

## ► Example 4

**Question:** What's the sq in. area of a 16 in. pizza? **Figure 1-5B**

(a) 100 sq in. (b) 150 sq in. (c) 200 sq in. (d) 256 sq in.

**Answer:** (c) 200 sq in.

$$\text{Area} = \pi \times r^2$$

$$\text{Area} = 3.14 \times (0.50 \times 16)^2$$

$$\text{Area} = 3.14 \times 8^2$$

$$\text{Area} = 3.14 \times (8 \times 8)$$

$$\text{Area} = 3.14 \times 64$$

$$\text{Area} = 200 \text{ sq in.}$$

**Author's Comment:** As you see in Examples 3 and 4, if you double the diameter of the circle, the area contained in the circle is increased by a factor of four! By the way, a large pizza is always cheaper per sq in. than a small pizza.

## 1.9 Parentheses

Whenever numbers are in parentheses, complete the mathematical function within the parentheses before proceeding with the rest of the problem.

Parentheses are used to group steps of a process in the correct order. For instance, adding the sum of 3 and 15 to the product of 4 and 2 equals 26.

$$(3 + 15) + (4 \times 2) = 18 + 8 = 26$$

## ► Example

**Question:** What's the current of a 36,000W, 208V, three-phase load? **Figure 1-6**

$$\text{Ampere (I)} = \text{Watts}/(E \times 1.732)$$

(a) 50A (b) 100A (c) 150A (d) 360A

**Answer:** (b) 100A

*Step 1: Perform the operation inside the parentheses first—determine the product of:  $208V \times 1.732 = 360V$*

*Step 2: Divide 36,000W by 360V = 100A*

The diagram shows a three-phase electrical system. On the left, a meter is connected to a 208V source. A label 'Math in Parentheses' points to the meter. On the right, a blue tank-like load is connected to the same system. A label '36,000W Load 3-Phase' points to the tank. Below the diagram, the following calculation is shown:

$$I = \frac{P}{(E \times \sqrt{3})} \quad I = \frac{36,000W}{(208V \times 1.732)} \quad I = \frac{36,000W}{360} = 100A$$

Whenever numbers are in parentheses, we must complete the mathematical function within the parentheses before proceeding with the rest of the problem.

**Figure 1-6**

## 1.10 Square Root

Deriving the square root of a number ( $\sqrt{n}$ ) is the opposite of squaring a number. The square root of 36 is a number that, when multiplied by itself, gives the product 36. The  $\sqrt{36}$  equals six, because six, multiplied by itself (which can be written as  $6^2$ ) equals the number 36.

Because it's difficult to do this manually, just use the square root key of your calculator.

$\sqrt{3}$ : Following your calculator's instructions, enter the number 3, then press the square root key = 1.732.

$\sqrt{1,000}$ : enter the number 1,000, then press the square root key = 31.62.

If your calculator doesn't have a square root key, don't worry about it. For all practical purposes in using this textbook, the only number you need to know the square root of is 3. The square root of 3 equals approximately 1.732.

To add, subtract, multiply, or divide a number by a square root value, determine the decimal value and then perform the math function.

### ► Example 1

**Question:** What's  $36,000W / (208V \times \sqrt{3})$  equal to?

- (a) 100A      (b) 120A      (c) 208A      (d) 360A

**Answer:** (a) 100A

**Step 1:** Determine the decimal value for the  $\sqrt{3} = 1.732$

**Step 2:** Divide 36,000W by  $(208V \times 1.732) = 100A$

### ► Example 2

**Question:** The phase voltage of a 120/208V system is equal to  $208V / \sqrt{3}$ , which is \_\_\_\_\_.

- (a) 120V      (b) 208V      (c) 360V      (d) 480V

**Answer:** (a) 120V

**Step 1:** Determine the decimal value for the  $\sqrt{3} = 1.732$

**Step 2:** Divide 208V by 1.732 = 120V

## 1.11 Volume

The volume of an enclosure is expressed in cubic inches (cu in.). It's determined by multiplying the length, by the width, by the depth of the enclosure.

### ► Example

**Question:** What's the volume of a box that has the dimensions of  $4 \times 4 \times 1\frac{1}{2}$  in.? **Figure 1-7**

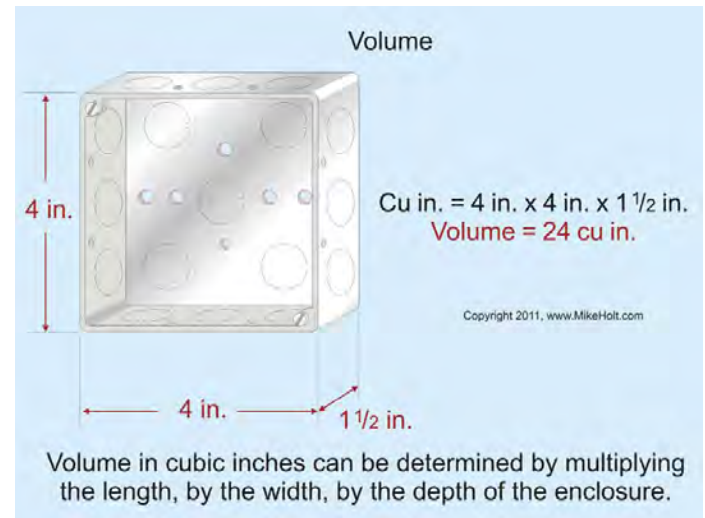
- (a) 12 cu in.      (b) 20 cu in.      (c) 24 cu in.      (d) 30 cu in.

**Answer:** (c) 24 cu in.

$$1\frac{1}{2} = 1.50$$

$$4 \times 4 \times 1.50 = 24 \text{ cu in.}$$

**Author's Comment:** The actual volume of a 4 in. square electrical box is less than 24 cu in. because the interior dimensions may be less than the nominal size and often corners are rounded, so the allowable volume is given in the *NEC* Table 314.16(A).



**Figure 1-7**

## 1.12 Kilo

The letter "k" is used in the electrical trade to abbreviate the metric prefix "kilo," which represents a value of 1,000.

To convert a number which includes the "k" prefix to units, multiply the number preceding the "k" by 1,000.

### ► Example 1

**Question:** What's the wattage value for an 8 kW rated range?

- (a) 8W      (b) 800W      (c) 4,000W      (d) 8,000W

**Answer:** (d) 8,000W

To convert a unit value to a "k" value, divide the number by 1,000 and add the "k" suffix.

### ► Example 2

**Question:** What's the kW rating of a 300W load? **Figure 1-8**

- (a) 0.30 kW      (b) 30 kW      (c) 300 kW      (d) 3,000 kW

**Answer:** (a) 0.30 kW

$$kW = \text{Watts} / 1,000$$

$$kW = 300W / 1,000 = 0.30 \text{ kW}$$