right) = x^{n+m}$$

$$\star\ \left(x^n\right)^m = x^{n\cdot m}$$

$$\frac{x^n}{x^m} = \frac{x^{n-m}}{1} = x^{n-m}$$

Objective: Know and use the rules of exponents to simplify radicals

Ex) Evaluate each expression. Show your work.

$$\left(\frac{4}{25}\right)^{\frac{3}{2}}$$

$$\left(x^n\right)\cdot\left(x^m\right)=x^{n+m}$$

$$\star\ \left(x^n\right)^m=x^{n\cdot m}$$

$$\frac{x^n}{x^m}=\frac{x^{n-m}}{1}=x^{n-m}$$

① $\left(\frac{4^1}{25^1}\right)^{3/2}$

$\frac{4^{1\cdot\frac{3}{2}}}{25^{1\cdot 3/2}} = \frac{4^{\frac{3}{2}}}{25^{\frac{3}{2}}}$ exp, ap

② $\frac{(\sqrt{4})^3}{(\sqrt{25})^3} = \frac{2^3}{5^3} = \boxed{\frac{8}{125}}$

Objective: Know and use the rules of exponents to simplify radicals

Ex) Evaluate each expression. Show your work.

$$\frac{25^{\frac{5}{8}}}{25^{\frac{1}{8}}}$$

① $25^{\frac{5}{8}-\frac{1}{8}}$

$= 25^{\frac{4}{8}}$ reduce

$= 25^{\frac{1}{2}}$

② $\sqrt{25^1} = \sqrt{25} = \boxed{5}$

$$\left(x^n\right)\cdot\left(x^m\right) = x^{n+m}$$

$$\left(x^n\right)^m = x^{n\cdot m}$$

$$\frac{x^n}{x^m} = \frac{x^{n-m}}{1} = x^{n-m}$$

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Ex) Evaluate each expression. Show your work.

$$36^{\frac{4}{3}} \cdot 36^{\frac{1}{6}}$$

① $36^{\frac{2\cdot 4}{2\cdot 3} + \frac{1}{6}}$

$= 36^{\frac{8}{6} + \frac{1}{6}}$

$= 36^{\frac{9}{6}}$ reduce

$= 36^{\frac{3}{2}}$

② $\left(\sqrt{36}\right)^3 = 6^3$

$= \boxed{216}$

Objective: Know and use the rules of exponents to simplify radicals

Ex) Evaluate each expression. Show your work.

$$\frac{16^{\frac{3}{2}}}{16^{\frac{1}{4}}}$$

① $\frac{2\cdot 3}{2\cdot 2} - \frac{1}{4}$

$16^{\frac{6}{4} - \frac{1}{4}}$

$= 16^{\frac{5}{4}}$

② $\left(\sqrt[4]{16}\right)^5 = 2^5 = 32$

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Closure

Explain the different meanings of the numerator and denominator of the expression. What is the value of the expression?

$$64^{\frac{2}{3}}$$

The denominator of 3 represents the cube root of the base of 64. The numerator of 2 represents the power on the cube root of 64. The value of the expression is 16.