

2.2 Square & Cube Roots

Perfect Square: A number that can be expressed as the product of two equal factors

ex. $16 = 4 \times 4$

Square Root: One of two equal factors of a number

ex. $\sqrt{49} = 7$

Perfect Cube: A number that can be expressed as the product of three equal factors

ex. $8 = 2 \times 2 \times 2$

Cube Root: One of three equal factors of a number

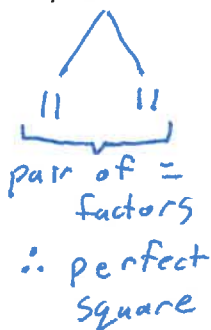
ex. $\sqrt[3]{64} = 4$

Prime factorization (factor tree) can be used to determine if a number is a perfect square or cube.

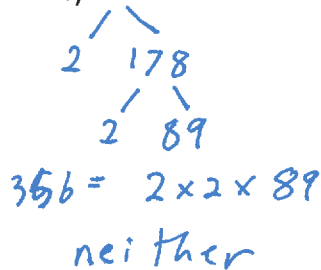
Ex.

Determine if each number is a perfect square, perfect cube, both, or neither. Determine the root(s) when possible.

a) 121



c) 356



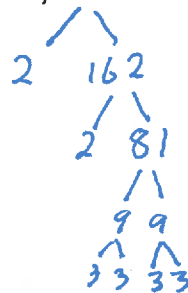
b) 729



perfect square
because 2 equal
factor sets

perfect cube because
3 equal factor sets

d) 324



Not a perfect cube

2. 3. 3. 2. 3. 3
perfect square

e) $(2 \times 2 \times 2 \times 2) \times (2 \times 2 \times 2 \times 2) \times (2 \times 2 \times 2 \times 2)$ f) $2^6 \times 3^3$

perfect square and a perfect cube

$$\sqrt{4096} = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 = 64$$

$$\sqrt[3]{4096} = 2 \times 2 \times 2 \times 2 = 16$$

$$\sqrt[4]{4096} = 2 \cdot 2 \cdot 2 = 8$$

f) $2^6 \times 3^3$

$$\begin{aligned} \sqrt[3]{2^6} &= 2^2 \\ \sqrt[3]{3^3} &= 3^1 = 3 \end{aligned}$$



Ex.

Evaluate, with the aid of a calculator if necessary:

a) $\sqrt{324}$
 $= 18$

b) $\sqrt[3]{13824}$
 $= 24$

c) $\sqrt{\frac{25}{361}} = \frac{\sqrt{25}}{\sqrt{361}}$
 $= \frac{5}{19}$

d) $\sqrt[3]{175616}$
 $= 56$

e) $\sqrt{36x^2}$
 $= 6x$
 $(6x)^2 = 36x^2$

f) $\sqrt[3]{8q^3}$
 $= 2q$

g) $\sqrt[3]{961z^6}$ $\rightarrow 6 \div 2$
 $= 31z^3$

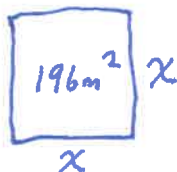
h) $\sqrt[3]{512m^{12}}$ $\rightarrow 12 \div 3$
 $= 8m^4$

i) $\sqrt[3]{\frac{27x^9}{1000y^{15}}}$
 $= \frac{3x^3}{10y^5}$

k) $\sqrt{\frac{100q^{10}u^{12}}{169x^{18}}}$
 $= \frac{10q^5u^6}{13x^9}$

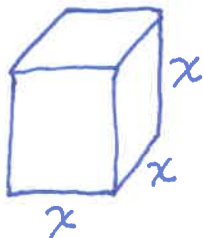
Ex.

- a) A floor mat for gymnastics is a square with an area of 196 m^2 . What is its side length?



$\sqrt{x^2} = \sqrt{196 \text{ m}^2}$
 $x = 14 \text{ m}$

- b) The volume of a cubic box is $27\,000 \text{ in}^3$. Determine its side length.



$x^3 = 27,000 \text{ in}^3$
 $x = \sqrt[3]{27,000 \text{ in}^3}$
 $x = 30 \text{ in}$