Multiplying and Simplifying Radicals

EXAMPLE: Perform the following multiplication: $\sqrt[3]{x} \cdot \sqrt[4]{x}$.

SOLUTION:

The **key step** when the indices of the radicals are different is to write the expressions with rational exponents.

$\sqrt[3]{x} \cdot \sqrt[4]{x} = x^{1/3} \cdot x^{1/4}$ (write with rational exponents)

$= x^{1/3 + 1/4}$ (use a propery of exponents)

$= x^{4/12 + 3/12}$ (create a common denominator for the exponent)

$= x^{7/12}$ (use another property of exponents)

$= \sqrt[12]{x^7}$ (write final answer in radical form to agree with original expression)

Try these yourself and check your answers.
Perform the indicated multiplication, and simplify completely.

a. $\sqrt{t} \cdot \sqrt[8]{t^3}$

b. $\sqrt[3]{2p^2} \cdot \sqrt{3p}$

SOLUTIONS:

a. $\sqrt{t} \cdot \sqrt[8]{t^3} = t^{1/2} \cdot t^{3/8}$ (write with rational exponents)

$= t^{1/2 + 3/8}$ (use a property of exponents)

$= t^{4/8 + 3/8}$ (create a common denominator for the exponents)

$= t^{7/8}$ (use another property of exponents)

$= \sqrt[8]{t^7}$ (write final answer in radical notation to agree with the original expression)

b. $\sqrt[3]{2p^2} \cdot \sqrt{3p} = \left(2p^2\right)^{1/3} \cdot (3p)^{1/2}$ (write with rational exponents)

$= \left(2p^2\right)^{2/6} \cdot (3p)^{3/6}$ (create a common denominator for the exponents)

$= \left(\left(2p^2\right)^2\right)^{1/6} \left((3p)^3\right)^{1/6}$

$= \left(4p^4 \cdot 27p^3\right)^{1/6}$

$= \left(108p^7\right)^{1/6}$

$= \sqrt[6]{108p^7}$

$= \sqrt[6]{108p^6 p}$

$= p \cdot \sqrt[6]{108p}$

TRY.

$\sqrt{24} \bullet \sqrt[4]{8}$

$\sqrt[5]{x} \bullet \sqrt{x}$

$\sqrt{x^3 y} \bullet \sqrt[3]{xy}$