

Math in Living C O L O R !!

To see Section 5.01 with explanations, examples, and exercises, [click here!](#)

5.01 Square Roots

Basic Algebra: One Step at a Time. Page 393 - 402: #50, 63, 64, 67, 88, 91, 93.

Dr. Robert J. Rapalje, Retired
Central Florida, USA

Simplifying square roots is not nearly as hard as you think it is, especially if it is explained in living color! Consider these exercises. Notice how the colors make the exercises so much easier to follow. Can you imagine what this would look like in black and white? Most of our television is in color--why not math?

P. 399: 50. $\sqrt{20}$

Find a perfect square that divides into 20 evenly. That would be 4.

Make two separate square roots:

$$\sqrt{\quad} \cdot \sqrt{\quad}$$

Put the perfect square factor in the (first) RED radical.

$$\sqrt{4} \cdot \sqrt{\quad}$$

Place the other factor that is "left-over" in the (second) BLUE radical.

$$\sqrt{4} \cdot \sqrt{5}$$

Take the square root of the perfect square:

Final answer: $2 \cdot \sqrt{5}$

Calculator check: $\sqrt{20} = 4.472135955$

$$2 \cdot \sqrt{5} = 4.472135955$$

63.

$$\sqrt{175}$$

Find a perfect square that divides into 175 evenly. That would be 25.

Make two separate square roots:

$$\sqrt{\quad} \cdot \sqrt{\quad}$$

Put the perfect square factor in the (first) RED radical.

$$\sqrt{25} \cdot \sqrt{\quad}$$

Place the other factor that is "left-over" in the (second) BLUE radical.

$$\sqrt{25} \cdot \sqrt{7}$$

Take the square root of the perfect square:

Final answer: $5 \cdot \sqrt{7}$

Calculator check: $\sqrt{175} = 13.22875656$

$$5 \cdot \sqrt{7} = 13.22875656$$

64.

$$\sqrt{54}$$

Find a perfect square that divides into 54 evenly. That would be 9.

Make two separate square roots:

$$\sqrt{\quad} \cdot \sqrt{\quad}$$

Put the perfect square factor in the (first) RED radical.

$$\sqrt{9} \cdot \sqrt{\quad}$$

Place the other factor that is "left-over" in the (second) BLUE radical.

$$\sqrt{9} \cdot \sqrt{6}$$

Take the square root of the perfect square:

$$3 \cdot \sqrt{6}$$

Calculator check: $\sqrt{54} = 7.348469228$

$$3 \cdot \sqrt{6} = 7.348469228$$

67.

$$\sqrt{80}$$

Find a perfect square that divides into 80 evenly. In this case, there are two perfect square numbers that would work. You can use either 4 or 16. If you have a choice, it will always be best to use the largest possible perfect square, which in this case is 16. If you used the number 4 as your perfect square number, see the explanation at the end of this exercise.

Make two separate square roots:

$$\sqrt{\quad} \cdot \sqrt{\quad}$$

Put the perfect square factor in the (first) RED radical.

$$\sqrt{16} \cdot \sqrt{\quad}$$

Place the other factor that is “left-over” in the (second) BLUE radical. In this case, the “left-over” factor is 5. It can be found by dividing 80 by 16.

$$\sqrt{16} \cdot \sqrt{5}$$

Take the square root of the perfect square:

$$4 \cdot \sqrt{5}$$

Calculator check: $\sqrt{80} = 8.94427191$

$$4 \cdot \sqrt{5} = 8.94427191$$

ALTERNATE METHOD:

It also is true that $\sqrt{80} = \sqrt{4} \cdot \sqrt{20}$
 $= 2 \cdot \sqrt{20} = 8.94427191$ (which appears to check!)

However, $2 \cdot \sqrt{20}$ is NOT simplified completely!

If you simplify this answer, you will get the same answer as before.

$$2 \cdot \sqrt{20}$$

$$2 \cdot \sqrt{4} \cdot \sqrt{5}$$

$$2 \cdot 2 \cdot \sqrt{5}$$

Final answer

$$4 \cdot \sqrt{5}$$

The first method is best! When looking for the “perfect square” factor, if there is more than one perfect square, always use the largest one.

88.

$$\sqrt{175x^{13}y^9}$$

Find a perfect square that divides into 175. That would be 25 times 7. Place the 25 in the first radical, along with powers of x and y that are divisible by 2.

$$\begin{aligned} & \sqrt{\quad} \cdot \sqrt{\quad} \\ & \sqrt{25x^{12}y^8} \cdot \sqrt{7xy} \\ & 5x^6y^4 \cdot \sqrt{7xy} \end{aligned}$$

91.

$$\sqrt{32x^4y^{16}}$$

Find a perfect square that divides into 32. That would be 16 times 2. Place the 16 in the first radical. Next, notice that all of the powers of x and y are divisible by 2. This means that these factors also go in the first radical.

$$\begin{aligned} & \sqrt{\quad} \cdot \sqrt{\quad} \\ & \sqrt{16x^4y^{16}} \cdot \sqrt{2} \\ & 4x^2y^8 \cdot \sqrt{2} \end{aligned}$$

93.

$$\sqrt{98x^7y^{13}}$$

Find a perfect square that divides into 98. That would be 49 times 2. Place the 49 in the first radical, along with powers of x and y that are divisible by 2.

$$\begin{aligned} & \sqrt{\quad} \cdot \sqrt{\quad} \\ & \sqrt{49x^6y^{12}} \cdot \sqrt{2xy} \\ & 7x^3y^6 \cdot \sqrt{2xy} \end{aligned}$$