

Elementary Algebra
Skill-Builder # SQRT – 2
Adding or Subtracting Square Root Radicals

Now we are ready to add and/or subtract radicals. The rule for adding or subtracting radicals is we can only add or subtract **like radicals**, i.e. radicals that have the **same index** and the **same radicand**. Since we are dealing only with index 2 radicals here, all we have to make sure of is that the radicands are the same.

Examples Perform the addition and/or subtraction.

1. $5\sqrt{3} - 4\sqrt{3} - 11\sqrt{3} + 2\sqrt{5}$

Solution: There are four radicals that we want to add/subtract but only the first three are like so these are the only ones we can combine. The idea is similar to combining like terms:

$$\begin{aligned} & 5\sqrt{3} - 4\sqrt{3} - 11\sqrt{3} + 2\sqrt{5} \\ & = (5 - 4 - 11)\sqrt{3} + 2\sqrt{5} \\ & = -10\sqrt{3} + 2\sqrt{5} \end{aligned}$$

2. $x\sqrt{2} + 2x\sqrt{x} - 2x\sqrt{2} + 5x\sqrt{x} - 5x\sqrt{2}$

Solution: Let us carefully put the like radicals together.

$$\begin{aligned} & x\sqrt{2} + 2x\sqrt{x} - 2x\sqrt{2} + 5x\sqrt{x} - 5x\sqrt{2} \\ & = (x\sqrt{2} - 2x\sqrt{2} - 5x\sqrt{2}) + (2x\sqrt{x} + 5x\sqrt{x}) \\ & = (x - 2x - 5x)\sqrt{2} + (2x + 5x)\sqrt{x} \\ & = -6x\sqrt{2} + 7x\sqrt{x} \end{aligned}$$

3. $3\sqrt{12} + 4\sqrt{27}$

Solution: There are two radicals we want to add but they are not like. We can try simplifying each one first.

$$\begin{aligned} 3\sqrt{12} &= 3\sqrt{2 \cdot 2} \cdot 3 = 3 \cdot 2\sqrt{3} = 6\sqrt{3} \\ 4\sqrt{27} &= 4\sqrt{3 \cdot 3} \cdot 3 = 4 \cdot 3\sqrt{3} = 12\sqrt{3} \end{aligned}$$

Thus we have:

$$3\sqrt{12} + 4\sqrt{27} = 6\sqrt{3} + 12\sqrt{3} = 18\sqrt{3}.$$

4. $5a\sqrt{6a^2b^3} - 7b\sqrt{24a^3b}$

Solution: Let us simplify each radical first.

$$\begin{aligned} 5a\sqrt{6a^2b^3} &= 5a\sqrt{6a \cdot b^2} \cdot b = 5ab\sqrt{6ab} \\ 7b\sqrt{24a^3b} &= 7b\sqrt{4 \cdot 6 \cdot a^2} \cdot ab = 7b \cdot 2a\sqrt{6ab} = 14ab\sqrt{6ab} \end{aligned}$$

Thus,

$$5a\sqrt{6a^2b^3} - 7b\sqrt{24a^3b} = 5ab\sqrt{6ab} - 14ab\sqrt{6ab} = -9ab\sqrt{6ab}.$$

Elementary Algebra
Skill-Builder # SQRT – 2
Adding or Subtracting Square Root Radicals

Find the following. Assume all variables represent positive real numbers.

1. $5\sqrt{3} + 4\sqrt{3} - 8\sqrt{3} - 3\sqrt{5}$	2. $-\sqrt{12} - 2\sqrt{12} - 12\sqrt{3} + 12\sqrt{12}$
3. $3\sqrt{ab} - 2a\sqrt{b} + 4a\sqrt{b} - 6\sqrt{ab} + 2ab$	4. $6\sqrt{25x} - 7\sqrt{9x} + 11\sqrt{x}$
5. $8\sqrt{20} + 4\sqrt{45} - 7\sqrt{80}$	6. $-x\sqrt{24x} + 3\sqrt{54x^3}$
7. $a\sqrt{28ab^5} + 2b\sqrt{63a^3b^3}$	8. $21xy\sqrt{27xy^2} - 15y^2\sqrt{12x^3}$

Elementary Algebra
Skill-Builder # SQRT – 2
Adding or Subtracting Square Root Radicals

Answers

1. $-2\sqrt{3}$	2. $6\sqrt{3}$
3. $-3\sqrt{ab} + 2a\sqrt{b} + 2ab$	4. $20\sqrt{x}$
5. 0	6. $7x\sqrt{6x}$
7. $8ab^2\sqrt{7ab}$	8. $33xy^2\sqrt{3x}$

Prepared by: Teresa V. Sutcliffe, Fall 2012