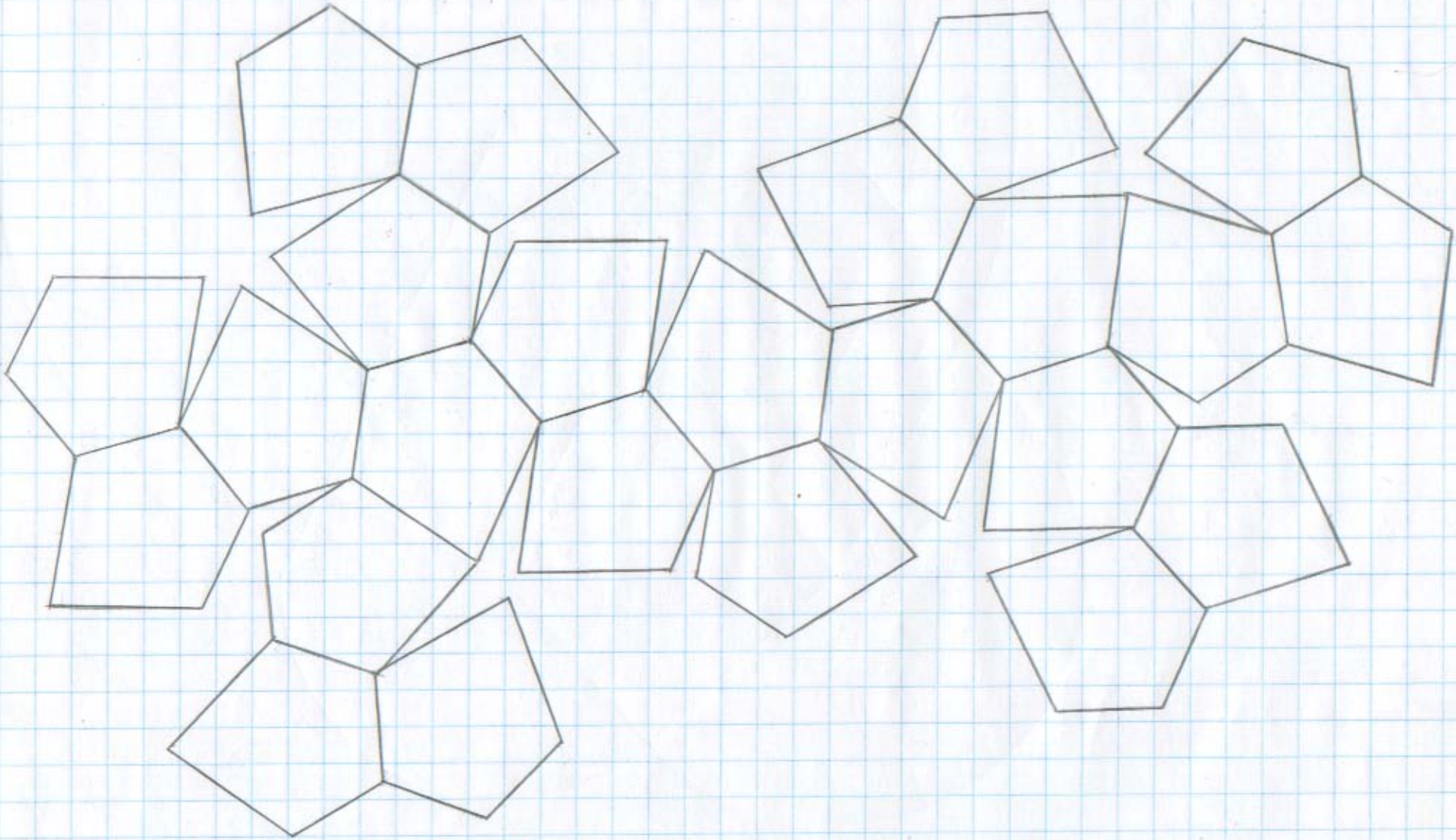
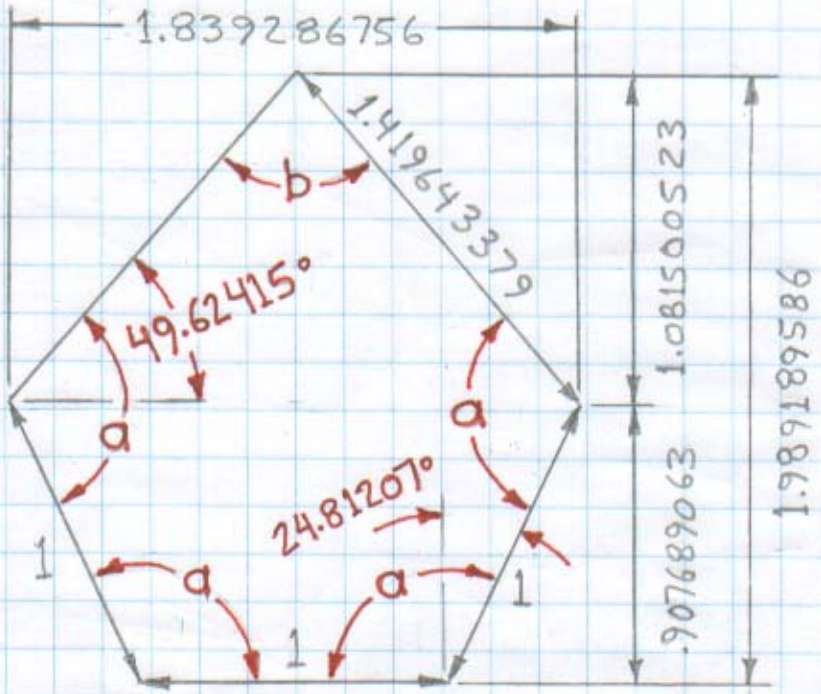
Development of Pentagonal Icositetrahedron (dextro or right-handed)

A larger printable version may be downloaded from:

http://mathworld.wolfram.com/pdf/PentagonalIcositetrahedron.pdf



Pentagonal Face Dimensions

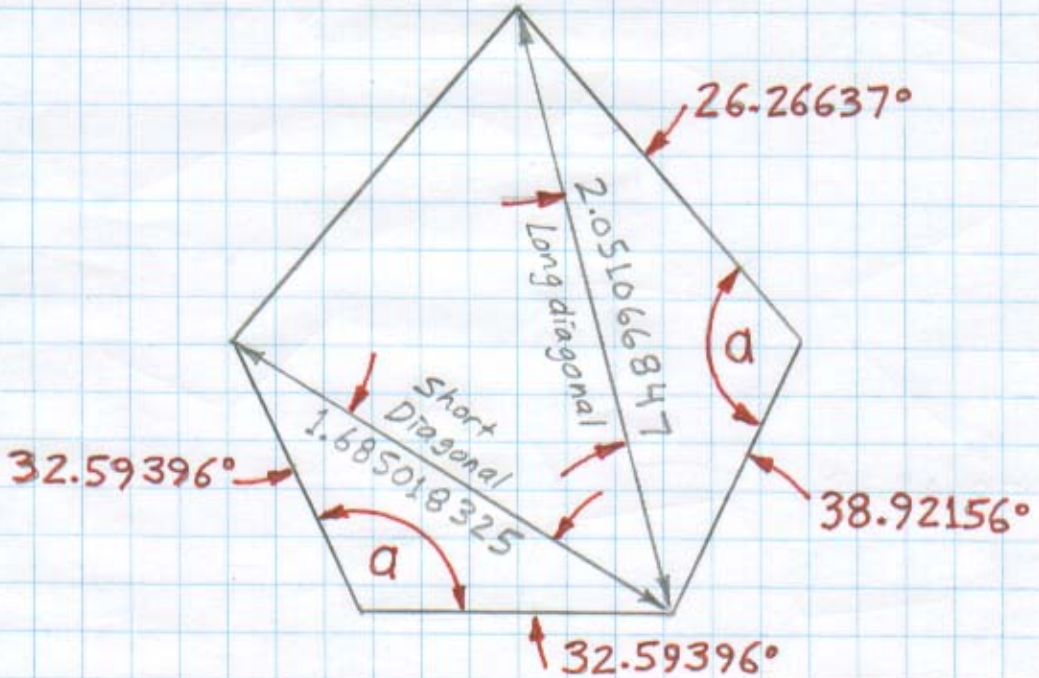


$$t = \frac{1}{3}\left(1 + \sqrt[3]{19 - 3\sqrt{33}} + \sqrt[3]{19 + 3\sqrt{33}}\right)$$

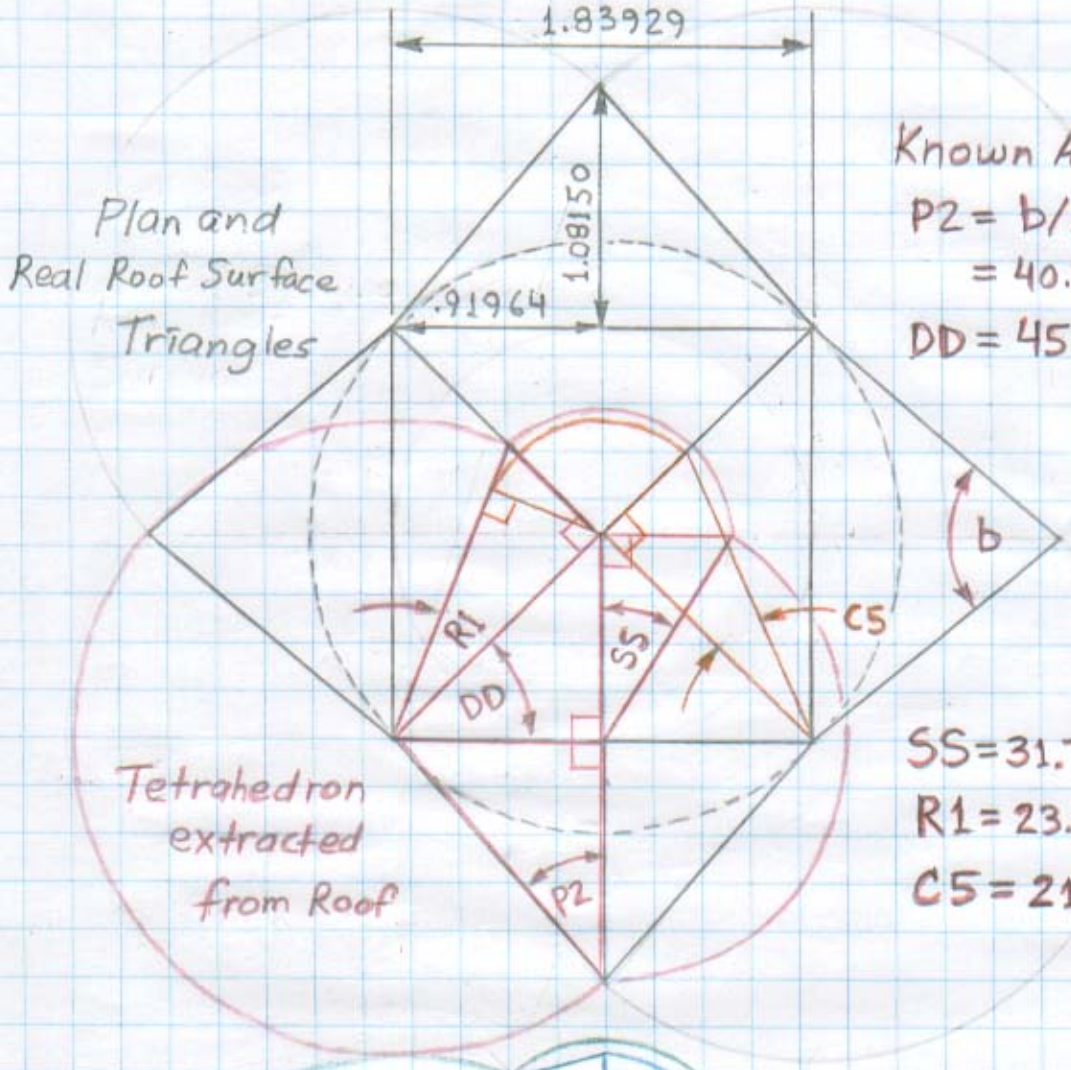
$$a = \arccos\left(\tfrac{1}{2}(1-t)\right) = 114.81207^\circ$$

$$b = \arccos(2-t) = 80.75170208^\circ$$

Ref: http://mathworld.wolfram.com/PentagonalIcositetrahedron.html



Developments of 4x80.75170° Vertex



Plan and Real Roof Surface Triangles

Tetrahedron extracted from Roof

Known Angles:

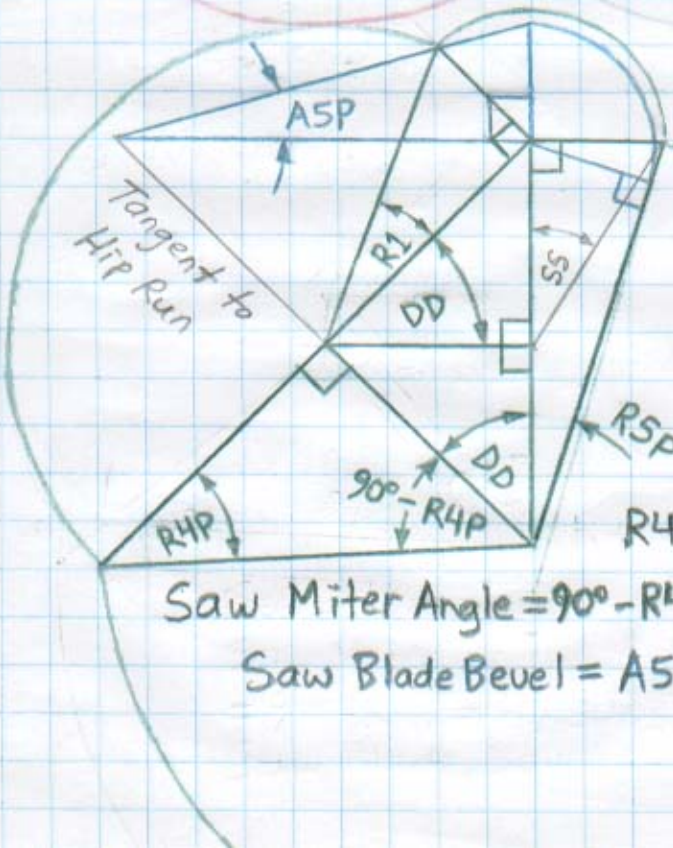
P2 = b/2
= 40.37585°

DD = 45°

SS = 31.75131°

R1 = 23.63386°

C5 = 21.84538°



Saw Miter and Saw Blade Bevel Angles for dowel (= unbacked Hip Rafter)

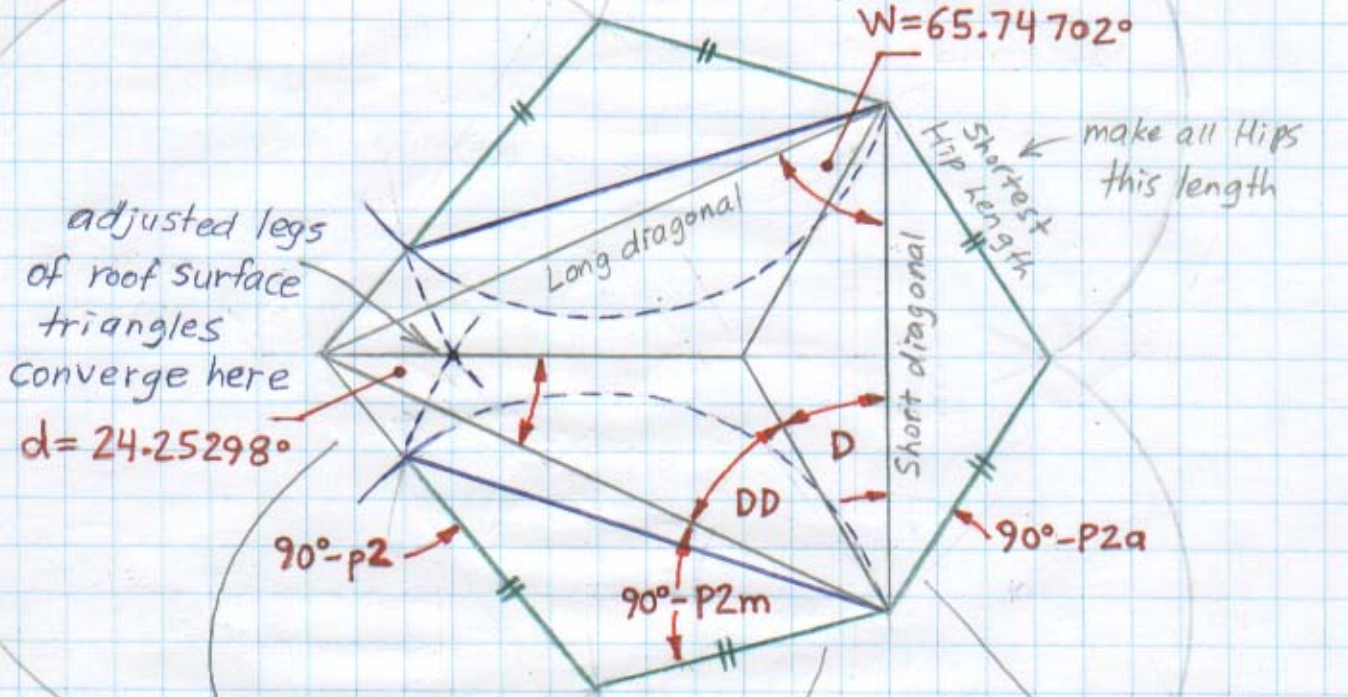
R4P = 42.49361°

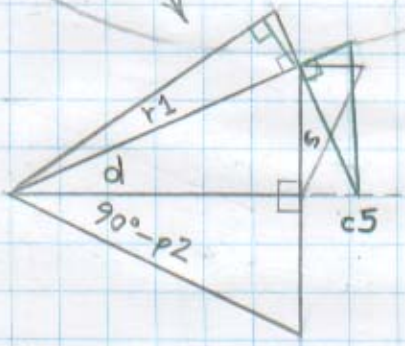
Saw Miter Angle = 90° - R4P = 47.50639°

Saw Blade Bevel = A5P = 16.46756°

Plan and Real Roof Surface Angles

Vertex formed by intersection of two unit edges and 1.41964 edge, 3x 114.81207 angles





Development #1

Known Angles: d and 90°-p2

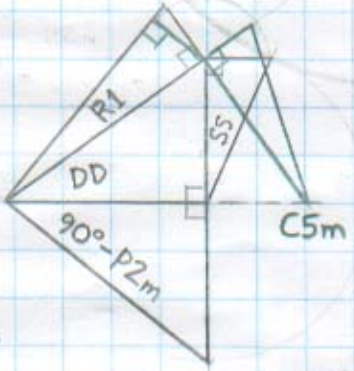
d = 24.25298°

90°-p2 = 26.26637°

s = 24.08702

r1 = 10.40547°

c5 = 21.84537°



Development #2

Known Angles: SS(=s) and 90°-P2m

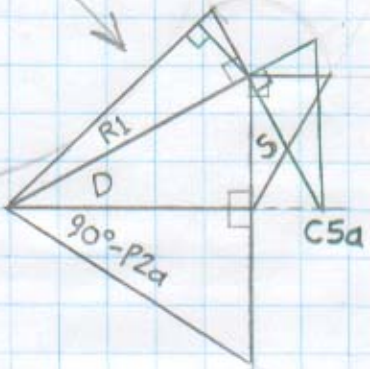
SS = 24.08702°

90°-P2m = 38.92156°

DD = 36.39787°

R1 = 14.85692°

C5m = 19.17807°



Development #3

Known Angles: D(=W-DD), R1 and 90°-P2a

D = 29.34914°

R1 = 14.85692°

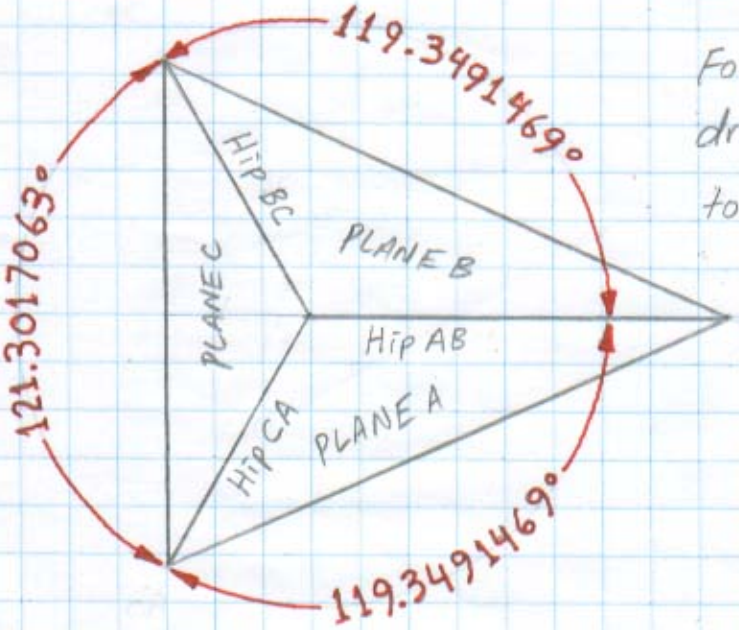
90°-P2a = 32.59396°

SS = 28.42373°

C5a = 24.51270°

Convergent or Compound Joint Calculator

Vertex formed by intersection of two unit edges and 1.41964 edge, 3× 114.81207° angles



Footprint is mirror of drawing on previous page to place Hip AB on the x-axis

Calculator Entries

Hip AB Rise = .183633123 Run = 1 Deck Angle = 0° ... x-axis to AB

Hip BC Rise = .265274605 Run = 1 Deck Angle = 119.3491469° AB to BC

Hip CA Rise = .265274605 Run = 1 Deck Angle = 121.3017063° BC to CA

Calculator Returns

Unit Convergence Vector **r**

$x = -.051939$ $y = 0$ $z = .99865$

Angle to Plumb Line (z-axis) = 2.977231°

$C5^* = 21.845383°$

$90° - P2^* = 32.593963°$

$DD^* = 30°$

$S5^* = 25.446475°$

$R1^* = 13.382706°$

Equal for all planes A, B and C

... agrees with geometry/trig on following page

Scientific Calculator

(dowel or unbacked Hip Rafter)

SAW MITER ANGLE

$90° - R4P^* = \arctan(\tan DD^* / \cos R1^*)$

$= 30.687663°$

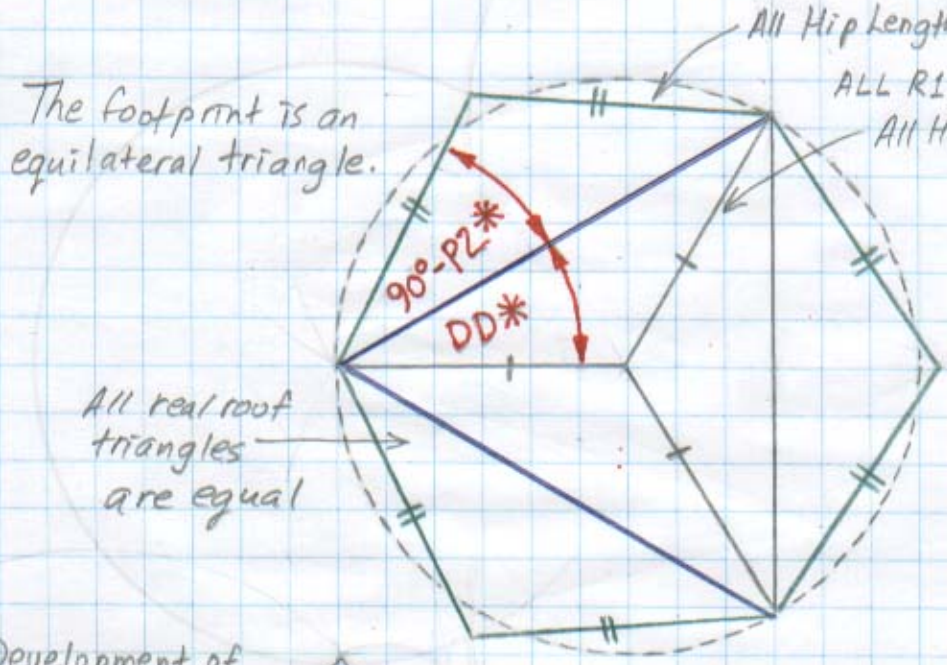
SAW BLADE BEVEL

$ASP^* = \arcsin(\sin R1^* \cos DD^*) = 11.562300°$

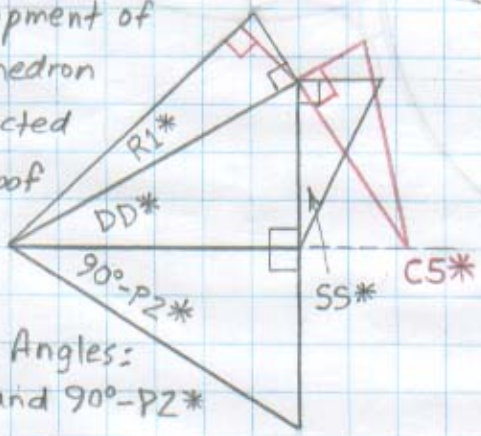
Inclined Deck : Plan and Real Roof Surface Angles

formed by intersection of two unit edges and 1.41964 edge

Note that this drawing also models the vertex formed by the intersection of three unit edges, 3 x 114.81207° angles



Development of Tetrahedron extracted from Roof



Known Angles:
DD* and 90°-PZ*

DD* = 30°

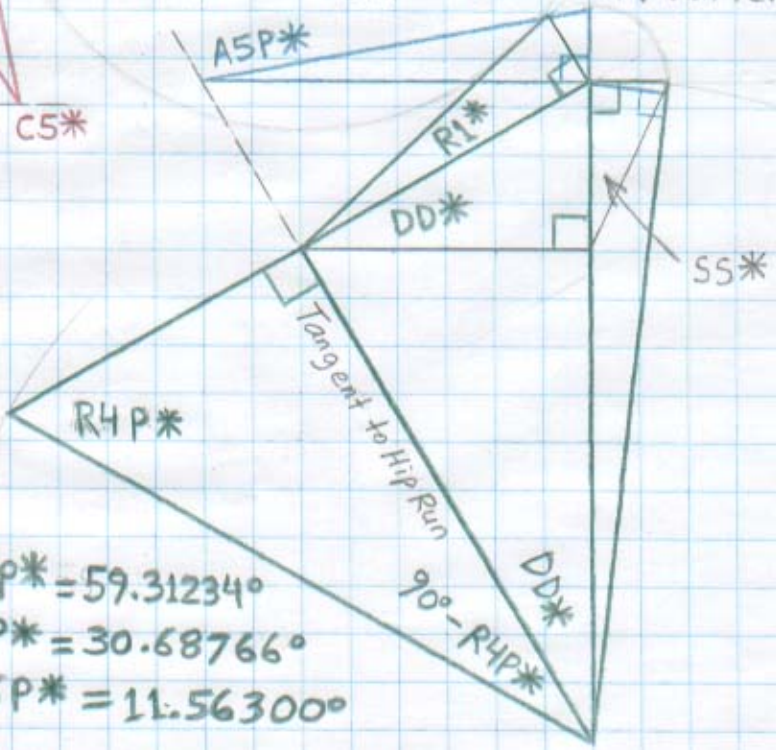
90°-PZ* = 32.59396°

SS* = 25.45647°

R1* = 13.38271°

C5* = 21.84538°

Saw Miter and Saw Blade Bevel Angles for dowel (= unbacked Hip Rafter)



R4P* = 59.31234°

Saw Miter Angle = 90° - R4P* = 30.68766°

Saw Blade Bevel = A5P* = 11.56300°