



Lesson #3: Roof Framing (20 class periods)

Objectives

Students will be able to...

- List and describe various types of roofs
- Identify the parts of a common rafter
- Understand how pitch and slope affect the installation of various roofing materials
- Layout and cut and install common rafters, cut and install ridge board
- Frame gable ends
- Build a scale model of a truss
- Layout a rafter either using the step-off method or rafter tables and cut it accurately
- Use basic geometry (Pythagorean theorem) to calculate rafter lengths
- Use a framing square, speed square, and rafter tables to order to layout a common rafter
- Describe compression and tension forces on roof frame
- Assess roof framing adherence to code, cleanliness, and accuracy (compared to the prints and to scale)

Standards

LS 11-12.6
RSIT 11-12.2
RLST 11-12.2
Writing 9-10.5
Geometry 5 & 8
Residential and Commercial Construction Pathway- D2.1, D2.2, D2.3, D3.1, D3.3, D3.5, D3.6, D3.7, D6.10, D6.11, D6.12, D6.13
Problem Solving and Critical Thinking 5.1, 5.2, 5.3
Health and Safety 6.2, 6.6, 6.7, 6.8, 6.10, 6.12
Responsibility and Leadership 7.3, 7.4, 7.5, 7.6, 7.7, 9.2, 9.3, 9.6, 9.7

Materials

Roof Types Power Point Presentation

<https://documentcloud.adobe.com/link/track?uri=urn%3Aaaid%3Ascds%3AUS%3Aea19c116-578d-48b3-9ecb-8f44725b2fad>

Roof Types Worksheet

Roof Type Picture Worksheet

Roof Framing Vocabulary Worksheet

Roof Framing Vocabulary PowerPoint

<https://documentcloud.adobe.com/link/track?uri=urn%3Aaaid%3Ascds%3AUS%3A2d99e27c-a65a-40fa-88d3-52097c949e85>

Parts of a Roof Worksheet

Roofing and Right Triangles Worksheet

Determine a Roof Pitch Handout

Laying out Common Rafters with a Square Handout

Using the Code Book: Roofing

Roof Framing Bill of Materials

Shed Prints

Roof Framing Order of Construction

Roof inspection grade sheet

Roof framing inspection guidelines

Correction Notice

Self-evaluation Form

Roof Framing Unit Final Test

Lesson Sequence

- Using the *Roof Types Power Point* introduce to students the different types of roofs. Have them fill in their *Roof Types Worksheet*.
- Using their roof types worksheet, have students identify the picture that corresponds with the roof type on the *roof type picture worksheet*.
- Pass out the *Roof Framing Vocabulary Worksheet*, and have students fill in the worksheet and you review the *Roof Framing Vocabulary Power Point Presentation*. Answer any questions students may have.
- Review the *Parts of a Roof Worksheet* as a class. Answer any questions students may have.
- Complete the *Roofing and Right Triangles Worksheet* together as a class.
- Pass out the *Determine a Roof Pitch* and *Laying out Common Rafters with a Square Handout*. Go over these together as a class. Have students highlight important information and answer any questions students have as you review them. Check for understanding through questioning.

BUILDING INDUSTRY TECHNOLOGY ACADEMY: YEAR TWO CURRICULUM

- Pass out the *Using the Code Book: Roofing worksheet* and have students work on this in teams. Then review together as a class. Answer any questions as needed.
- Model Roof Framing-In the shop show you all how the roof materials are going to be cut and assembled. As your students gather around the workbench, have a couple of roof lumber packages, as well as a prototype roof on display. You should have a model ready to be stacked, with several pre-cut rafters and frieze blocks prepared. Take one of the lumber bundles and explain that tomorrow, each construction company will receive their next draw. They will then purchase their roof framing lumber and begin their roofs. Say: today I am going to demonstrate how to layout, cut, and stack a conventionally framed roof.
- Have students fill out their accountant ledgers and get paid if they have a successful inspection.
- Pass out Roof Framing *Bill of Materials*. Also pass out the *Shed Prints* so students can create their list of materials.
- Pass out and review the *Roof Framing Order of Construction*. Have students begin building once they have their materials. When teams finish, instruct students to look over their *Inspection Grade Sheet* and *Roof Framing Guidelines*. Students may receive a *Correction Notice* if needed.
- Have students complete the *Self-Evaluation Form* and review for the *Roof Framing Unit Final Test*.
- Pass out the *Roof Framing Unit Final Test*.

Assessment

Informal assessment throughout the whole Wall framing project
Use rubrics and project guidelines to grade student's final projects
Use Wall Framing Unit Final to assess student learning of floor framing concepts

Accommodations/Modifications

Strategic Partner Pairing
One on One Support
Calculators
Extra Time If Needed
Additional Visuals
Check for Understanding

Roof Types Worksheet

Describe each roof either through our class discussions or on the Internet.

1. Flat:

2. Shed:

3. Gable:

4. A-Frame:

5. Hip:

6. Clerestory (Half Monitor):

7. Gambrel:

8. Gable and Valley:

BUILDING INDUSTRY TECHNOLOGY ACADEMY: YEAR TWO CURRICULUM

9. Hip and Valley:

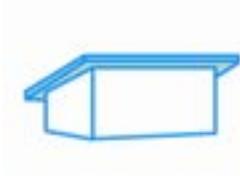
10. Mansard:

11. Butterfly:

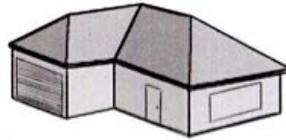
12. Dutch Hip:

Roof Types Picture Worksheet

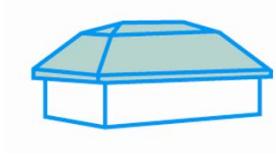
Directions: Fill in name of roof type online below drawing as you watch the PowerPoint Basic Roof Types.



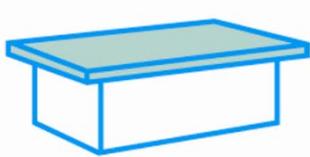
1. _____



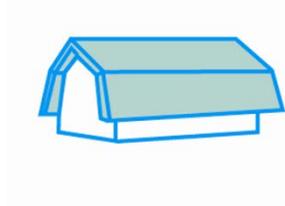
2. _____



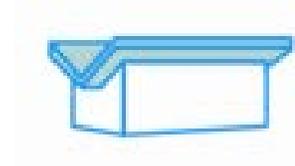
3. _____



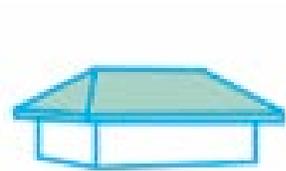
4. _____



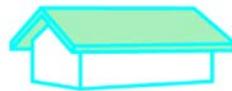
5. _____



6. _____



7. _____



8. _____



9. _____



10. _____



11. _____



12. _____

Roof Types Picture Worksheet – *Answer Key*

1. Shed
2. Hip and valley
3. Mansard
4. Flat
5. Gambrel
6. Butterfly
7. Hip
8. Gable
9. Half monitor or clerestory
10. Gable and valley
11. Dutch hip
12. A-frame

Roof Framing Vocabulary Worksheet

Fill in as you watch the PowerPoint Roof Framing Terms.

1. Conventional stack:

2. Truss:

3. Gable roof:

4. Hip roof:

5. Rafter:

6. Ridge:

7. Bird mouth:

BUILDING INDUSTRY TECHNOLOGY ACADEMY: YEAR TWO CURRICULUM

8. Plumb cut:

9. Tail:

10. Ceiling joist / collar tie:

11. Pitch/slope:

12. Chord:

13. Run:

14. Web:

15. Gusset/gang nail plots:

BUILDING INDUSTRY TECHNOLOGY ACADEMY: YEAR TWO CURRICULUM

16. Fink truss:

17. Scissors truss:

18. Gable truss:

19. Gable stud:

20. Frieze Block:

21. Purlin:

22. Sway Brace:

23. Span:

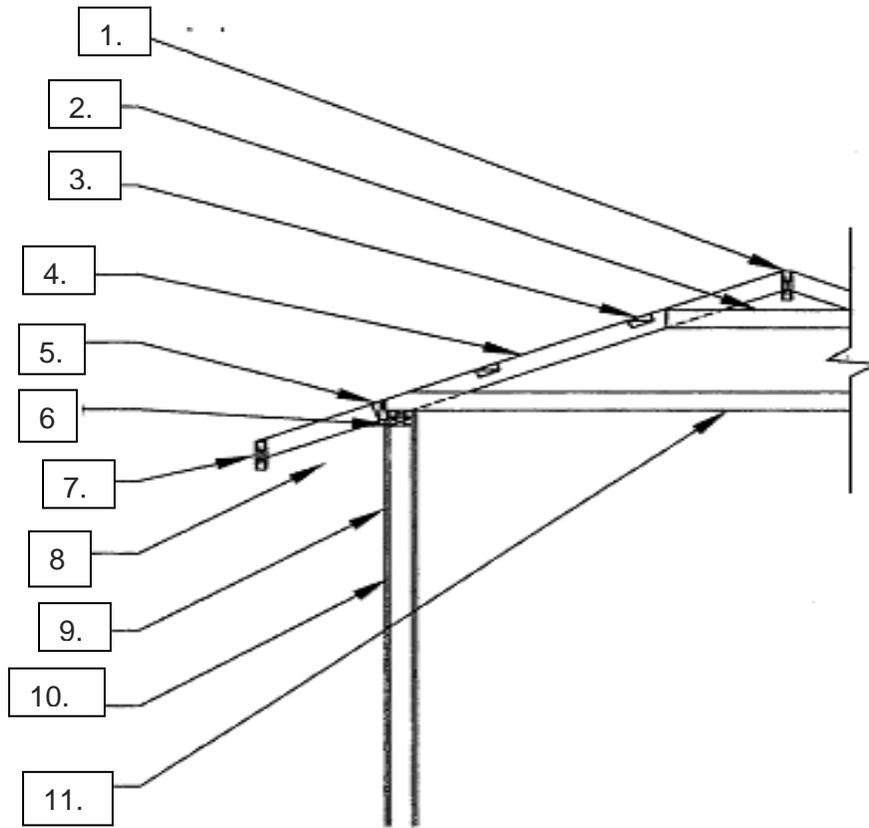
Roof Framing Vocabulary Worksheet – Answer Key

1. Conventional stack: **Uses rafters, ceiling joists and ridge. One of two types of roof framing used in residential construction.**
2. Truss: **a structure comprising one or more triangular units constructed with straight slender members whose ends are connected at joints referred to as nodes.**
3. Gable roof: **Water flows in two directions from a ridge (think Snoopy doghouse.) One of two of the most popular type of roofs in Southern California.**
4. Hip roof: **Water flows in four directions (think pyramid.) The other of the two most popular types of roofs in Southern California.**
5. Rafter: **Roof framing equivalent to the stud, primary load-bearing member of a conventionally stacked roof (the sloped portion.)**
6. Ridge: **Horizontal framing member that forms the peak of a roof. We nail the top end of the rafters to it. Ties the top of the rafters together.**
7. Bird's Mouth: **The notch in the bottom of the rafters so they will sit on the double top plate.**
8. Plumb cut: **Any cut on a rafter that will be plumb when the rafter is installed.**
9. Tail: **The end of a rafter that extends beyond the seat-cut. It makes up the eave, or overhang of the roof.**
10. Ceiling joist / collar tie: **Are ways we create triangulation (thus greater strength) in conventionally stacked roofs. Ties the bottom of the rafters together.**
11. Pitch/slope: **Roof pitch or slope is the angle of the roof surface above the "flat" or horizontal plane. Roofers express roof slope as "rise" or "pitch", measured in inches of vertical rise per foot of horizontal distance or "run".**
12. Run: **vertical rise per foot of horizontal distance or "run".**
13. Chord: **Top and bottom members of a truss.**
14. Web: **Webs are the internal components of trusses. Webs typically run from the top chord to the bottom chord. They may be vertical or at an angle to the vertical.**
15. Gusset/gang nail plates: **A panel or bracket of wood or metal fastened to the intersections of members or at corners to provide strength and stiffness.**
16. Fink truss: **One of two most commonly used truss shapes in residential construction. interior supports (web) are in a pattern that looks like the letter "W". Some know it as a "W truss". The web makes up a "W".**

17. Scissors truss: **Sloped top and bottom chords resulting in vaulted (angle) ceilings in residential homes. Provides that extra ceiling height, and makes rooms look and feel bigger.**
18. Gable truss: **Two roof surfaces of equal pitch meeting at a ridge along the middle of the building.**
19. Gable stud: **A framing stud that connects the gable end top plate and a rafter directly above the top plate.**
20. Frieze Block: **A space block between each rafter or truss at the double top plate. Closes off the open space into the attic. Must be nailed to the double top plate.**
21. Purlin: **A support beam for rafters, it shortens the span of the rafters. It is supported by braces off an interior bearing wall. Maximum brace angle of 45°.**
22. Sway Brace: **A brace set at about a 45° angle that is attached at the double top plate and the ridge. It locks the ridge in place to restrict side to side movement.**
23. Span: **The entire horizontal distance across that a roof cover.**

Parts of a Roof

Directions: Write the component name on the corresponding line.

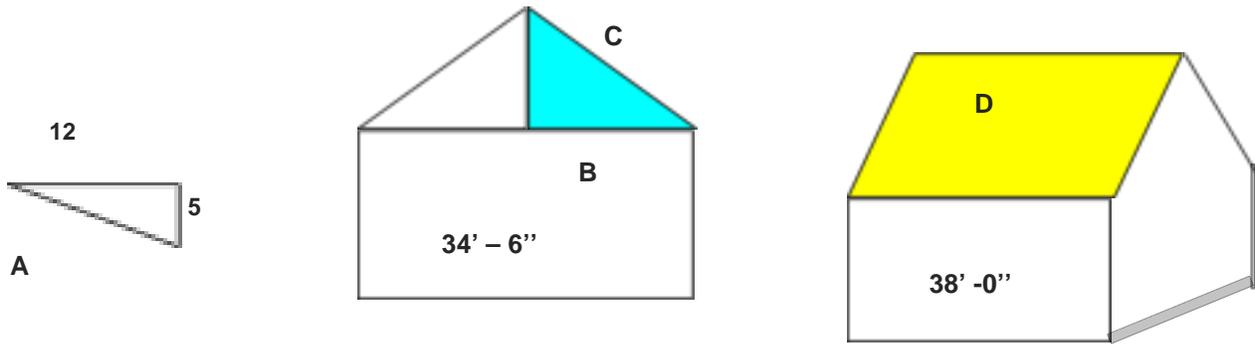


1. _____	7. _____
2. _____	8. _____
3. _____	9. _____
4. _____	10. _____
5. _____	11. _____
6. _____	

Parts of a Roof – Answer Key

1. Ridge board
2. Collar tie
3. Look-out/outrigger
4. Rafter
5. Frieze block
6. Top plates
7. Fascia
8. Eave
9. Shear panel
10. Wall framing
11. Ceiling joists

Roofing and Right Triangles



1. What is the length of the hypotenuse of the right triangle formed by the roof slope?
2. How many units of run are there?
3. How long is the hypotenuse formed by the roof?
4. What is the area of one side of the roof?
5. Determine the number of roofing squares needed to cover the complete roof, adding 10% for waste?

Determine a Roof Pitch Handout

Roof pitch is determined by finding the amount of rise per foot run. If you are framing a new home, garage, shed, or similar building the pitch of the roof can be obtained by looking on the plans. It is represented by a triangular shaped drawing and expressed in inches, 4/12, 5/12, etc. the higher the number the steeper the pitch or angle of incline.

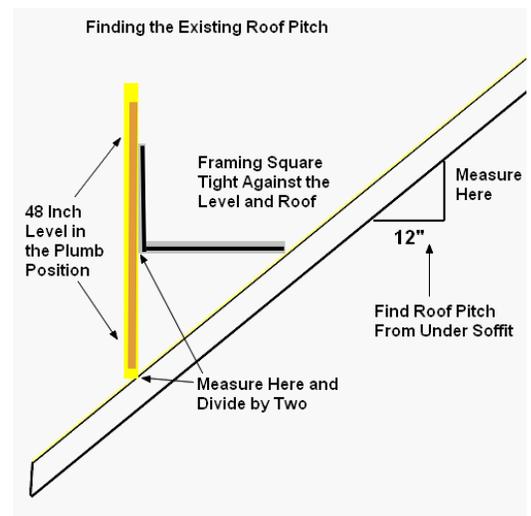
When building an addition, it is often necessary to tie the new roof into an existing one. In order to tie the two together the existing pitch must be known.

Find Existing Roof Pitch

1. The easiest way is to use a tool called a pitch finder that can be placed on top of the roof, on gable end soffit, or in the attic under a rafter to find the pitch. This is a special tool and can also be used to find level, plumb, or any angle in between.

2. Another method is to use a level and framing square from on top of the roof.

- Place a framing square on the uphill side of the roof with the body level and the tongue facing up.
- Place a carpenter's level in the plumb position against the roof and the tongue of the square.
- Keeping the level tight to the roof surface, the tongue of the framing square, and the body of the square tight to the roof move the square and level around until the level reads plumb.
- Make a pencil mark where the heel of the framing square meets the level and measure this distance. Divide the measurement in two, the answer is the pitch.

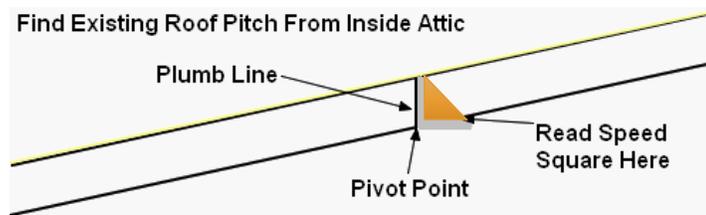


3. You can also use a level from under the soffit on a gable end to find the pitch. This technique also works well for figuring the angle cuts on siding.

- On a ladder and under the soffit make a level mark from the soffit towards the center of

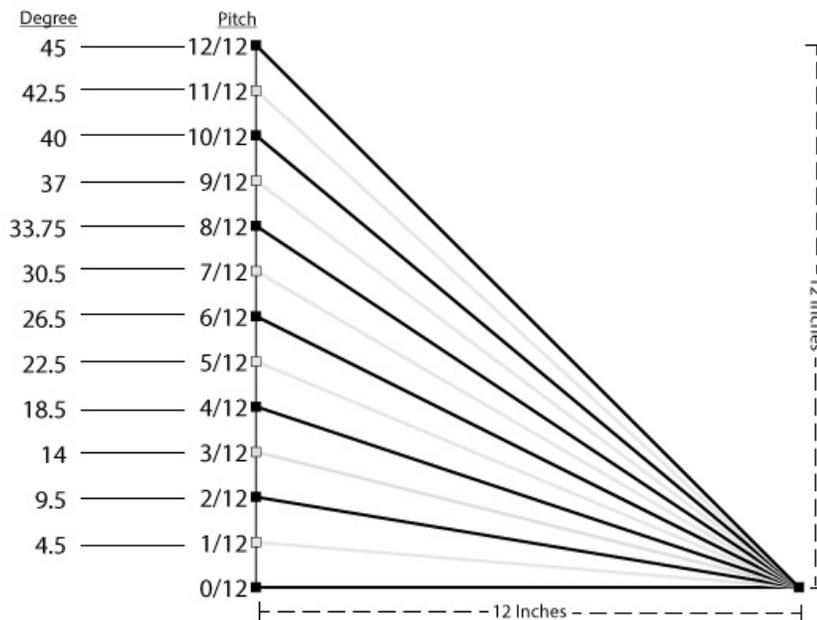
the gable.

- Measure 12" from the soffit along this line and make a mark.
 - Plumb up from the 12" mark until you run into the soffit again and measure this distance, this is the pitch of the roof.
4. The pitch can also be determined from inside the attic provided the common rafters are 2 X 8 or larger with the use of a level and speed square.
- From inside the attic make a plumb line on the side of one of the common rafters.
 - Align a speed square along this plumb mark and read the pitch along the common rafter scale.



Roof Pitch Chart

Use this pitch chart to give you an idea how steep a roof is when someone says the pitch of the roof is 4/12 or whatever it is.



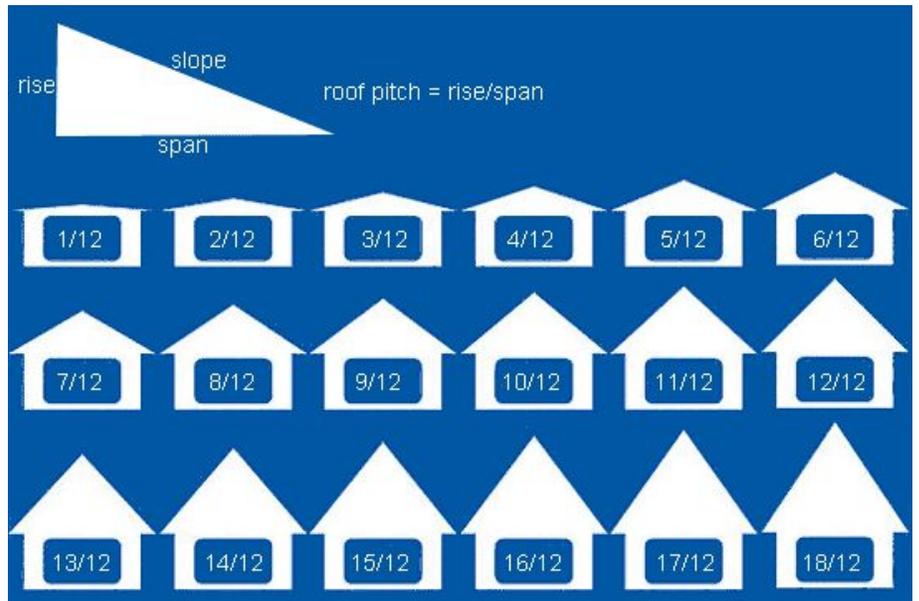
Tips on Roof Pitches

There are several factors to consider when deciding upon a pitch for a new roof such as geographical location, aesthetics, and cost. In general, the steeper the roof the more it will

cost to build and maintain, but the roofing material will last longer before needing replacement.

Low Pitched Roofs

Are so called when the pitch is below 3 1/2. Though easier to work on and cheaper to construct asphalt shingles should not be used on lower pitched roofs. They require special roofing materials and will need routine maintenance more often.



Medium Pitched Roofs

This pitch range is between 3 1/2 and 7 1/2 and makes up the bulk of most new roofs in America. A pitch of 4 to 6 is the pitch I would recommend to anyone building a garage, shed, or similar building. These roofs can be walked safely by an average person and require no special equipment.

Steep Pitched Roofs

Are anything above a 7 1/2 and require special equipment to keep roofer's and material from sliding off but will last longer than lower roof pitches.

Laying out Common Rafters with a Square

Three Different Methods of Laying Out Common Rafters with A Square

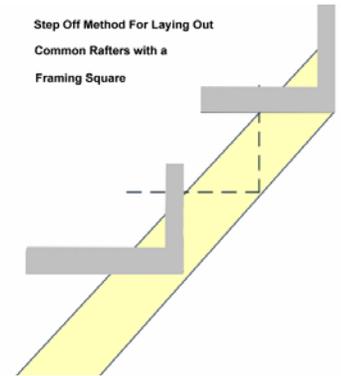
Roof Rafter Layout run time 10:50

<https://www.youtube.com/watch?v=xblqwOf3JI>

1. Stepping Off Common Rafters with a Framing Square

Scenario: You pull up to the job site at 6:40 AM knowing that your first task of the day is to cut the common rafters for a 24' garage.

- Step 1: Determine the span of the common rafters. Measure the overall width of the building, for this example it shall be 24 feet.
- Step 2: Find the run of the common rafter. For a simple gable roof this is half the overall width of the building. In this case to determine the run divide 24' divided by 2 = 12'.
- Step 3: Determine pitch of roof. In this example it will be a 6/12. This pitch means there will be 6 inches of rise for every 12 inches of run.
- Step 4: All actions performed with the framing square should be along the top edge of rafter so place material accordingly. Begin by placing the square at the top edge of rafter with the tongue (skinny part) on 6" and the body (fat part) on 12", draw your plumb cut (where rafter rests against the ridge board) also mark where body section intersects the material.



Now move the framing square down the common rafter and line up tongue with previous body mark. Since the run of the rafter is 12' this action will be repeated 12 times. After you have verified repeating this step 12 times mark out another plumb cut line on the 12th body mark. This line represents the outside edge of the building and plumb cut of the bird's mouth.

Next, I like to add the tail or overhang of the building. Now mark out your seat or level cut of the bird's mouth. The last step is to take off half the thickness of the ridge board, by

BUILDING INDUSTRY TECHNOLOGY ACADEMY: YEAR TWO CURRICULUM

returning to the top plumb cut and shortening it. If you are using a 1 1/2" thick ridge board this would be 3/4".

Synopsis: Determine span, determine run, determine pitch, layout rafter, cut, and test.

2. Framing Square with Regular Calculator

This method of laying out common rafters is much faster, more accurate, and easier than stepping them off with a framing square. The basic steps for laying out the rafter are still the same only you do not have to step off the square a dozen times.

- Step 1: Determine span of common rafters. 24'
- Step 2: Determine run of common rafters. 24' divided by 2 = 12'
- Step 3: Determine length of common rafters per foot run. This can be found on the left side body of the framing square. What you are looking for is a table on the square like the one below. This is an abbreviated version of what is on the square

Pitch in Inches	12	11	10	9	8	7	6
Length Common Rafters Per Foot Run	16.97	16.28	15.62	15	14.42	13.89	13.42
Length Hip or Valley Rafters Per Foot Run	20.78	20.22	19.70	19.21	18.76	18.36	18
Diff Length of Jacks 16" Centers	22 5/8	21 11/16	20 13/16	20	19 1/4	18 1/2	17 7/8
Diff Length of Jacks 24" Centers	33 15/16	32 9/16	31 1/4	30	28 7/8	27 13/16	26 13/16

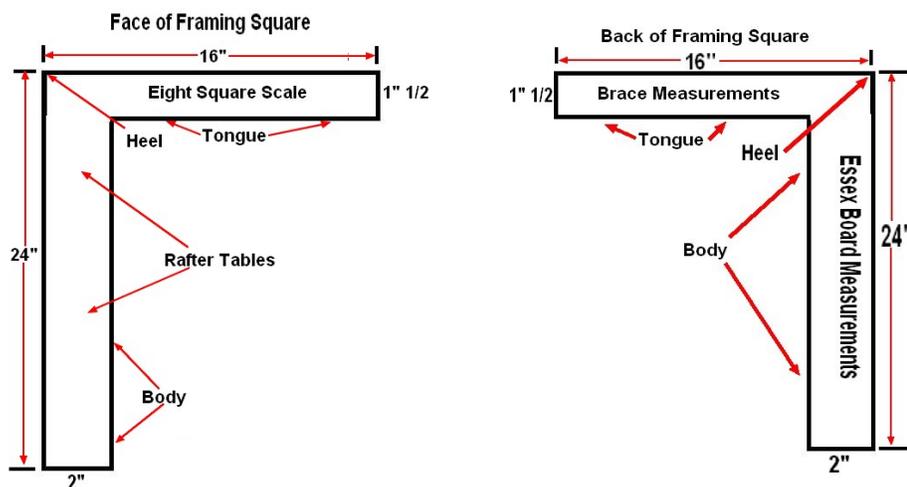
Since this roof has a 6/12 pitch if you look under the number 6 on the top row you should find the number 13.42". The .42 portion is in fractions of an inch and will need to be converted over to feet and inches later.

- Step 4: Determine length of rafter. This step is accomplished by taking the span times the length per foot run. In this example the formula is $12 \times 13.42 = 161.04$ " So the length of our rafter is 161.04 inches.

BUILDING INDUSTRY TECHNOLOGY ACADEMY: YEAR TWO CURRICULUM

- Step 5: Convert decimal point to fraction of an inch. In this case the .04 inch is of no importance since it is such a minute amount, after all .125 is only 1/8". In the real world you will seldom get this lucky so I will give you an example of how to convert decimal points to fractions of an inch. If you have a decimal point of .625, enter .625 into your calculator and times it by 8 or $.625 \times 8 = 5$ which is 5/8" since you multiplied it by 8. If you multiply by 16 the answer would be in 16's of an inch.
- Step 6: Layout rafter. As before beginning by placing framing square on top of rafter, tongue on 6", body on 12", and mark your top plumb cut. From the top edge of this mark measure along the top edge of rafter 161 inches (13' 5") and make another pencil mark. Place the framing square on this mark as before and draw another plumb cut line. This line represents the outside of the building, add tail cut as needed. Next step is to mark seat cut for birds' mouth, then shorten top plumb cut by half the thickness of ridge board.

Synopsis: Determine span, determine run, determine pitch, determine length, layout rafter, cut, and test.



3. Framing Square and Construction Master

This method is by far the fastest, easiest, and most accurate of these three methods of marking and cutting common rafters. Anyone who does this kind of carpentry work really should learn how to use a Construction Master calculator.

- Step 1: Determine overall span of rafters.
- Step 2: Determine run of rafters.

- Step 3: Determine length of rafter.
- Step 4: Layout rafter.

All four of these steps are much easier with a construction calculator. All you really need to know is the span and pitch to cut the common rafters. After just a few times of doing it this way you should be comfortable with the calculator.

Armed with the information of 12' span and 6/12 pitch, here is how I would go about figuring the length of the common rafter. Using a Construction Master calculator, I would enter 24' minus 1" 1/2 divided by 2= run 11'11" 1/4 then 6" pitch then diag. 13'4" 3/16.

The length of the common rafter from the outside wall to the ridge board is 13'4" 3/16, however there is so much more information available just from entering the run and pitch factors.

Using the Code Book: Roofing

Directions: Using the *IRC for One- and Two-Family Dwellings*, find the answers to the following questions:

1. What chapter and page does roof ceiling construction begin?

Chapter: _____ Page: _____

2. What is the **minimum lap** between ceiling joist ends?

3. Under what **section number** do we find the code governing wood truss design?

4. Using Table R802.4(1) on page 246 what is the **maximum allowable span** for 1-2x6 Douglas-fir /Larch ceiling joists placed at 16" on center?

5. Determine the **maximum allowable span** for a Douglas-fir/Larch select structural 2x10 placed at 24" on center that carries a dead load of 20 psf.

6. Write out the first sentence of section R802.10.4 *Alterations to trusses*:

7. According to figure R802.5.1, what is the **minimum angle** and spacing for 2x4 purlin support braces?

8. What is the **table number** where we find the minimum net thickness of a given sheet of plywood for a given rafter or beam spacing?

Using the Code Book: Roofing – *Answer Key*

1. Chapter 8 page 417
2. 3 inches
3. R 802.10.1
4. 16-4 feet
5. 20-7 feet
6. Truss members shall not be cut, notched, drilled, spliced or otherwise altered in any way.
7. 180 degrees

Roof Framing Order of Construction

1. Print Reading - Layout

- Begin by pulling layout down both walls parallel to the ridge of the long roof section. Start at the 'front' of the house and pull to the 'back' of the house. (Change the other layouts to conform) Rafters are marked with an "R," every 1 5/16 inch and go, while the ceiling joists are marked on the other side of the same line (and back) with a "J."
- Once layout is marked across the entire length of the walls, take the beam, and position it parallel to the wall on the right, with one end flush to the back-right corner of the wall. Transfer layout from the wall onto the beam.
- Install the beam as per the plans with some glue and a few toe-nailed pins.
- Next layout the short section of walls, pulling layout from left to right. As with the long section, the rafter "R," is marked to the 'go' side of the line, while the ceiling joist "C" is marked 'back.'

2. Install Ceiling Joists

- Once layout is complete, you can begin to install the ceiling joists with a dab of white glue, and a toe-nailed pin at the end of the joist. Note: the # joists that butt into the beam will have to have $\frac{5}{16}$ of an inch removed from them to allow for the thickness of the beam. When pinning the joists to the beam, make sure to pin from the side of the joist opposite where the rafter laps it. This will keep them in, should it happen to stick out, from interfering with the fit between the rafter and the joist.

3. Set the Ridges

- Next, take your ridge material, and cut your short ridge at 11 inches.
- Make a mark one inch in from one end. Your long ridge is already cut at 22 inches, so all you must do is make a mark one inch in from each of its ends. These marks align with the outside of the house, and act as your first and last layout marks.
- Take your long ridge and lay it parallel to the right wall top plate, with the one-inch-in marks aligned with the outside of the front and back walls.
- Like the beam, transfer the layout from the plate to the ridge.
- Do the same with the short ridge.
- Make sure to transfer only the rafter layout, not the ceiling joist layout.
- Using a pair of ridges 'posts,' and a pair of rafters for each end of the ridge, set the ridge.
- Place the posts under the end of the ridge to help establish its height, while gluing and pinning a pair of opposing rafters at each end.

- Check to make sure that the 'heel cut' marks on the rafters align with the outside edge of the top plate. (close counts) When satisfied that everything 'lines up,' glue and pin the rafters to both the top plates and the ceiling joists.
- On the long ridge, it wouldn't be a bad idea to install a couple of rafters 'mid span,' to help keep it straight.

Tip: you have precut rafters, and in order to effectively use your 'manpower,' each company/team should have people pre-cutting materials while the layout, beam install, etc., is taking place.

4. Install Rafters

- Once both ridges are set, in-fill with rafters.
- Make sure to glue and nail the rafters to the ridge, plate, and ceiling joists.

5. Install Frieze Blocks

- Next, unless you have already done so, cut 48 frieze blocks at 11/8 inches long.
- Mark a control line across the top of the entire length of the rafters to serve as a guide for installing the frieze blocks.
- Install blocks between rafters aligning the top edge with the control line, and the bottom edge resting up against the top plate.
- Fasten with a dab of glue and a micro-pin on each end.

Note: be sure to check the fit of each frieze block before you install it; don't force it! Adjust the length of the blocks as necessary before installing them.

6. Install Gable Studs

- Next, install the gable studs.
- First, measure out from the ridge post 2 inches and make a mark. The gable stud will be placed on the side of the line that is 'back,' towards the ridge.
- Take one of the eight inch two by fours, set it on the layout line on the plate, and behind the gable rafter. Take a pencil and scribe the gable stud using the bottom of the rafter as a guide.
- Remove it, cut it on the line, and then use it as a pattern, tracing it onto five more pieces of material. They can then be installed with a dab of glue and two pins after the layout has been marked at all three gable ends.

7. Install the Outriggers

- Begin by carefully notching the gable rafters to accept a flat 2x4, directly above the gable stud.
- Measure the distance from the outside edge of the gable rafter to the edge (face) of the first rafter in from it.
- Add 1 inch to this measurement and cut your outrigger. Install with glue and pins.
- The outriggers for each gable end must be individually measured as they will all be different.

8. Install Fascia and Barge Rafters

- Now that the outriggers are in, install the fascia and the barge rafters.
- Make a scarf joint directly over a rafter tail along the long span of the roof, as well as the compound corner miters at the corners, and the miter at the ridge.

9. Sheet your roof

If your plan shows a Blind Valley play Larry Haun's video on roof framing queued to the segment where he demonstrates how to install the blind valley.

- The area where the blind valley is going to frame over the long/main section of the roof has already been sheeted.
- To begin with, we need to mark, cut and install our ridge extension.
- Place the piece of ridge extension material on top of the short ridge and slide it over until it touches the sheeting of the long section of roof.
- Then make a mark on the extension ridge material that aligns with the end of the short ridge. This establishes the length of the extension ridge.
- Without moving the extension ridge piece, mark the long miter on the other end that will allow it to plane in with the long section of roof. To do so, take a scrap of ridge material (it must be the same width/depth, or this won't work) place it on edge on the long roof section, and tight against the extension ridge. Then mark the ridge extension, using the top edge of the scrap as a guide.
- Take it off and cut it. After it is cut, check the fit, and if it's good, attach it with glue and pins. *Make sure to keep it aligned/straight with the short roof ridge. If you don't, you are going to have problems with the rest of the blind valley.
- Next, take a ruler or other straight edge, and draw lines that start at the point where the extension ridge 'dies' into the long roof, to a point where the top edge of the sheeting and the top edge of the last rafter of the short roof all align. This will be our guide for installing the valley "nailer" pieces.
- Cut one-inch wide strips of plywood material to fit. Hold them back about an eighth inch from the line, and glue and gun them down, (make sure to only nail through the ply where you have a rafter underneath).

BUILDING INDUSTRY TECHNOLOGY ACADEMY: YEAR TWO CURRICULUM

- Next, pull layout from the short ridge onto the extension ridge, and pull layout parallel from the rafters onto the nailers. On the layout marks, measure from the top edge of the extension ridge to the outer top edge of the nailers.
- Remember or write this measurement down as you will need it in a minute.
- Set a piece of 2x6 rafter material on top of the ridge (at the layout mark) with its end aligned with the outer edge of the nailers, (again, at the layout mark).
- As with the extension ridge, set a piece of rafter scrap on edge across the nailers, tight against the rafter, and mark the rafter using the top edge of the scrap as a guide. This gives you the 'reverse' cut needed to make the rafter plane with the long section of roof.
- Once the reverse cut is made, measure from the long point of the reverse cut back the distance you measured a minute ago. This mark will be the long point of your plumb cut where the rafter attaches to the ridge.
- Using one of your rafter templates, mark the plumb cut aligning the long point of the template with the mark you made from your measurement.
- Cut the plumb cut and check fit. The rafter should fit flush with the top of the ridge, and flush with the outer edge of the nailers, when placed on layout. If it doesn't fit properly, make appropriate adjustments.
- When satisfied with the fit, trace its twin (for the other side of the ridge) on a piece of rafter material. The original can then be installed with glue and pins, while the other one is cut and installed. Repeat this process for the four remaining rafters, and that is it.

Roof Inspection Grade Sheet

When you have completed framing your model roof, you must have it inspected/graded before you can move on. The following are the criteria by which your roof framing will be graded, including the points available for each area.

Framed roof appearance (i.e. square, complete, strong, slope)	25 points _____
Top chords flat and level in relation to each other	5 points _____
Ridge is accurately placed (i.e. height, placing on top plate)	10 points _____
All framing parts are accurately placed (i.e. frieze blocks, outrigger, etc.)	15 points _____
Frieze Blocks are installed equally between the rafters	15 points _____
The slope of the rafters is the same as the slope of the trusses.	25 points _____
Overall score of appearance and strength	95 points _____

Roof Framing Inspection Guidelines

When inspecting, or being inspected, two criteria must be met.

1. Is the structure built to code?
2. Is the structure build to the prints?

If either of these criteria is not met at any time during the construction of any structure, then that structure will fail inspection. Failed inspections can hurt your production schedule, budget, and ultimately your company.

1. Are the top chords flat and level? _____
2. Is the slope of the roof correct? _____
3. Is the length of the rafters the same as the trusses? _____
4. Has the fascia been measured correctly and installed? _____
5. All framing parts are accurately placed (gable stud, ridge beam, barge rafters, etc.) _____
6. The 'heel cut' marks on the rafters align with the outside edge of the top plate _____

To successfully pass inspection, the model of the construction company you are inspecting must meet **all** the above codes and specifications (specs). Even if only one code or spec is not met, the model (and the company that built it) will fail the inspection.

If you pass a model's roof framing, you must justify your decision in writing. You must explain how/why the model roof framing passed inspection as opposed to failed. Your report must be at least one half of a page long, and spelling and grammar count. If these writing requirements are not met, then all the employees of your company will be penalized by a loss of points on the assignment.

If you fail a company for a violation of any of the codes/specs listed above, you must record why they failed, and what they must do to correct the problem(s). You must fill out a "Correction Notice" and leave it with the company president of the model roof you are inspecting. Your construction team will inspect the roof as a group, but writing the report is done by only one member of the company.

There will be five inspections: (2) for floor framing, (2) for wall framing, and (1) for roof framing.

Every member of your company must take a turn writing at least one report during the construction phase of this project.

Self-Evaluation

1. What I have learned about this portion of framing so far is...

2. Four terms and their definitions that I have learned about this portion of framing are...

3. Safety practices that I have been observing...

4. What I would still like to learn about framing is...

Roof Framing Unit Final Test

Part One

Directions: Fill in the missing words in each sentence using the word bank. Each term will be used once.

1. The end of the rafter that extends beyond the seat-cut is known as the _____, and makes up the eave, or overhang of the roof.
2. The angle, or slope of a roof is referred to as the _____, which is noted as the inches of vertical rise over 12 inches of horizontal run.
3. This horizontal framing member forms the peak of the roof. It is what we nail the top of the rafters to. It is the _____.
4. The Bird's Mouth, or _____ is the point where a rafter attaches to the double top plate of a wall.
5. The roof framing equivalent of the stud, the _____ is the primary load-bearing member of a conventionally stacked roof.
6. _____ and _____ are ways we create triangulation (thus greater strength) in conventionally stacked roofs.
7. We make a _____ at the top of a rafter where it is to be nailed to the ridge.
8. The two types of roof framing used in residential construction are the _____ and the _____.
9. Twisting, bending, or pulling forces are referred to as _____ forces.
10. Trusses are assembled using either metal _____, or plywood _____ to connect the joints.
11. The _____ truss is the most commonly used truss shape in residential construction.
12. The members of a truss that fit between the chords are referred to as the _____.
13. If you preferred vaulted (angled) ceilings in your home instead of flat ceilings, you would use a _____ truss.

Conventional Stack
Ridge
Collar Ties
Gang-Nail Plates
Truss
Compression
Seat Cut
Pitch
Fink / W
Tail
Gable
Plumb Cut
Chords
Tension
Hip
Rafter
Ceiling Joists
Webs
Gussets
Scissors

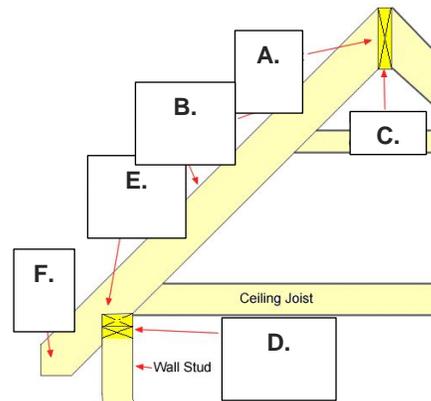
14. The two most common **roof styles** in Southern California are the _____ and the _____.
15. The top and bottom members of a truss are referred to as the _____.
16. A framing member that experiences crushing forces is said to be under _____.

Part Two

Match the components of each diagram with its correct term.

Conventional Stack:

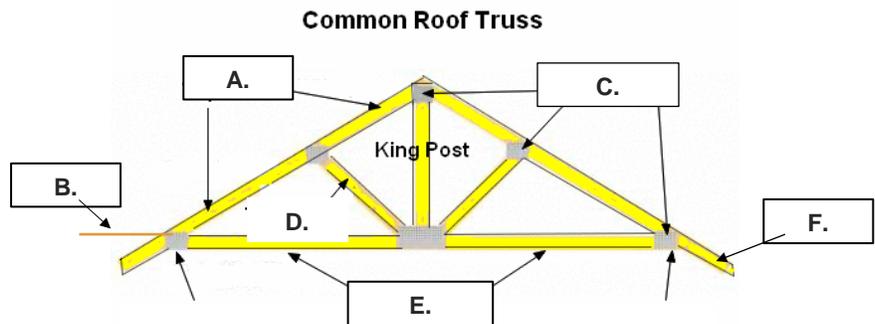
1. _____ ridge
2. _____ rafter
3. _____ rafter tail
4. _____ bird's mouth
5. _____ double top plate
6. _____ plumb-cut



Match the components of each diagram with its correct term.

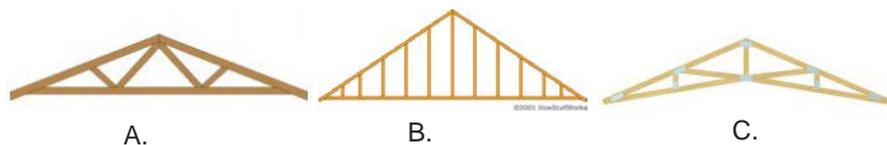
Truss:

7. _____ webs
8. _____ top chord
9. _____ bottom chord
10. _____ tail
11. _____ gusset/gang-nail
12. _____ heel



Directions: Identify the following types of trusses.

13. _____ fink
14. _____ scissors
15. _____ gable



Roof Framing Unit Final Test – *Answer Key*

1. Tail
2. Pitch
3. Ridge
4. Seat cut
5. Rafter
6. Ceiling joists and collar ties
7. Plumb cut
8. Truss
9. Conventional stack
10. Gang nail plates and gussets
11. Flink
12. Webs
13. Scissors
14. Gable and hip
15. Chords
16. Compression
17. C
18. B
19. F
20. E
21. D
22. A
23. D
24. A
25. E
26. F
27. C
28. B
29. A
30. C
31. B
32. C
33. C
34. T

Roof Framing Bill of Materials

Part #	Description	Material Type	Dimensions (calculate footage)		Footage (bd/ft, lin/ft, sq/ft)	Quantity Of Parts	Unit Cost	Total Cost
				=				\$-
				=				-
				=				-
				=				-
				=				-
				=				-
				=				-
				=				-
				=				-
To calculate board feet with all measurements in inches:							$\frac{T \times W \times L}{144}$	Total Cost: \$-