

Unit 4: Radical Expressions & Equations

4.4 Multiplying Radical Expressions

Multiplying radicals requires the same index. Then multiply the coefficients and multiply the radicands.

In general, $(m\sqrt[k]{a})(n\sqrt[k]{b}) = mn\sqrt[k]{ab}$, where k is a natural number, and m, n, a , and b are real numbers. If k is even, then $a \geq 0$ and $b \geq 0$.

ex. multiply [always ensure that final answers are in simplest radical form]

a) $(-3\sqrt{2x})(4\sqrt{6})$

$$= -12 \sqrt{12x}$$

$$= \boxed{-24\sqrt{3x}}$$

b) $7\sqrt{3}(5\sqrt{5} - 6\sqrt{3})$

$$= 35\sqrt{15} - 42\sqrt{9}$$

$$= \boxed{35\sqrt{15} - 126}$$

OR $\boxed{-126 + 35\sqrt{15}}$

c) $(2\sqrt{7})(4\sqrt{75}) \xrightarrow{OR} (2\sqrt{7})(20\sqrt{3})$

$$= 8\sqrt{525}$$

$$= \boxed{40\sqrt{21}}$$

d) $(8\sqrt{2} - 5)(9\sqrt{5} + 6\sqrt{10})$

$$8\sqrt{2}(9\sqrt{5} + 6\sqrt{10}) - 5(9\sqrt{5} + 6\sqrt{10})$$

$$= 72\sqrt{10} + 48\sqrt{20} - 45\sqrt{5} - 30\sqrt{10}$$

$$= \boxed{42\sqrt{10} + 5\sqrt{5}}$$

e) $9\sqrt[3]{2w}(\sqrt[3]{4w} + 7\sqrt[3]{28})$

$$= 9\sqrt[3]{8w^2} + 63\sqrt[3]{56w}$$

$$= \boxed{18\sqrt[3]{w^2} + 126\sqrt[3]{7w}}$$

f) $(2\sqrt{6} + 3\sqrt{2})^2$

$$(2\sqrt{6} + 3\sqrt{2})(2\sqrt{6} + 3\sqrt{2})$$

$$= 2\sqrt{6}(2\sqrt{6} + 3\sqrt{2}) + 3\sqrt{2}(2\sqrt{6} + 3\sqrt{2})$$

$$= 4\sqrt{36} + 6\sqrt{12} + 6\sqrt{12} + 9\sqrt{4}$$

$$= 42 + 12\sqrt{12}$$

$$= \boxed{42 + 24\sqrt{3}}$$

OR

$$\begin{aligned} (a+b)^2 &= a^2 + 2ab + b^2 \\ (a-b)^2 &= a^2 - 2ab + b^2 \end{aligned}$$

$$(2\sqrt{6})^2 + 2(2\sqrt{6})(3\sqrt{2}) + (3\sqrt{2})^2$$

$$4\sqrt{36} + 12\sqrt{12} + 9\sqrt{4}$$

$$9\sqrt{4}$$

$$18$$

ex. An equilateral triangle is inside a square as shown. The area of the square is 32 cm^2 .

a) What is the exact perimeter of the triangle?

$$x^2 = 32$$

$$x = \sqrt{32}$$

$$x = 4\sqrt{2} \text{ cm}$$

$$P_{\Delta} = 3(4\sqrt{2})$$

$$= \boxed{12\sqrt{2} \text{ cm}}$$

b) Determine the exact height of the triangle.

$$(4\sqrt{2})^2 - (2\sqrt{2})^2 = h^2$$

$$32 - 8$$

$$24 = h^2$$

$$h = \sqrt{24}$$

$$h = \boxed{2\sqrt{6} \text{ cm}}$$

c) What is the exact area of the triangle?

$$\text{Area}_{\Delta} = \frac{1}{2} b \times h$$

$$= \frac{1}{2} (4\sqrt{2})(2\sqrt{6})$$

$$= 4\sqrt{12}$$

$$= \boxed{8\sqrt{3} \text{ cm}^2}$$

