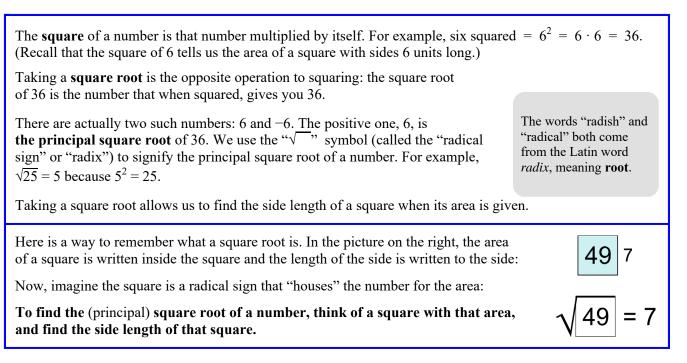
## **Square Roots**



1. Find the (principal) square roots.

<b>a.</b> $\sqrt{100}$	<b>b.</b> $\sqrt{64}$	<b>c.</b> $\sqrt{4}$	d. $\sqrt{0}$
<b>e.</b> $\sqrt{81}$	<b>f.</b> $\sqrt{144}$	<b>g.</b> $\sqrt{1}$	<b>h.</b> $\sqrt{10,000}$

2. It is especially easy to find square roots of numbers that are perfect squares: numbers we get by squaring whole numbers. For example, 49 is a perfect square because it is 7<sup>2</sup>.
Fill in the list of perfect squares from 1<sup>2</sup> to 20<sup>2</sup> at the right:

3. Find the square roots of these perfect squares.

<b>a.</b> $\sqrt{169}$	<b>b.</b> √900
<b>c.</b> $\sqrt{225}$	<b>d.</b> $\sqrt{121}$
<b>e.</b> $\sqrt{441}$	<b>f.</b> $\sqrt{8,100}$
<b>g.</b> $\sqrt{324}$	<b>h.</b> $\sqrt{400}$
i. <u>√6,400</u>	j. √25,600
<b>k.</b> $\sqrt{16,900}$	<b>I.</b> √1,000,000

x	<i>x</i> <sup>2</sup>	x	$x^2$
1	1	11	
2	4	12	
3	9	13	
4		14	
		15	
			256
	49		289
8			324
9			

Most whole numbers are *not* perfect squares, and their square roots are unending decimals. (In fact, their square roots are **irrational numbers**, which means they cannot be written as a fraction, and their decimal expansions are unending decimals without any repeating patterns in the digits.)

We can handle that situation in at least three ways:

- 1. We can find an approximate value of such square roots **with a calculator**, rounding the answer to a reasonable accuracy. This is necessary if we're dealing with a real-life application.
- 2. We can find an approximate value using **guess and check**, and decimal multiplication. For example, we know that the value of  $\sqrt{17}$  will be between 4 and 5 (since  $\sqrt{16} = 4$  and  $\sqrt{25} = 5$ ). We can also tell that it will be closer to 4 than 5, since 17 is very close to 16. So, we could guess that it is 4.1, square that, and based on the result, refine our guess.
- 3. We can **indicate such values using the square root symbol**, and not find a decimal approximation. For example, the side of a square with an area of 2 square units is  $\sqrt{2}$  units. This is the preferred way in pure mathematics, and any time you want to convey an accurate value.
- 4. Between which two whole numbers do the following square roots lie? Do not use a calculator. Tell also which of those whole numbers the root is closer to.

**a.** 
$$\sqrt{5}$$
 **b.**  $\sqrt{24}$  **c.**  $\sqrt{47}$  **d.**  $\sqrt{83}$ 

5. Tell the side of the square (exact value) when its area is given. Indicate the side length using the square root symbol, if the area is not a perfect square. Note:  $u^2$  signifies square units, and *u* signifies a unit.

<b>a.</b> area = $25 u^2$	<b>b.</b> area = 1,600 $u^2$	<b>c.</b> area = 5 $u^2$	<b>d.</b> area = $11 u^2$
side =	side =	side =	side =

6. **a.** What is the area of a square, if its side measures  $\sqrt{8}$  units?

- **b.** What is the value of  $(\sqrt{7})^2$ ?
- **c.** What is the side of a square with an area of 130 square meters? Give an exact value.

**Example 1.** Since 
$$0.5 \cdot 0.5 = 0.25$$
, then  $\sqrt{0.25} = 0.5$ .  
**Example 2.** Since  $\frac{2}{3} \cdot \frac{2}{3} = \frac{4}{9}$ , then  $\sqrt{\frac{4}{9}} = \frac{2}{3}$ .

7. Find the square roots.

a. 
$$\sqrt{0.16}$$
 b.  $\sqrt{0.01}$ 
 c.  $\sqrt{1.21}$ 

 d.  $\sqrt{\frac{16}{25}}$ 
 e.  $\sqrt{\frac{100}{9}}$ 
 f.  $\sqrt{\frac{49}{36}}$