



BUILDING INDUSTRY TECHNOLOGY ACADEMY

A program promoted by the
California Homebuilding Foundation



PROJECT #5: BUILDING CABINETS

YEAR TWO

PROJECT #5 BUILDING CABINETS

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Lesson 1: Building a Cabinet (15 Class Periods)



Lesson #1: Building a Cabinet (15 Days)

Objectives

Students will be able to...

- Draft a design of a kitchen.
- Develop a bill of materials.
- Build a three-dimensional object based on two-dimensional drawings.
- Calculate the measurements in making a raise panel door.
- Build a raised panel door.
- Calculate the measurements in order to build a drawer for a specific cabinet.

Common Core Standards

LS 11-12.6
RSIT 11-12.2
RLST 11-12.2
Writing 9-10.5
Problem Solving/Critical Thinking 5.4
Health and Safety 6.2, 6.3, 6.6, 6.12
Responsibility and Leadership 7.4, 9.3
CCSS.MATH.PRACTICE.MP6
CCSS.MATH.PRACTICE.MP2
CCSS.MATH.PRACTICE.MP1
Residential and Commercial Construction Pathway D2.1, D2.2, D3.1, D3.7

Materials

Designing a Kitchen Worksheet
Cabinetry Handout
Base Cabinet Working Drawing
Carcass Order of Construction
Bill of Materials-Carcass
Face Frame Order of Construction
Bill of Materials-Face Frame
Raised Panel Door Order of Construction
Bill of Materials-Raised Panel Door
Cabinet Drawer Order of Construction
Bill of Materials-Cabinet Drawer

Self-Evaluation

Lesson Sequence

- Review and teach the *Cabinetry Handout*. Have students highlight important information and answer any questions students may have.
- Hand out the Designing Your Kitchen worksheet. Pay attention to Kitchen Cabinet Design Guidelines. they must follow along otherwise they will have trouble completing their assignment.
- Tell the students one of the most important rooms in any house is the kitchen. The kitchen is the one room in the house that you always get your return on investment or ROI. Return on investment meaning what you invest into the kitchen you get back in increased home value. The next room in the house is the bathroom. The kitchen remodel is can be extensive and can be small.
 - One of the first things one must decide is what style of cabinetry they would like whether it is modern, rustic, Victorian etc.
 - Once you have decided your style then the material you would like to use is the next step.
 - At this point in the process you must look at what space is available for your kitchen. For our situation you will have a blank slate and will be able to start from scratch. But in the real world, unless you are building your house from the ground up you must work with what you have or pay the costs of moving plumbing fixtures and electrical fixtures. Therefore, if the homeowner is trying to save on costs, he would elect to leave the sink in the same spot and leave the major appliances where they are. However, anything is possible and if they would like to pay the cost then everything can be moved.
 - Some things in kitchens are basic norms. Like counter heights, appliance sizes, kitchen sink centered to window. Even though the norms can range a bit here and there are general sizes that one goes by when designing a kitchen.
- Design a kitchen together and afterwards they will be designing their own.
 - Explain that on their graph paper where the cabinets are going is blackened in along the edge.
 - You may add an island if you would like. Your drawing must be to scale and must fill in all necessary dimensions. Distinguishing upper and lower cabinets.
 - Walk them through how you first want to locate where the sink is going and the major appliances first, then you work from there according to functionality.
 - Like the dishwasher should be close to the sink as well as the trash can or trash compactor.
- Work with the students in laying out the kitchen together guiding them in the right direction and explaining to them if ideas won't work by explaining whether it be cause

of functionality or whatever the case might be. Depending on time available once you are finished have the students start working quietly on their own kitchen.

- Have students design their own kitchen. Collect at the end of the period.
- Review the *Base Cabinet Working Drawing*. Discuss the working drawing giving them the chance to answer some of the questions about the project. Like what type of joinery will they be using, how big is the cabinet, what type of material will they be working with.
- After that tell them to turn to the *Carcass Order of Construction*. Review with the class the order of construction reminding the students of the various safety rules involved with the different cuts in completing their project.
- Have students begin filling out their *Bill of Materials-Carcass*. Allow students to begin their project once their bill of materials is completed.
- For the next five days students will be busy on their projects. Instructor is to walk around monitoring the students on the machine tools for proper safety techniques and watching students assembling, to make sure they do not need assistance.
- Review the *Face Frame Order of Construction* answering any questions they might have.
- Pass out the *Bill of Materials-Face Frame* and have students start filling it in. Once they have finished, they may begin working on the face frame. Monitor Student work.
- Hand out the *Raised Panel Door Order of Construction* and review with the students. Answer any questions students may have.
- Pass out the *Bill of Materials-Raised Panel Door* and have students start filling it in. Once they have finished, they may begin working on the raised panel door. Monitor student work.
- Pass out the *Cabinet Drawer Order of Construction* and review with the students.
- Pass out the *Bill of Materials-Cabinet Drawer* and have students start filling it in. Once they have finished, they may begin working on the cabinet drawer. Monitor student work.
- Once project is completed have students complete the *Self-Evaluation* to reflect on their experience during this project.

Assessment

Informal assessment throughout the project.
Check for understanding through monitoring work and questioning.
Use cabinet rubric to grade final project.

Accommodations/Modifications

One on One Support
Check for Understanding
Extra Time If Needed
Visuals

Cabinetry Handout

The fundamental focus of the cabinetmaker is the production of cabinetry. Although the cabinetmaker may also be required to produce items that would not be recognized as cabinets, the same skills and techniques apply.

A cabinet may be built-in or freestanding. A built-in cabinet is usually custom made for a situation and it is fixed into position, on a floor, against a wall, or framed in an opening. For example, modern kitchens are examples of built-in cabinetry. Free-standing cabinets are more commonly available as off-the-shelf items and can be moved from place to place if required. Cabinets may be wall hung or suspended from the ceiling.

Cabinet Production

There are 3 different methods of production employed to manufacture cabinets. The terms used to describe these methods are: Stock, Semi-Custom and Custom. The terminology has nothing to do with the quality of the cabinet rather the method in which it was produced.

- **Stock cabinets** are ready-made, pre-manufactured and ship when an order is received. They can't be altered or customized. What you see is what you get.
- **Semi-Custom** cabinets come in basic sizes like stock cabinets but give designers the flexibility to resize cabinet drawers and doors and modify the depth of the cabinets themselves.
- **Custom cabinets** are built specifically for the area in which they will be used. Custom cabinets allow the customer complete freedom in the design and construction of the cabinetry.

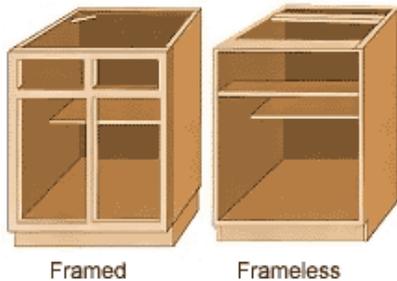
Cabinet Types

These are the four basic types of cabinets:

- A **base cabinet** is a cabinet that sits on the floor. A base interior can have several options such as shelving, drawers, organizational pull outs and much more.
- A **wall cabinet** is a cabinet typically mounted to a wall. They come in several different heights. They most commonly contain shelving.
- A **tall cabinet** is one that sits on the floor, but it stretches tall above the countertop height. These cabinets are mainly used for pantry space and appliances.
- **Specialty units** maximize square footage and organizational efforts. They include appliance garages, corner cabinets, suspended units, cooktop & sink fronts etc.

Cabinet Construction

The types of cabinet construction are framed construction and frameless construction. Framed cabinets incorporate a wood frame around the front outer edge of the cabinet box. This face frame is generally made of solid wood and adds strength to the cabinet by reinforcing the open side.



Frameless cabinets are made without any front panel or frame so that the doors completely cover the front of the cabinet box. This is sometimes referred to as European construction.

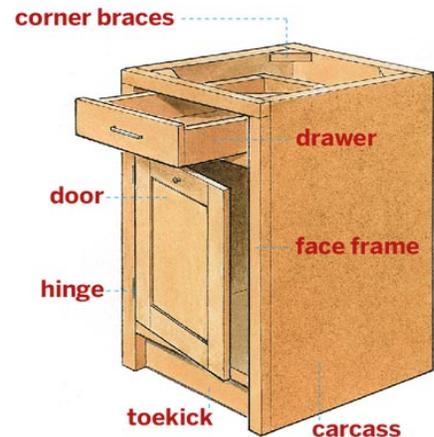
Cabinet components and Hardware Bases

Cabinets which rest on the floor, are supported by some sort of a base. This base could be a fully enclosed base, a scrolled based, bracket feet or it could be a set of legs.

Adjustable feet

A relatively new type of adjustable leg has been adopted from the European cabinet system which offers several advantages. First off, in making base cabinets for kitchens, the cabinet sides would be cut to 34 1/2 inches, yielding four cabinet side blanks per 4 foot by 8-foot sheet. Using the adjustable feet, the side blanks are cut to 30 inches, thus yielding six cabinet side per sheet.

These feet can be secured to the bottom of the cabinet by having the leg base screwed onto the cabinet bottom. They can also be attached by means of a hole drilled through the cabinet bottom at specific locations. The legs are then attached to the cabinet bottom by a slotted, hollow machine screw. The height of the cabinet can be adjusted from inside the cabinet, simply by inserting a screwdriver into the slot and turning to raise or lower the cabinet. The holes in the cabinet are capped by plastic inserts, making the appearance more acceptable for residential cabinets. Using these feet, the cabinets need not be shimmed or scribed to the floor for leveling. The toe kick board is attached to the cabinet by means of a clip, which is either screwed onto the back side of the kick board, or a barbed plastic clip is inserted into a saw kerf, also made on the back side of the kick board. This toe kick board can be made to fit each base cabinet or made to fit a run of cabinets. Kitchen cabinets, or any cabinet generally at which a person may stand, usually have a fully enclosed base in which the front edge has been set back 75 mm or so to provide room for toes, known as the kick space. A scrolled base is like the fully enclosed base, but it has areas of the base material removed, often with a decorative pattern, leaving feet on which the cabinet stands. Bracket feet are separate feet, usually attached in each corner and occasionally for larger pieces in the middle of the cabinet.



Compartments

A cabinet usually has at least one compartment. Compartments may be open, as in open shelving; they may be enclosed by one or more doors; or they may contain one or more drawers. Some cabinets contain secret compartments, access to which is generally not obvious.

Designing a Kitchen Worksheet

Attached is a sheet of graph paper, your assignment is to design your own kitchen.

Guidelines:

- Must include all major appliances and sizes:
 - o Refrigerator, oven cook top, dishwasher, sink and microwave
- Must be drawn to scale
- Must use all necessary dimension and extension lines
- May include an island
- The area on the graph paper where the kitchen is located is blacked in on the border
- Must Identify where upper and lower cabinets are located
- Must point out the style of cabinets they want and the type of doors:
 - o full overlay, half overlay, inset doors
- Must point out also the type of material for your cabinet boxes and for the face frame.

Kitchen Style _____

Cabinet Box Material _____

Face Frame Material _____

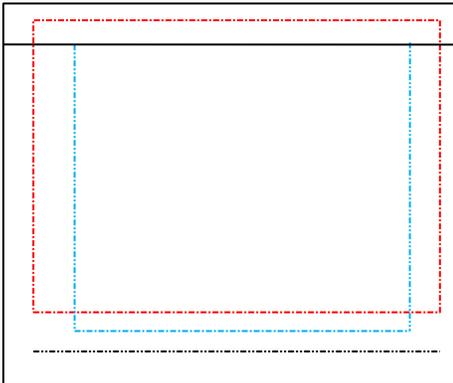
Type of Doors _____

Joints being used _____

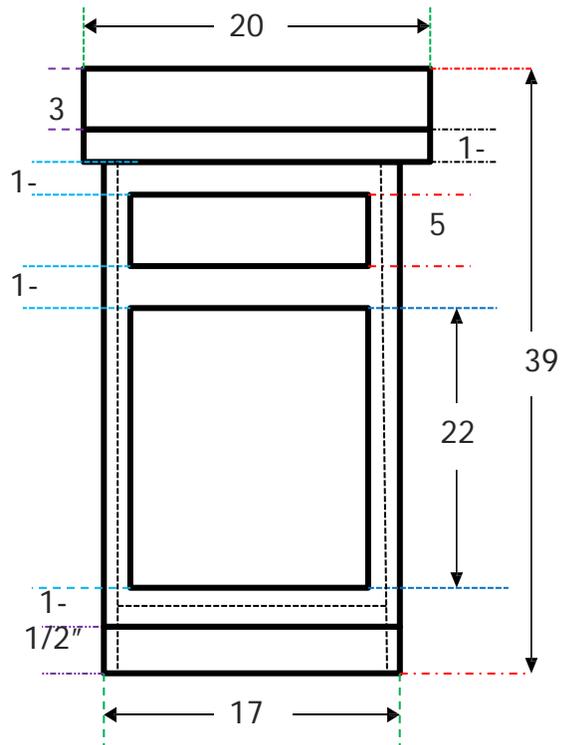
Base Cabinet Working Drawing

All pieces are $\frac{3}{4}$ " thick unless otherwise noted.

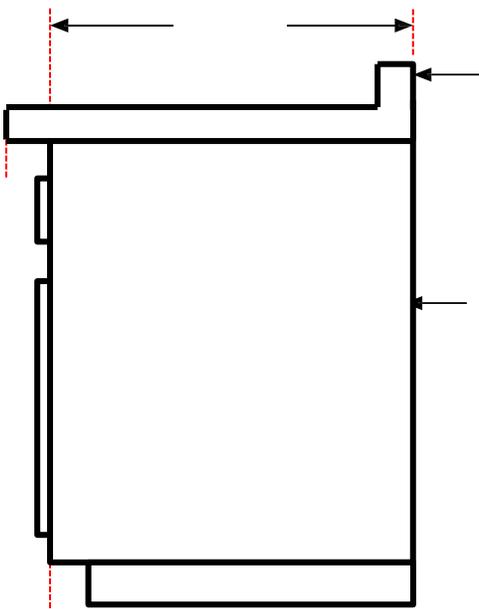
Top View



Front View



Side View



Carcass Order of Construction

After completing a step, put a check mark on the line.

1. _____ Cut the two sides (standards) of the cabinet
2. _____ Cut the top and bottom fixed and adjustable shelves
3. _____ Measure and mark the rabbet at top of the standards and the dado for the bottom shelf
4. _____ Cut the rabbet and dado into each standard using the radial arm saw
5. _____ Route the rabbet for the recessed back panel into one edge of the sides and the top and bottom shelves using the router
6. _____ Mark out the dado for the fixed shelf
7. _____ Cut the fixed shelf dado using the radial arm saw
8. _____ Bore the adjustable shelving holes using the rabbet at the top of the standard as your reference against the stop pins of the line-borer in the false front.
9. _____ Rip the fixed shelf to allow for the thickness of the back panel
10. _____ Dry fit the top and bottom and fixed shelf with the sides (standards). If the fit is good assemble using glue and two finish nails per shelf per side
11. _____ Check unit for square
12. _____ Check dimensions of back panel by measuring right off the assembled carcass
13. _____ Cut back panel considering appropriate tolerances
14. _____ With carcass lying on its face install back panel using glue and brads
15. _____ Move on to the face frame

If you are going to hang your cabinet on a wall see your instructor about installing a back-brace/nailed in the cabinet box.

Face Frame Order of Construction

After completing a step, put a check mark on the line.

1. _____ Double-check rail length by measuring width of assembled carcass and subtracting 2½ inches (this allows for the width of the stiles) Add 1/16 of an inch tolerance and you are ready to begin cutting stock.
2. _____ Cut Poplar or Pine to length needed for 2 stiles and 3 rails.
3. _____ Rip both stiles at 1¼ inch
4. _____ Rip one rail at 1¼ inch
5. _____ Rip two remaining rails at 1½
6. _____ Machine two pocket holes at each end of the rails. Make sure your machine the same face of each rail. Be careful not to flip the rail over when turning it around to pocket-hole the other end.
7. _____ Dry fit the face frame members to make sure the frame will completely cover the face of the carcass.
8. _____ Assemble the Face-Frame by placing a small amount of glue on the end of each rail then aligning and clamping it in- between the stiles.
9. _____ After the Face-Frame is completely assembled check the frame for square one more time. Do so by measuring the diagonals of the frame. If the measurements are the same your frame is square if not you must adjust it until it is.
10. _____ Attach the Face-Frame to the carcass by applying a small bead of glue to the face (front edge) of the standards and shelves. Place the Face Frame on the carcass check for an even reveal and complete the assembly with 1½ - 2-inch finish nails.
11. _____ If necessary, route the Face-Frame flush with sides of the carcass using the flush trimming V groove bit installed on the router.
12. _____ Finish sand Face-Frame and outside of carcass.
13. _____ Move onto the raised panel door.

Raised Panel Door Order of Construction

1. _____ Cut Stile Rail and Panel Stock to length.
2. _____ Rip Stiles Rails and Panel to width.
3. _____ Machine the Cope at both ends of the Rails (Make sure the good face is down). Be sure you do not flip the rails over when you turn them around to cut the Cope at the other end.
4. _____ Machine the Sticking into one edge of each Stile and Rail (again good face down).
5. _____ Raise the panel making sure to mill the cross-grain first then shaping the long grain.
6. _____ Dry fit all the pieces to make sure they fit properly. If using space balls install two in each stile and rail before making your dry-fit.
7. _____ When ready to assemble the doors brush glue into the coped ends of the rails (this is the only place where we apply glue).
8. _____ Assemble the two rails with one of the stiles making sure to align the outer of all three pieces.
9. _____ Insert the panel and install the other stile.
10. _____ Place a clamp at each end of the door to hold the joints tight for 24 hours. Make sure your door is square. If it isn't you must adjust it before the glue sets.
11. _____ When the glue is dry remove the clamps and finish sand the door paying close attention to the stile rail joints.
12. _____ After sanding is complete ask your instructor to shape the finger pull detail for you.
13. _____ Get 2 cup hinges and their face-frame mounting plates from your instructor. Bore the door and insert the hinges with the instructor's guidance.
14. _____ Measure your finished door to make sure that it is one inch larger than your face-frame opening in length and width.
15. _____ Using the measurement from the edge of the door to the center of each hinge as a guide and allowing for a 1/2 inch overlay make a center mark to install your hinge plates by installing the mounting plates on the inside edge of the face frame using two #6 x3/4 course thread screws.
16. _____ Clip your hinges onto their plates and adjust the fit and reveal of the door using the appropriate adjustments on the hinges.

Cabinet Drawer Order of Construction

1. _____ Cut the MDF False front, Back and Sides to length then rip to desired width.
2. _____ Cut the drawer Bottom to length then rip to width.
3. _____ Cut the Pine Drawer Front to length and rip to width.
4. _____ Rabbet the ends of the drawer sides to accept the false front and the back.
5. _____ Have your instructor rabbet the bottom edge of the false front, back and sides to accept the drawer bottom.
6. _____ Find the center of the false front (both horizontally and vertically). Make two marks on the horizontal centerline at 3 inches from the vertical centerline.
7. _____ Drill a 3/16-inch hole through the false front at each of the marks.
8. _____ Dry fit the box assembly to make sure everything fits correctly.
9. _____ Assemble the false front back and sides by applying a small amount of glue to the rabbets and fastening with three 1-inch brads per joint. Check for square.
10. _____ Attach the bottom to the assembled false front back and sides by applying a small amount of glue to the rabbet and nailing the bottom in with 5/8 brad nails.
11. _____ Have your instructor mill the finger pull edge into your drawer front.
12. _____ Sand Drawer front as necessary.
13. _____ Attach drawer front to the drawer box assembly by using two drawer front adjusting screws placed through the holes drilled in the false front.
14. _____ Check for an even reveal between the drawer front and the false front. Make any necessary adjustments. Tighten adjusting screws.
15. _____ Place drawer into cabinet and your project is complete!

Cabinets Self-Evaluation

1. What I had learned from this project ...

2. Parts of the project I am most proud of ...

3. Safety practices I have been observing...

4. What I have learned that I should be doing, from this point on, to ensure any other projects have an excellent outcome.



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Project #4: Building Stairs