

4.3

$$\begin{aligned} \#18. \quad & 6\sqrt[4]{3 \times 6^4} \\ & \begin{aligned} & \sqrt[4]{?} = 6 \\ & \sqrt[4]{6^4} = 6 \end{aligned} \\ & = \sqrt[4]{3 \times 1296} \\ & = \boxed{\sqrt[4]{3888}} \end{aligned}$$

$$\begin{aligned} \#17. \quad a) \quad & \sqrt[4]{48} \\ & = \sqrt[4]{16 \times 3} \\ & = \sqrt[4]{16} \times \sqrt[4]{3} \\ & = 2\sqrt[4]{3} \end{aligned}$$

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$$\begin{aligned} \sqrt{\frac{2}{3}} &= \text{yes} \\ &= \frac{\sqrt{2}}{\sqrt{3}} \end{aligned}$$

$$\begin{aligned} \sqrt{\sqrt{2}} &= \text{irrational} \\ \text{NO} \end{aligned}$$

$$\begin{aligned} \#12. \quad a) \quad & 3\sqrt{2 \times 3^2} \\ & = \sqrt{18} \\ i) \quad & 5^3\sqrt{2 \times 5^3} \\ & = \sqrt[3]{2 \times 5^3} \\ & = \sqrt[3]{250} \end{aligned}$$

perfect  
4th  
roots

$$\begin{cases} 1^4 = 1 \\ \textcircled{2^4} = 16 \\ 3^4 = 81 \end{cases}$$

$$\begin{aligned} 10c) \quad & \sqrt{108} = \sqrt{36 \times 3} \\ & = 6\sqrt{3} \\ & = \sqrt{4 \times 27} \\ & = \sqrt{4} \times \sqrt{27} \\ & = 2\sqrt{27} = 2\sqrt{9 \times 3} \\ & = 2 \times \sqrt{9} \times \sqrt{3} \\ & = 2 \times 3 \times \sqrt{3} \\ & = \boxed{6\sqrt{3}} \end{aligned}$$

## 4.4 Rational Exponents and Radicals

Recall:

$$(x^a)(x^b) = x^{a+b}$$

$$\frac{(x^a)}{(x^b)} = x^{a-b}$$

$$(x^a)^b = x^{a \cdot b}$$

Consider the following:

$$\begin{aligned} &(5^{1/2})(5^{1/2}) \\ &= 5^{1/2+1/2} \\ &= 5^{2/2} = 5^1 \end{aligned}$$

and

$$\therefore 5^{1/2} = \sqrt{5}$$

$$\begin{aligned} &(\sqrt{5})(\sqrt{5}) = \sqrt{5 \cdot 5} \\ &= \sqrt{25} \\ &= 5 \end{aligned}$$

Similarly:

$$\begin{aligned} &(5^{1/3})(5^{1/3})(5^{1/3}) \\ &= 5^{1/3+1/3+1/3} \\ &= 5^{3/3} \\ &= 5 \end{aligned}$$

and

$$\therefore 5^{1/3} = \sqrt[3]{5}$$

$$\begin{aligned} &(\sqrt[3]{5})(\sqrt[3]{5})(\sqrt[3]{5}) \\ &= \sqrt[3]{5 \cdot 5 \cdot 5} \\ &= \sqrt[3]{125} \\ &= 5 \end{aligned}$$

\* If  $n$  is a natural number and  $x$  is a rational number then

$$x^{1/n} = \sqrt[n]{x}$$

ex. a)  $16^{1/2}$

$$\begin{aligned} &= \sqrt{16} \\ &= 4 \end{aligned}$$

b)  $(-64)^{1/3}$

$$\begin{aligned} &= \sqrt[3]{-64} \\ &= -4 \end{aligned}$$

c)  $32^{1/5}$

$$\begin{aligned} &= \sqrt[5]{32} \\ &= 2 \end{aligned}$$

\* And if the numerator of the exponent is not 1 ....

ex.  $16^{3/4} = (16^{1/4})^3$

$$\begin{aligned} &= (4\sqrt{16})^3 \\ &= (2)^3 \\ &= 8 \end{aligned}$$

$(16^3)^{1/4}$   
(huge)<sup>1/4</sup>

$$x^{m/n} = \sqrt[n]{x^m} \text{ or } (\sqrt[n]{x})^m$$

*usually easier*

$$\sqrt[4]{16^3}$$

ex. Express as a power

a)  $\sqrt[3]{5^2}$   
 $= 5^{2/3}$

b)  $(\sqrt[4]{7})^3$   
 $= 7^{3/4}$

ex. Express as a radical, then evaluate find the value of

a)  $15^{2/3}$   
 $= \sqrt[3]{15^2}$   
 or  $(\sqrt[3]{15})^2 \doteq 6.08$   
 Math  $\sqrt{x}$

b)  $(-27)^{4/3}$   
 $= \sqrt[3]{(-27)^4}$  or  $(\sqrt[3]{-27})^4$   
 $= (-3)^4$   
 $= 81$

c)  $(0.01)^{3/2}$   
 $= \left(\frac{1}{100}\right)^{3/2}$   
 $= \frac{(1)^{3/2}}{(100)^{3/2}}$   
 $= \frac{1}{(\sqrt{100})^3}$   
 $= \frac{1}{10^3}$   
 $= \frac{1}{1000}$

d)  $(0.75)^{1.2} \doteq 0.71$   
 $= \left(\frac{3}{4}\right)^{6/5}$   
 $= \left(\sqrt[5]{\frac{3}{4}}\right)^6$   
 $\doteq 0.71$

$1.2 = \frac{12}{10} = \left(\frac{6}{5}\right)$