

Examples 5 in Irrationals in Arithmetic 3

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Examples 5 in Irrationals

Simplify each radical below or put each in a mixed radical if it can be done so.

A mixed radical is a radical multiplied by a rational such as $2\sqrt{3}$ and $4\sqrt[3]{2}$.

0. $\sqrt{2\sqrt{4}}$

1. $\sqrt{2\sqrt{16}}$

2. $\sqrt{3\sqrt{36}}$

3. $\sqrt{6\sqrt{225}}$

4. $\sqrt{2\sqrt[3]{125}}$

5. $\sqrt[3]{4\sqrt{9}}$

6. $\sqrt[3]{4\sqrt{4}}$

7. $\sqrt[3]{32\sqrt{16}}$

8. $\sqrt[3]{10\sqrt[3]{64}}$

9. $\sqrt[3]{0.8}$

A. $\sqrt[3]{0.008}$

B. $\sqrt[3]{0.016}$

C. $\sqrt[3]{\frac{0.001}{0.027}}$

D. $\sqrt[3]{\frac{0.01}{2.7}}$

E. $\sqrt{\frac{4.84}{9}}$

F. $\sqrt{\frac{0.0004}{0.81}}$

G. $\sqrt[3]{\frac{-0.001}{0.027}}$

H. $\sqrt{\frac{0.4}{0.009}}$

I. $\sqrt[3]{\frac{8}{0.081}}$

J. $\sqrt[3]{\frac{1.5}{9}}$

**Suggestions or Solutions
To the Examples 5 in Irrationals**

0. $\sqrt{2\sqrt{4}} = \sqrt{2\sqrt{2^2}} = \sqrt{2 \cdot 2} = 2$. So by the same token, we can have

$$\sqrt{6\sqrt{3}\sqrt{4\sqrt{9}}} = \sqrt{6\sqrt{3}\sqrt{4\sqrt{3^2}}} = \sqrt{6\sqrt{3}\sqrt{4 \cdot 3}} = \sqrt{6\sqrt{3}\sqrt{12}} = \sqrt{6\sqrt{36}} = \sqrt{6^2} = 6.$$

$$1. \sqrt{2\sqrt{16}} = \sqrt{2\sqrt{4^2}} = \sqrt{2 \cdot 4} = \sqrt{2} \sqrt{4} = 2\sqrt{2}$$

$$2. \sqrt{3\sqrt{36}} = \sqrt{3 \cdot 6} = \sqrt{3 \cdot 3 \cdot 2} = 3\sqrt{2}$$

$$3. \sqrt{6\sqrt{225}} = \sqrt{6\sqrt{25 \cdot 9}} = \sqrt{6\sqrt{15 \cdot 15}} = \sqrt{6 \cdot 15} = \sqrt{3 \cdot 2 \cdot 3 \cdot 5} = 3\sqrt{10}$$

$$4. \sqrt{2\sqrt[3]{125}} = \sqrt{2\sqrt[3]{5^3}} = \sqrt{2 \cdot 5} = \sqrt{10}$$

$$5. \sqrt[3]{4\sqrt{9}} = \sqrt[3]{4 \cdot 3} = \sqrt[3]{12}$$

$$6. \sqrt[3]{4\sqrt{4}} = \sqrt[3]{4 \cdot 2} = 2$$

$$7. \sqrt[3]{32\sqrt{16}} = \sqrt[3]{8 \cdot 4 \cdot 4} = \sqrt[3]{8 \cdot 8 \cdot 2} = \sqrt[3]{8} \cdot \sqrt[3]{8} \cdot \sqrt[3]{2} = 2 \cdot 2\sqrt[3]{2} = 4\sqrt[3]{2}$$

$$8. \sqrt[3]{10\sqrt[3]{64}} = \sqrt[3]{10\sqrt[3]{4^3}} = \sqrt[3]{10 \cdot 4} = \sqrt[3]{5 \cdot 8} = 2\sqrt[3]{5}$$

$$9. \sqrt{0.8} = \sqrt{\frac{8}{10}} = \sqrt{\frac{4}{5}} = \frac{\sqrt{4}}{\sqrt{5}} = \frac{2}{\sqrt{5}} = \frac{2\sqrt{5}}{\sqrt{5}\sqrt{5}} = \frac{2\sqrt{5}}{5}$$

$$A. \sqrt[3]{0.008} = \sqrt[3]{0.001 \cdot 8} = \sqrt[3]{(0.1)^3 \cdot 8} = \sqrt[3]{(0.1)^3} \cdot \sqrt[3]{8} = 0.1 \cdot 2 = 0.2.$$

And of course, we can put it this way, too: $\sqrt[3]{0.008} = \sqrt[3]{(0.2)^3} = 0.2$.

$$B. \sqrt[3]{0.016} = \sqrt[3]{\frac{16}{1000}} = \sqrt[3]{\frac{8 \cdot 2}{1000}} = \sqrt[3]{\frac{8}{1000} \cdot 2} = \sqrt[3]{\left(\frac{2}{10}\right)^3 \cdot 2} = \sqrt[3]{\left(\frac{2}{10}\right)^3} \cdot \sqrt[3]{2} = \frac{2}{10} \cdot \sqrt[3]{2} = \frac{1}{5} \cdot \sqrt[3]{2} = \frac{\sqrt[3]{2}}{5}$$

$$C. \sqrt[3]{\frac{0.001}{0.027}} = \sqrt[3]{\frac{1}{27}} = \frac{1}{3}. \text{ And we can put it this way, too: } \sqrt[3]{\frac{0.001}{0.027}} = \sqrt[3]{\left(\frac{0.1}{0.3}\right)^3} = \sqrt[3]{\left(\frac{1}{3}\right)^3} = \frac{1}{3}.$$

$$D. \sqrt[3]{\frac{0.01}{2.7}} = \sqrt[3]{\frac{0.1}{27}} = \sqrt[3]{\frac{1}{27} \cdot 0.1} = \sqrt[3]{\frac{1}{27}} \cdot \sqrt[3]{0.1} = \frac{1}{3} \sqrt[3]{\frac{1}{10}} = \frac{1}{3} \cdot \frac{1}{\sqrt[3]{10}} = \frac{1}{3} \cdot \frac{\sqrt[3]{100}}{\sqrt[3]{10} \cdot \sqrt[3]{100}} = \frac{1}{3} \cdot \frac{\sqrt[3]{100}}{10} = \frac{\sqrt[3]{100}}{30}$$

$$E. \sqrt{\frac{4.84}{9}} = \sqrt{\frac{484}{900}} = \sqrt{\frac{121 \cdot 4}{900}} = \sqrt{\frac{121 \cdot 4}{225 \cdot 4}} = \sqrt{\frac{121}{225}} = \sqrt{\left(\frac{11}{15}\right)^2} = \frac{11}{15}$$

$$F. \sqrt{\frac{0.0004}{0.81}} = \sqrt{\frac{4}{8100}} = \sqrt{\left(\frac{2}{90}\right)^2} = \frac{2}{90} = \frac{1}{45}$$

$$G. \sqrt[3]{\frac{-0.001}{0.027}} = -\sqrt[3]{\frac{1}{27}} = -\frac{1}{3}$$

$$H. \sqrt{\frac{0.4}{0.009}} = \sqrt{\frac{400}{9}} = \sqrt{\left(\frac{20}{3}\right)^2} = \frac{20}{3}$$

$$I. \sqrt[3]{\frac{8}{0.081}} = \sqrt[3]{\frac{8000}{81}} = \sqrt[3]{\frac{20^3}{27 \cdot 3}} = \sqrt[3]{\frac{20^3}{3^3}} \cdot \sqrt[3]{\frac{1}{3}} = \frac{20}{3} \sqrt[3]{\frac{1}{3}} = \frac{20}{3} \cdot \frac{1}{\sqrt[3]{3}} = \frac{20}{3} \cdot \frac{\sqrt[3]{27}}{\sqrt[3]{3} \cdot \sqrt[3]{27}} = \frac{20}{3} \cdot \frac{\sqrt[3]{27}}{3} = \frac{20\sqrt[3]{27}}{9}$$

$$J. \sqrt[3]{\frac{1.5}{9}} = \sqrt[3]{\frac{15}{90}} = \sqrt[3]{\frac{3}{18}} = \sqrt[3]{\frac{1}{6}} = \frac{1}{\sqrt[3]{6}} = \frac{\sqrt[3]{36}}{\sqrt[3]{6} \cdot \sqrt[3]{36}} = \frac{\sqrt[3]{36}}{6}$$