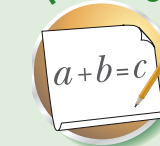


Multiplying radicals is pretty straightforward. Unlike adding and subtracting radicals, the radicals do not need to have the same number and/or variable, called the radicand, under the radical sign. The radicals must, however, have the same index, which is the small number just in front of the radical sign.

When multiplying two radicals, you first multiply any coefficients, or terms in front of the radicals, and then multiply the terms under the radical signs. The answer will have one radical sign with

an index that matches the indexes of the original radicals. You place the product of the coefficients to the left of the radical sign and place the product of the radicands under the radical sign. For example, $4\sqrt{5} \times 3\sqrt{6}$ equals $12\sqrt{30}$.

After multiplying radicals, you should check whether the resulting radical can be simplified. For example, the radical $\sqrt{20}$ can be broken down to $\sqrt{(4)(5)}$. Since 4 is equal to 2^2 , you can remove 2^2 from beneath the radical sign to give you a simplified expression of $2\sqrt{5}$.

Practice


Multiply the following radical expressions, making sure you simplify your answers. You can check your answers on page 261.

- 1) $\sqrt{2} \times \sqrt{7}$
- 2) $\sqrt{11} \times \sqrt{11}$
- 3) $\sqrt[3]{4} \times \sqrt[3]{6}$
- 4) $\sqrt{10} \times \sqrt{35}$
- 5) $\sqrt[3]{4} \times \sqrt[3]{5}$
- 6) $\sqrt[4]{100} \times \sqrt[4]{200}$

Multiply Radicals With Numbers

$$2\sqrt[3]{7} \times 8\sqrt[3]{3} = 16\sqrt[3]{21}$$

Note: Red arrows labeled 'Index' point from the '3' in the first radical to the '3' in the second radical, and then to the '3' in the final radical.

$$\begin{aligned} 3\sqrt{2} \times 6\sqrt{8} &= 18\sqrt{16} \\ &= 18\sqrt{2 \times 2 \times 2 \times 2} \\ &= 18 \times 2 \times 2 \\ &= 72 \end{aligned}$$

$$\begin{aligned} 4\sqrt{6} \times \sqrt{6} &= 4\sqrt{36} \\ &= 4\sqrt{2 \times 2 \times 3 \times 3} \\ &= 4 \times 2 \times 3 \\ &= 24 \end{aligned}$$

$$\begin{aligned} 7\sqrt{3} \times 3\sqrt{9} &= 21\sqrt{27} \\ &= 21\sqrt{3 \times 3 \times 3} \\ &= 21 \times 3\sqrt{3} \\ &= 63\sqrt{3} \end{aligned}$$

$$\begin{aligned} 9\sqrt[3]{10} \times 3\sqrt[3]{4} &= 27\sqrt[3]{40} \\ &= 27\sqrt[3]{2 \times 2 \times 2 \times 5} \\ &= 27 \times 2\sqrt[3]{5} \\ &= 54\sqrt[3]{5} \end{aligned}$$

$$5\sqrt[3]{2} \times 2\sqrt[3]{9} = 10\sqrt[3]{18}$$

Multiply Radicals With Variables

$$10\sqrt[3]{x} \times 3\sqrt[3]{y} = 30\sqrt[3]{xy}$$

Note: Red arrows labeled 'Index' point from the '3' in the first radical to the '3' in the second radical, and then to the '3' in the final radical.

$$\begin{aligned} 7\sqrt{x} \times 5\sqrt{x} &= 35\sqrt{x^2} \\ &= 35\sqrt{x \times x} \\ &= 35|x| \end{aligned}$$

$$\begin{aligned} 3\sqrt{4x^2} \times \sqrt{16x^2} &= 3\sqrt{64x^4} \\ &= 3\sqrt{2 \times 2 \times 2 \times 2 \times 2 \times 2 \times x \times x \times x \times x} \\ &= 3 \times 2 \times 2 \times 2 \times x \times x \\ &= 24x^2 \end{aligned}$$

$$7\sqrt{x^2} \times 7\sqrt{y} = 49\sqrt{x^2y}$$

$$\begin{aligned} 6\sqrt[3]{a^2} \times 5\sqrt[3]{a^3} &= 30\sqrt[3]{a^5} \\ &= 30\sqrt[3]{a \times a \times a \times a \times a} \\ &= 30a\sqrt[3]{a^2} \end{aligned}$$

$$\begin{aligned} 4\sqrt{a} \times 8\sqrt{16} &= 32\sqrt{16a} \\ &= 32\sqrt{2 \times 2 \times 2 \times 2 \times a} \\ &= 32 \times 2 \times 2\sqrt{a} \\ &= 128\sqrt{a} \end{aligned}$$

- You can only multiply radicals if both radicals have the same index.

Note: The index is the small number before the radical sign, such as the 3 in $\sqrt[3]{7}$. If a small number does not appear before a radical sign, assume the index is 2.

- To multiply radicals, first multiply the numbers in front of the radical signs and write the result in front of a new radical sign, using the same index.

Note: If a number does not appear in front of a radical sign, assume the number is 1. For example, $\sqrt{6}$ equals $1\sqrt{6}$.

- Multiply the numbers under the radical signs and write the result under the new radical sign.

- If your answer can be simplified, simplify the answer.

Note: For information on simplifying radicals, see page 170.

- You can also multiply radicals that have a variable under the radical sign.
- As with numbers, if radicals have a variable under the radical sign ($\sqrt{\quad}$), you can only multiply the radicals if both radicals have the same index.

- To multiply radicals, first multiply the numbers in front of the radical signs and write the result in front of a new radical sign, using the same index.

- Multiply the variables and/or numbers under the radical signs and write the result under the new radical sign.

Note: When multiplying variables with the same letter, add the exponents. For example, $x^2 \times x^3$ equals x^5 . If a variable does not have an exponent, assume the exponent is one. For example, x is the same as x^1 .

- If your answer can be simplified, simplify the answer.