

LESSON
7

Multiplying and Dividing Square Roots

Review It!

When you multiply and divide expressions with square roots, remember this word:

radicand number under the radical sign $4\sqrt{18}$ ← 18 is the radicand.

Example 1 Multiply radicals to find the product: $3\sqrt{2} \times 4\sqrt{5}$

Step 1 Multiply. Multiply the radicands separately.

$$3 \times 4 = \underline{\hspace{2cm}}$$

$$\sqrt{2} \times \sqrt{5} = \sqrt{2 \times 5} = \underline{\hspace{2cm}}$$

Step 2 Multiply the products.

$$12 \times \sqrt{10} = \underline{\hspace{2cm}}$$

So, $3\sqrt{2} \times 4\sqrt{5} = \underline{\hspace{2cm}}$.

Example 2 Divide radicals to find the quotient: $\frac{15\sqrt{10}}{3\sqrt{5}}$

Step 1 Divide. Divide the radicands separately.

$$\frac{15}{3} \times \sqrt{\frac{10}{5}} = \underline{\hspace{2cm}} \times \underline{\hspace{2cm}}$$

Step 2 Simplify.

$$\underline{\hspace{2cm}} \times \sqrt{2} = 5\sqrt{2}$$

So, $\frac{15\sqrt{10}}{3\sqrt{5}} = \underline{\hspace{2cm}}$.

REMEMBER Multiply the quotients.

Try It!

Multiply.

1. $3\sqrt{5} \times 4\sqrt{7}$
 $12\sqrt{35}$

2. $8\sqrt{2} \times 6\sqrt{3}$
 $48\sqrt{6}$

Multiply. Simplify the answer.

3. $6\sqrt{8} \times 3\sqrt{6}$
 $12\sqrt{3}$

4. $9\sqrt{3} \times 5\sqrt{6}$
 $135\sqrt{2}$

5. $5\sqrt{5} \times 9\sqrt{15}$
 $225\sqrt{3}$

6. $12\sqrt{21} \times 3\sqrt{7}$
 $252\sqrt{3}$

Divide.

7. $\frac{12\sqrt{15}}{6\sqrt{5}}$
 $2\sqrt{3}$

8. $\frac{20\sqrt{18}}{4\sqrt{9}}$
 $5\sqrt{2}$

9. $\frac{34\sqrt{20}}{2\sqrt{10}}$
 $17\sqrt{2}$

10. $\frac{42\sqrt{30}}{7\sqrt{6}}$
 $6\sqrt{5}$

Solve.

11. The product of two numbers is $6\sqrt{15}$. One of the numbers is $2\sqrt{3}$. What is the other number? $3\sqrt{5}$

12. The quotient of two numbers is $4\sqrt{7}$. The lesser number is $3\sqrt{3}$. What is the greater number? $12\sqrt{21}$

$$\frac{12\sqrt{21}}{3\sqrt{3}} = 4\sqrt{7}$$

Ask Yourself

1. What are the radicands? 3 and 4, or 5 and 7?

3. What is the greatest perfect-square factor of 48? 4, or 16?

7. What are the radicands? 12 and 6, or 15 and 5?

11. What do you find? $6\sqrt{15} \times 2\sqrt{3}$, or $6\sqrt{15} \div 2\sqrt{3}$?

On Your Own!

Circle the best answer for each question.

1. Multiply: $4\sqrt{7} \times 11\sqrt{3}$

- A. $44\sqrt{21}$
- B. $44\sqrt{10}$
- C. $15\sqrt{21}$
- D. $15\sqrt{10}$

2. Multiply: $9\sqrt{2} \times 3\sqrt{13}$

- A. $12\sqrt{15}$
- B. $12\sqrt{26}$
- C. $27\sqrt{15}$
- D. $27\sqrt{26}$

3. Simplify: $\frac{24\sqrt{26}}{8\sqrt{2}}$

- A. $6\sqrt{6}$
- B. $3\sqrt{24}$
- C. $3\sqrt{13}$
- D. $6\sqrt{2}$

4. Simplify: $\frac{50\sqrt{40}}{5\sqrt{8}}$

- A. $45\sqrt{32}$
- B. $10\sqrt{32}$
- C. $45\sqrt{5}$
- D. $10\sqrt{5}$

5. Multiply: $2\sqrt{12} \times 5\sqrt{5}$

- A. $150\sqrt{4}$
- B. $20\sqrt{30}$
- C. $20\sqrt{15}$
- D. $10\sqrt{17}$

6. Multiply: $4\sqrt{9} \times 3\sqrt{20}$

- A. $12\sqrt{29}$
- B. $72\sqrt{5}$
- C. 360
- D. $108\sqrt{20}$

7. The product of two numbers is $15\sqrt{3}$. One of the numbers is $\sqrt{15}$. What is the other number?

- A. $\sqrt{5}$
- B. $3\sqrt{3}$
- C. $3\sqrt{5}$
- D. $10\sqrt{3}$

8. The quotient of two numbers is $7\sqrt{3}$. The greater number is $21\sqrt{21}$. What is the lesser number?

- A. $3\sqrt{7}$
- B. $14\sqrt{7}$
- C. $14\sqrt{18}$
- D. $441\sqrt{7}$

$$\begin{array}{r} 10\sqrt{60} \\ 10\sqrt{4 \cdot 15} \\ 10 \cdot 2\sqrt{15} \\ 20\sqrt{15} \end{array}$$

$$\begin{array}{r} 12\sqrt{180} \\ 12\sqrt{36 \cdot 5} \\ 12 \cdot 6\sqrt{5} \\ 72\sqrt{5} \end{array}$$

$$\begin{array}{l} 3\sqrt{5} \cdot \sqrt{15} = 15\sqrt{3} \\ 3\sqrt{75} \\ 3\sqrt{25 \cdot 3} \\ 3 \cdot 5\sqrt{3} = 15\sqrt{3} \end{array}$$

$$\begin{array}{l} 21\sqrt{21} = 7\sqrt{3} \\ \boxed{3\sqrt{7}} \end{array}$$

9. Find the value: $\frac{25\sqrt{50}}{5\sqrt{15}} \times \frac{6\sqrt{6}}{10\sqrt{20}}$

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$$\frac{25\sqrt{25 \cdot 2}}{5\sqrt{5 \cdot 3}} \times \frac{6\sqrt{2 \cdot 3}}{10\sqrt{4 \cdot 5}} = \frac{5 \cdot 5 \cdot 2 \cdot 2 \cdot 2}{5 \cdot 3 \cdot 2} = 3$$

10. Find the value: $\frac{10\sqrt{18}}{3\sqrt{3}} \times \frac{\sqrt{5}}{5}$

$2\sqrt{2}$

$$\frac{10\sqrt{9 \cdot 2}}{15} = \frac{10 \cdot 3\sqrt{2}}{15} = \frac{30\sqrt{2}}{15}$$

Math Words

Fill in the blanks.

- 11. The answer to a division problem is the quotient.
- 12. The answer to a multiplication problem is the product.
- 13. A number that divides evenly into another number is a factor.
- 14. The number under the square root sign is the radicand.