

Multiply (FOIL) the following problems. Make sure you write your answer in "simplest form".

$$\begin{aligned} 1) \quad (2 - 7\sqrt{3})(2 + 7\sqrt{3}) \\ &= 4 + 14\sqrt{3} - 14\sqrt{3} - 49\sqrt{9} \\ &= 4 - 49(3) \\ &= -143 \end{aligned}$$

$$\begin{aligned} 2) \quad (5 + \sqrt{6})^2 \\ &= (5 + \sqrt{6})(5 + \sqrt{6}) \\ &= 25 + 5\sqrt{6} + 5\sqrt{6} + \sqrt{36} \\ &= 25 + 10\sqrt{6} + 6 \\ &= 31 + 10\sqrt{6} \end{aligned}$$

$$\begin{aligned} 3) \quad (4 + 3\sqrt{5})(8 - \sqrt{5}) \\ &= 32 - 4\sqrt{5} + 24\sqrt{5} - 3\sqrt{25} \\ &= 32 + 20\sqrt{5} - 3(5) \\ &= 17 + 20\sqrt{5} \end{aligned}$$

$$\begin{aligned} 4) \quad (10 - \sqrt{2})(1 - 4\sqrt{7}) \\ &= 10 - 40\sqrt{7} - \sqrt{2} + 4\sqrt{14} \end{aligned}$$

Name the conjugate.

5) $8 + 11\sqrt{11}$ $8 - 11\sqrt{11}$

6) $-1 - \sqrt{21}$ $-1 + \sqrt{21}$

7) $\sqrt{6} + 9\sqrt{5}$ $\sqrt{6} - 9\sqrt{5}$

Simplify (rationalize the denominator) by using the conjugate.

$$\begin{aligned} 8) \quad \frac{8}{3 - \sqrt{7}} \cdot \frac{(3 + \sqrt{7})}{(3 + \sqrt{7})} \\ &= \frac{24 + 8\sqrt{7}}{9 - \sqrt{49}} \\ &= \frac{24 + 8\sqrt{7}}{9 - 7} \\ &= \frac{24 + 8\sqrt{7}}{2} \\ &= 12 + 4\sqrt{7} \end{aligned}$$

$$\begin{aligned} 9) \quad \frac{\sqrt{2}}{1 + 2\sqrt{3}} \cdot \frac{(1 - 2\sqrt{3})}{(1 - 2\sqrt{3})} \\ &= \frac{\sqrt{2} - 2\sqrt{6}}{1 - 4\sqrt{9}} \\ &= \frac{\sqrt{2} - 2\sqrt{6}}{1 - 12} \\ &= \frac{\sqrt{2} - 2\sqrt{6}}{-11} \end{aligned}$$

$$\begin{aligned} 10) \quad \frac{4 + \sqrt{5}}{2 - \sqrt{5}} \cdot \frac{(2 + \sqrt{5})}{(2 + \sqrt{5})} \\ &= \frac{8 + 4\sqrt{5} + 2\sqrt{5} + \sqrt{25}}{4 - \sqrt{25}} \\ &= \frac{8 + 6\sqrt{5} + 5}{4 - 5} \\ &= \frac{13 + 6\sqrt{5}}{-1} = -13 - 6\sqrt{5} \end{aligned}$$

Add or subtract the following radicals.

$$\begin{aligned} 11) \quad & 12\sqrt{17} + 8\sqrt{17} - 11\sqrt{17} \\ & = 9\sqrt{17} \end{aligned}$$

$$\begin{aligned} 12) \quad & \sqrt[3]{9} - 4\sqrt{10} + 5\sqrt[3]{9} \\ & = 6\sqrt[3]{9} - 4\sqrt{10} \end{aligned}$$

$$\begin{aligned} 13) \quad & 8\sqrt{24} - 7\sqrt{54} \\ & = 8\sqrt{4}\sqrt{6} - 7\sqrt{9}\sqrt{6} \\ & = 8(2)\sqrt{6} - 7(3)\sqrt{6} \\ & = 16\sqrt{6} - 21\sqrt{6} \\ & = -5\sqrt{6} \end{aligned}$$

$$\begin{aligned} 14) \quad & -2\sqrt[3]{80} + 3\sqrt[3]{270} \\ & = -2\sqrt[3]{8}\sqrt[3]{10} + 3\sqrt[3]{27}\sqrt[3]{10} \\ & = -2(2)\sqrt[3]{10} + 3(3)\sqrt[3]{10} \\ & = -4\sqrt[3]{10} + 9\sqrt[3]{10} \\ & = 5\sqrt[3]{10} \end{aligned}$$

$$\begin{aligned} 15) \quad & \sqrt{50} + \sqrt{27} + \sqrt{32} + 5\sqrt{12} \\ & = \sqrt{25}\sqrt{2} + \sqrt{9}\sqrt{3} + \sqrt{16}\sqrt{2} + 5\sqrt{4}\sqrt{3} \\ & = 5\sqrt{2} + 3\sqrt{3} + 4\sqrt{2} + 5(2)\sqrt{3} \\ & = 9\sqrt{2} + 13\sqrt{3} \end{aligned}$$

$$\begin{aligned} 16) \quad & \sqrt[3]{16} - 7\sqrt[3]{-250} \\ & = \sqrt[3]{8}\sqrt[3]{2} - 7\sqrt[3]{125}\sqrt[3]{2} \\ & = 2\sqrt[3]{2} - 7(-5)\sqrt[3]{2} \\ & = 2\sqrt[3]{2} + 35\sqrt[3]{2} \\ & = 37\sqrt[3]{2} \end{aligned}$$

$$\begin{aligned} 17) \quad & -4\sqrt{49} + 2\sqrt{63} - 5\sqrt{9} \\ & = -4(7) + 2\sqrt{9}\sqrt{7} - 5(3) \\ & = -28 + 2(3)\sqrt{7} - 15 \\ & = -43 + 6\sqrt{7} \end{aligned}$$

$$\begin{aligned} 18) \quad & \sqrt{40} + \sqrt{200} + \sqrt[3]{128} \\ & = \sqrt{4}\sqrt{10} + \sqrt{100}\sqrt{2} + \sqrt[3]{64}\sqrt[3]{2} \\ & = 2\sqrt{10} + 10\sqrt{2} + 4\sqrt[3]{2} \end{aligned}$$