



CRSP

Canadian Restructured School Plan
Le Projet D'une École Canadienne Restructurée

House Design
Drafting

CRSP is a project of the



Canadian Vocational Association
Association canadienne de la formation professionnelle

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Why study the topic?

Welcome to the House Design--Drafting Learner Guide. If you have always wanted to draw a house or home, then this is the learner guide for you. The guide leads you through a simple and well-planned course in drawing house plans with the help of a computer-aided drafting program.

In this guide, you will find all the information you need to draw detailed floor plans that include dimensions, furniture, and appliances. You will not be covering anything electrical beyond the basic electrical plan, however!

Working on this learner guide will allow you to expand your career options. Once you have finished the guide, you may be interested in learning more about career opportunities in technical illustration or architecture.

You will also develop your thinking skills as you learn how a simple home is built and all the preliminary work that must go into a house before even the first nail is hammered.

What do I need to know before I begin?

You must have a computer and know how to use it.

You will also need to select a computer-aided design (CAD) system and familiarize yourself with the program. If you have access to the Internet, you could use the Internet shareware market to find a good CAD system. To search for a good shareware CAD program, research Shareware.Com or Jumbo.Com. There are many CAD systems to choose from. Some examples are Generic CAD, Minicad, and Turbocad. Look for a CAD package with architectural options included.

What will I know and be able to do when I have completed the guide?

You will be able to:

- Express your ideas on paper in a variety of ways.
- Lay out a **floor plan**.
Beginning with a sketch, you will learn how to place and size rooms, locate doors, and lay out windows.
- Lay out a **kitchen, bathrooms, and a utility room**.
You will find out how to design a comfortable kitchen. You will learn where to place the fixtures and how to tie it all together.
- **Dimension** a floor plan.
You will learn how to place your dimensions where they will be best understood.
You will label doors and windows.
You will label dos and don'ts.
- Add **electrical** symbols to a floor plan.
You will learn where to place receptacles.
You will learn what lights a room best, when to use ground faults, where to place your meter base, etc.
- Draw in the **plumbing, heating and air conditioning**.
You will learn how to control the atmospheres in the house. For example, you will learn how to keep the house both energy efficient and comfortable in all weather conditions.
- Draw a **site plan**.
You will learn how to make the house fit onto the property on which you intend to build.
- Know what to consider in the **finished product** and what the next stages of building a real home would be.
- Solve a variety of house design drafting problems.

What resources are available to help me?

Books

Alberta Power Limited. *Residential Electric Wiring Guide*.

Brown, Walter C. *Drafting*. Willcox, Illinois: Goodheart, 1985.

Jensen, Cecil. *Architectural Drawing and Design*. Toronto: McGraw Hill, 1982.

Sutton, William. *Building Construction*. Toronto: John Wiley & Sons, 1984.

Check out the books at your school or local library.

Other Resources

People

The best resources are people who work in the industry. Carpenters, draftspersons, shop teachers, and architects have a good deal of knowledge to share. Remember, though, that it is up to you to find the answers. Resource people in the community are often very glad to give you advice, but do not expect them to provide *all* the answers.

The Internet

Pleione's Universe
<http://www.pleione.com>

RamDesign Home Page
<http://odyssey.on.ca/~ramdesign>

CAD Drafting & Services
<http://www.3d-render.com>

Ayres Drafting Service
<http://ourworld.compuserve.com>

Professional Drafting
<http://www.drafting.com>

Project Plans
<http://www.dot.ca.gov/hq>

Boston Architects
<http://architects.org>

Architectural Technology
<http://www.sheridanc.on.c>

Architects
<http://stats.bls.gov/oco>

Useful Addresses

Building Standards Branch
Alberta Labour
707 I.B.M. Building
10808 -99 Avenue
Edmonton, Alberta
T5K 0G2

Community Planning Development
Department of Municipal Affairs
Box 216
Halifax, Nova Scotia
B3J 2M4

Technical Standards Division
4th Floor, West Tower
3300 Bloor Street West
Toronto, Ontario
M8X 2X4

How may I meet the expectations of the guide?

By completing all the activities outlined in this guide. This will involve:

- * completing all CAD drawings and hand drawings
- * solving a variety of house design drafting problems
- * using a CAD program competently to draw a house
- * understanding how working drawings are developed
- * practising drawing different types of house plans to scale

If you have previous knowledge in house design, you may satisfy the requirements by drawing your own scaled house design that takes into consideration all the guide requirements.

When should my work be done?

It should take you approximately 25 hours of class time to complete this learner guide. (Each activity should take about three hours to complete, depending on your knowledge of your CAD program and your understanding of architectural drafting.)

Each day, work at your own pace to complete the learner guide assignments.

How will I demonstrate I have met the expectations?

By completing all the assignments and lessons in this guide and organizing them in a portfolio.

Have each assignment checked and approved by an instructor before you proceed to the next one. When you present your work to an instructor, it is important to show that you understand what you have accomplished and why it was important to complete each particular assignment.

Your work will be assessed according to the following standards:

1. The drawings are done to mastery level.
2. The house design is to scale with a functional floor plan.
3. The drafting is completed on time and is presented in a visually appealing and professional manner.

What activities do I need to do?

You need to complete the seven activities given below. The amount of time you spend on each activity is up to you. Keep in mind, though, that extra reading, working with someone in the industry, or conducting independent research will definitely save you time in the long run.

Activity 1: The Floor Plan Template

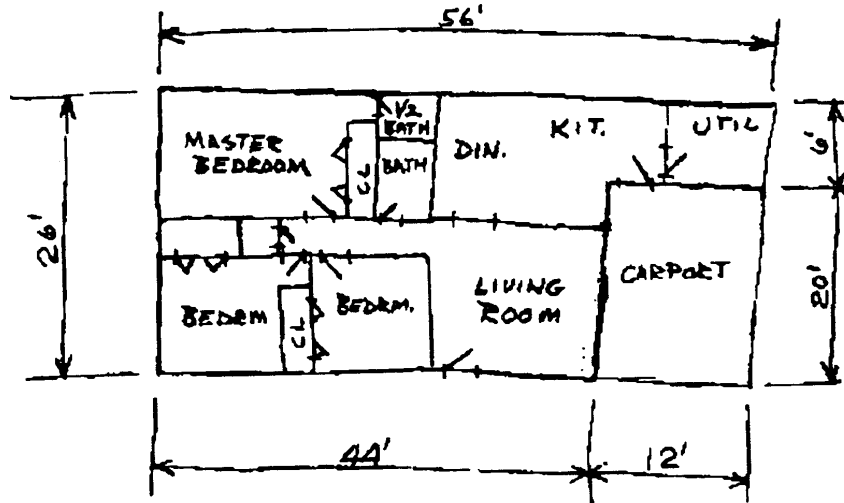
The floor plan is the place to start. Usually people sketch several drawings of their dream homes before they put them in front of a professional draftsman. Once you have a rough sketch, it becomes the template for your entire set of drawings. It is possible to see from the sketch where the plumbing will be, where the electrical outlets will be, how big the rooms will be, the size of the doors and windows, etc.

While it is possible to start with the exterior views of the house, doing so would limit the interior of the home to what the outside looks like. This is not a good idea. You want to make the home practical first and worry about the way it looks second.

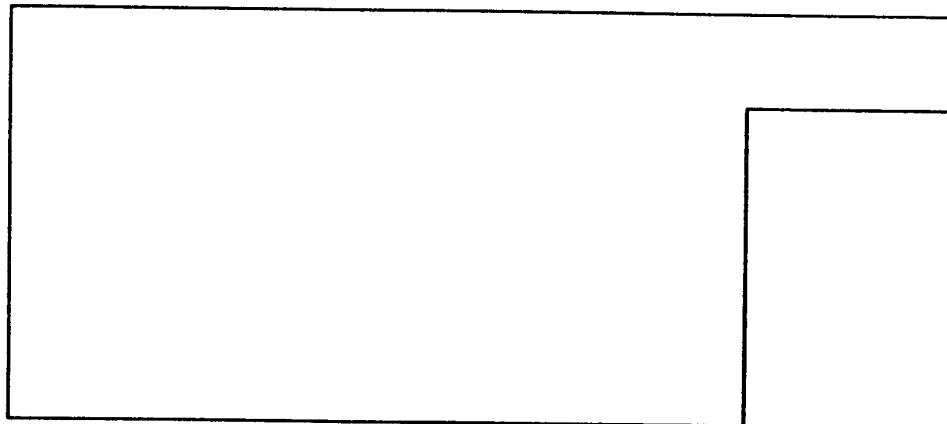
In this activity, you will work through a rough sketch that someone has already designed. It is easier to learn from a sketch that has already been made.

In your CAD program, set up a 24 x 36 sheet of paper. Set your Drawing Layer to Layer 0. Set your Snap or Snap to Grid to 2 inches. You are going to make all of your drawings to scale. In other words, if you draw a line that is one inch long, the program treats and measures this line at one inch.

Now study the hand-drawn sketch below. This is a single line drawing of a house plan. It is the kind of sketch a professional receives from someone who walks into his or her office looking to build a house.



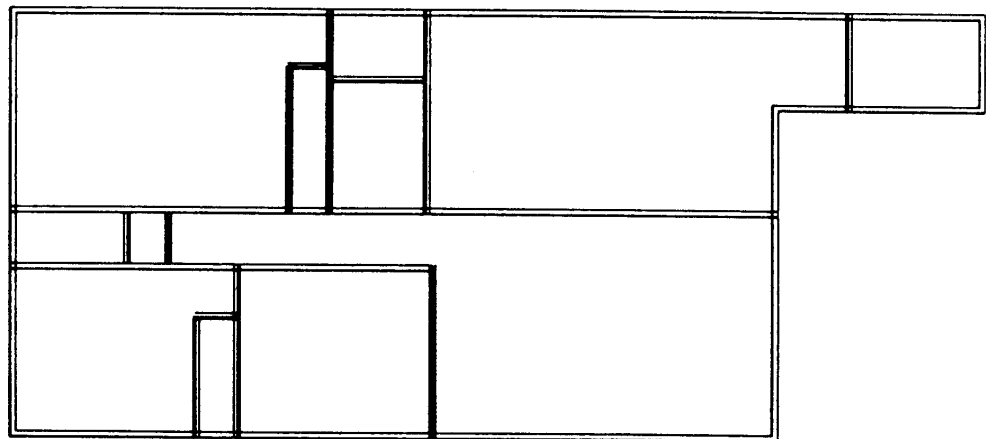
You are going to reproduce this hand-drawn sketch on your computer. Start by drawing the outside perimeter of the house. Beginning with the top line of the house, start a line to the left upper corner of your screen and draw it to the right 56 feet. Then draw a line down 6 feet. The next line is 12 feet to the left, then 20 feet down, then 44 feet left, then 26 feet up to where you began. These are the exterior walls. Your computer drawing should look like the following:



Adding the Wall Dimensions

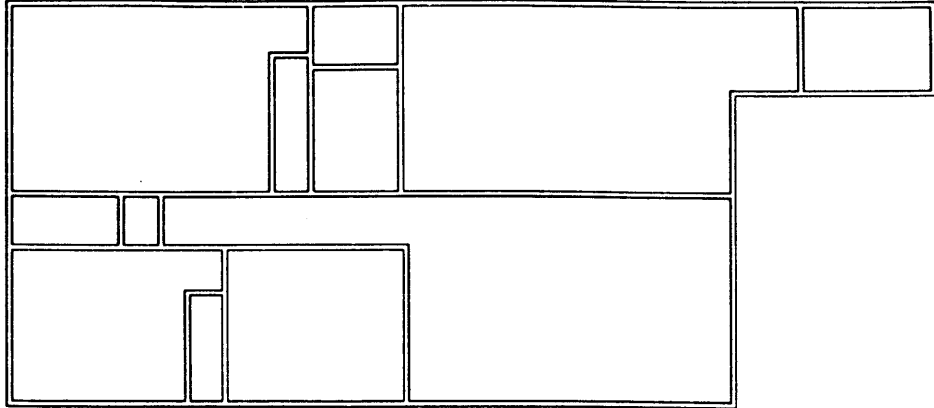
In Canada, most walls on houses are built using 2" x 4" or 2" by 6" studs. As you probably know already, finished lumber is not exactly 2" x 4", and once you put up dry wall, you have a wall that is almost 5 inches thick. Because you are going to dimension your house from the outside to the centre wall, this will make the wall thicknesses sort of irrelevant.

The hall and the perimeter walls will be different from the interior walls. All interior walls will be offset 2 inches on each side of your centre lines. The perimeter walls need to offset by 4 inches on the inside, and the hall needs to be offset outside 4 inches. The reason the hall walls are offset outside is to keep a minimum of 3 feet or 36" clear in the hall.



House Drawing

Now add the wall dimensions to your drawing. Once you have done this, erase the centre lines. They are no longer needed. Trim the lines at the intersections and join the lines that need to be joined. When finished, your drawing should look like the illustration below.



House Plan Wall Drawing

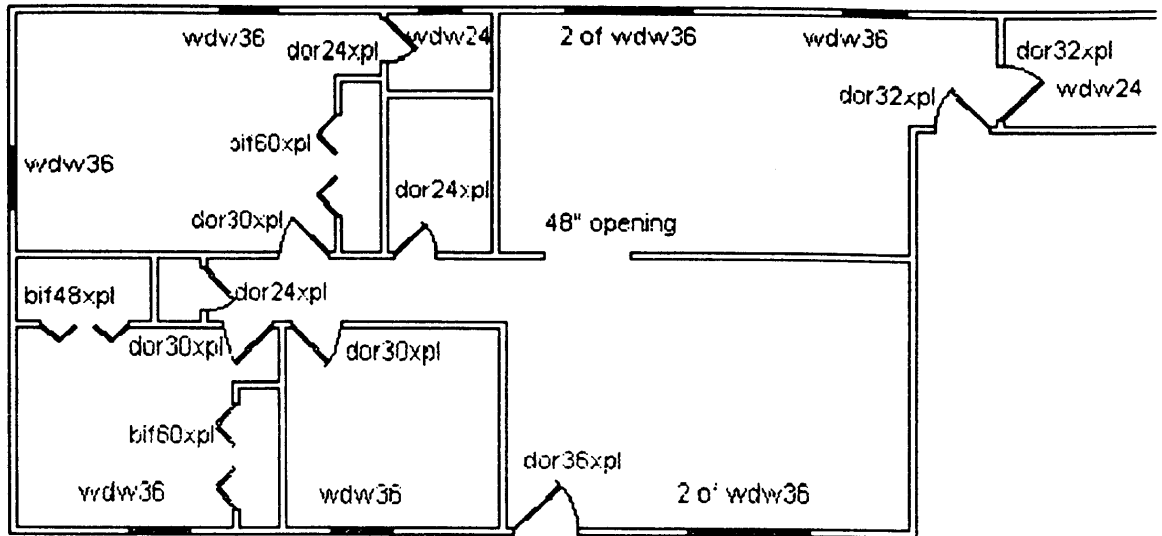
Adding Doors and Windows

Now you need to add some doors and windows to your house. The following table lists the minimum door sizes. Once you are familiar with the information given in the table, you will add the doors to your drawing.

Minimum Door Sizes (in inches)	
Main Entrance	36
Secondary Entrance	32
Bedrooms	30
Study or Library	32
Bathrooms	24
Utility Rooms	32
Linen Closets	16
Bedroom Closets	24
Pantries	12
Storage Rooms	32

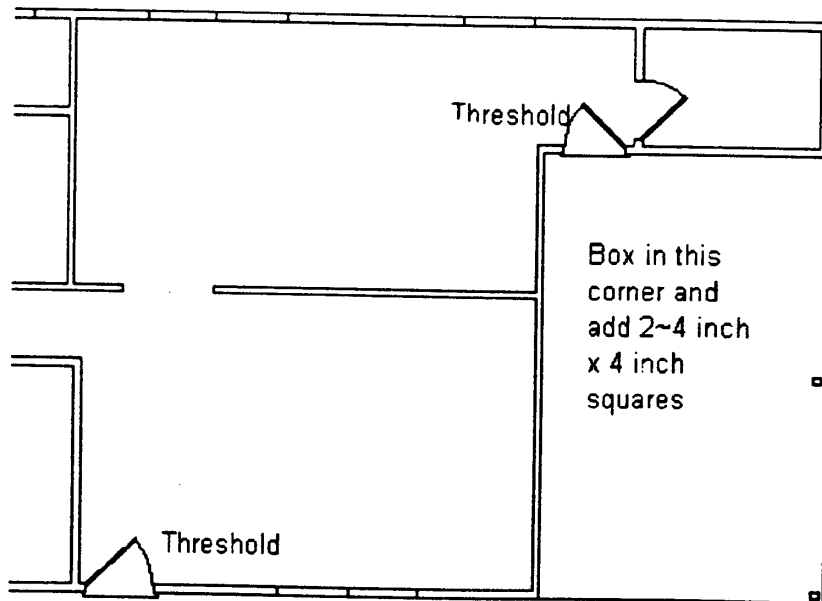
Note: The nearest a door should be to a wall is 3 inches because of the trim surrounding the door casing! Therefore, place all doors 4 inches from the walls so that the 2-inches snap still works. It is also a good idea to swing a door to the closest wall for the sake of comfort.

Refer to the drawing below to see where you should place the doors and windows in your house. Do not worry about labelling the doors and windows in your drawing at this time.



Windows and Doors Drawing

In the following illustration, notice that the garage has been drawn in and that both entrance doors now have lines in front of them. These are the thresholds.



Activity 2: The Kitchen and Service Areas

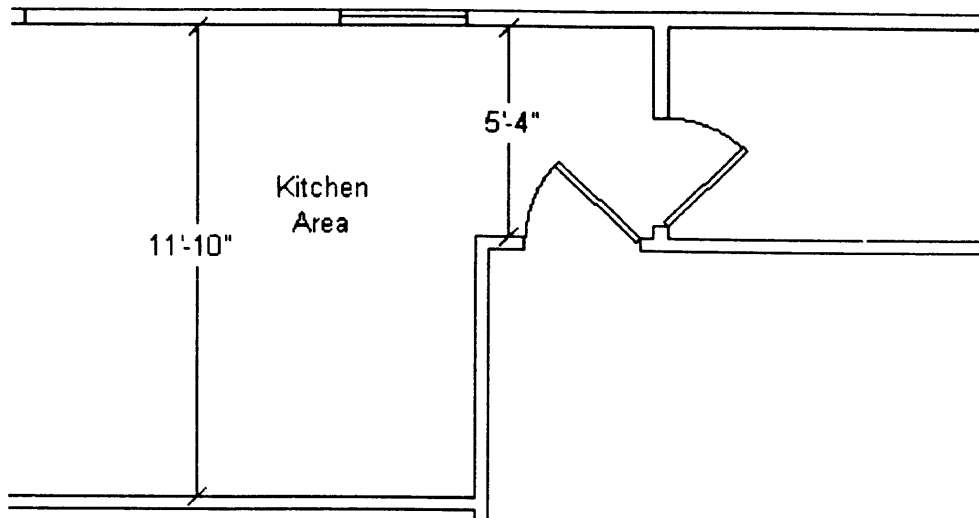
The Kitchen

The homemaker spends a good deal of his or her time in the kitchen. The kitchen needs to be comfortable, yet functional. This living space consists of a sink area, cooking area, and a food storage area. Taken together, these three components are called the **working area** or **working triangle**. The best layout for a kitchen is one that requires the least number of steps to reach each appliance. A good working triangle does not exceed 12 to 14 feet all the way around.

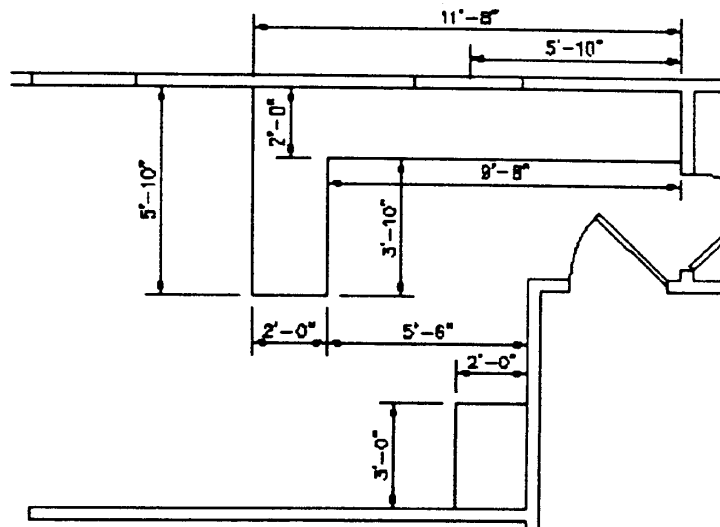
The following list gives you a good idea of the sizes of the different elements that go into a kitchen. Study and learn this information.

- As a rule, kitchen cabinets are 24 inches deep and 34 to 36 inches high.
- Factory or pre-made cabinets are built using 3-inch width increments. That is, they are 12, 15, 18, 21, 24, 27, 30, 33, 36, 39 inches, etc.
- The minimum size for a double-bowl sink and cabinet is 30 inches. Never use less than 36 inches.
- Most homemakers prefer to have a window at their sink so they can look out while working there.
- Range/Stove sizes are 24, 30, 32, 42, and 48 inches. The most common size is 30 inches.
- Refrigerator sizes are 24, 30, 32, 34, 36, 42, and 48 inches. The most common size is 36 inches.
- Dishwasher widths are generally 24 inches.

The following illustration shows a close up of the kitchen area. Zoom in on this area on your computer. You are going to begin by drawing in the kitchen cabinets. Notice how much space you have to work with. Remember that when you design a kitchen, it is important to leave plenty of room for walking around. As a rule, use a 36-inch minimum as a guide. In other words, if there is not 36 inches clear for walking, it is necessary to redesign the cabinet layout.

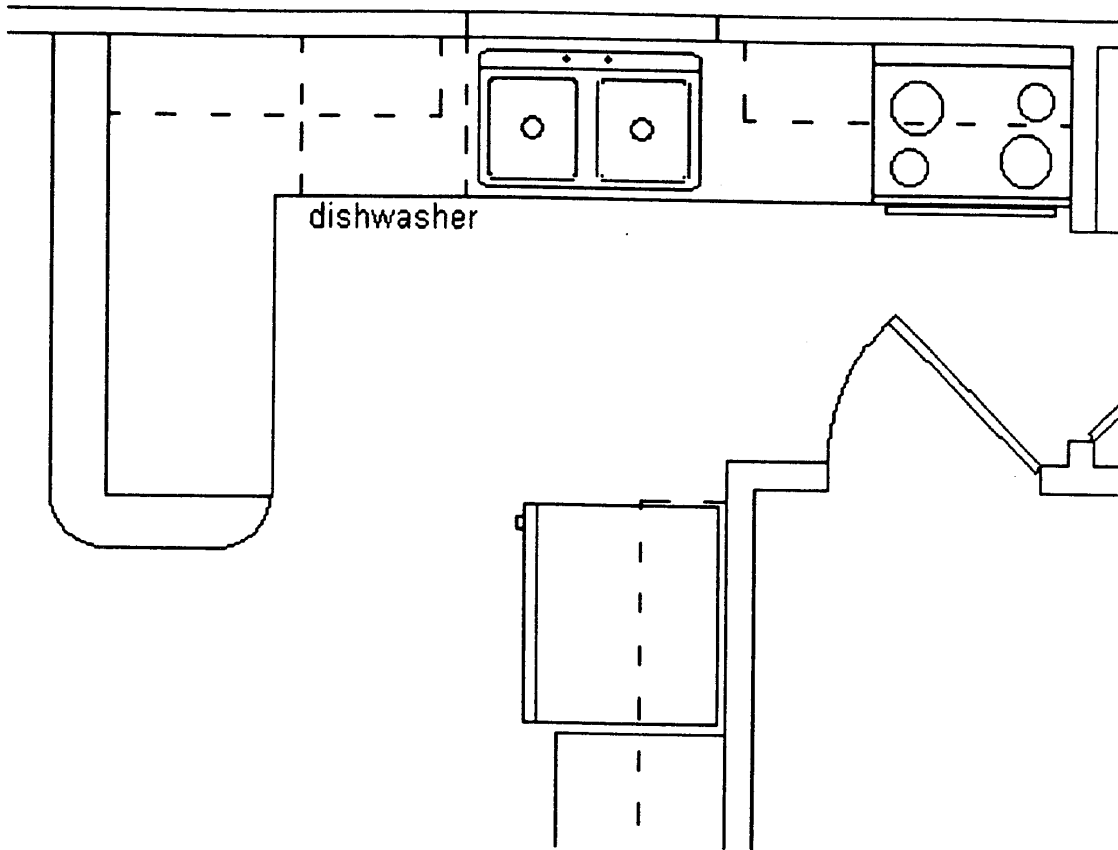


Draw in the cabinets the same way that they appear in the following illustration. You can use the “offset” or “copy” command to copy a line from the wall to the 24-inch depth of the cabinets. Then, using the dimensions given in the illustration, complete the cabinet outlines.



Notice the dimension on the centre of the window in the kitchen. When you place the double sink, you want your window to be centred there. Remember that this house has been pre-designed and you want everything to fit into place.

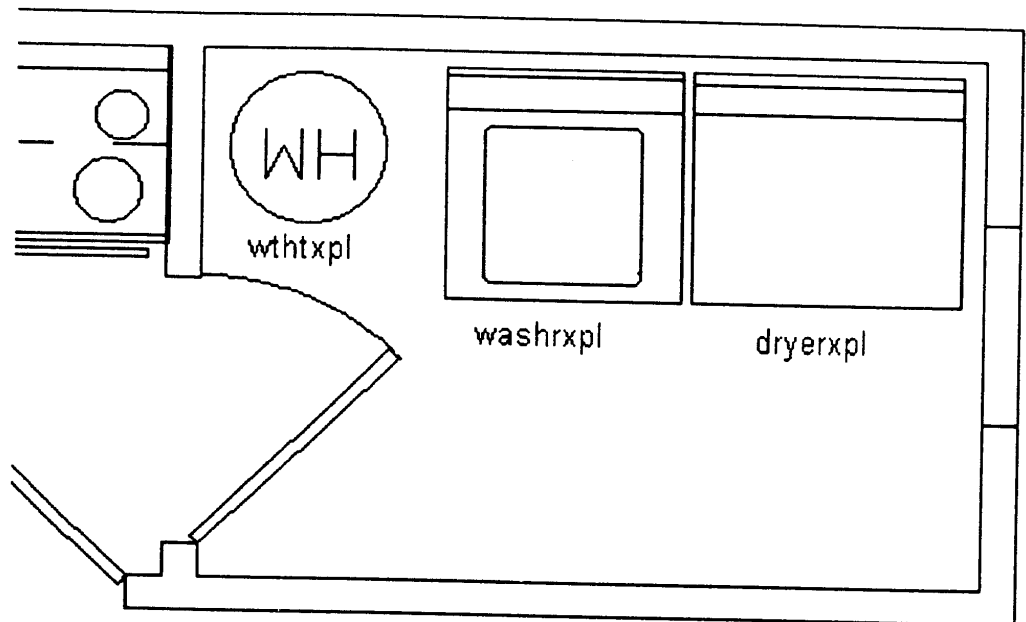
Now that you have placed the cabinets, you can add the appliances. For this house design, you will use the most common sizes for the appliances. The range will be 30 inches; the refrigerator will be 34 inches, but it is important to allow 36 inches for it; and the sink will be a 33- to 34-inch double sink. Again, it is important to allow 36 inches for the sink. Insert the appliances as shown in the illustration below.



Notice that in the above illustration, there is a hidden line showing the upper cabinets and hidden lines showing the dishwasher. The upper cabinets are generally 12-inches deep, and almost all household dishwashers are 24 inches wide. The dishwasher will go right beside the sink. Notice that an 8-inch lip is also placed on two sides of the cabinet leg sticking down to make it a bar top. Make your kitchen match the illustration and you will have completed the kitchen.

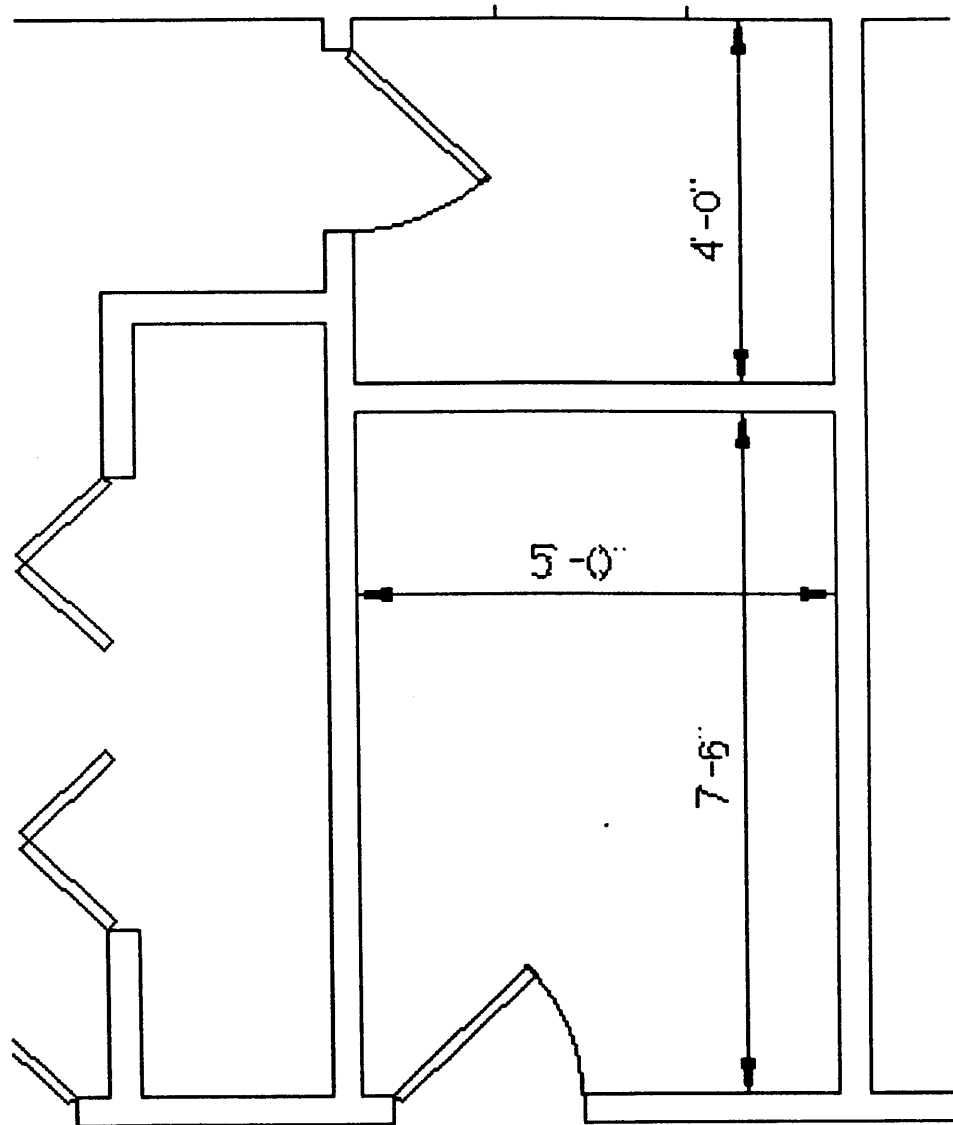
The Utility Room

The utility room contains the water heater, the washing machine, and the dryer. Draw these three elements as shown in the following illustration. You need to keep in mind that the dryer needs to be vented. This is why the dryer should be placed on an outside wall. And if you are designing your house for a colder climate, you would not place the plumbing on an outside wall unless this wall was made thicker so that it could hold more insulation. Duplicate the following image on your computer to complete the utility room.

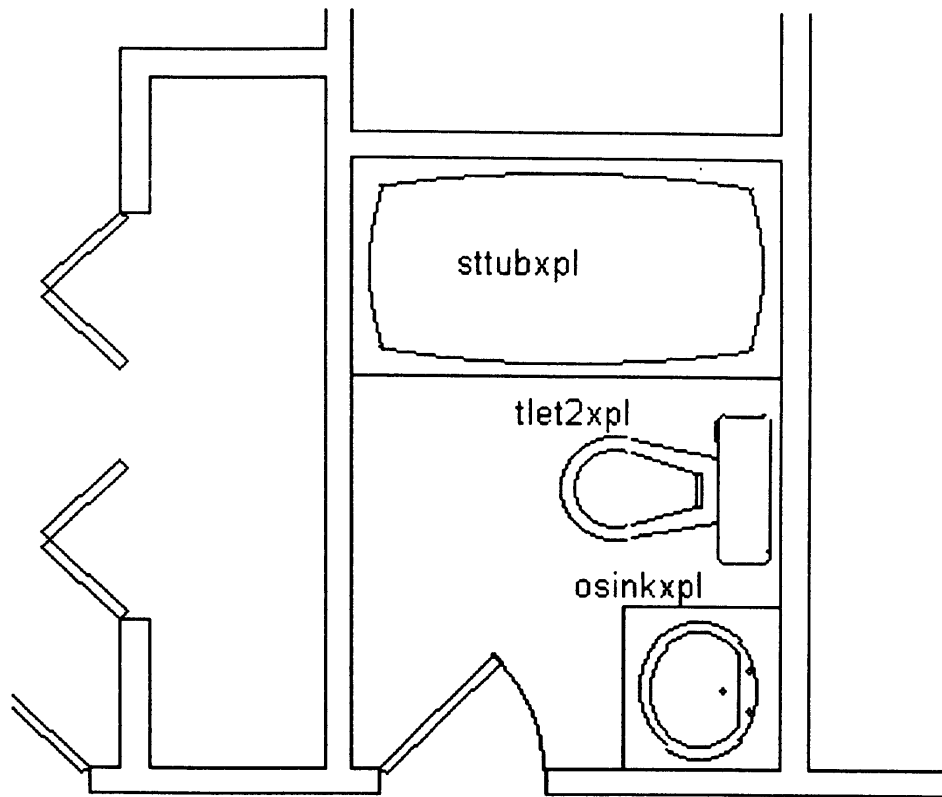


The Bathrooms

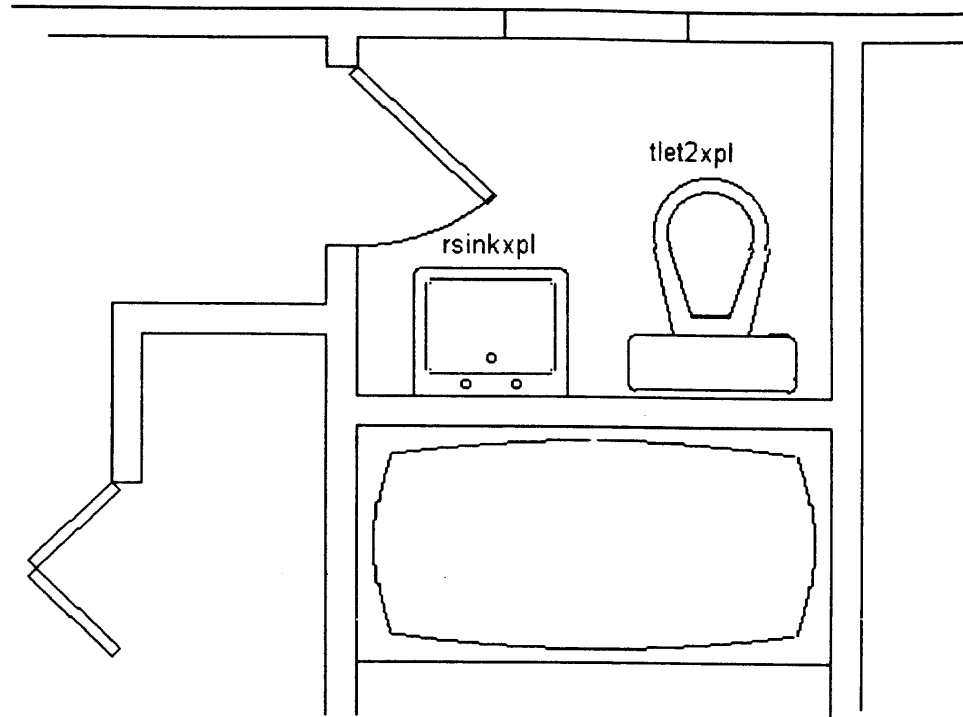
Bathrooms can be as large as you want or as small as 5 feet by 7 feet, the minimum size for a functional bathroom with a sink, toilet, and tub. Look at the following image.



Notice that in the illustration, the bathroom is shown with the dimensions of the inside walls. This is to show you that the minimum “standard” bathtub width is 60 inches or 5 feet. There also needs to be plenty of room for the toilet and the sink. The toilet needs 34 inches clear, the sink vanity needs a minimum of 24 inches, and the depth of the tub needs to be a minimum of 32 inches. This adds up to 90 inches or 7 feet 6 inches. Using this information and the following diagram, draw in the bathroom.



There is also a half bath for the master bedroom. Because space is limited in this little room, you are going to put in a wall sink instead of a vanity because the wall sink takes up less space. Complete the half bath as shown below.



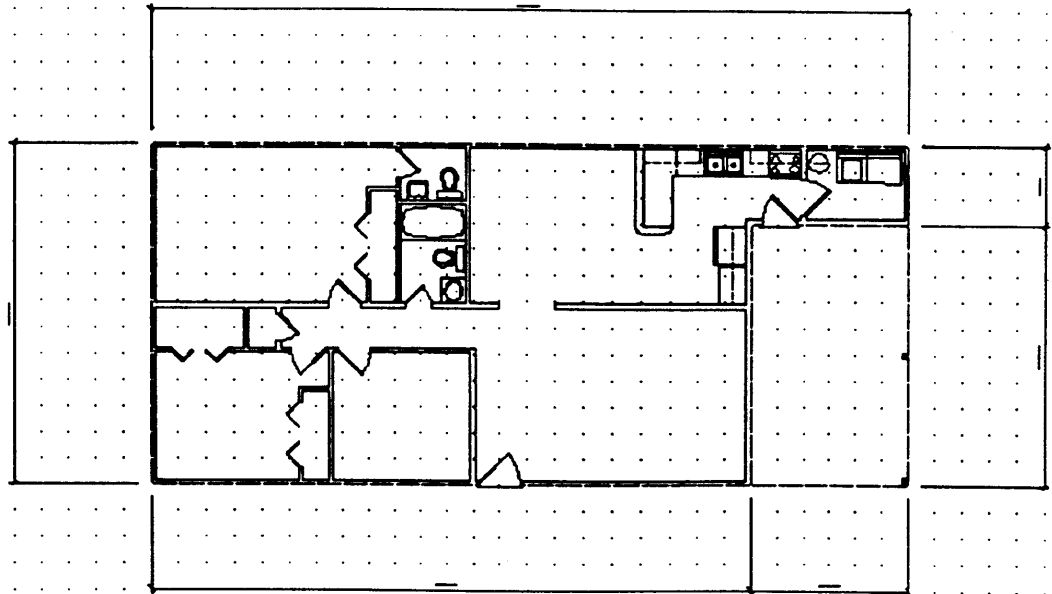
Activity 3: Dimensioning Your Floor Plan

Builders need to know exactly where the walls, windows, and doors are going to be located. They would also like to know the door and window sizes and anything else that is special on the plan. For builders, the dimensions and any special notes come in very handy.

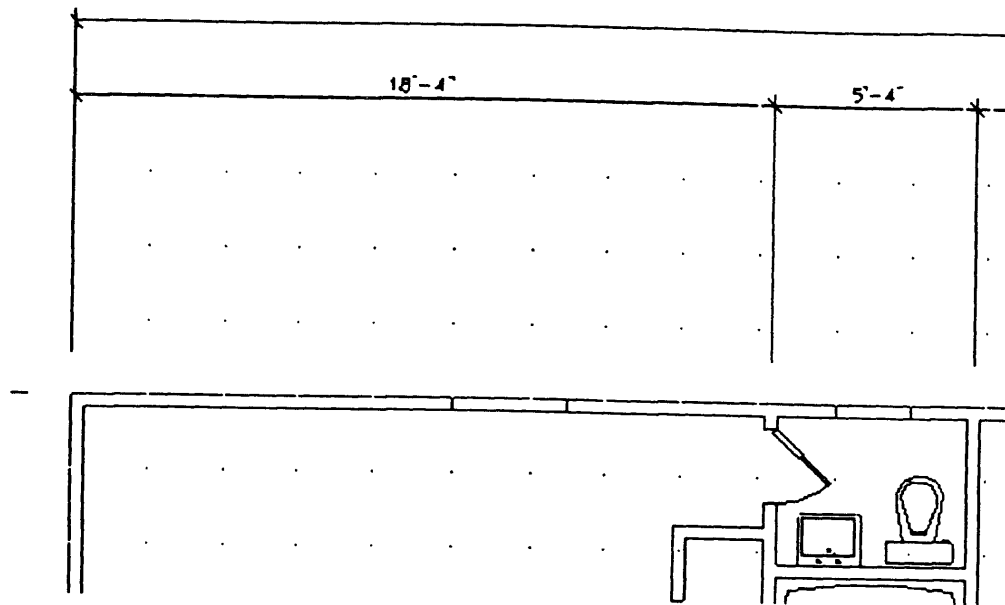
You will begin by looking at the overall dimensions of the house.
Follow these steps:

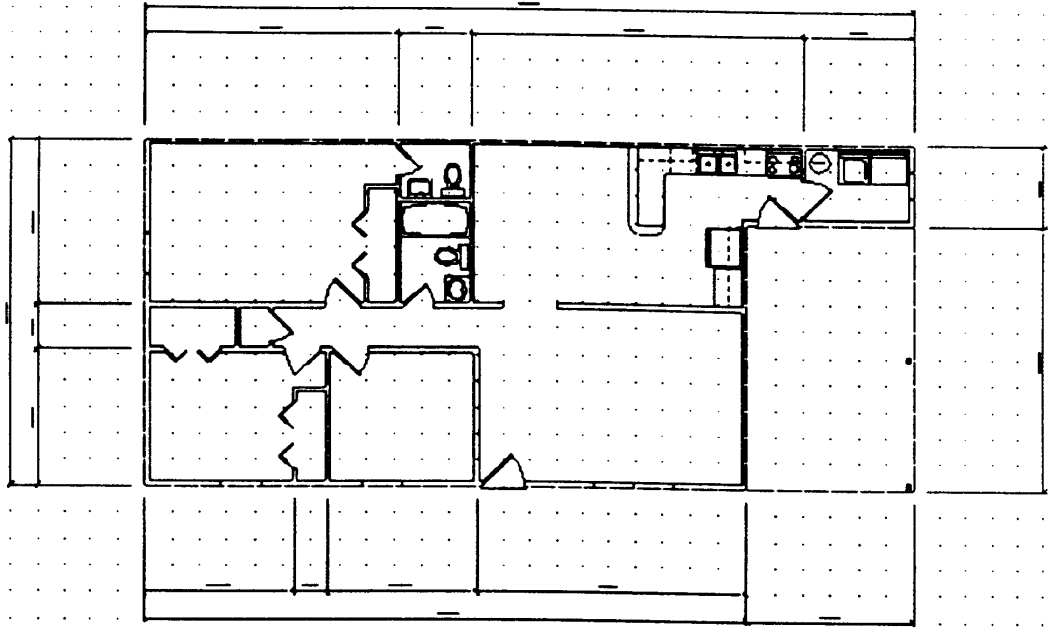
1. If your CAD program uses layers, create a layer called “Dimensions” and make this layer your current layer.
2. Make the dimensions a different colour from the colour you used to draw in the main floor plan.
3. Make sure your snap is on and it is still at 2 inches.
4. If your grid can be set to an increment of 2 feet and you are still able to keep your 2-inch snap, then set your grid accordingly. This will help you keep your dimensions at least 24 inches apart.
5. Set your dimension leader to a slash or tick if you have that option. (This is a 45-degree line at the end of the dimension leader.) If you cannot do this, the arrowhead will do just as well.
6. Set your dimension height to a minimum of 4 inches.

Look at the following sketch before you begin the overall dimensioning. The idea is to dimension every major break on the perimeter of the house and still leave room for the interior and opening dimensions. As a rule of thumb, you should place the overall dimensions at least 10 feet from the house. Do this if the paper size allows. Be sure to leave plenty of room for all the dimensions.



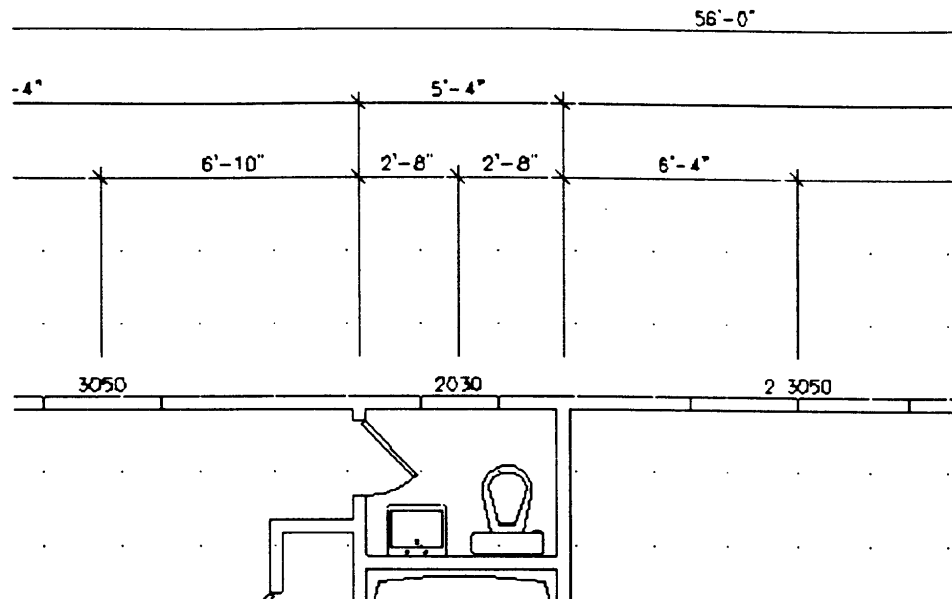
Next, place the interior wall dimensions that touch the exterior perimeter. Place a dimension at the centre of each interior wall except for those at the carport. The carport or garage area will be dimensioned like interior walls because they are part of the house. See the two images below to get an idea of what you are supposed to do. Make sure you do not put the extension line too close to the house.





Now you will do the doors and windows. It is not usually necessary to dimension the opening size. A simple size note will do because you may not know the exact rough opening size of the window or door. Manufacturers hardly ever make their products exactly the same sizes as those made by their competitors. Once you have made the size note, dimension to the centre of the opening.

Use a simple note to show the size of the windows. (For example, if a window size is 3 feet 0 inches wide and 5 feet 0 inches high, note it as 3050.) To note a door or cased opening size that is 3 feet wide, mark it 3-0 to make it different from the window note. This will help to avoid confusion. Place these notes into the door swings and above, below, to the right, or to the left of the windows. Refer to the illustration that follows.



Here is some other information to use when adding your notes to the drawing:

Main entrance doors are 3-0.

The bedroom entrance doors are 2-6.

The left bedroom bifold closet doors are 4-0 BIF. (BIF is the bifold note.)

The right bedroom bifold closet doors are 4-0 BIF. (BIF is the bifold note.)

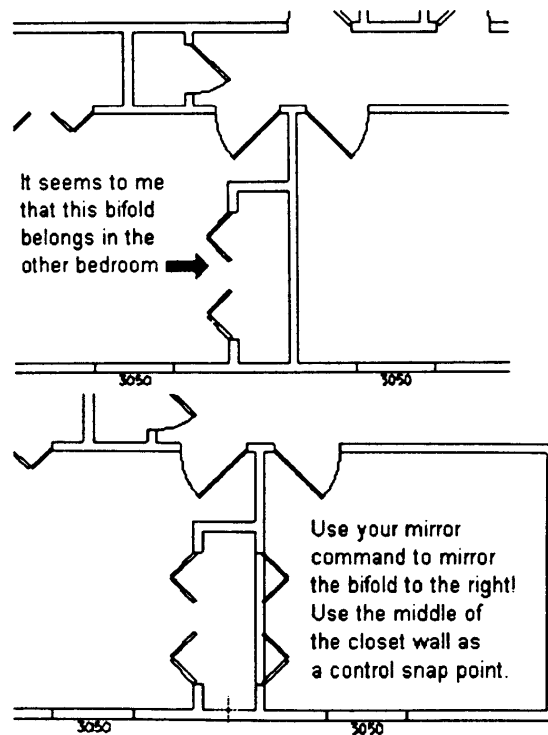
Did you notice in the illustration at the top of page 21 that the right bedroom bifold door has been drawn in the wrong room? This is an example of a simple mistake that can throw the whole plan off and make you look dumb to your client. Look at the information below to learn how to fix this mistake.

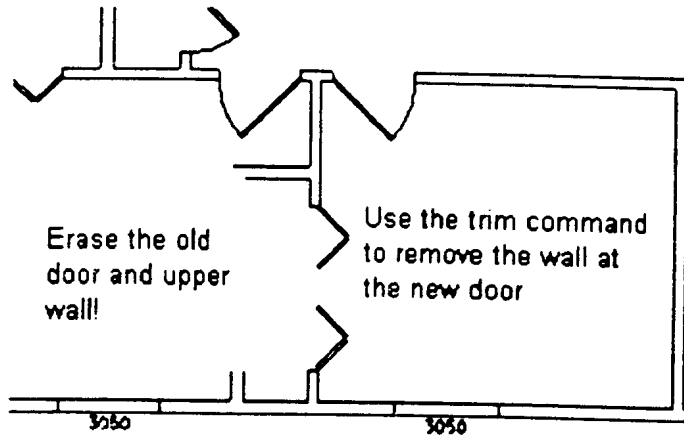
- Bathroom and hall closet doors are 2-0.
- The kitchen and utility room doors are 2-8.

- The cased opening between the dining room and the living room should be noted as 4-0 C.O. (C.O. stands for cased opening and means that there is trim around it, but no door is attached.) (Note: Casing can also be just Sheetrock and does not always refer to wood trim.)
- Living room windows are 2~3050. (Two windows placed together.)
- All bedroom windows are 3050.
- The bathroom window in the master bedroom is 2030.
- The kitchen sink window is 3030.
- The utility room window is 2030.
- The dining room window is 2~3050 (Two windows placed together.)

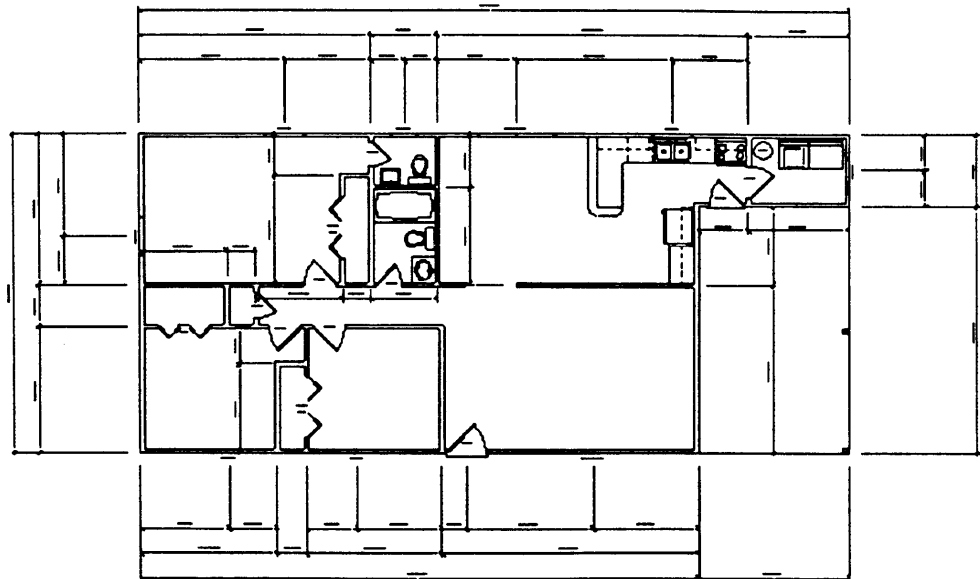
Fix the Mistake

Expect a mistake from time to time. This time the mistake is small, but a misplaced wall, door, window, cabinet, etc., can affect the whole set of drawings. Refer to the images given below to see how to fix the incorrectly-positioned closet doors.





Use the following image and the table and door size information given above to complete your dimensioned drawing. When you are finished, you can move on to the next activity.



Activity 4: General Wiring in a Home

General Considerations

When thinking about the electrical needs of your home, you need to consider the location of lighting outlets, the convenience of the outlets, the distance to the breaker box, the location of wall switches, and a plan for future expansion needs.

A. The Location of Lighting Outlets

The amount and type of lighting you put in each room will depend on two things: the kind of work that will be done in the room and the atmosphere you wish to create in the room. In most cases, the best results are achieved through the use of both permanent lighting fixtures and portable lamps.

B. The Location of Convenience Outlets

The Canadian Code requires that in all rooms except the bathroom, the convenience outlets must be located so that no point along the usable wall space is more than 6 feet from an outlet.

Wall space is taken up by a window that extends to the floor, a fireplace, a doorway as well as the area of wall covered by the door when it is open because this area is not considered as usable wall space. The minimum length of wall space requiring a convenience outlet is 36 inches measured along the floor line. When planning the location of outlets, place them towards the end of the wall space rather than towards the centre. This reduces the likelihood of the outlet being hidden by a piece of furniture. Where possible, leave one outlet free for connecting such appliances as vacuum cleaners or floor polishers. In most cases, convenience outlets are located 12 inches above the floor line.

C. The Location of Separate Circuit Outlets

This type of outlet is designed to carry the load of a high wattage appliance. Separate circuit outlets should be located wherever such appliances as refrigerators, dishwashers, freezers, baseboard heaters,

and air conditioners are to be used. The Canadian Code also requires that each exterior outlet and each outlet in the laundry room be wired to a separate circuit. The position of the outlet on the walls varies according to the area in which it is located. In most cases, the outlet is placed 12 inches above the floor line.

D. The Location of Split Duplex Receptacle Outlets

These outlets are most frequently found at the kitchen counter, but they should also be located wherever two high wattage appliances will be plugged into one duplex receptacle. (For example, near the dining room table.) The kitchen counter outlets are generally installed approximately 44 inches above the floor line. In the eating area, they should be at table height. In most other locations, they should be 12 inches above the floor line.

E. The Location of the Wall Switches

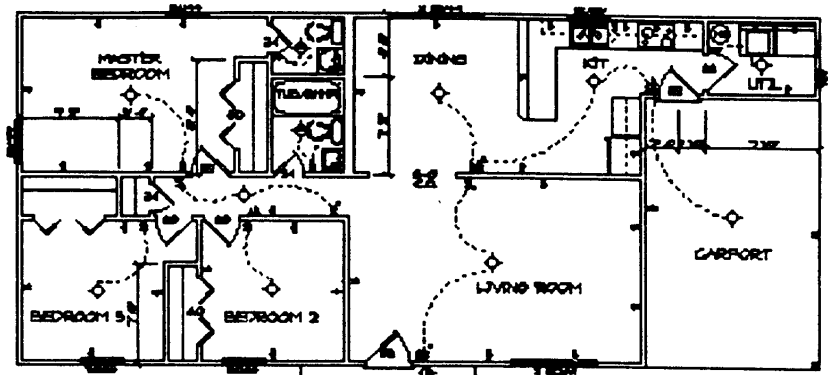
The main source of light in each room should be controlled by a wall switch located on the latch side of the door or on the traffic side of the archway. Some exceptions to the rule are the control of exterior lights from inside, the control of stairway lights from adjoining areas, and the control of lights from outside areas as is often the case with closets and storage rooms. When a room has more than one door, there should be a wall switch at each door that controls the main source of light in the room. In a well-planned home, you should be able to turn on a continuous path of light in front of you as you walk through the house. You should also be able to turn off the lights without having to retrace your steps. In most cases, wall switches are mounted 48 inches above the floor line.

F. Planning for the Future

When designing the wiring system for your home, plan for the future. Include wiring and outlets for appliances and equipment that may be installed at a later date. It is easier and less expensive to add extra wiring when the home is being built than later after it has been completed.

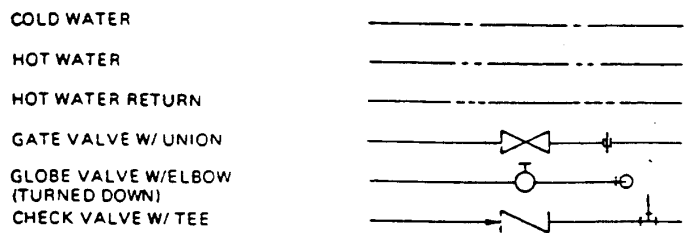
Now that you have read all of this information, you are ready to add electricity to your home. Before you will begin, you will need to learn

the electric wiring symbols commonly used in the profession. Check a good reference book or ask your instructor for this information. Now you can begin drawing in the symbols. Use a dashed line to show where the wire would be laid. Refer to the overview drawing given below. Remember to take your time and think about the needs of each room as well as the information about wiring you have just read.



Activity 5: Plumbing, Heating and Air Conditioning

Using the following symbols, draw in the plumbing throughout the house on a different layer.

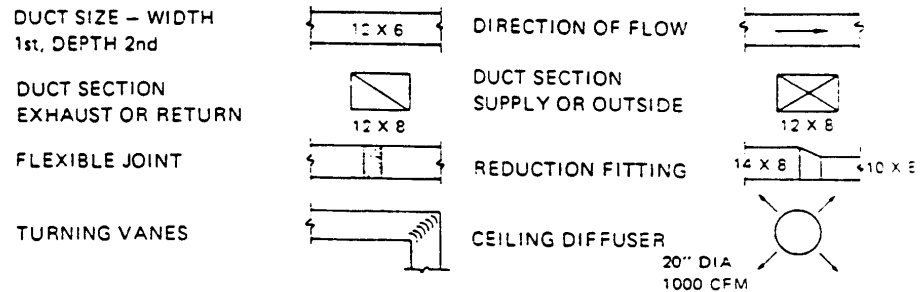


Note the different symbol used for the hot water return.

Temperature control in your home is provided by the heating and air conditioning systems. Duct layouts can be quite detailed. In most cases

the duct system is dual ducted. This means that the same duct carries hot or cold air depending on the room temperature.

Use the following symbols to add the duct work to the house.



Lesson 6: Building Layout

The investigation and preparation of the site are not usually carried out by the carpenter, but these steps are nevertheless important and must be carried out before layout and excavation can take place.

The building layout for most residential buildings and smaller structures can be done most efficiently using steel measuring tapes, wood stakes, and sometimes nylon building line. Excavations for general construction can include everything from provision for a house basement to a massive earth removal project for a large building. Naturally, soil conditions and types will largely determine the method of excavation and the type of building that can be built.

Try to lay out your house on a piece of land. To do this job, you will need the following equipment: a sledge hammer, a claw hammer, an 8-point saw, a nylon building line, a hand level, 16 stakes, and common nails. With your equipment, try to lay out your house. The house you are drafting should be fairly simple to fit on a lot because of its shape.

Zoning

Most cities and larger towns have bylaws restricting different areas to certain types of structures. The issuing of a building permit to the owner or builder will usually indicate that the proposed structure is being located according to local regulations.

The site plan is usually the first sheet in a set of architectural drawings. Its primary purpose is to show the location of the structure on the property. The site plan also serves to indicate the following:

- a. Property dimensions and conformation.
- b. The location of the property in the municipal unit.
- c. The location of existing and/or proposed service lines.
- d. Geographical directions. (North is usually shown.)
- e. Grade elevations (existing and proposed).
- f. Structure elevation.
- g. Overall lateral structure dimensions.
- h. External area finish (pavement, grass, gravel, etc.).
- i. Parking, play, sports, or other areas.
- j. Sidewalks, driveways, patios, and pools.
- k. The legal description of the property and the type of proposed structure.
- l. The location of test holes (for soil samples).

In a single-family residential construction, the “set back” of the house from the front property line is usually determined by local laws. Some other things to consider when creating a site plan:

- a. The convenient access to and circulation around the dwelling.
- b. Adequate natural light and ventilation of rooms and spaces.
- c. Reasonable privacy.
- d. The utilization of the lot for laundry drying, gardening, landscaping, and outdoor living.
- e. Where necessary, the space for safe and sanitary sewage disposal facilities.

Keeping in mind this zoning information, create a site plan for your home.

Activity 7: The Finished Product

At this point, you should now understand the basics of drafting a house. Before you begin your next set of plans, you should be able to answer the following set of questions:

- What facilities do you need, considering the size of the family that will be living in the house?
- What special features will your house have?
- How big will your house be?

- What materials will you use to construct the house?

Using your computer, write a report in which you discuss all of these factors. Ask your instructor for the handout entitled “How to Select Your Plan” if it is available. In the handout, look through the house designs for future ideas.

Once you have finished all your drafting assignments and your report, prepare a presentation in a neat, professional manner. Be sure to indicate all your rough and finished work. You will present your work to your instructor and the rest of your class. This will help you to build your confidence for making presentations to others. The people who see your presentation will fill out an evaluation form. You will include this evaluation form with all your project documents.

Where do I go from here?

Now that you have learned the basics, there are several options available to you. You could conduct further independent research on housing design. Or maybe you would like to move on to the building stage. The first thing you should do is build a scale model of your house design. For this model, you could use balsa wood or poster board. (You may wish to print out your design from the computer and use it to help you cut the pieces for the house.) Drafting and designing your dream home are interesting and fun exercises to do.

This learner guide may have opened up several new career options you had not ever considered before. Would you like to study architecture or drafting? Do you think you might like to make a career out of this kind of work? One excellent way to explore these career options further is to get a summer job working for an architect or carpenter.

LEARNER GUIDE WRITING TEAMS

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Campobello Island Consolidated School
Carleton North Senior High School
Fundy High School
Grand Manan High School
John Caldwell School
Nackawic High School
Southern Victoria High School
St. Stephen High School
Sir James Dunn Academy
Tobique Valley High School
Woodstock High School

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