

## SECTION XIX

## WEIGHTS AND MEASURES

Tables of Weights and Measures and Other Information That May Be Helpful to the Assessor/Appraiser.

<b>Metric Measure</b>		
Millimeter	=	0.001 meter
Centimeter	=	0.01 meter
Decimeter	=	0.1 meter
Meter	=	39.3685 inches
Kilometer	=	1000 meters
Kilometer	=	.062137 miles
Meter	=	1.0935 yards
Meter	=	3.2807 feet
1 Foot	=	0.30480 meter
1 Foot	=	3.04 centimeters
1 Inch	=	2.54 centimeters
<b>Linear Measure</b>		
1 Foot	=	12 inches
1 Yard	=	3 feet-36 inches
1 Rod	=	5½ yards-16½ feet
1 Furlong	=	40 rods-220 yards-660 feet
1 Mile	=	8 furlongs-320 rods-1,760 yards-5,280 feet
<b>Surveyor's Linear Measure</b>		
1 Link	=	7.92 inches
1 Rod	=	25 links
1 Chain	=	4 rods-100 links-66 feet
1 Furlong	=	10 chains
1 Mile	=	8 furlong-80 chains
<b>Square Measure</b>		
1 Square Foot	=	144 square inches
1 Square Yard	=	9 square feet-1,296 square inches
1 Square Rod	=	1 pole/perch-30¼ square yards-272¼ square feet
1 Rood	=	40 square rods
1 Acre	=	160 square rods-4,840 square yards-43,560 square ft
1 Square Mile	=	640 acres
<b>Surveyor's Square Measure</b>		
1 Square Rod	=	625 square links
1 Square Chain	=	16 square rods
1 Acre	=	10 square chains
1 Square Mile	=	640 acres
<b>Cubic Measure</b>		
1 Cubic Foot	=	1,728 cubic inches-7,481 gallons
1 Cubic Yard	=	27 cubic feet
1 Cord Foot	=	16 cubic feet
1 Cord of Wood	=	8 cord-128 cubic feet
1 Perch of Masonry	=	24¼ cubic feet
1 Bushel	=	1.2445 cubic feet
<b>Angles And Arcs Measure</b>		
1 Minute	=	60 seconds
1 Degree	=	60 minutes
1 Right Angle	=	90 degrees-1 quadrant
1 Circumference	=	360 degrees-4 quadrants

<b>Board Measure</b>	=	
1 Board Foot	=	Length in feet x width in feet x thickness in inches

Measurement In General Use		
1 Link	=	7.92 inches
1 foot	=	12 inches
1 yard	=	3 feet or 36 inches
1 rod	=	16½ feet, 5½ yards or 25 links
1 surveyor's chain	=	66 feet, or 4 rods, or 100 links
1 furlong	=	660 feet, or 40 rods
1 mile	=	8 furlongs, 320 rods, 80 chains, or 5,280 feet
1 square rod	=	272¼ square feet or 30¼ square yards
1 acre contains	=	43,560 square feet
1 acre contains	=	160 square rods
1 span	=	9 inches
1 hand	=	(horse measurement) 4 inches
1 knot	=	(nautical) 6,080.27 feet
1 fathom	=	(nautical) 6 feet
1 stone	=	14 pounds
1 square acre	=	Approximately 208.7 feet on each side
1 acre	=	Approx 8 rods by 20 rods, or any two combinations of rods whose product is 160

#### SIMPLE FORMULA CONVERTING SQUARE FEET TO ACRES

Multiply by 23 and point off 6 places (This method is not exact but is useful for rough calculations)

Example: 1500 feet x 2050 feet = 3,075,000 square feet x 23 = 70.73 acres

#### BOARD MEASURE

Multiply thickness in inches by width in inches, divide product by 12 and multiply result by the length in feet. The result is board measure content.

Conversion factors for converting lineal feet of lumber into board feet.

Example: 50 – 2 inches x 10 inches 20 feet long  
 50 x 20 feet = 1000 lineal feet  
 2 inches x 10 inches = 20 square inches divided by 12 =  
 1.667 board feet x 1000 lineal feet equals 1,667 board feet

#### TABLE FOR THE CONVERSION OF LINEAL FEET INTO BOARD FEET

2 inches x 4 inches	(1 lineal foot)	.667 board feet
3 inches x 4 inches	(1 lineal foot)	1.000 board feet
2 inches x 6 inches	(1 lineal foot)	1.000 board feet
2 inches x 8 inches	(1 lineal foot)	1.333 board feet
2 inches x 10 inches	(1 lineal foot)	1.667 board feet
2 inches x 12 inches	(1 lineal foot)	2.000 board feet
2 inches x 14 inches	(1 lineal foot)	2.333 board feet
2 inches x 16 inches	(1 lineal foot)	2.667 board feet
3 inches x 6 inches	(1 lineal foot)	1.500 board feet
4 inches x 6 inches	(1 lineal foot)	2.000 board feet
4 inches x 8 inches	(1 lineal foot)	2.667 board feet
4 inches x 10 inches	(1 lineal foot)	3.333 board feet
4 inches x 12 inches	(1 lineal foot)	4.000 board feet
6 inches x 6 inches	(1 lineal foot)	3.000 board feet
6 inches x 8 inches	(1 lineal foot)	4.000 board feet
10 inches x 12 inches	(1 lineal foot)	10.000 board feet
12 inches x 12 inches	(1 lineal foot)	12.000 board feet

## PRINCIPLES

PLANE FIGURE – A plane surface bounded by either straight or curved lines and having no thickness.

SOLID – A body, such as a barrel, building, etc.

SQUARE MEASURE – Area calculation requiring only two dimensions, length and width.

CUBIC MEASURE – Cubic or cubage means volume and gives size in terms of its bulk. Calculation requires 3 dimensions, length x width x depth or height or thickness.

## MEASURES AND THEIR EQUIVALENTS

A gallon of water (U.S. Standard) weighs  $8 \frac{1}{3}$  pounds and contains 231 cubic inches.

A cubic foot of water contains  $7\frac{1}{2}$  gallons, 1,728 cubic inches and weighs  $62\frac{1}{2}$  pounds.

Doubling the diameter of a pipe increases its capacity four times.

To find the pressure in pounds per square inch of a column of water, multiply the height of the column in feet by .434.

To find the capacity of tanks any size, given the dimensions of a cylinder in inches, to find its capacity in U.S. gallons: square the diameter, multiply by the length and by .0034 (Note: See table of tank capacities.)

Rectangular tanks multiply the length by the width by the depth (All in inches) and divide the result by 231. The answer is the capacity in gallons.

$31\frac{1}{2}$  gallons equals one barrel.

B.T.U. (British Thermal Unit) is the amount of the heat required to raise one pound of water one degree Fahrenheit.

A ton of refrigeration is measured by the displacement of the amount of heat required to melt a ton of ice in 24 hours. One motor horsepower of an electrically powered unit is normally required to produce one ton of refrigeration. 12,000 B.T.U. equals one tone.

Kilowatts multiplied by 1.3405 equal horsepower.

## WEIGHTS & MEASURES

1 cubic inch of Cast Iron weighs	0.26 pounds
1 cubic inch Wrought Iron weighs	0.28 pounds
1 cubic inch Water weighs	0.036 pounds
1 inch of Water weighs	62.321 pounds
1 United States gallon weighs	8.33 pounds
1 Imperial gallon weighs	10.00 pounds
1 United States gallon equals	231.01 cubic inches
1 Imperial gallon equals	277.274 cubic inches
1 cubic foot of Water equals	7.48 U.S. gallons
1 gallon of water weighs	8.34 pounds
1 gallon equals	.1337 cubic feet
1 gallon equals	.1074 bushels
1 cubic foot equals	.8032 bushels
1 barrel (oil) equals	42 gallons
1 barrel (water) equals	31.5 gallons

Pressure in pounds per square inch of column of water equals .434 times the height of the column in feet.

## AREAS

Square foot area of surface equals square of one side multiplied by factors shown.

Regular Shaped	Number of Sides	Factor
Equilateral Triangle	3	.433
Pentagon	5	1.721
Hexagon	6	2.598
Heptagon	7	3.634
Octagon	8	4.828
Nonagon	9	6.182
Decagon	10	7.694
Undecagon	11	9.366
Dodecagon	12	11.196

TABLES – For Use in Area and Content Capacity Computations

Capacity of Circular Tanks – Per Foot of Height in Gallons & Bushels

Diameter in Feet	Circum.	Square Foot Area	Gallons	Bushels	Barrels (Oil) (Oil-42 gals. Ea.)
3	9.42	7.07	53	6	1.26
4	12.57	12.57	94	10	2.24
5	15.71	19.63	147	16	3.5
6	18.85	28.27	212	23	5.0
7	21.99	38.48	288	31	6.8
8	25.13	50.27	376	42	9.0
9	28.27	63.62	477	51	11.3
10	31.42	78.54	587	63	14.0
11	34.56	95.03	711	76	16.9
12	37.69	113.10	846	91	20.2
13	40.84	132.73	993	107	23.7
14	43.98	153.94	1,151	124	27.4
15	47.12	176.72	1,322	142	31.5
16	50.26	201.06	1,504	162	35.8
17	53.41	226.98	1,698	182	40.4
18	56.55	254.47	1,903	204	45.3
19	59.69	283.53	2,121	228	50.5
20	62.83	314.16	2,350	252	56.0
21	65.97	346.36	2,591	278	61.7
22	69.12	380.13	2,843	305	67.7
23	72.26	415.48	3,108	334	74.0
24	75.40	452.39	3,384	364	80.6
25	78.54	490.87	3,672	394	87.4
26	81.68	530.93	3,971	427	94.6
27	84.82	572.56	4,283	460	102.0
28	87.97	615.75	4,606	495	109.7
29	91.11	660.52	4,941	531	117.6
30	94.25	706.86	5,287	568	125.8
31	97.39	754.77	5,646	606	134.4
32	100.53	804.25	6,016	646	143.2
33	103.67	855.30	6,398	687	152.3
34	106.81	907.92	6,791	730	161.6
35	109.96	962.11	7,197	773	171.3
36	113.10	1,017.88	7,614	818	181.3
37	116.24	1,075.21	8,043	864	191.5
38	119.38	1,134.11	8,483	911	202.0
39	122.52	1,194.59	8,936	960	212.7
40	125.66	1,256.64	9,400	1,010	223.8

To find the capacity in barrels (oil) = Diameter squared x height.

To find the capacity in gallons = Diameter squared x 5.8748 x height  
(Diameter & height in feet).

## AREAS AND MEASUREMENTS

To find the circumference of a circle, multiply the diameter by 3.1416.

To find the diameter, multiply circumference by 0.3183 or divide circumference by 3.1416.

To find the radius, multiply circumference by 0.15915.

To find the side of an inscribed square, multiply the diameter by 0.07071 or multiply the circumference by 0.2551.

To find the side of an equal square, multiply the diameter by 0.8863 or multiply the circumference by 0.2821.

Square: A side multiplied by 1.1142 equals the diameter of its circumscribing circle.

A side multiplied by 4.443 equals the circumference of its circumscribing circle.

A side multiplied by 1.126 equals the diameter of an equal circle.

A side multiplied by 3.547 equals circumference of an equal circle.

To find the area of a circle, multiply the circumference by one-quarter of the diameter or multiply the square of the diameter by 0.7854 or multiply the square of the circumference by 0.07958 or multiply the square of one-half of the diameter by 3.1416.

To find the surface of a sphere or globe, multiply the diameter by the circumference or multiply the square of the diameter by 3.1416 or multiply four times the square of the radius by 3.1416.

To find tank capacities, diameter square x .0034 = gallons per inch of height – Base 42 gallons per barrel.

To find area of a triangle – multiply base by  $\frac{1}{2}$  perpendicular height.

To find area of an ellipse – product of both diameters x .7854.

To find area of a parallelogram – base x altitude.

To find cu. inches in a ball – multiply cube of diameter by .5236.

To find cubic contents of a cone – multiply area of base by one-third the altitude.

Area of rectangle equals length multiplied by width.

Surface of frustum of cone or pyramid equals sum of circumference of both ends x  $\frac{1}{2}$  slant height plus area both ends.

Contents of frustum of cone or pyramid: multiply area of two ends and get square root – add the two areas and time  $\frac{1}{3}$  altitude.

## CONVERSION TABLES

To convert bushels to ton, multiply number of bushels by 60 and divide the product by 2000 (average maximum weight of commodities 60 pounds per bushel.)

To convert gallons to bushels, divide gallons by 9.35. Answer in bushels.

To convert cubic measure into bushels, multiply by 0.8035.

To find capacity of cylindrical tanks standing on end: To find the capacity in cubic feet of a round tank or cistern, multiply the square of the average diameter by the depth and multiply the product by .785.

SEC. = 1 SQ. MILE = 640 ACRES

4 furlongs 40 ch. 160 rods 2640 feet <b>NW 1/4</b> 160 ACRES				2 furlongs 80 ACRES		20 chains 80 ACRES	
4 furlongs	160 rods			80 rods	1320 feet		
10 chains	2 furlongs 20 ACRES 1320 feet		660 ft. 20 AC.	40 rods 20 AC.	20 chains 40 ACRES N.W.S.E.		80 rods 40 ACRES N.E.S.E.
1 furlong	20 chains 20 ACRES 80 rods		<b>SW 1/4</b>		20 chains 40 ACRES S.W.S.E.		20 chains 40 ACRES S.W.S.E.
40 rods 5 ACRES	20 rds	330 ft.	1 furlong	10 chains	20 chains 40 ACRES S.W.S.E.		1320 feet 40 ACRES S.W.S.E.
660 ft. 5 ACRES	5A	5A	10A	10A	40 ACRES		40 ACRES
10A	10A	10A	10A	<b>SE 1/4</b>		1320 feet	2 furlongs
1 furlong	10 chains		40 rods	660 ft.	1320 feet		2 furlongs

1 MILE = \* FURLONGS

1 LINK 7.92 inches

1 FOOT 12 inches

1 YARD 36 inches  
3 feet

1 ROD OR POLE 16.5 feet  
5.5 yards  
25 links  
66 ft.

1 CHAIN 100 links  
4 rods

1 FURLONG 40 Rods  
660 Feet

1 Mile 5280 Feet  
320 rods  
80 chains  
8 furlongs

320 RODS 5280 Feet

1 SQUARE FOOT 144 sq. inches

1 SQUARE YARD 9 sq. feet

1 SQUARE ROD 272.25 sq. feet  
30.25 sq. yards

1 ACRE 43560 sq. feet  
160 sq. rods  
10 sq. chains

1 ACRE is about 208.75 feet square, or 8 rods wide by 20 rods long, or any two numbers of rods whose product is 160.  
Example: 25 x 125 ft. = 0717 acre

1 SQUARE MILE OR 1 SECTION EQUALS 640 ACRES

1 TOWNSHIP 36 sq. miles Or 36 sections  
1 TOWNSHIP 6 MILES SQ.