

Multiplying Radicals

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PRE-CALCULUS 11 RADICALS MULTIPLYING RADICALS

A. Definitions

1. **radical**: a mathematical symbol representing a root.

B. Multiplying Simple Radicals

1. Multiply and simplify where possible.

$$\begin{aligned} \text{a) } & (\sqrt{3})(\sqrt{2}) \\ & = \boxed{\sqrt{6}} \end{aligned}$$

To Solve
a) multiply the coefficients together and multiply the radicands together.
b) Simplify if possible

$$\begin{aligned} \text{b) } & (\sqrt{10})(\sqrt{8}) \\ & = \sqrt{80} \\ & = \sqrt{16} \cdot \sqrt{5} \\ & = \boxed{4\sqrt{5}} \end{aligned}$$

$$\begin{aligned} \text{c) } & (3\sqrt{2})(5\sqrt{6}) \\ & = 15\sqrt{12} \\ & = 15\sqrt{4} \cdot \sqrt{3} \\ & = \boxed{30\sqrt{3}} \end{aligned}$$

$$\begin{aligned} \text{d) } & (-3\sqrt{5})(4\sqrt{5}) \\ & = -12\sqrt{25} \\ & = \boxed{-60} \end{aligned}$$

If the roots are large numbers try simplifying the radicals first.

$$\begin{aligned} \text{e) } & (\sqrt{24})(\sqrt{98}) \\ & \sqrt{4} \cdot \sqrt{6} \quad \sqrt{49} \cdot \sqrt{2} \\ & (2\sqrt{6})(7\sqrt{2}) \\ & = 14\sqrt{12} \\ & \quad 14\sqrt{4} \cdot \sqrt{3} \\ & = \boxed{28\sqrt{3}} \end{aligned}$$

$$\begin{aligned} \text{f) } & (2\sqrt{6})(\sqrt{12})(\sqrt{54}) \\ & \quad \sqrt{4} \cdot \sqrt{3} \quad \sqrt{9} \cdot \sqrt{6} \\ & (2\sqrt{6})(2\sqrt{3})(3\sqrt{6}) \\ & = 12\sqrt{108} \\ & \quad 12\sqrt{36} \cdot \sqrt{3} \\ & = \boxed{72\sqrt{3}} \end{aligned}$$

$$\begin{aligned} \text{g) } & (-2\sqrt{3})^2 \\ & (-2\sqrt{3})(-2\sqrt{3}) \\ & = 4\sqrt{9} \\ & = \boxed{12} \end{aligned}$$

$$\begin{aligned} \text{h) } & \left(\frac{2}{3}\sqrt[3]{10}\right)\left(12\sqrt[3]{5}\right)\left(\frac{1}{2}\sqrt[3]{5}\right) \\ & = 4\sqrt[3]{250} \\ & \quad 4\sqrt[3]{25} \cdot \sqrt[3]{2} \\ & = \boxed{20\sqrt[3]{2}} \end{aligned}$$

Assignment: Multiplying Radicals Assignment #1, 3, 4



Write the conjugate of each. Then multiply each pair.

a) $4\sqrt{6} + 3$

b) $-3\sqrt{11} + \sqrt{2}$

Complete Assignment Questions #11 - #19

Assignment

1. Multiply and simplify where possible. Do not use a calculator.

a) $(\sqrt{7})(\sqrt{3})$

b) $4\sqrt{3} \times 2\sqrt{5}$

c) $8\sqrt{11} \cdot 5\sqrt{2}$

d) $(\sqrt{15})(\sqrt{3})$

e) $10\sqrt{5} \times 9\sqrt{5}$

f) $3\sqrt{6} \cdot 5\sqrt{10}$

g) $(\sqrt{18})(\sqrt{50})$

h) $-3\sqrt{5} \times 2\sqrt{2}$

i) $7\sqrt{54} \cdot 2\sqrt{6}$

j) $(\sqrt{32})(\sqrt{6})$

k) $\sqrt{15} \times 3\sqrt{27}$

l) $3\sqrt{20} \times 4\sqrt{45}$

2. Write each radical as the product of two mixed radicals

a) $15\sqrt{18}$

b) $35\sqrt{6}$

3. Express in simplest form. Do not use a calculator.

a) $(\sqrt{3})^2$ b) $(4\sqrt{2})^2$ c) $(-3\sqrt{5})^2$ d) $-(\sqrt{12})^2$ e) $(\sqrt{5})^3$

4. Express in simplest form.

a) $\sqrt{5} \times 2\sqrt{3} \times 3\sqrt{2}$ b) $2\sqrt{6} \times 2\sqrt{3} \times 3\sqrt{2}$ c) $(-2\sqrt{6})(2\sqrt{3})(-3\sqrt{3})$

d) $\left(\frac{2}{3}\sqrt{27}\right)(\sqrt{6})$ e) $2\sqrt{\frac{8}{25}} \times 5\sqrt{2}$ f) $3\sqrt[3]{16} \times 2\sqrt[3]{4} \times 2\sqrt[3]{2}$

5. Consider the product $6\sqrt{5} \times 3\sqrt{8}$.

a) Use a two decimal place approximation for each radical to determine a two decimal place approximation for the product.

b) Determine the exact value of the product as a mixed radical in simplest form.

c) Determine a two decimal place approximation to the answer in b).

d) Which of the two decimal place approximations is more precise? Explain.

Answer Key

1. a) $\sqrt{21}$ b) $8\sqrt{15}$ c) $40\sqrt{22}$ d) $3\sqrt{5}$ e) 450 f) $30\sqrt{15}$ g) 30
 h) $-6\sqrt{10}$ i) 252 j) $8\sqrt{3}$ k) $27\sqrt{5}$ l) 360

2. Answers may vary a) $(3\sqrt{3})(5\sqrt{6})$ b) $(5\sqrt{2})(7\sqrt{3})$

3. a) 3 b) 32 c) 45 d) -12 e) $5\sqrt{5}$

4. a) $6\sqrt{30}$ b) 72 c) $36\sqrt{10}$ d) $6\sqrt{2}$ e) 8 f) $48\sqrt[3]{2}$

5. a) 113.94 b) $36\sqrt{10}$ c) 113.84 d) c) because rounding is not done until the last step.

6. a) $12 - \sqrt{30}$ b) $\sqrt{2} - 2$ c) $4\sqrt{21} - 8\sqrt{15}$

7. a) $6\sqrt{2} - 6$ b) $4\sqrt{3} - 4$ c) $4\sqrt{15} + 40\sqrt{2}$ d) $20\sqrt{22}$

- e) $15 - 2\sqrt{15}$ f) $7\sqrt{10} - 14\sqrt{6}$ g) $40 - 4\sqrt{3} - 5\sqrt{2}$

8. a) $-14 - 5\sqrt{3}$ b) $5 + 2\sqrt{6}$ c) $112 + 28\sqrt{2}$ d) $76\sqrt{2} - 30\sqrt{15}$

9. a) $79 - 20\sqrt{3}$ b) $98 - 16\sqrt{3}$ c) $72 + 48\sqrt{2}$ d) $1936 - 192\sqrt{13}$

- e) $120 - 60\sqrt{3}$ f) $33 - 6\sqrt{10} + 10\sqrt{2} - 12\sqrt{5}$

10. a) Area = $105\sqrt{2} - 9$, Perimeter = $12\sqrt{3} + 12\sqrt{6}$.

- b) Area = $45\sqrt{5} - 6\sqrt{7}$, Perimeter = $30\sqrt{5} - 4\sqrt{7} + 6$

11. a) 4 b) 1 c) 22

12. a) $\sqrt{2} + \sqrt{5}$ b) $4 - \sqrt{7}$ c) $-3\sqrt{8} + 15$

13. a) $\sqrt{3} + 1$, 2 b) $2 - \sqrt{5}$, -1 c) $2\sqrt{6} + \sqrt{3}$, 21

- d) $2\sqrt{8} - \sqrt{27}$, 5 e) $\sqrt{32} + \sqrt{3}$, 29 f) $-3\sqrt{40} - 2\sqrt{10}$, 320

14. B 15. C 16. C

17.

7	4		
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18.

2			
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19.

2	0		
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