Area is a measurement of the amount of surface in a region. Area is used to describe the size of a rug, parking lot, a farm, national park. Area is measured in square units. The area of a geometric figure is the number of squares that are necessary to cover the region. Common units of area are square miles, acres, square yards, square feet, square inches, hectares, square kilometers, square meters, and square centimeters.

Some units of area are simply a linear measurement unit that is squared; for example, a "square meter" represented as m², whereas others are unique to area measurement, such as hectares and acres.

Some units of area may be expressed in several different ways:

<table>
<thead>
<tr>
<th>Unit of Area</th>
<th>Other Ways</th>
</tr>
</thead>
<tbody>
<tr>
<td>square meter</td>
<td>meter * meter or m² or sqm</td>
</tr>
<tr>
<td>square foot</td>
<td>foot<em>foot or ft² or sq. ft or ft</em>ft</td>
</tr>
</tbody>
</table>

OK, working in international commerce, I understand why I need to know how to convert currency, determine local time elsewhere in the world and be able to convert lengths from English to metric units.

But why do I need to work with area measurement?

For several possible reasons, including:

- To determine transportation costs. In order to compute cube you must first compute area. Transportation charges are directly based on cube for ocean shipping, and may be based on cube for other modes, and must be known to arrange transportation for all but small shipments.
- If you are involved in conveyance load planning (e.g., trucks, intermodal containers, rail cars), you begin with a floor plan, for which you will want to know the total available floor area.
- If you are involved in organizing a warehouse, work or office space, computing floor area for rooms and objects is important.
Area of a Rectangle
To calculate the area of a rectangle, multiply the width of the rectangle by the length of the rectangle.
\[ A = \text{length} \times \text{width} \]

Example 1: What is the area of a 4 ft. x 8 ft. sheet of plywood?

\[
\begin{array}{c}
\text{4 ft} \\
\text{8 ft}
\end{array}
\]

\[ \text{Area} = 4 \text{ ft} \times 8 \text{ ft} = 32 \text{ square feet} \]

Example 2: Calculate the area of a rectangle that is 4 ft-3in by 5ft-6in.

\[
\begin{array}{c}
\text{4 ft-3 inches} \\
\text{5 ft-6 inches}
\end{array}
\]

Solution: First, we reduce the dimensions to a single unit before multiplying them. You can convert to all inches or all feet:

USING INCHES: We have: 4 feet 3 inches = 51 inches
5 feet 6 inches = 66 inches.
So, the area is: \( A = 51 \text{ inches} \times 66 \text{ inches} = 3366 \text{ square inches} \) (or 3366 in\(^2\))

USING FEET: We have 4 feet 3 inches = 4 \( \frac{3}{4} \) feet or 4.25 feet
5 feet 6 inches = 5 \( \frac{1}{2} \) feet or 5.5 feet
So, the area is: \( A = 4.25 \text{ feet} \times 5.5 \text{ feet} = 23.375 \text{ sq. feet} \) (or ft\(^2\))

A bothersome chore in the English system is the need to convert back into an expression using both feet and inches after making an area computation. To avoid this, the result should be left in decimals. Better yet, if we need our result in metric measure, convert the linear measurements from English to metric before computing the area.

Area of a Square

A square is a rectangle with the same dimension on each side. To determine the area of a square you simply multiply one side by the other side, or "square" the single dimension. For example, the area of a 1.75 meter square is: \( 1.75 \times 1.75 = 3.0624 \text{ m}^2 \). If you should want your answer in centimeters, simply move the decimal to the right 4 spaces (yes, 4 spaces because you are now dealing with area, not linear measurement).
Converting Area Units

If you are converting between two units of area, you may be fortunate enough to have a convenient conversion factor. For example, when dealing with land, we use the units:

- 1 hectare = 2.47 acres
- 1 square meter = 10.76 square feet

In these cases, you can simply use the conversion factor.

If you do not have a conversion factor that goes directly from the units that you are beginning with to the units you are converting to, there is an alternative method. Consider a situation in which you are attempting to convert 10 square meters into square yards. If you know that 1 meter = 1.094 yards, you can use that information to convert.

**Example 1: Convert 10 square meters to square yards.**

**Solution:**

a) First we determine the starting and the ending units.
   - Starting unit is square meters (denominator of the conversion ratio)
   - Ending unit is square yards (numerator of the conversion ratio)

b) We use the relationship: 1 meter = 1.094 yards. To obtain square meter and square yards, we multiply each measure by itself as shown below.
   
   \[
   \begin{align*}
   1 \text{ meter} & \times 1 \text{ meter} = 1.094 \text{ yards} \times 1.094 \text{ yards} \\
   1 \text{ square meter} & = 1.196836 \text{ square yards}
   \end{align*}
   \]

c) Next we multiply 10 square meters by the conversion ratio \( \frac{1.196836 \text{ square yards}}{1 \text{ square meter}} \).

\[
10 \text{ square meters} = \frac{10 \text{ sq.meters}}{1} \times \frac{1.196836 \text{ sq.yards}}{1 \text{ sq.meter}}
\]

\[
= 10 \times 1.196836 \text{ sq.yards} = 11.96836 \text{ square yards}.
\]