Before we get into converting area and volume, it is important to understand how a straight line (1 dimension), a square (2 dimensions), and a cube (3 dimensions) all relate to each other. You can see this in the first three images above. A grid with a length and width of 10 cm produces an area of 100 blocks, each one 1 cm$^2$. Take that same grid, and give it a depth of 10 cm, and now we have a 3 dimensional figure made up of 1000 cm$^3$ blocks.

We can apply this idea to converting area and volume.

Converting a straight line distance is easy, with just one simple calculation. We know there are 2.54 cm in a single inch. So a one inch straight line is 2.54 cm. If we take a square that has a length and width of 1 inch, we know that it has an area of 1 in$^2$. Does that mean then that it has an area of 2.54 cm$^2$? The answer is, no. It in fact has an area of 6.5 cm$^2$. That is because we have to convert both the length (1 in = 2.54 cm) and the width (1 in = 2.54 cm) then multiply them to get the conversion. This idea is central to converting area and volume.

Example: Convert a 12 cm$^2$ area into mm$^2$. We know 1 cm = 10 mm, so ...

$$12 \times 10 \times 10 = 1200 \text{mm}^2$$
We multiply by the conversion twice, once for each length & width.

**Activity 1:** Convert these area units.  
1 in = 2.54 cm  
1 m = 100 cm  
1 yd = 3 ft

a) 9.3 in$^2$ = _____ cm$^2$  
b) 3.5 m$^2$ = _____ cm$^2$  
c) 300 ft$^2$ = _____ yd$^2$

The same principle applies to volume. Because there are three dimensions, we have to multiply any straight line conversion factor by itself three times (so we are cubing it).

Example: Convert a volume of 765 ml into in$^3$.  

$$765 \div 2.54 \div 2.54 \div 2.54 = 46.7 \text{in}^3$$
We divide by the conversion 3 times, for 3 dimensions.

**Activity 2:** Convert these volume units. Remember 1 ml = 1 cm$^3$.

a) 200 in$^3$ = _____ cm$^3$  
b) 4500 cm$^3$ = _____ m$^3$  
c) 900 in$^3$ = _____ ft$^3$

Finally, it turns out there are some units that are already units of area or volume. We know, for example, that 1 ml is 1 cm$^3$, so we don’t have to do anything special when converting. The same is true for other values. For example:

10,000 m$^2$ = 1 hectare (ha)  
1 acre (ac) = 43560 ft$^2$  
1 barrel = 9702 in$^3$

**Activity 3:** Use the conversion values above to answer the questions.

a) 42,000 m$^2$ = _______ ha  
b) 3 ac = __________ ft$^2$  
c) 28 ft$^3$ = _____ barrels
Homework:
1. Use a diagram to show why
a square measuring 1 yd x 1 yd
(1 yd²) has an area of 9 ft².
   Hint: 1 yd = 3 ft

Conversions: 1 ft = 12 in 1 in = 2.54 cm 1 m = 100 cm 1 cm = 10 mm 1 yd = 3 ft
2. Straight line conversions – 1 dimension – just multiply or divide to get your conversion.
   a) 4 ft = _____ in  b) 3000 cm = ____ m  c) 5 yd = _____ ft  d) 200 mm = ____ cm
3. Converting area – 2 dimensions – you have to convert twice!
   a) 2000 cm² = _____ m²  b) 5 cm² = _____ mm²  c) 36 ft² = ____ yd²
   d) 4 m² = _____ cm²  e) 4 yd² = _____ ft²  f) 1448 in² = ______ ft²
   g) 5000 mm² = _____ cm²  h) 2 yd² = _____ ft²  i) 3 in² = _____ cm²
   j) 400 cm² = _____ in²  k) 41 ft² = _____ in²  l) 3 cm² = _____ in²
4. Tricky 2 step conversions – you have to convert twice. Use 2 steps; see below.
   Example: 1 ft² = _____ cm²  1) 1 x 12 x 12 = 144 in²  2) 144 x 2.54 x 2.54 = 929 cm²
      a) 2.5 ft² = _____ cm²  b) 5 yd² = _____ in²  c) .03 m² = ______ mm²
      d) 12 in² = ______ mm²  e) 1200 cm² = _____ ft²  f) 20,000 in² = ______ yd²

5. Converting volume – 3 dimensions – you have to multiply or divide by the factor 3 times!
   a) 3.1 m³ = _____ cm³  b) 2000 cm³ = _____ in³  c) 9 ft³ = _______ in³
   d) 8 yd³ = _______ ft³  e) 2 cm³ = _______ mm³  f) 10000 mm³ = _______ cm³
   g) 270 ft³ = ______ yd³  h) 200000 cm³ = _____ m³  i) 24 in³ = _______ cm³
6. Converting volume – 2 steps – same as in question 4 above, but with volume not area.
   a) .05 ft³ = ______ mm³  b) 0.2 yd³ = _______ in³  c) 12000000 mm³ = ___ m³

6. Convert units of area and volume that do not involve multiple calculations. See activity 3.
   a) 3.5 ha = _____ m²  b) 130680 ft² = _____ ac  c) 2000000 m² = _____ ha
   d) 5 ac = __________ ft²  e) 3 barrels = _______ ft³  f) 29106 ft³ = _____ barrels