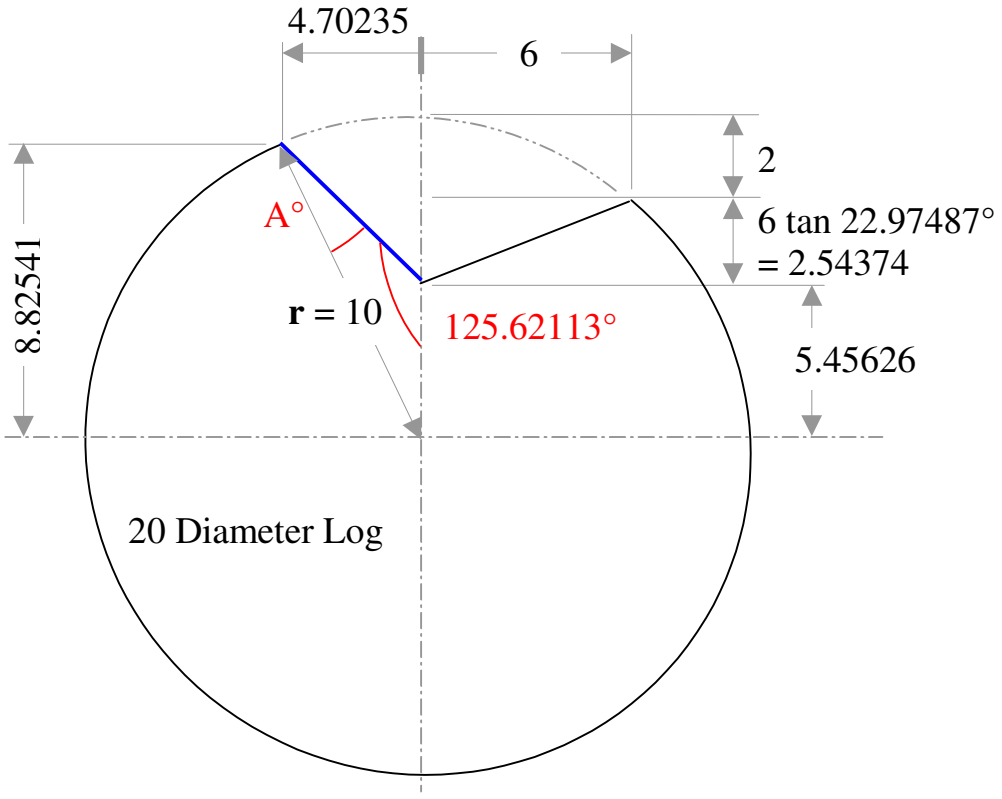
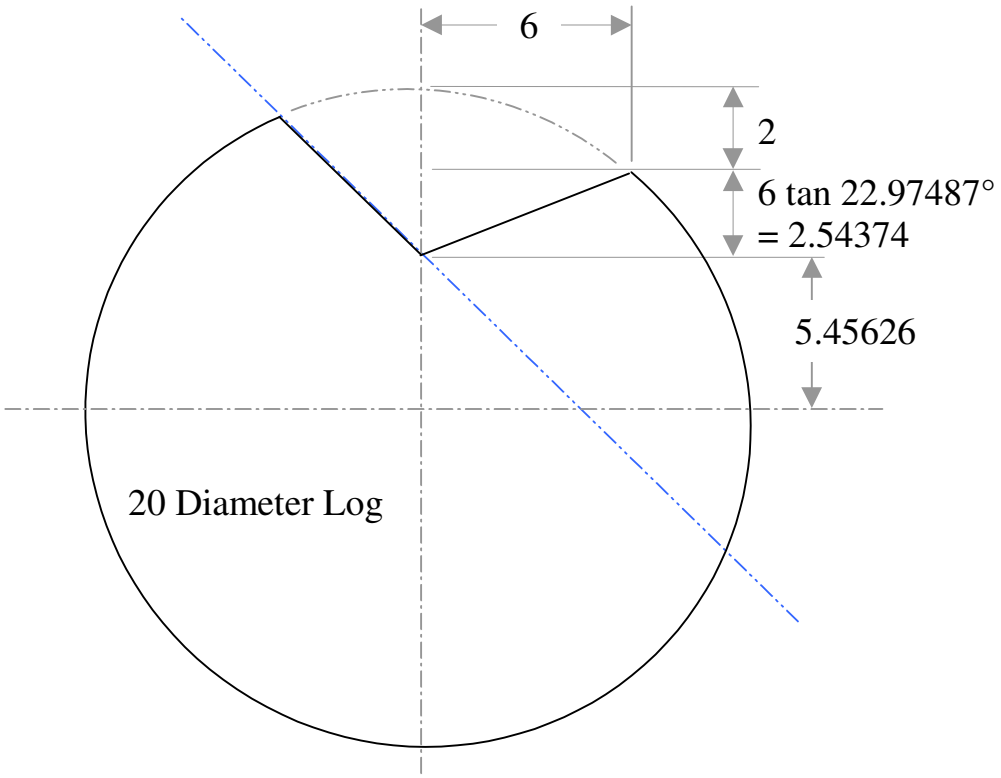
IRREGULAR BACKING ANGLE LAYOUT
Layout about the Centerline



Main Pitch = 10 / 12
Adjacent Pitch = 13 / 12
Total Deck Angle = 90°
Main Backing Angle = 22.97487°
Adjacent Backing Angle = 35.62113°

Sagitta = $10 - \sqrt{10^2 - 6^2} = 2$
Dimension from origin to sagitta = $\sqrt{10^2 - 6^2} = 8$
Dimension from origin to trough = 8 – 2.54374 = 5.45626
13 / 12 Side Backing Angle = 35.62113°
Angle from Plumb = 125.62113°
sin A° = 5.45626 × sin 125.62113° ÷ 10 = .44353
A° = arcsin (.44353) = 26.32933°
Angle between Plumb and Line on Roof Plane
= 180° – (125.62113° + 26.32933°) = 28.04954°
Line on Roof Plane = 10 × sin 28.04954° ÷ sin 125.62113° = 5.78476
5.78476 cos 35.62113° = 4.70235
Dimension above Centerline = $\sqrt{10^2 - 4.70235^2} = 8.82541$

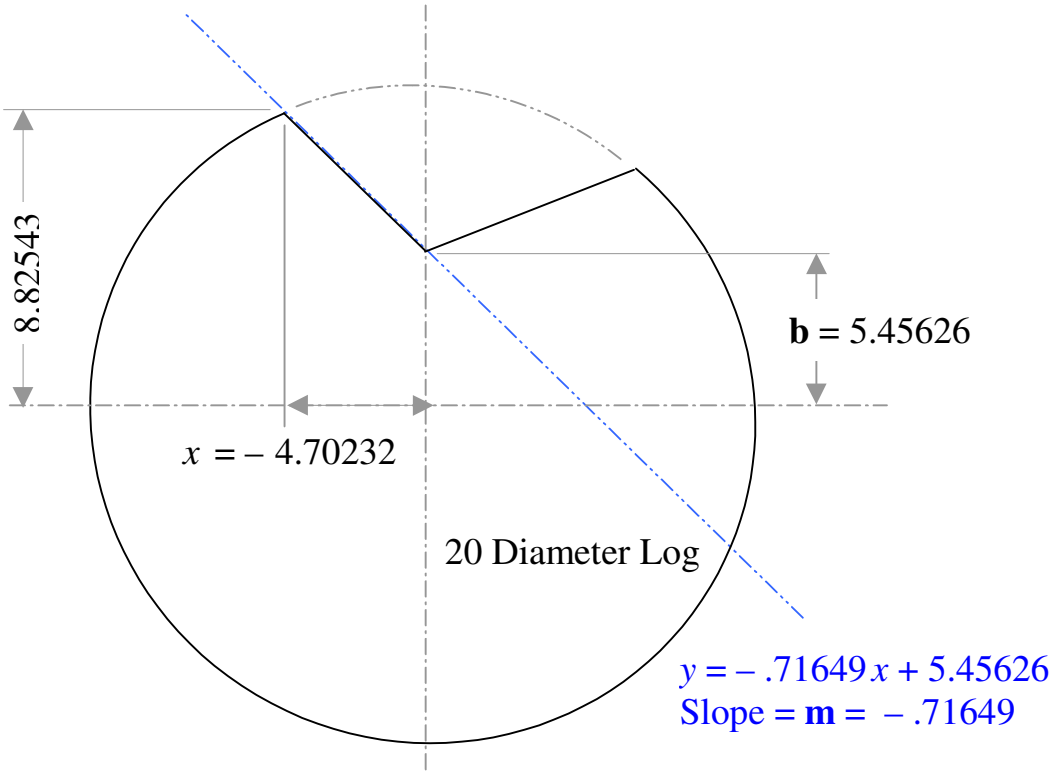
IRREGULAR BACKING ANGLE LAYOUT
Layout about the Centerline



Main Pitch = 10 / 12
Adjacent Pitch = 13 / 12
Total Deck Angle = 90°
Main Backing Angle = 22.97487°
Adjacent Backing Angle = 35.62113°

Sagitta = $10 - \sqrt{10^2 - 6^2} = 2$
Dimension from origin to sagitta = $\sqrt{10^2 - 6^2} = 8$
Dimension from origin to trough = 8 – 2.54374 = 5.45626
Equation of Circle with center at the Origin: $x^2 + y^2 = \mathbf{r}^2$
Equation of Straight Line: $y = \mathbf{m}x + \mathbf{b}$
13 / 12 Side Backing Angle = 35.62113°
r = 10 **m** = – tan 35.62113° = – .71649 **b** = 5.45626

IRREGULAR BACKING ANGLE LAYOUT
Layout about the Centerline



Equation of Circle: $x^2 + y^2 = 100$, therefore $y = \sqrt{100 - x^2}$
Since the circle and line intercept:
$\sqrt{100 - x^2} = -.71649\,x + 5.45626$
$100 - x^2 = .51336\,x^2 - 7.81871\,x + 29.77077$
$1.51336\,x^2 - 7.81871\,x - 70.22923 = 0$
Solving using the General Quadratic Formula: $x = \dfrac{-\mathbf{b} \pm \sqrt{\mathbf{b}^2 - 4\mathbf{ac}}}{2\mathbf{a}}$

where **a** = 1.51336 **b** = – 7.81871 **c** = – 70.22923

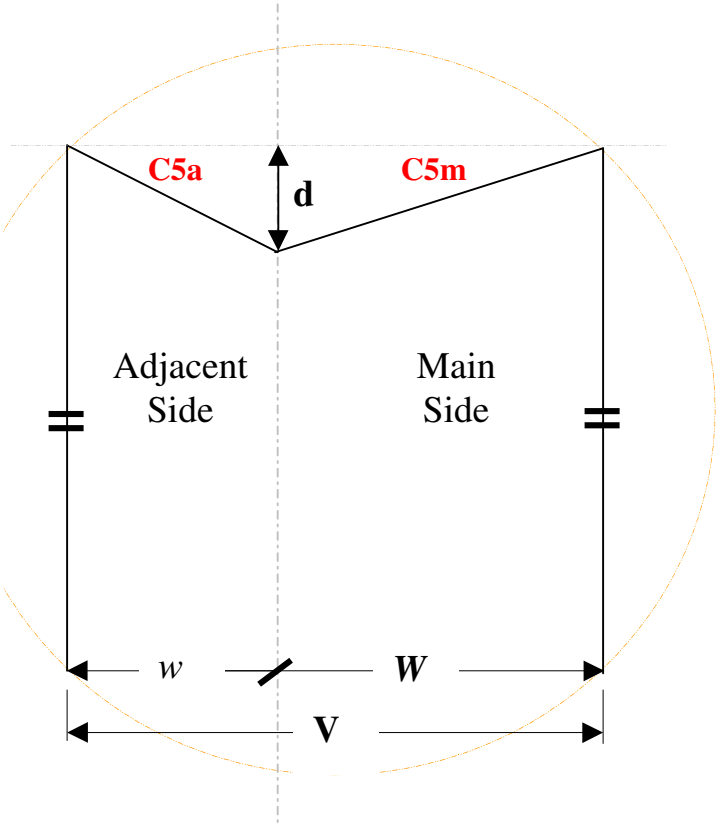
$$x = \frac{7.81871 \pm \sqrt{(-7.81871)^2 - (4 \times 1.51336 \times -70.22923)}}{2 \times 1.51336}$$

$x = 9.86878$ or $x = -4.70232$
Since the intercept is to the left of the origin, we select $x = -4.70232$

$y = \sqrt{100 - (-4.70232)^2} = 8.82543$
$y = -.71649 \times (-4.70232) + 5.45626 = 8.82543$

OFFSETTING the VALLEY TROUGH LINE

In the event that the pitches and deck angles are irregular, this layout will force the transverse axis (width) of the Valley to be at right angles to the length. Subsequent joinery is simplified, and as an aesthetic consideration, equal arcs will be visible on each side of the log Valley rafter.



Cross Section through Valley Rafter

Overall **VALLEY WIDTH** = **V** = ***W*** + *w*

W = **V** tan **DD** ÷ (tan **DD** + tan **D**)

w = **V** tan **D** ÷ (tan **DD** + tan **D**)

Consider two Valley peaks that meet at a center post. A similar calculation with the **R4B** angles can be carried out directly on the Valley rafter.

W = **V** tan **R4Bm** ÷ (tan **R4Bm** + tan **R4Ba**)

w = **V** tan **R4Ba** ÷ (tan **R4Bm** + tan **R4Ba**)

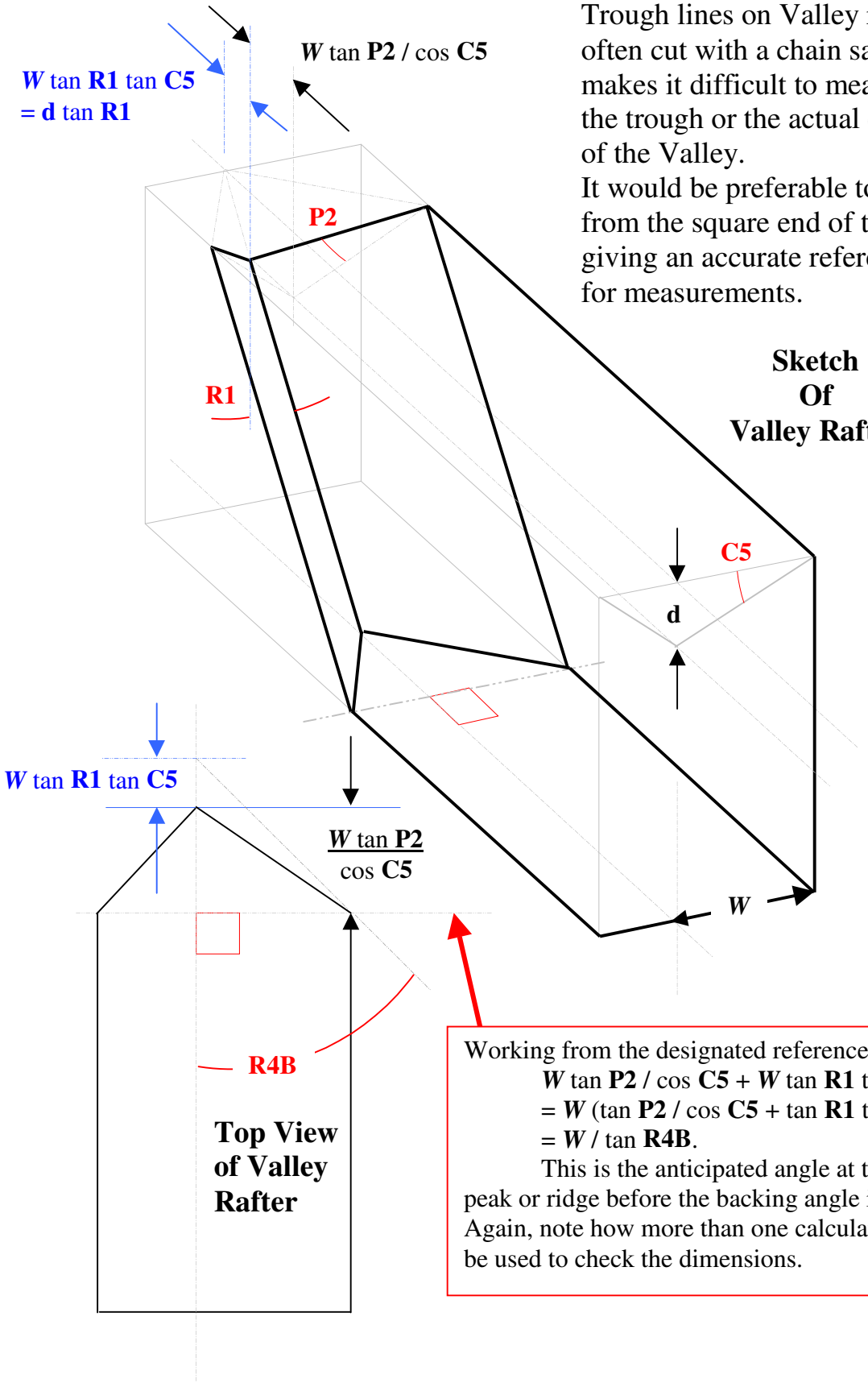
Both sets of calculations return the same respective values for ***W*** and *w*. Assume that the Main side pitch is the lesser value, hence **DD** is greater than **D**. Common sense dictates that ***W*** should be greater than *w*.

The figures may further be checked using the formula:

d = ***W*** tan **C5m** = *w* tan **C5a**

In other words, there can only be one resulting dimension for the trough line depth. **Note how the dimensions can always be double-checked, since they are linked by more than one set of angles**.

VALLEY PEAK: MOVING the WORKING POINT



Trough lines on Valley rafters are often cut with a chain saw. This makes it difficult to measure from the trough or the actual end point of the Valley.
It would be preferable to work from the square end of the stock, giving an accurate reference point for measurements.

Sketch Of Valley Rafter

Working from the designated reference line
W tan **P2** / cos **C5** + ***W*** tan **R1** tan**C5**
= ***W*** (tan **P2** / cos **C5** + tan **R1** tan**C5**)
= ***W*** / tan **R4B**.
This is the anticipated angle at the Valley peak or ridge before the backing angle is cut. Again, note how more than one calculation may be used to check the dimensions.