

10.3 b

Operations with Radicals

(multiplying and dividing)

Who uses this?

Physicists

Astronomers

Actuaries

Economists

Examples 1-3

$$\sqrt{\frac{36}{49}} = \frac{\sqrt{36}}{\sqrt{49}} = \frac{6}{7}$$

$$\sqrt{\frac{100}{225}} = \frac{\sqrt{100}}{\sqrt{225}} = \frac{10}{15} = \frac{2}{3}$$

$$\sqrt{\frac{72}{40}} = \sqrt{\frac{9}{5}} = \frac{\sqrt{9}}{\sqrt{5}} = \frac{3 \cdot \sqrt{5}}{\sqrt{5} \cdot \sqrt{5}} = \frac{3\sqrt{5}}{\sqrt{25}} = \frac{3\sqrt{5}}{5}$$

Examples 4-6

$$\frac{\sqrt{12}}{\sqrt{15}} = \sqrt{\frac{12}{15}} = \sqrt{\frac{4}{5}} = \frac{\sqrt{4} \cdot \sqrt{5}}{\sqrt{5} \cdot \sqrt{5}} = \frac{2\sqrt{5}}{\sqrt{25}} = \frac{2\sqrt{5}}{5}$$

$$\sqrt{\frac{18y}{36y^3}} = \sqrt{\frac{1}{2y^2}} = \frac{\sqrt{1}}{\sqrt{2y^2}} = \frac{1 \cdot \sqrt{2}}{y\sqrt{2} \cdot \sqrt{2}} = \frac{\sqrt{2}}{2y}$$

$$\frac{\sqrt{24}}{\sqrt{3n}} = \sqrt{\frac{8}{n}} = \frac{\sqrt{8}}{\sqrt{n}} = \frac{2\sqrt{2} \cdot \sqrt{n}}{\sqrt{n} \cdot \sqrt{n}} = \frac{2\sqrt{2n}}{n}$$

Example 7

$$\sqrt{\frac{16a^2}{4b^2}} = \sqrt{\frac{4a^2}{b^2}} = \frac{\sqrt{4a^2}}{\sqrt{b^2}} = \frac{2a}{b}$$

Example 8

$$\sqrt{3}(\sqrt{12} + 4)$$

$$\sqrt{3 \cdot 12} + 4\sqrt{3}$$

$$\sqrt{2 \cdot 2 \cdot 3 \cdot 3} + 4\sqrt{3}$$

$$2 \cdot 3 + 4\sqrt{3}$$

$$\boxed{6 + 4\sqrt{3}}$$

Example 9

$$\sqrt{8}(\sqrt{5} + 4)$$

$$\sqrt{8 \cdot 5} + 4\sqrt{8}$$

$$\sqrt{2 \cdot 2 \cdot 2 \cdot 5} + 4\sqrt{2 \cdot 2 \cdot 2}$$

$$2\sqrt{10} + 8\sqrt{2}$$

Example 10

$$(4 + 4\sqrt{5})(1 + \sqrt{5})$$

$$\begin{array}{r} 4 \quad +4\sqrt{5} \quad +4\sqrt{5} \quad +4\sqrt{5 \cdot 5} \\ \hline 4 \quad +8\sqrt{5} \quad +20 \end{array}$$

$$24 + 8\sqrt{5}$$

Example 11

$$\begin{aligned} & (\sqrt{2}-3)^2 \\ & (\sqrt{2}-3)(\sqrt{2}-3) \\ & \sqrt{2 \cdot 2} - \underline{3\sqrt{2}} - \underline{3\sqrt{2}} + 9 \\ & \underline{2} - 6\sqrt{2} + \underline{9} \end{aligned}$$

$$\boxed{11 - 6\sqrt{2}}$$

Example 12

$$\begin{aligned} & (\sqrt{2}-3)(\sqrt{2}+3) \\ & \sqrt{2 \cdot 2} + \underline{3\sqrt{2}} - \underline{3\sqrt{2}} - 9 \\ & \underline{2} - \underline{9} \end{aligned}$$

$$\boxed{-7}$$

Example 13

$$\frac{12}{\sqrt{11}-\sqrt{7}} \cdot \frac{\sqrt{11}+\sqrt{7}}{\sqrt{11}+\sqrt{7}}$$

$$12\sqrt{11}+12\sqrt{7}$$

$$\frac{\sqrt{11 \cdot 11} + \sqrt{11 \cdot 7} - \sqrt{7 \cdot 11} - \sqrt{7 \cdot 7}}$$

$$\frac{12\sqrt{11}+12\sqrt{7}}{\underline{11} \quad \underline{-7}}$$

$$\frac{12\sqrt{11}+12\sqrt{7}}{4}$$

$$\frac{12\sqrt{11}+12\sqrt{7}}{4} \quad \frac{12\sqrt{11}+12\sqrt{7}}{4}$$

$$3\sqrt{11}+3\sqrt{7}$$

Example 14

$$\frac{8}{\sqrt{3}-1} \cdot \frac{\sqrt{3}+1}{\sqrt{3}+1}$$

$$\frac{8\sqrt{3} + 8}{\sqrt{3 \cdot 3} + \sqrt{3} - \sqrt{3} - 1}$$

$$\frac{8\sqrt{3} + 8}{\underline{3} - \underline{1}}$$

$$\frac{8\sqrt{3} + 8}{2}$$

$$\frac{8\sqrt{3}}{2} + \frac{8}{2}$$

$$4\sqrt{3} + 4$$