Hip/Valley Rafters meet Plumb Planes through Eaves/Ridges
R4B and R4P Angles on Bottom Shoulders of Hip/Valley Rafters

Definition of **Total Deck Angle** (equal to **DD + D**)

Valley Rafters: The **Total Deck Angle** is the angle measured between the **Valley Ridges**, on a level plane passing through the **Ridges**.

Hip Rafters: The **Total Deck Angle** is the angle measured between the **Hip Eaves**, on a level plane passing through the **Eaves**.

Note how the definition above affects the location of the **R4** angles on Hips and Valleys.The **R4** angles are projections of Deck angles **DD**, **D**, and their complements 90 – **DD** and 90 – **D**, to the bottom shoulder of a Hip or Valley Rafter.

> **R4B**m is a projection of **DD**
> **R4B**a is a projection of **D**
> **R4P**m is a projection of 90 – **DD**
> **R4P**a is a projection of 90 – **D**

> **R4B** angles are located near **Hip Eaves** or **Valley Ridges**.
> **R4P** angles are located near **Hip Peaks** or **Valley Feet**.

The **Main Side R4** values may be solved using:

> tan **R4B** = cos **R1** tan **DD**
> tan **R4P** = cos **R1** ÷ tan **DD**

Substitute **D** for **DD** to solve for the **Adjacent Side** values:

> tan **R4B** = cos **R1** tan **D**
> tan **R4P** = cos **R1** ÷ tan **D**

Examples of three cases are given:
Unequal Pitches meet at a Total Deck Angle = 90°
Equal Pitches meet at a Total Deck Angle ≠ 90°
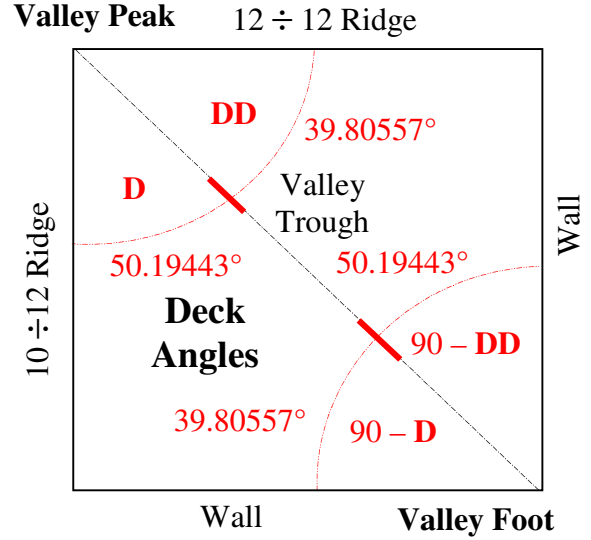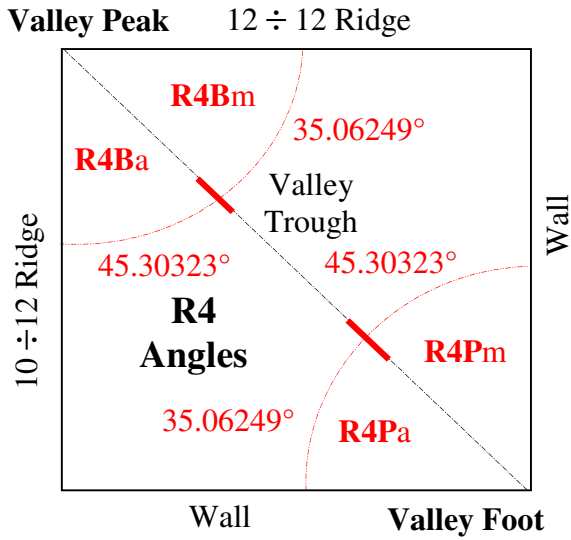Unequal Pitches meet at a Total Deck Angle ≠ 90°

The example selected for Unequal Pitches meet at a Deck Angle ≠ 90 degrees is a special case, a **Convergent Joint**, and the angles involved are measured with respect to an **Inclined Deck**.

Regardless of whether the work is done on a squared face or "on the round" with the layout on a cutting deck, **R4** values govern the layout on the bottom rafter shoulders.
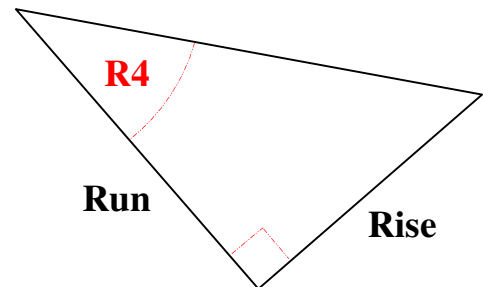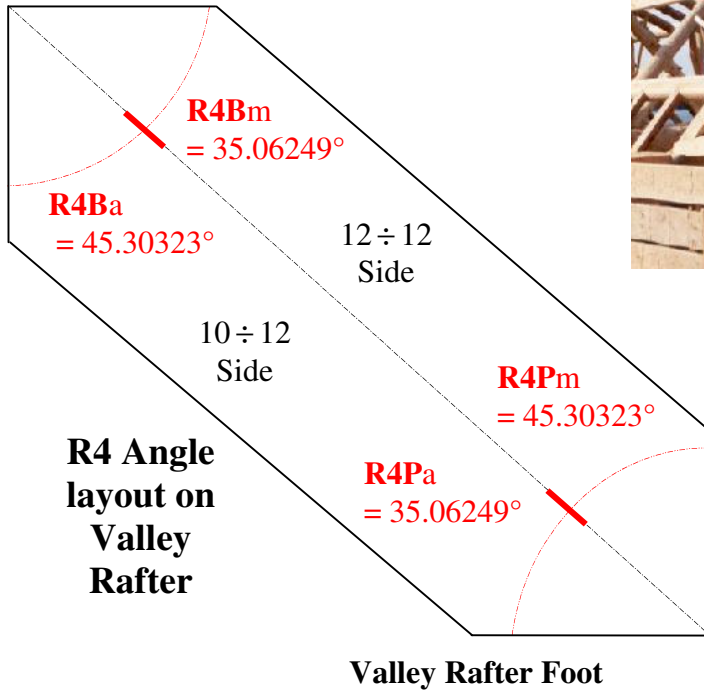
Valley Rafter
Main Pitch = 12 ÷ 12   Adjacent Pitch = 10 ÷ 12
Deck Angle between Ridges = 90°

Valley Peak   12 ÷ 12 Ridge

R4Bm

35.06249°

R4Ba

Valley
Trough

10 ÷ 12 Ridge

45.30323°   45.30323°

**R4
Angles**

35.06249°

R4Pm

R4Pa

Wall

Wall   **Valley Foot**

Valley Peak   12 ÷ 12 Ridge

DD

39.80557°

D

Valley
Trough

10 ÷ 12 Ridge

50.19443°   50.19443°

**Deck
Angles**

90 – **DD**

39.80557°

90 – **D**

Wall

Wall   **Valley Foot**

Above: Angles as seen in Plan

Valley Rafter Peak

R4Bm
= 35.06249°

R4Ba
= 45.30323°

12 ÷ 12
Side

10 ÷ 12
Side

R4Pm
= 45.30323°

**R4 Angle
layout on
Valley
Rafter**

R4Pa
= 35.06249°

Valley Rafter Foot

R4

Run

Rise

The **R4** angle **Run** lies on the
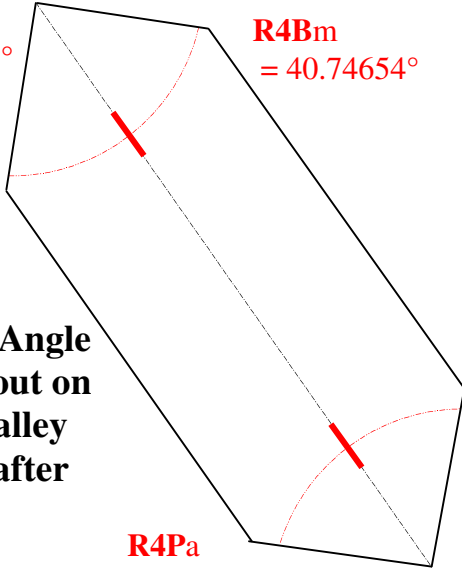long axis of the Hip/Valley.
Rise = Run × tan R4

More Valley Rafter Examples

Valley Rafter Peak at Ridges

R4Ba
= 40.74654°

R4Bm
= 40.74654°

**R4 Angle
layout on
Valley
Rafter**

R4Pm
= 40.74654°

R4Pa
= 40.74654°

Valley Rafter Foot at Eaves

Main Pitch = 10 ÷ 12
Adjacent Pitch = 10 ÷ 12
Deck Angle between Ridges = 90°

All Deck angles **DD**, **D** and
their complements = 45°
All **R4B** = **R4P** = 40.74654°

Valley Rafter Peak at Ridges
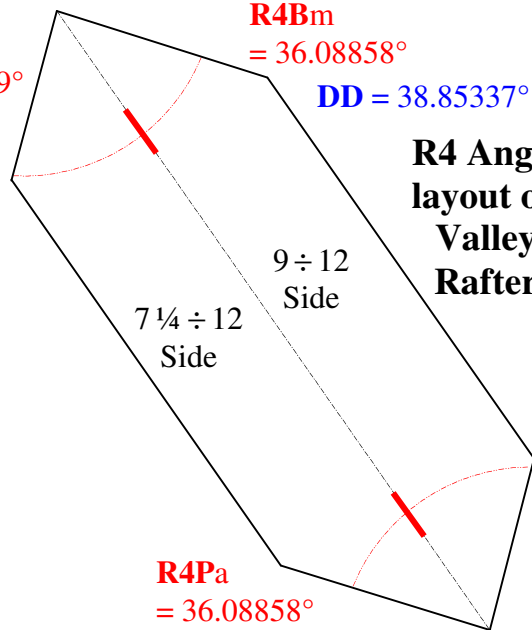
R4Ba
= 48.32249°
D = 51.14663°

R4Bm
= 36.08858°
DD = 38.85337°

**R4 Angle
layout on
Valley
Rafter**

$9 \div 12$
Side

$7 \tfrac{1}{4} \div 12$
Side

90 – **DD**
= 51.14663°

R4Pm
= 48.32249°

R4Pa
= 36.08858°

90 – **D** = 38.85337°

Valley Rafter Foot at Eaves

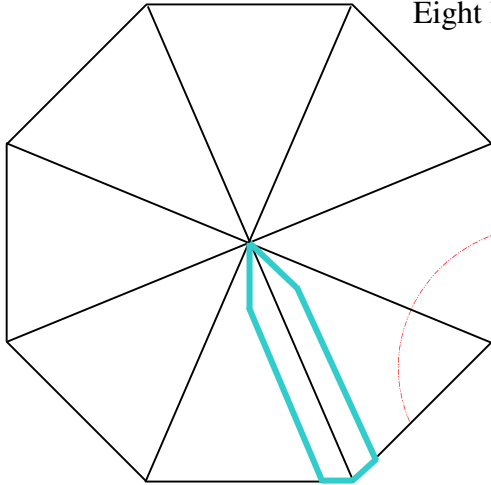**Main Pitch = 9 ÷ 12**
Adjacent Pitch = 7 ¼ ÷ 12
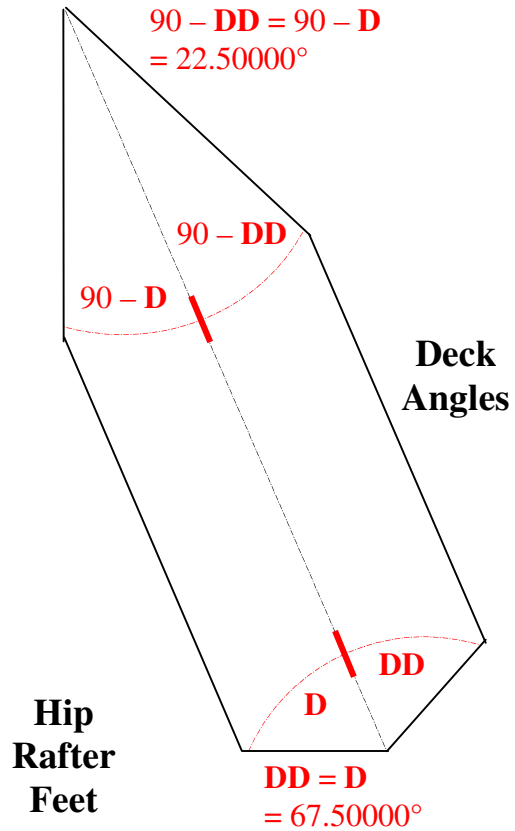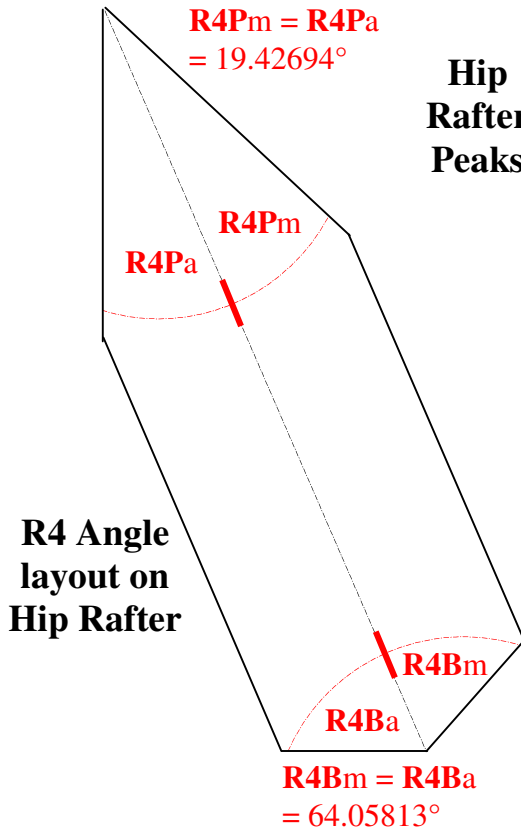**Deck Angle between Ridges = 90°**

Hip Rafter
Pitches of Triangular Planes
Main Pitch = Adjacent Pitch = 8 ÷ 12
Deck Angle between Eaves = 135°

### Gazebo Footprint: Regular Octagon
Eight Hip Rafters meet at the Center

Deck Angle
measured
between
Eaves
= 135°

R4Pm = **R4P**a
= 19.42694°

**Hip
Rafter
Peaks**

90 – **DD** = 90 – **D**
= 22.50000°

R4Pm

R4Pa

90 – **DD**

90 – **D**

**Deck
Angles**

**R4 Angle
layout on
Hip Rafter**

R4Bm

R4Ba

**Hip
Rafter
Feet**

DD

D
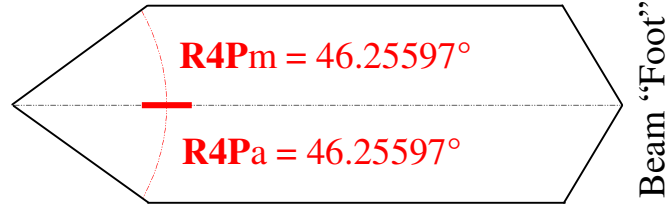
R4Bm = **R4B**a
= 64.05813°

DD = **D**
= 67.50000°

Unequal Pitches meet at Deck Angle ≠ 90°

Convergent Joint

Two 8 ÷ 12 Rafters meet two Beams Calculations are with respect to an **Inclined Deck**, all **R1** = 16.16075°. Refer to the material on this subject for information on how the values in the examples were determined.
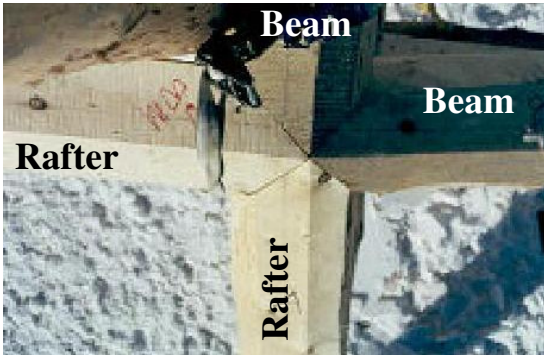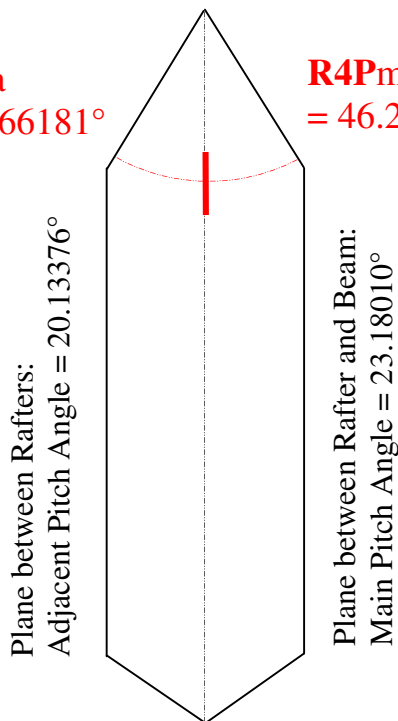

Plane between Beams:
Main Pitch Angle = 23.18010°

R4Pm = 46.25597°

R4Pa = 46.25597°

Plane Rafter and Beam:
Adjacent Pitch Angle = 23.18010°

R4Pa = 36.66181°

R4Pm = 46.25597°

Plane between Rafters: Adjacent Pitch Angle = 20.13376°

Plane between Rafter and Beam: Main Pitch Angle = 23.18010°

8 ÷ 12 Rafter "Foot"

Above: Beam

Main Pitch Angle = 23.18010°
Adjacent Pitch Angle = 23.18010°
Total Deck Angle at Beam "Foot"
= 85.18292°
Deck Angles at "Peak"
Main Side: 90 – **DD** = 47.40854°
Adjacent Side: 90 – **D** = 47.40854°

Left: 8 ÷ 12 Rafter

Main Pitch Angle = 23.18010°
Adjacent Pitch Angle = 20.13376°
Total Deck Angle at Beam "Foot"
= 94.81708°
Deck Angles at "Peak"
Main Side: 90 – **DD** = 47.40854°
Adjacent Side: 90 – **D** = 37.77438°