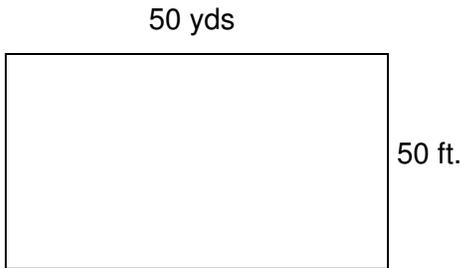




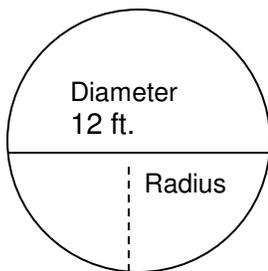
CERTIFIED POOL/SPA OPERATOR® PREP



Surface area of a square/rectangle; Length X Width = Square Feet
All calculations are done in FEET. If you have a diagram that is labeled in yards or meters, you must CONVERT the yards or meters to feet!
To convert yards, multiply yards X 3 (there are 3 feet in each yard) to get the measurement in feet.

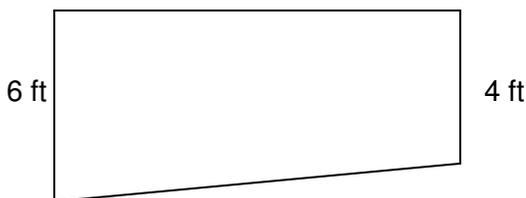
In this diagram, 50 yds X 3 = 150 ft.

Therefore, in this diagram, to determine surface area, multiply L X W. The surface area of this diagram is L 150 X 50 = 7,500 Sq. Ft.



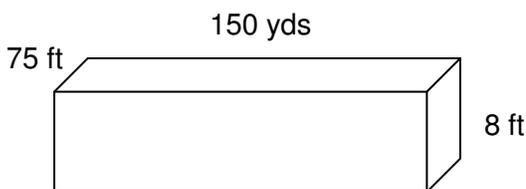
Surface area of a circle. To determine surface area, multiply 3.14 X the RADIUS X the RADIUS = square feet.
The RADIUS is always one half of the diameter. The diameter of the circle in this diagram is 12 feet. Therefore, the RADIUS is 6 ft.

The surface area of this circle is 6 X 6 X 3.14 = 113.04 Sq. Ft.



Sometimes, we need to determine the AVERAGE DEPTH of a pool with a sloped bottom. To calculate the average depth, we do a simple 'average' calculation; Add the shallow depth + the deep depth, and then divide by 2. This formula will work only if the pool bottom has a constant slope – one angle from shallow to deep, as pictured here.

The average depth of this pool is 4 + 6 ÷ 2 = 5



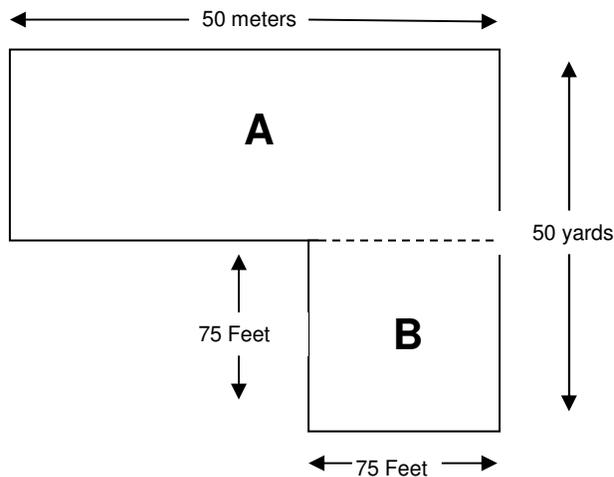
When we multiply feet X feet X feet, our answer is given in CUBIC FEET – therefore, if we do our volume according to the formula of surface area X average depth, our answer will be in cubic feet. However, in pools, we refer to the volume of water in GALLONS. So, once we do our surface area X depth calculation, we have to convert cubic feet to gallons. Since each cubic foot can hold approximately 7.5 gallons of water, the complete volume formula is: Surface area X depth X 7.5 = gallons.

In the above pool, the length is 150 YARDS, the width is 75 feet, and the depth is a constant 8 feet. What is the volume of this pool? REMEMBER, all calculations must be done in FEET!

Convert length to feet 150 X 3 = ft. THEN do volume: 450 X 75 X 8 X 7.5 = 2,025,000 gallons



CERTIFIED POOL/SPA OPERATOR® PREP



If we have a pool and we have lost 1.75 inches of water over a period of 7 days, how much water did we lose each day?

$$1.75 \text{ inches lost} \div 7 \text{ Total Days} = 0.25 \text{ Inches Lost per day}$$

If we have an "L" shaped pool that measures 50 meters long by 25 yards wide, with a 75 ft by 75 ft diving area – how many gallons of water did we lose if we lost a total of 1 inch?

First Calculate Surface area. In an "L" shaped pool it is best to break the pool into 2 different components to calculate this.

Section "A" Measures 50 meters by (50 yards – 75 ft)

$$\text{Convert Meters to Feet: } 50 \text{ meters} \times 3.28 = 164 \text{ ft}$$

$$\text{Convert Yards to Feet: } 50 \text{ yards} \times 3 = 150 \text{ ft}$$

$$164 \text{ ft length} \times 75 \text{ ft width} = 12,300 \text{ sq ft surface area}$$

Section "B" measures 75 ft by 75 ft

$$75 \text{ ft length} \times 75 \text{ ft width} = 5,625 \text{ sq ft surface area}$$

When dealing with calculating gallons in water lost, understand that our depth (inches of water lost) is a constant depth. There is no need to calculate an average depth as the entire pool has lost the same amount of water, equally.

Add the surface area of the 2 sections together for your total surface area

$$12,300 \text{ sq ft surface area "A"} + 5,625 \text{ sq ft surface area "B"} = 17,925 \text{ sq ft surface area total}$$

In order to calculate gallons, we need to have our depth measured in feet. In this scenario, we have lost 1 inch of water. To convert inches to feet, we must divide inches by 12 (there are 12 inches in a foot)

$$1 \text{ inch} \div 12 \text{ (inches in a foot)} = .0833 \text{ ft depth}$$

Calculate Gallons:

$$17,925 \text{ Total Surface Area} \times .0833 \times 7.5 = 11,198.64 \text{ gallons lost in this pool}$$

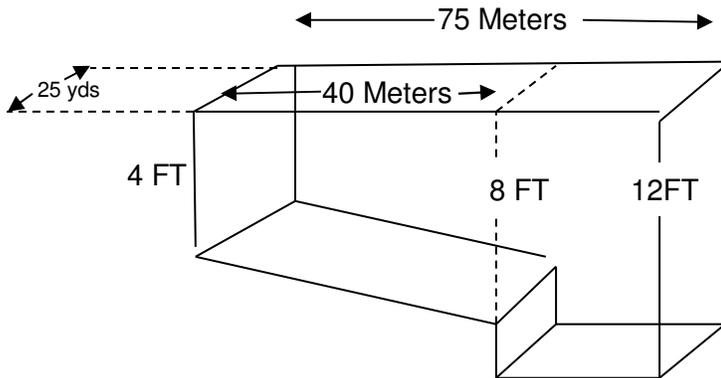
Had we lost 5 inches of water, we would then take the gallonage calculated above and then multiply by 5.

How many gallons of water did we lose in this pool if we lost 1.75 inches of water?

$$17,925 \text{ Total Surface Area} \times .0833 \times 7.5 = 11,198.64 \text{ gallons in 1 inch} \times 1.75 \text{ lost} = 19,597.62 \text{ gal}$$



CERTIFIED POOL/SPA OPERATOR® PREP



When calculating volume (gallons) for a pool with multiple depths, it is best to break the pool into multiple components based off of those depths

The example to the left is a 75 meter long pool by 25 yards wide with a 40 meter shallow end that slopes from 4 ft to 8 ft deep. The pool also has a diving well with a constant 12 foot depth

The Shallow end of this pool measures 40 meters long by 25 yards wide, with a constant slope depth of 4 ft to 8 ft.

First: Convert meters to feet (3.28 feet per meter)

$$\underline{40} \text{ meters} \times 3.28 = \underline{131.2} \text{ ft}$$

Next: Convert yards to feet (3 ft per yard)

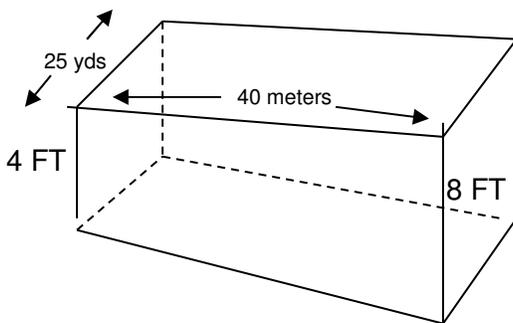
$$\underline{25} \text{ yards} \times 3 = \underline{75} \text{ ft}$$

Calculate average Depth:

$$\underline{4} \text{ shallow end depth} + \underline{8} \text{ deep end depth} \div 2 = \underline{6} \text{ ft avg depth}$$

Place numbers into your formula: Length x Width x Avg Depth x 7.5 = Gallons

$$\underline{131.2} \text{ length} \times \underline{75} \text{ width} \times \underline{6} \text{ avg depth} \times 7.5 = \underline{442,800} \text{ gal}$$



The Deep end of this pool measures (75 - 40 meters) long by 25 yards wide, with a constant depth of 12 ft.

First: Convert meters to feet (3.28 feet per meter)

$$\underline{35} \text{ meters} \times 3.28 = \underline{114.8} \text{ ft}$$

Next: Convert yards to feet (3 ft per yard)

$$\underline{25} \text{ yards} \times 3 = \underline{75} \text{ ft}$$

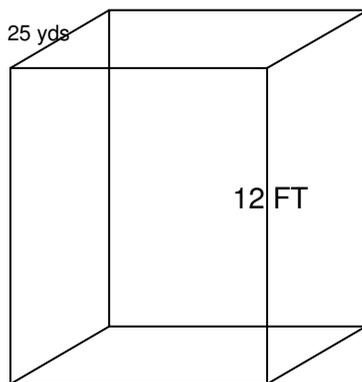
Calculate average Depth:

Depth is a constant 12 ft – no need to calculate average depth

Place numbers into your formula: Length x Width x Avg Depth x 7.5 = Gallons

$$\underline{114.8} \text{ length} \times \underline{75} \text{ width} \times \underline{12} \text{ depth} \times 7.5 = \underline{774,900} \text{ gal}$$

$$\text{Length: } 75 \text{ meters} - 40 \text{ meters} = \underline{35}$$



The final step in calculating gallons for a pool with multiple depths, is to add the gallons calculated for each individual section together – giving us total gallons of water

$$\underline{442,800} \text{ shallow end gallons} + \underline{774,900} \text{ deep end gallons} = \underline{1,217,700} \text{ Total Pool Gallons}$$



CERTIFIED POOL/SPA OPERATOR® PREP



Converting Fluid Ounces to Gallons:

There are 128 ounces in a Gallon, to convert ounces to gallons you will divide number of fluid ounces by 128

In order to achieve break point chlorination, you will need to add 540 fl ounces of liquid chlorine to your pool, how many gallons do you need?

$$\underline{540} \text{ fluid ounces} \div 128 = \underline{4.2} \text{ Gallons}$$

Converting Ounces to Pounds

There are 16 ounces in a pound, to convert ounces to pounds you will divide the number of ounces by 16

From your water test results, you have determined that you will need to add 60 ounces of Cyanuric acid to bring your stabilizer level from 0 ppm to 30 ppm, how many pounds do you need?

$$\underline{60} \text{ ounces} \div 16 = \underline{3.75} \text{ Pounds}$$

If you are cooking dinner for 12 people and your recipe states that it will feed 4 people, you must triple (multiply x 3) the ingredients to prepare enough food for your guests. If the label on a bucket of calcium hypochlorite states that 2 ounces will raise the chlorine level of 10,000 gallons of water by 1 ppm. You have 10,000 gallons of water, but you require a 3 ppm chlorine level increase – How much calcium hypochlorite must you add?

Formula (recipe) 2 oz of Calcium Hypochlorite will raise the chlorine level of 10,000 gallons of water by 1 ppm

A) Chemical dose from label: $\underline{2}$

B) Gallons \div 10,000 = $\underline{1}$ A $\underline{2}$ x B $\underline{1}$ x C $\underline{3}$ = $\underline{6}$ oz

C) Desired ppm increase \div 1 = $\underline{3}$

How many pounds is that?

$$\underline{6} \text{ ounces} \div 16 = \underline{0.375} \text{ lbs.}$$

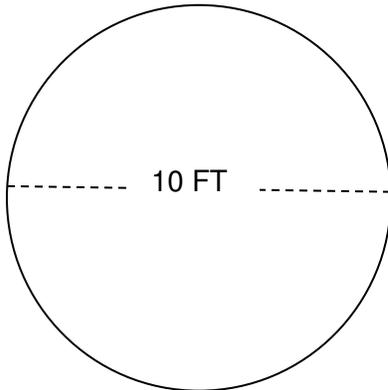
A 25,000 gallon pool has a required turnover rate of 6 hours, what is the flow rate (gpm) required to meet this turnover rate?

Formula: Gallons \div Turnover Rate \div 60 = gallons per minute required

$$\underline{25,000} \text{ gallons} \div \underline{6} \text{ turnover rate} \div 60 = \underline{69.44} \text{ gpm required}$$



CERTIFIED POOL/SPA OPERATOR® PREP



A circular spa has a Diameter of 10 feet and a constant depth of 3 feet. How many gallons of water does our spa hold?

Step 1: Calculate Surface Area

Formula: Radius x Radius x 3.14

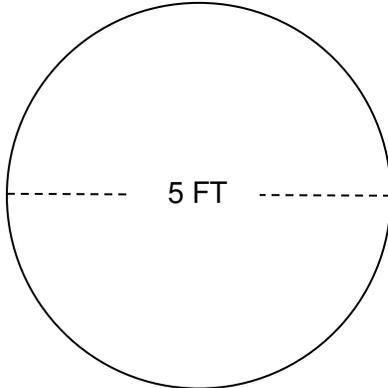
Radius = $\frac{1}{2}$ Diameter

$$\underline{10} \text{ Diameter} \div 2 = \underline{5} \text{ Radius}$$

$$\underline{5} \text{ Radius} \times \underline{5} \text{ Radius} \times 3.14 = \underline{78.5} \text{ sq ft surface area}$$

Our spa has a constant depth of 3 feet (no need to calculate average depth).

$$\underline{78.5} \text{ sq ft surface area} \times \underline{3} \text{ depth} \times 7.5 = \underline{1,766.25} \text{ gal}$$



A Sand Filter has a Diameter of 5 ft and has a filter media rate of 10 gallons per minute per sq ft of filter area. What is the maximum flow rate this sand filter can handle?

Filter Area = Surface Area

First Calculate Surface Area

Formula: Radius x Radius x 3.14

Radius = $\frac{1}{2}$ Diameter

$$\underline{5} \text{ Diameter} \div 2 = \underline{2.5} \text{ Radius}$$

$$\underline{2.5} \text{ Radius} \times \underline{2.5} \text{ Radius} \times 3.14 = \underline{19.625} \text{ sq ft surface area}$$

We have been told that this sand filter has a filter media rate of 10 gallons per minute per sq ft of filter area. As filter area = surface area, this means that this filter can handle a maximum of 10 gallons per minute for every 1 sq ft of surface area.

Formula: Surface Area x Filter Media Rate = Maximum Flow Rate

$$\underline{19.625} \text{ sq ft of surface area} \times \underline{10} \text{ Filter Media Rate} = \underline{196.25} \text{ gpm Max Flow Rate}$$