

FO-2213 Forest Measurements  
**Topic 10: Log Rules for Board Foot Volume**

**Chapter 6**

**Log:** a portion of a tree that is 8 ft or more in length; i.e. round wood portion of a tree.

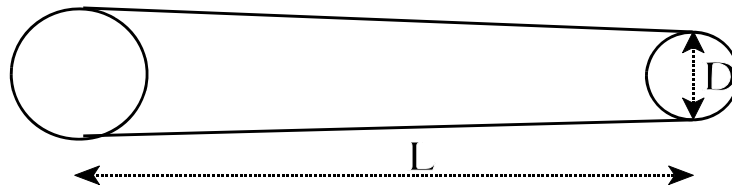
**Scaling:** the process of measuring volumes of individual logs.

**Units of Measure:**

cubic foot =  $\text{ft}^3 = 12 \text{ in.} \times 12 \text{ in.} \times 12 \text{ in.} = 1,728 \text{ cubic inches.}$

cord = stack of wood that is 8 ft long x 4 ft high that contains 4 ft sticks  
=  $128 \text{ ft}^3$  of wood, bark, and airspace.

board foot = a plank that is 1 in. thick, 12 in. wide, and 1 ft long  
= Thickness (inches) x Width (inches) x Length (ft)/12



**Scaling diameter (D)** = diameter inside bark at the small end of the log rounded to the nearest 1 inch class.

**Scaling length (L)** = length of the log in increments of 2 ft and the log must have a minimum of 0.3 ft of trim per log .

**Log Rule(s)/Equations:**

$$\text{Doyle Board Feet} = (D - 4)^2 L / 16$$

Was originally developed by a Preacher (Edwin Doyle, 1825) and has no mathematical basis. Under scales small logs and over scales large logs.

$$\text{Scribner Board Feet} = (0.79D^2 - 2D - 4)L / 16$$

Was originally developed by a store keeper (J.M. Scribner, 1846) as a diagram log rule; i.e. log diameter was drawn on a sheet of paper to proper scale dimensions with thickness of boards and 0.25" saw kerf. The sum of the board volumes became the log volume. Doyle and Scribner will equal volumes at approximately 26 inches.

International 1/4 Board Feet	= 0.199D <sup>2</sup> - 0.6426D	4 ft. log
	= 0.398D <sup>2</sup> - 1.0850D - 0.2713	8 ft. log
	= 0.597D <sup>2</sup> - 1.3290D - 0.7143	12 ft. log
	= 0.796D <sup>2</sup> - 1.3740D - 1.2295	16 ft. log

Int'l 1/4 Equation Taper = 0.5 inches per 4 ft. section

Originally developed by Judson Clark (1906) as a mathematical formula assuming a 1/8 inch sawkerf and 1/2 inch of taper per 4 ft of length. The Int'l 1/4 log rule assumes 1/4 inch sawkerf and 1/16 inch for shrinkage or 5/16 inches total deduction. Volumes with the Int'l 1/4 inch log rule approximate lumber tally from a sawmill.

There are no direct equations for Int'l 1/4 inch volumes for log lengths that are not multiples of 4 ft., so you must use the 4 ft. equation or a portion of it and then increase the scaling diameter of the remaining log segment by 0.5 inches per 4 ft. and utilize the appropriate log equation above. The equations for International 1/4 log volume are thus:

$$10 \text{ ft. log} = 0.5(0.199D^2 - 0.6420D) + 0.398(D+0.25)^2 - 1.0850(D+0.25) - 0.2713$$

$$14 \text{ ft. log} = 0.5(0.199D^2 - 0.6420D) + 0.597(D+0.25)^2 - 1.3290(D+0.25) - 0.7143$$

$$18 \text{ ft. log} = 0.5(0.199D^2 - 0.6420D) + 0.796(D+0.25)^2 - 1.3740(D+0.25) - 1.2295$$

$$20 \text{ ft. log} = [0.199D^2 - 0.6420D] + 0.796(D+0.5)^2 - 1.3740(D+0.5) - 1.2295$$

### Local Customs:

Since the Doyle Log Rule under-scales small logs, there is a local custom in the South to “give-a-bark and take-a-bark”. This means that scaling diameter is computed as DOB minus 1 bark thickness then rounded to nearest full inch. For example if DOB = 13.0 inches and 1x-bark = 0.4 then scaling diameter = 13.0 - 0.4 = 12.6 rounded to 13 inches scaling diameter. Diameters are rounded at the 0.6 inch mark, not the 0.5 inch mark.

**Overrun vs. Underrun:** the difference between mill tally and log scale expressed as a percentage of log scale.

$$\% \text{ Over / Under run} = \left[ \frac{\text{mill tally} - \text{log scale}}{\text{log scale}} \right] \times 100\%$$

The Doyle log rule will generally result in overruns of 20-60% and the Scribner log rule less than 20% overrun. The Int'l 1/4 inch log rule will be close to mill tally or will yield an underrun if the mill is not real efficient.