

Chapter 13

Drawing an Architectural Floor Plan

In this chapter, you will learn the following to World Class standards:

- Starting a floor plan using an architectural sketch
- Creating a drawing using the architectural template
- Creating the perimeter wall with the polyline and explode tools
- Creating the interior walls with tools on the modify panel
- Using the properties tool to modify a dimension variable
- Roughing in a bathroom, vestibule and stairs
- Using a door block on a floor plan
- Using a window block on a floor plan
- Drawing a fireplace
- Drawing a kitchen
- Drawing a pantry and laundry room
- Finishing the bathroom
- Completing the basement stairs
- Labeling the floor plan

Starting a Floor Plan Using an Architectural Sketch

A drawing can be defined as an accumulation of ideas visualized into a communicable form. A designer of an architectural project might ask a number of questions: "How many rooms will be in the house?" "How many people will utilize this dwelling, and what kind of workflow will it require?" Identifying the customer is always a tricky question. For example, a company that may be building a series of houses along a new street might feel that it is the customer, but as all owners soon discover, the end user ultimately determines the reputation and the demand for the final product. What does the designer or architect bring to the equation? They bring experience, the ability to collect information from all parties involved, the application of style using art and creativity, and safety from an understanding of ergonomics and convenience. A good designer will collect as much information as possible, sort through the magnitude of requests, prioritize the output based upon design criteria and create a storyboard or sketch that the CAD operator can then draft on the computer.

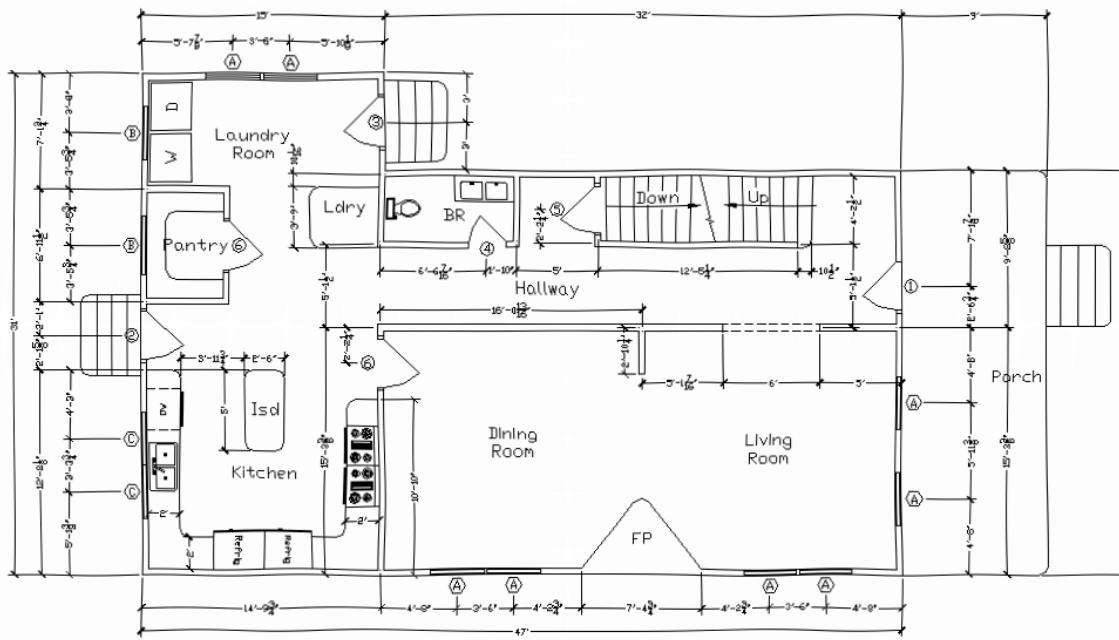
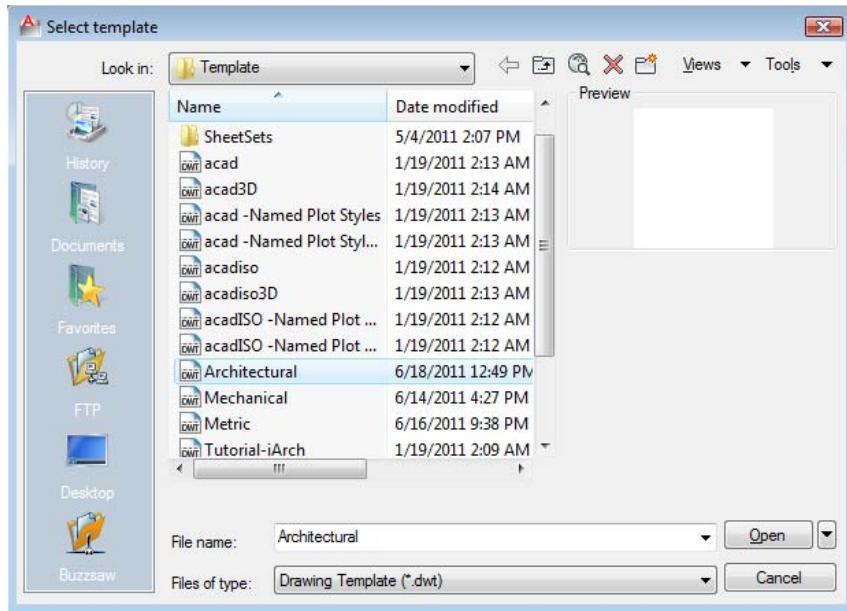


Figure 13.1 – Receiving a sketch from the architect

In an architectural setting, the sketch of the first floor is often the first rough draft of the project that demonstrates possibilities for the living space. This floor is the center of work and leisure in most dwellings. The drawing shown in Figure 13.1 is a design concept of an existing city lot of 40' width by 100' length. Not every home will have 3000 to 5000 square feet; many residential and commercial businesses are small or medium plan sets that employ each area of floor space as efficiently as possible, while demonstrating flexibility to withstand use over time. Many drafters receive an initial sketch on paper with rough dimensions, but this detail, although rough, has a massive amount of precise measurements for completing the AutoCAD drawing. In appendix E, you will find a larger copy of the floor plan, which will be easier to read.

Creating a Drawing Using the Architectural Template

You will begin the architectural floor plan problem by selecting the architectural template you created in a previous chapter. In Figure 13.2, you can see the “Select template” window, loaded by selecting the New tool on the Quick Access Toolbar. The Select template shows a list of drawing templates. Scroll down the list and select Architectural.dwt.



If you did not create the Architectural template in chapter 8b, then you will want to stop now and make the template using the Mechanical template as a guide. In chapter 8b there is a list of modifications to the units, dimension style, line scale, and other specific variables that will enable you to work on any residential drawing without the bothersome routine of configuring all of these settings each time you work on a new file.

Figure 13.2 – Starting with the architectural template

Many professionals ask why the Rectangle problem is so important in developing drawing strategies, a concept so fundamental in every discipline, but often lacking in CAD documentation. After asking them some of the questions listed below, almost all technical experts go right back to work on the Rectangle problem and labor through the basics of 2D drawing, presently the most common style of CAD work in industry.

1. What are your drawing times for floor plans?
2. Can your architects or architectural designers draw and interact in CAD while the customer is watching, or does the process take so long the client needs to return in a few days or even weeks?
3. Does your company use standard settings for each type of drawing?
4. Does your company employ templates to increase speed and accuracy?

Time is what keeps the professional from completing the design process and accuracy is of the utmost importance. The advantage of the computer aided design system over pencil drafting is that the software contains a multitude of powerful tools. Almost unanimously,

CAD users from every sector of the design field feel that they need to improve their 2D drawings, as the format is the primary form of communication to machinists or construction workers. They feel they know the CAD commands but that they developed the process and procedures for deploying these commands in a highly effective manner.

In the Rectangle problem, you begin to learn these tactics, using eight lines and three circles to draw 58 entities. From those original eleven building blocks, you quickly and efficiently generated 81 total entities. Almost all drawings need to begin with the same approach. Just like in the Rectangle problem, you will start the floor plan by drawing the perimeter.

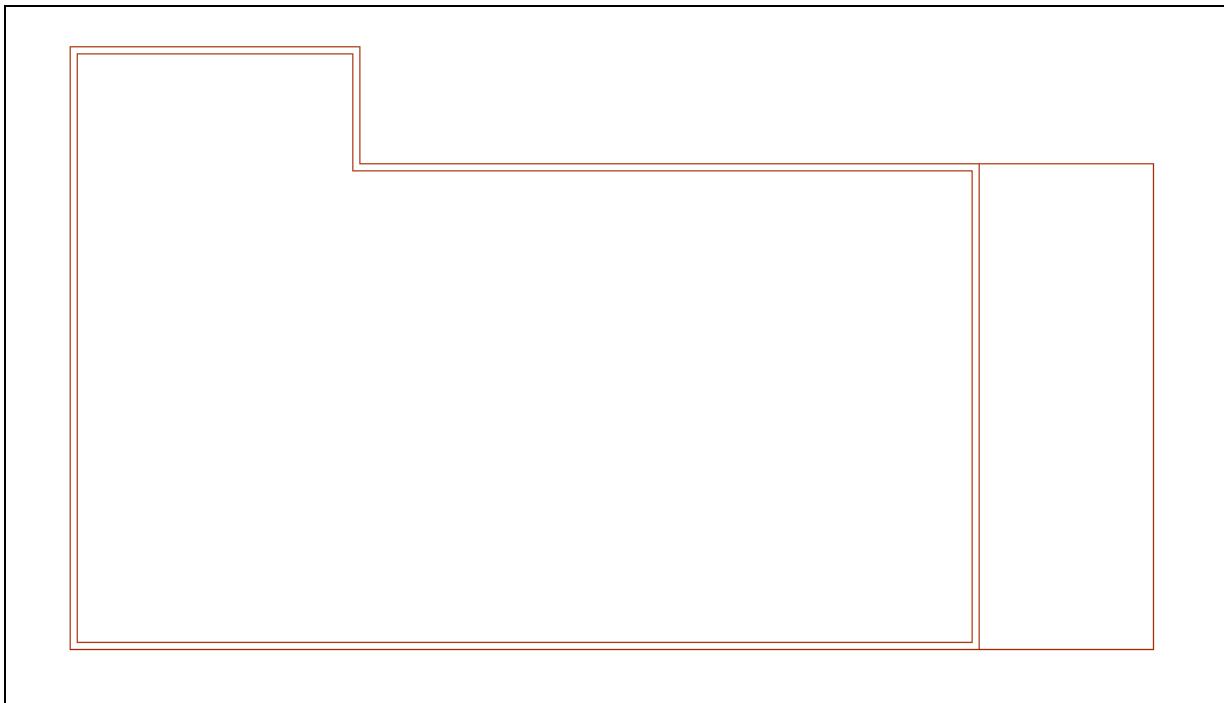


Figure 13.3 – Exterior walls and porch

Creating the Perimeter Wall with the Polyline and Explode Tools

Select the Polyline tool on the Draw panel and pick a starting point in the lower left-hand corner of the display. With the Ortho mode (F8) set to On, draw a polyline 47' to the right, 25' up, 32' to the left, 6' up, 15' to the left, and 31' down, hitting ENTER to complete the command. For the architectural units, the format for inputting feet-inches is simple.



The architectural unit is the most flexible of all unit formats in AutoCAD. Many CAD operators type dashes and inch marks like those displayed on the AutoCAD status bar on their input when drawing lines, but this is only a waste of time. The system default is still in inches, so the inch (“”) is never needed. The only time you need a dash is when you type a fraction after a number representing an inch (See Table 13.1 – Yellow Highlight).

Architectural Measurements			
Feet	Inches	Degree or Fraction	AutoCAD Input Format
20	0	0	20'
10	6	0	10'6
5	3	1/2	5'3-1/2
4	2	0.5	4'2.5
2	0	3/4	2'3/4
1	0	0.875	1'0.875

Table 13.1 – Architectural unit format

Draw the polyline on the Wall layer and then Offset the line 4.5 inches to the inside, creating the inside of the exterior wall. Explode both polylines using the Explode tool on the Modify panel, and the polyline will now become individual lines.

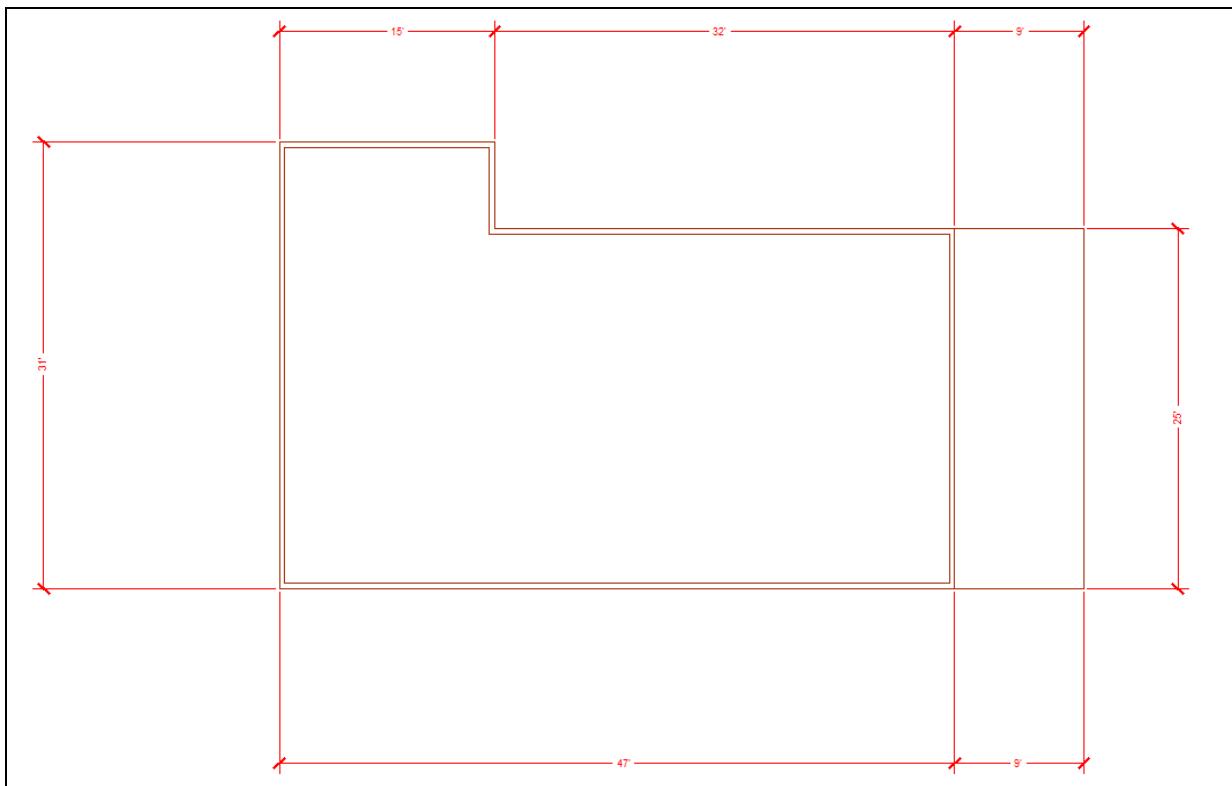


Figure 13.4 – Placing dimensions on the floor plan

Draw the 9' by 25' porch using the Line tool on the Draw panel, starting at the lower right corner of the house. Next, change to the Dimension Layer and place dimensions on the drawing as shown in Figure 13.4, so that you can check your work as you go on this complex design. Make sure to give yourself room between the wall and the dimension line for windows and more dimensions.

Creating the Interior Walls with Tools on the Modify Panel

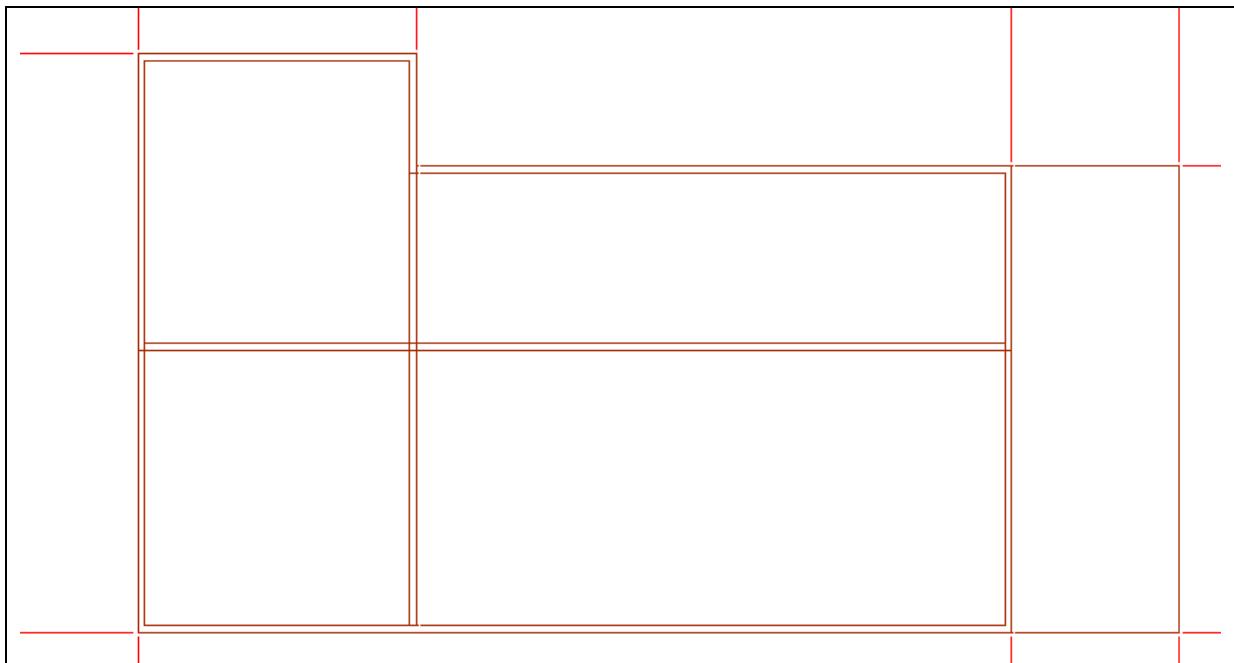


Figure 13.5 – Extending an interior wall and copying a wall

As in the Rectangular problem, the majority of the remaining lines and arcs will come from the original set. Copy the bottom two lines up 15'1.125 using the Copy tool on the Modify panel, and lengthen the center horizontal lines to the interior of the bottom wall using the Extend tool (Figure 13.5). Use Trim tool to form the corner of the dining room wall as shown in the sketch.

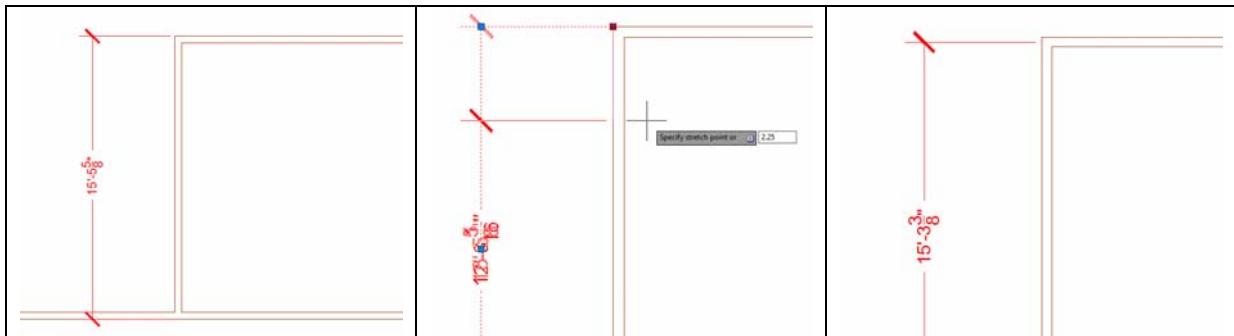


Figure 13.6 – Adding the dimension

Figure 13.7 – Moving the vertex 2.25 down

Figure 13.8 – The finished placement

Dimension the wall from the outside of the exterior wall using the Perpendicular Osnap mode as shown in Figure 13.6. Then, as you see in Figure 13.7, grab the grip and move the top extension line straight down; type 2.25 and ENTER to move it down half of width of the wall. The final dimension is 15'-3 3/8" measured from the outside wall to the center of the interior wall.

Using the Properties Tool to Modify a Dimension Variable

Select the 15'-3 3/8" dimension, right-click, and select Properties. The Properties window lists the categories of General, Misc, Lines and Arrows, Text, Fit, Primary Units, Alternate Units, and Tolerances with variables that represent the 15'-3 3/8" dimension.



To remove the dimension extension line that is covering the exterior wall, select the Lines and Arrows category and change the Ext Line 2 label from "On" of "Off" (Figure 13.9).

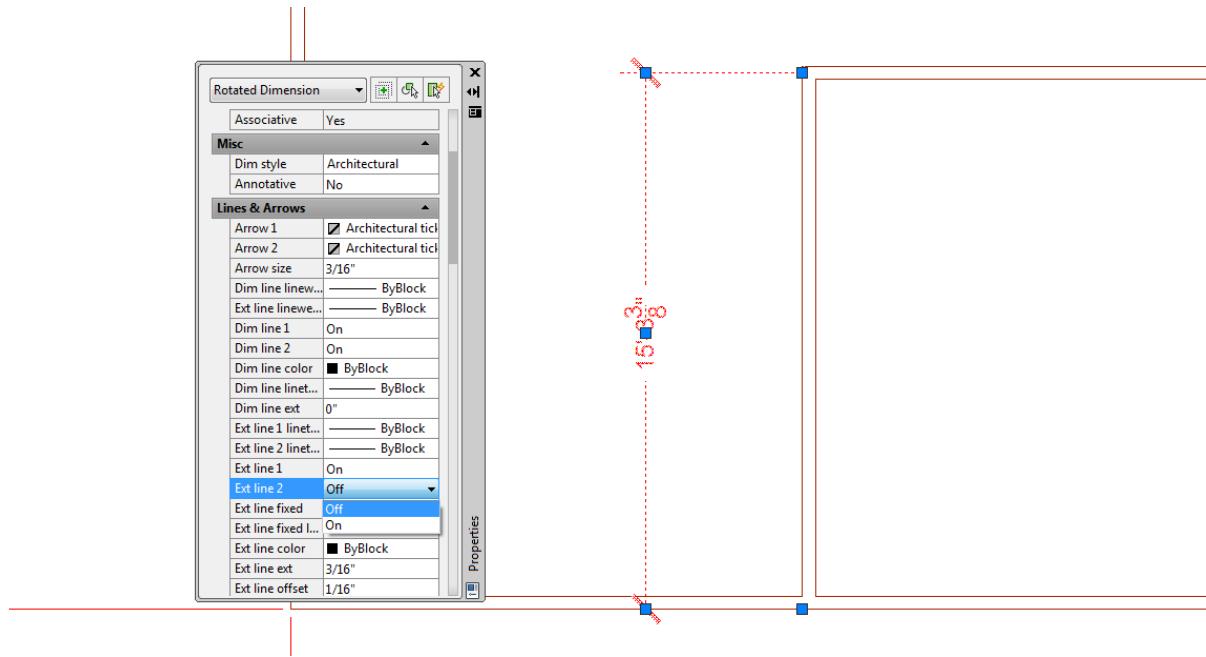


Figure 13.9 – Turning off a dimension extension line

Roughing in a Bathroom, Vestibule and Stairs

Once you place one vertical and one horizontal interior wall in the drawing, you will ideally be able to copy all remaining walls from the originals. Copy the left dining room wall to the right a distance of 16'13/16. Detail the wall intersections using the Extend, Trim and Fillet tools as necessary. You will quickly create the main rooms in the interior of the floor plan using this technique. Dimension the interior walls from the center of one wall to the center of another wall. You can insert the measurements on the drawing at the endpoints of the lines and then move the dimension extension lines over 2.25 to the midpoint of the wall using the same technique covered previously. Your drawing should now resemble Figure 13.10.

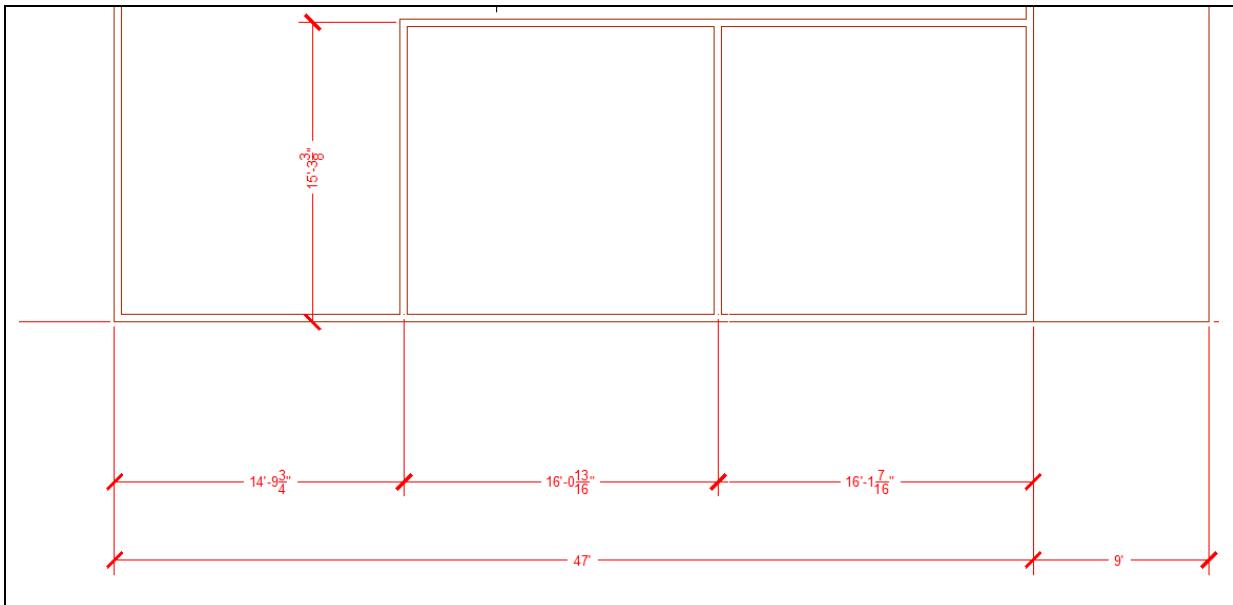


Figure 13.10 – Detailing the dining and living rooms

Copy the wall at the top of the dining room 5' 1-1/2 up to form the hallway. Extend the exterior wall out to the hallway, then trim and fillet the corners as necessary as shown in Figure 13.11. Copy the left side of the bathroom wall 8' 4-7/16 to the right to make the opposite wall of the bathroom as shown in Figure 13.12.

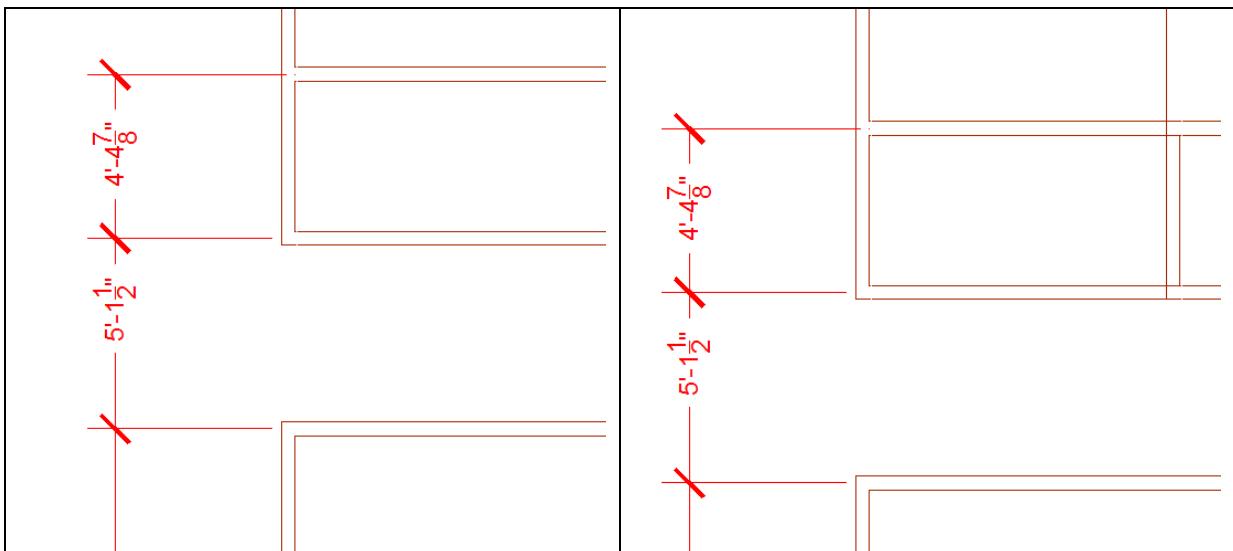


Figure 13.11 – Creating the hallway

Figure 13.12 – Creating the bathroom

When working with architectural drawings, you should not worry about dimensions that do not round off to the nearest foot or inch like 5'-1". Neither should you be anxious with the hallway being precisely 4' wide to maximize a standard building material. Builders install floors along the joists and the dimension of a finished room will vary in fractions from one construction site to another for the same design.

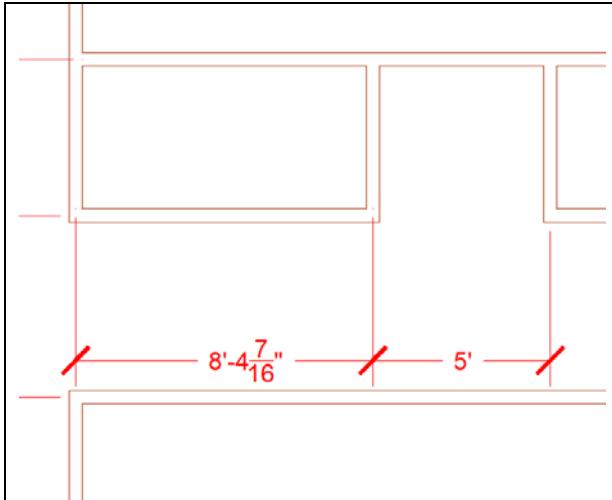


Figure 13.13 – Creating the vestibule to the basement stairs

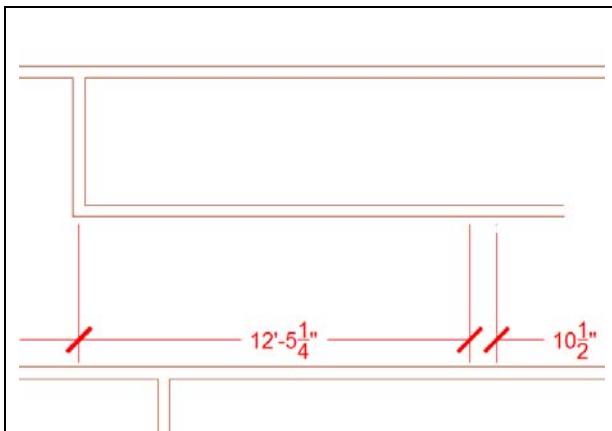


Figure 13.14 – Dimensioning the stairs

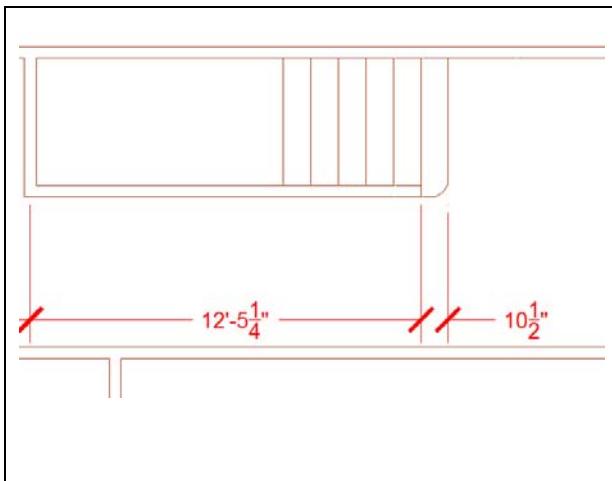


Figure 13.15 – Drawing the stairs

After finishing the walls of the bathroom, copy the right bathroom wall 5' to the right to create the vestibule leading to the basement stairs. Copy the bottom horizontal wall to the right past 5' and the use the Fillet and Trim tools to create the corner of the vestibule as shown in Figure 13.13.

Draw the 12'5-1/4 and 10-1/2 dimensions from the 5' dimension and then modify any set of lines as necessary using the grips (Figure 13.14).

Now that you have finished all of the major interior rooms, you can draw the stairway wall to the end of the 12'5-1/4 dimension. The stairs are 10.5 inches apart with a 7" radius arc (use the Fillet tool on the corner) as shown in Figure 13.15. The steps go upstairs on the right side of the detail, so you can stop after six steps. You will show a break in the downstairs steps to the basement later in this lesson. Once you have created one step using the Copy and Trim tools, use the Offset tool set to 10.5 to create the other four steps.



Using a Door Block on a Floor Plan

To insert the 36-inch wide exterior door into the outside wall, select the Insert tool on the Block panel under the Insert tab. If you haven't already, go to www.worldclasscad.com and download the necessary blocks for this problem. In the Insert window on the graphical display as shown in Figure 13.16, select the block named **door_ext_36_right**. Make sure you have selected the Door layer in the Layer Control list box before placing the door.

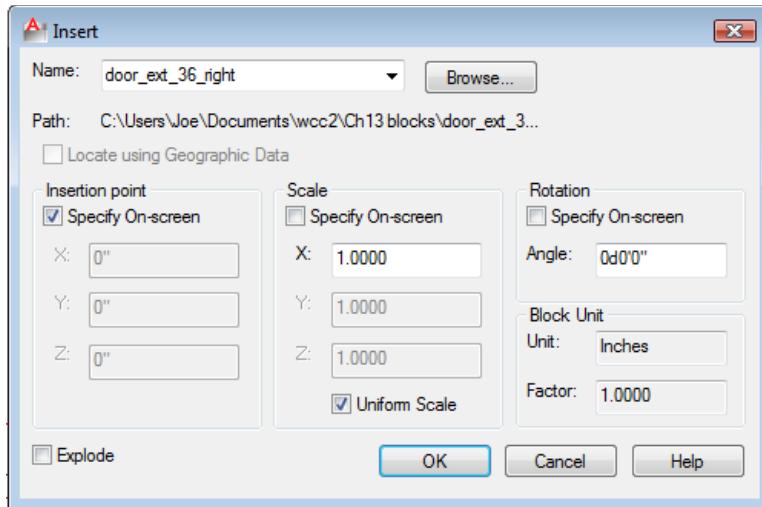
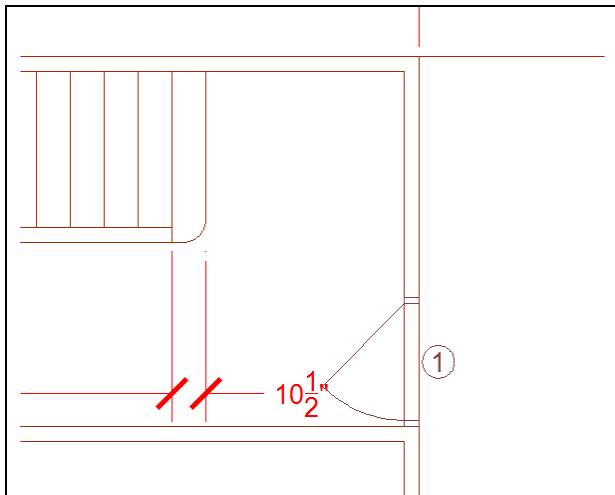
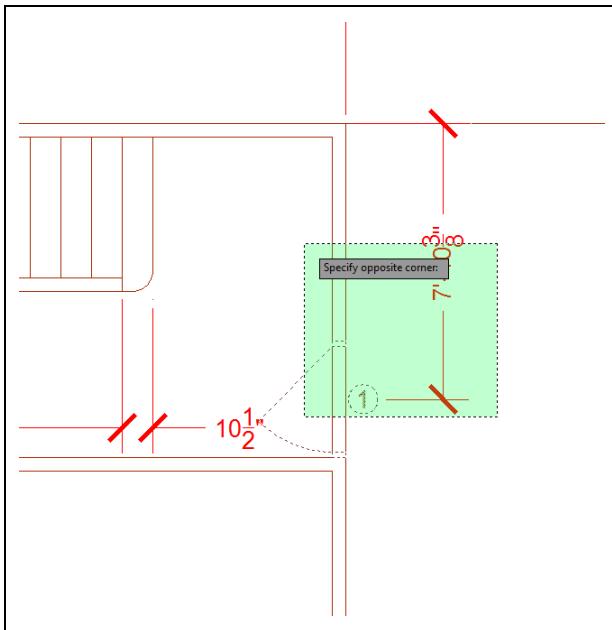


Figure 13.16 – Selecting the 36-inch door in the insert window



Select the OK button and insert the door in the drawing, placing the insertion point on the right wall anywhere as shown in Figure 13.17. The door and window blocks in the library have attributes connected to them, but after inserting the door, the command line will prompt you to supply a “Door number?” According to the sketch, the front entry is “1.” Type “1” and ENTER. Place a dimension on the drawing from the top right corner of the dwelling to the east quadrant of the door number indicator.

Figure 13.17 – Inserting the door block



To move both the dimension and the door into a proper location of 7'1-7/8 choose the Stretch tool on the Modify panel, first pick the door. Then, pick to the right of the dimension create a selection window across the door, wall and dimension as shown in Figure 13.18 using a crossing (dotted) window. After the second pick to define the crossing window, hit ENTER and specify a base point or displacement by picking anywhere on the drawing. Once you pick an open area of the graphical display with the left mouse button, drag the dimension and door towards the 7'1-7/8 measurement and in the case shown type 8.5 (7'10-3/8 minus 7'1-7/8) and ENTER to move the door into exact position.

Figure 13.18 – Stretching the door

The distance you need to move the door may vary depending on the initial placement. Some CAD operators will place the door exactly on an endpoint or midpoint of another object and then move the door into position from there. Use whatever method you feel most comfortable using. Then add the 2'6-3/4 and 9'8-5/8" dimensions as shown in Figure 13.19. Trim the lines of the exterior wall to make the doorway as shown in Figure 13.20.

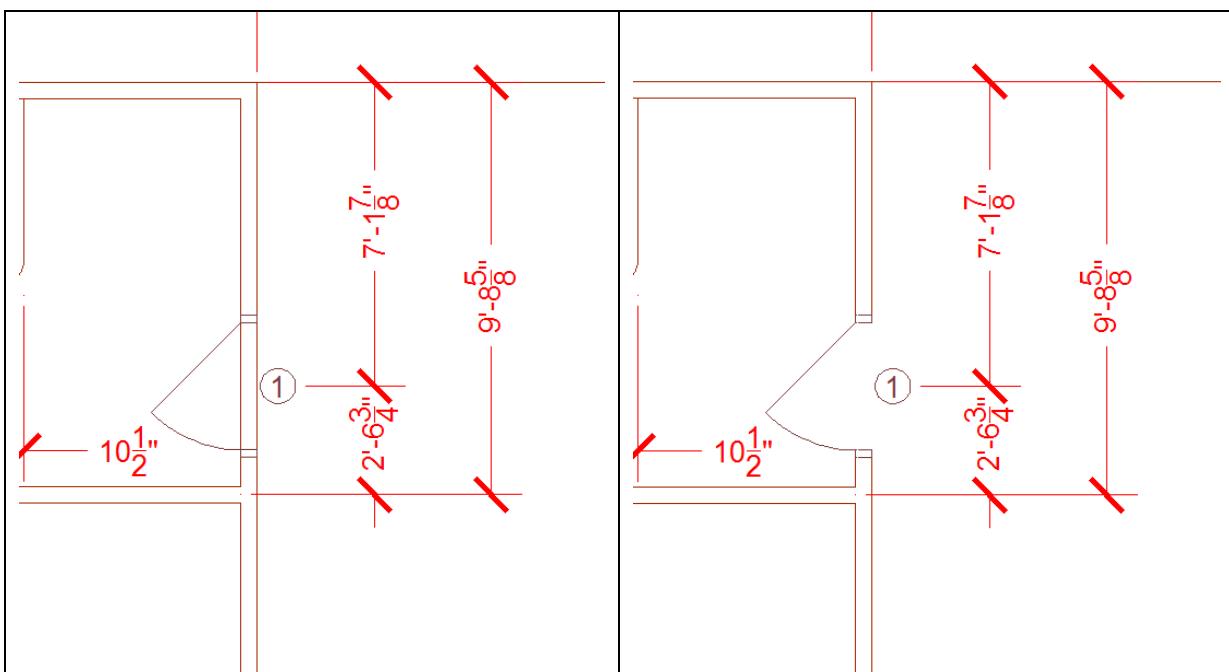
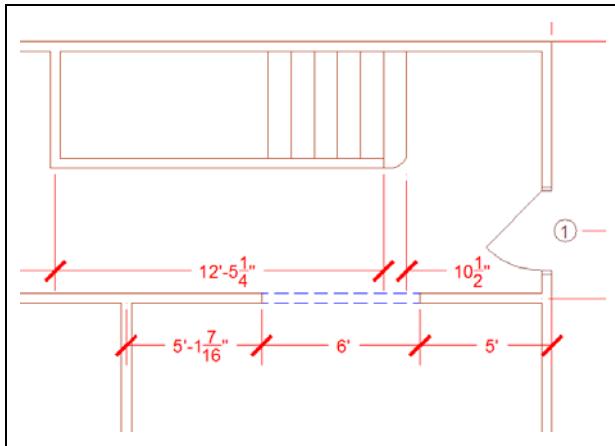


Figure 13.19 – Adding dimensions

Figure 13.20 – Trimming the doorway

Making an Opening in the Living Room Wall



With the door and entry well on their way to completion, you can add the 6-foot opening between the hallway and the living room. Offset the outside line 5' to the left and the newly offset line again 6' to the left. Use the tools on the Modify panel to trim the longer lines to length. Trim away the wall in the 6-foot opening and use the Line tool while on the Hidden layer to draw the two hidden lines shown in the Figure 13.21. Add the three dimensions to check your work. Then pan your view into the living room.

Figure 13.21 – Making an entrance

Using a Window Block on a Floor Plan

To insert the 36-inch wide window into the outside wall, select the Insert tool on the Block panel. Select the block named **window_36_vert** in the Insert window as shown in Figure 13.22. Make sure you are in the Window layer before you place the window.



As you may notice, the styles and placement of the dimensions in these pictures may change throughout the chapter. It is your responsibility as a designer to notice when certain aspects of the drawing are interfering with each other and make the necessary changes. Grips make modifying individual entities very simple.

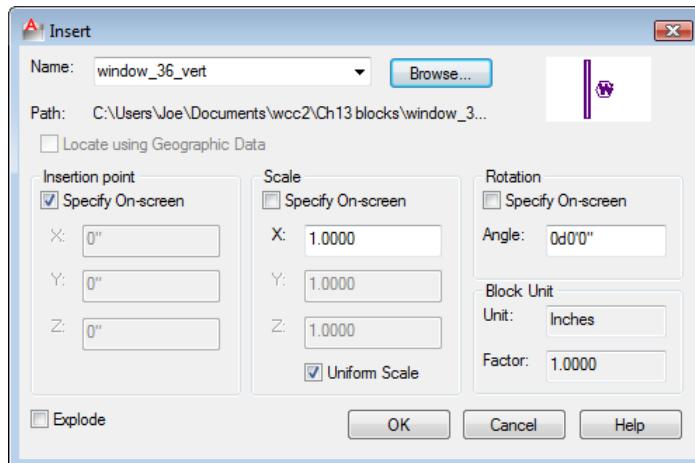
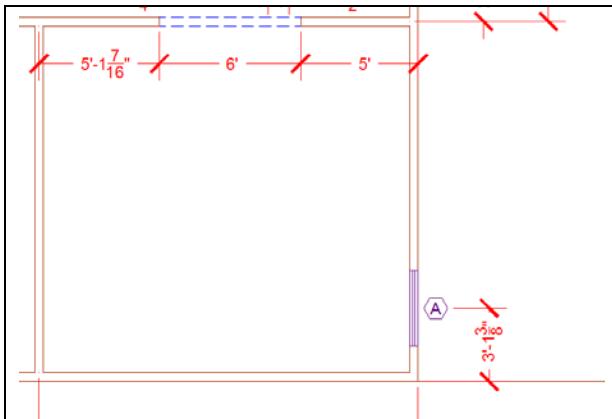
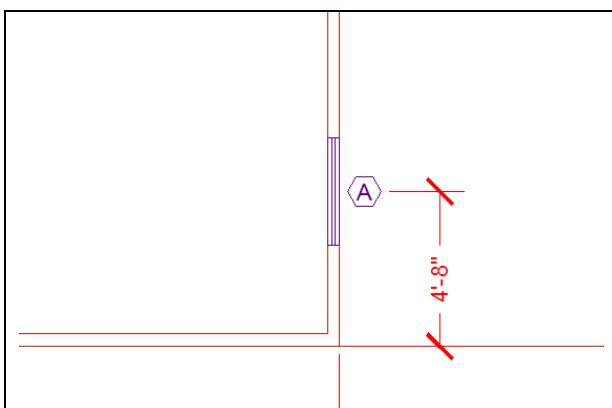


Figure 13.22 – Selecting the 36-inch door in the insert window



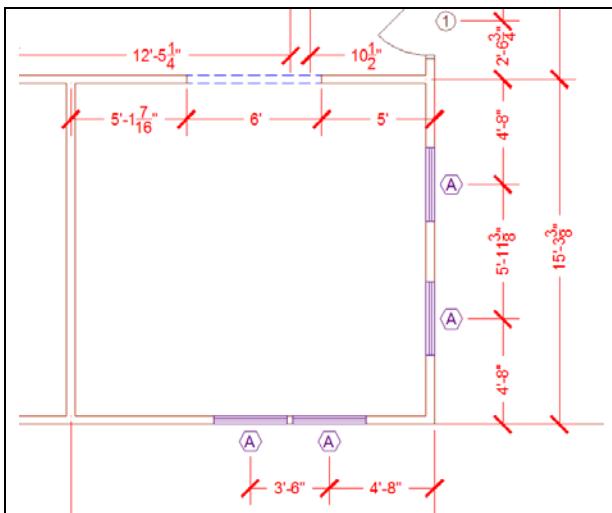
Select the OK button and insert the window in the drawing, placing the insertion point on the right wall anywhere as shown in Figure 13.23. The window blocks in the library have attributes connected to them, so after inserting the window, the command line will prompt you to supply a “Window letter?” According to the sketch, the two front windows are labeled “A.” Type “A” and ENTER. Place a dimension on the drawing as shown.

Figure 13.23 – Inserting a window block



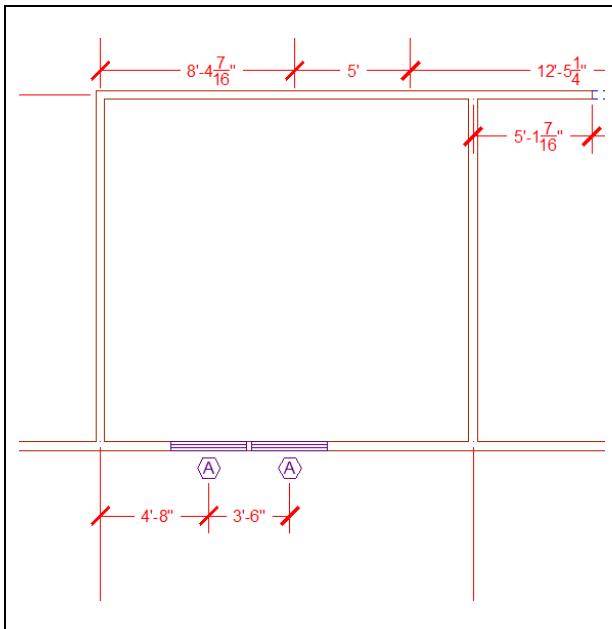
To move both the dimension and the window into a proper location 4'-8 away from the corner of the house, first place a 4'8 dimension from the corner going up the wall. Then use the Move tool to move the window in line with the upper extension line of the dimension. Use the grip of the dimension line to move its endpoint from the wall to the left corner of the window letter symbol as shown in Figure 13.24.

Figure 13.24 – The front window



Copy the first window up 5'11-3/8 to create the second front window. Place dimensions between the windows and from second window to the midpoint of the interior wall as shown in Figure 13.25. Place a dimension (15'3-3/8) from the exterior wall to the midpoint of the interior wall. Repeat the process of inserting windows using the **window_36_horiz** block on the bottom exterior wall. Place the dimension as shown in Figure 13.25.

Figure 13.25 – Adding two windows



Place a 4'8 dimension on the exterior wall of the dining room starting at the left wall. Copy the last two windows along with the 3'-6 dimension over to the dining room exterior wall, using the midpoint of the left window as the basepoint and the right end of the 4'8 dimension as the second point. Use the grips of the 4'8 dimension to move the extension line endpoint from the wall to the midpoint of the window letter symbol as show in Figure 13.26. This approach is excellent for a CAD operator because whenever possible you can copy entire sets of entities rather than drawing them all from scratch, ultimately reducing your drawing times. Next, you will create the double-sided fireplace and move to detail the dining room.

Figure 13.26 – Copying two windows

Drawing a Fireplace

The fireplace has a hearth projecting 45 degrees into both the living and dining room. To begin creating it you need to offset the wall 3'6-1/8 to both sides (Figure 13.27). Then reset the Offset command by hitting ENTER twice, set the offset distance to 2'8, and offset the inner edge of the top wall down. Rotate the vertical lines forty-five degrees inward using the bottom endpoint as the point of rotation as shown in Figure 13.28. Fillet the two crossing lines with a seven-inch radius.

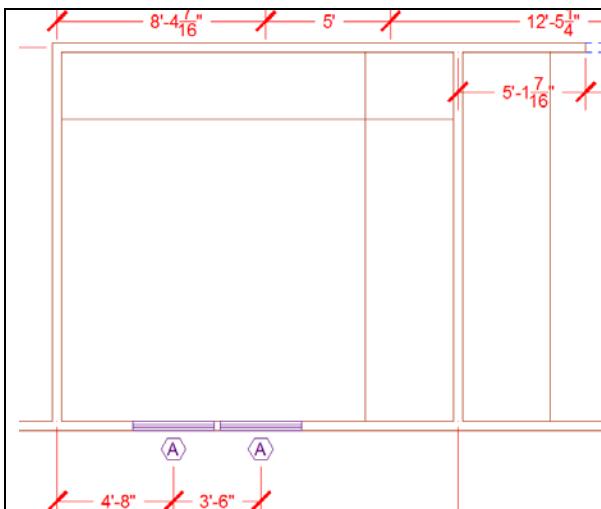


Figure 13.27 – Offsetting lines

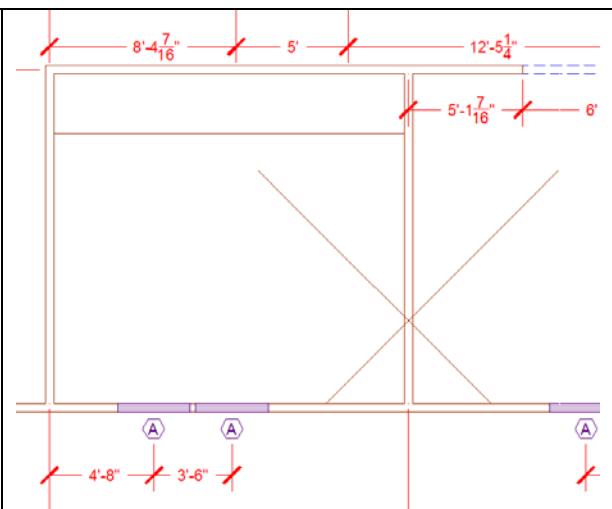


Figure 13.28 – Rotating lines

Now trim the lines as shown in Figure 13.29. You then need to place dimensions on the fireplace. Use the line you offset from the top wall to create the opening between the dining room and the living room. When you obtain the exact type of this special fireplace that will built, you will return to the drawing and update the view. You will add the chimney detail at that time, also.

While remaining in the dimension layer, create three lines that intersect the two rooms, as shown in Figure 13.29. Also, move the endpoints of the 16'0-13/16" and 16'1-7/16" dimensions that go through the 7'4-3/4" dimension back behind the text of that dimension by using the grips.

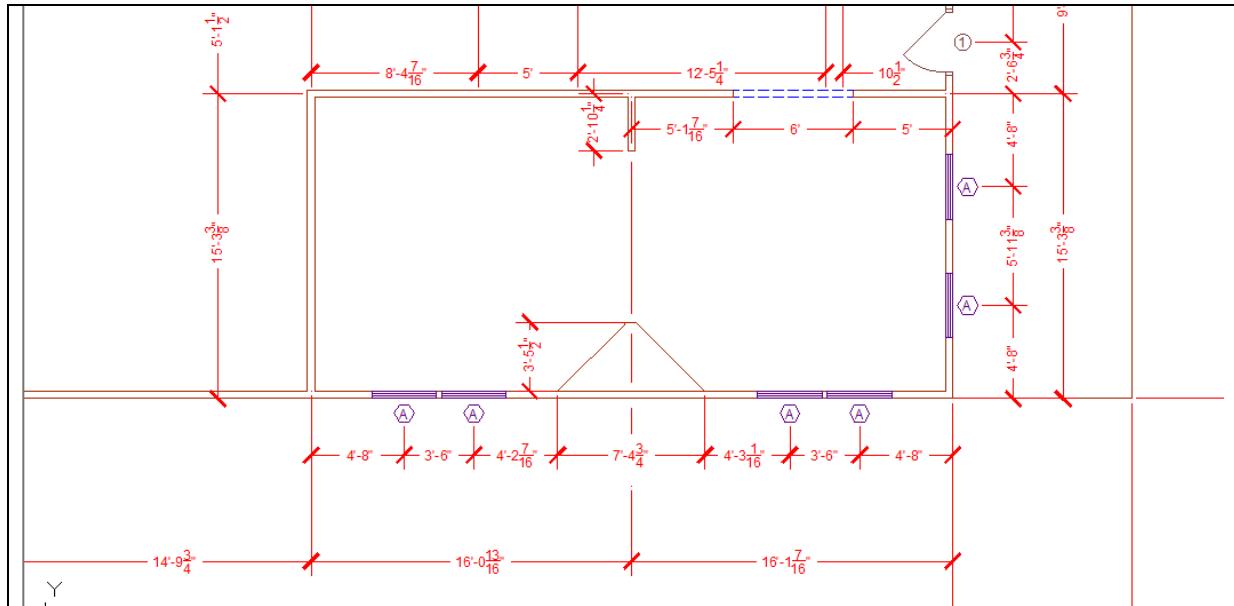
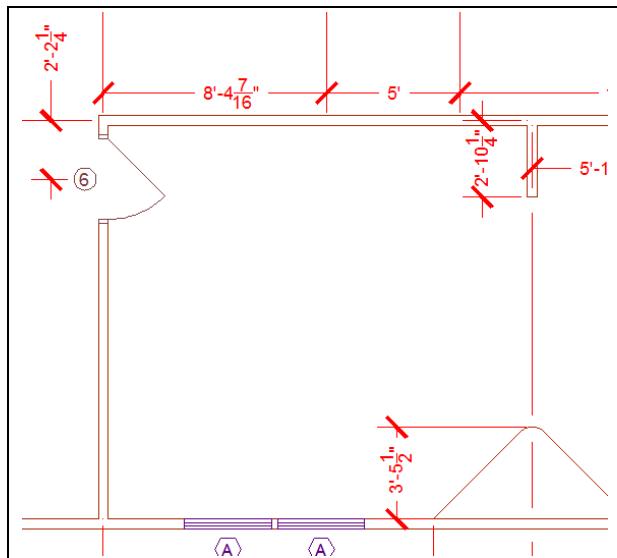


Figure 13.29 – Completing the fireplace and the entry to the dining room



To insert the 36-inch interior door into the wall separating the kitchen and the dining room, select the Insert tool on the Block panel. In the Insert window, select the block named **door_ext_36_left** from the list of blocks. Select the OK button and insert the door in the drawing, placing the insertion point on the left wall anywhere as shown in Figure 13.30. The command line will prompt you for a “Door number?” According to the sketch, the kitchen door to the dining room is “6.” Type “6” and hit ENTER. Position the door and place the appropriate dimension as shown in Figure 13.30. Also, trim away the wall from inside the doorway.

Figure 13.30 – Placing a door in a wall

Drawing a Kitchen

You will discover that a kitchen contains countless details that do not otherwise appear in other parts of the house. The first step you will take is to offset the inside of each wall 24 inches (2 feet) as shown in Figure 13.31, because there is a counter that wraps around three sides of the kitchen. Also, add lines that represent the vertical ends at the top of the kitchen: 10'10" from the bottom exterior wall on the right side and 12'8-1/8" on the left. Fillet the rounded edges with a seven-inch radius. Dimension the counters as shown in Figure 13.32. A good way to keep track of your dimensions is to highlight each dimension on a copy of the sketch from Appendix E each time you add one. Remember, if a red dimension extension line overlaps a floor plan line, you need to go to the dimension's Properties and turn off the overlapping extension line.

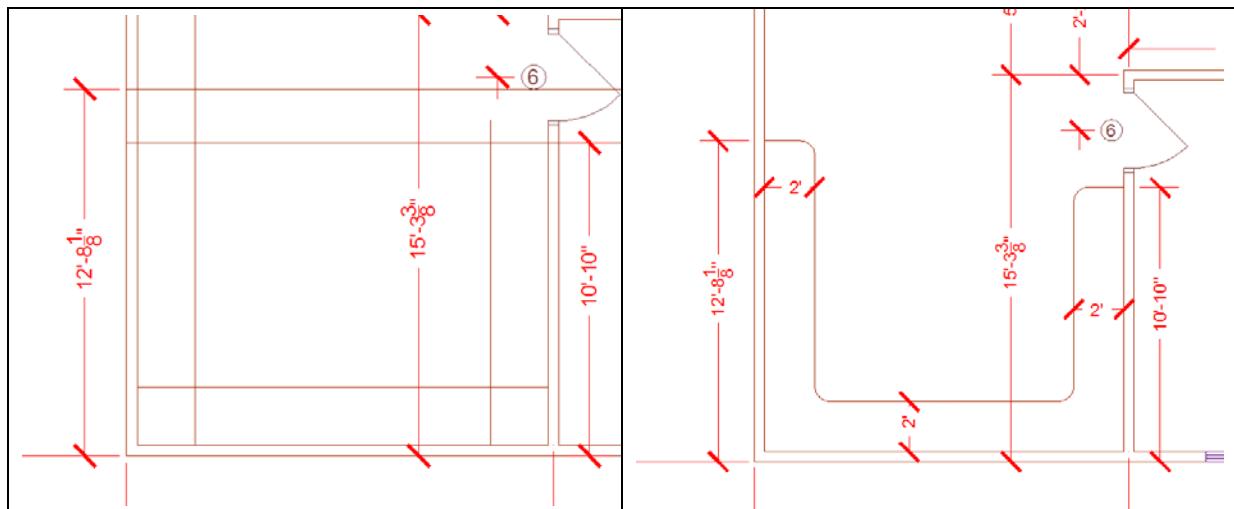


Figure 13.31 – Offset for the counter

Figure 13.32 – Fillet and trim

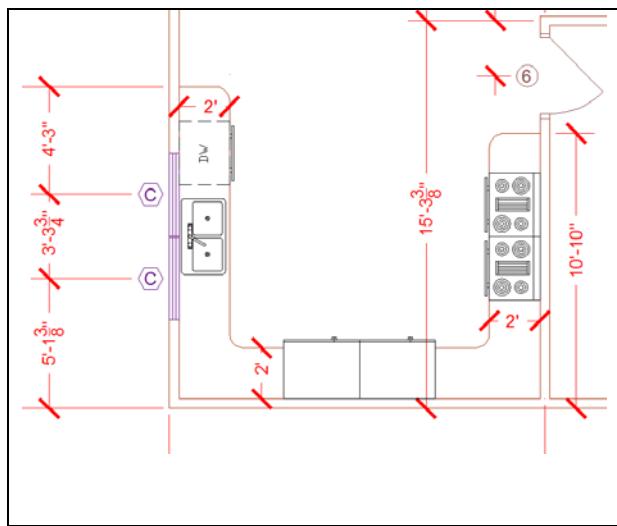


Figure 13.33 – Inserting the appliances

You now need to use the Insert tool on the Block panel to insert the kitchen_sink, dishwasher, window_36_vert_left, range-oven - 30 in top, and refrigerator-2 door - 36 in top blocks into the kitchen. Start out with the two windows, labeling them "C" as shown in Figure 13.33. Next insert the kitchen sink and center the apparatus between the two windows. The two range-ovens are located directly across from the sink. Locate the two refrigerators at the midpoint of the counter. Place all of the appliances on the 0 layer. Trim away the line of the counter from inside the refrigerators.

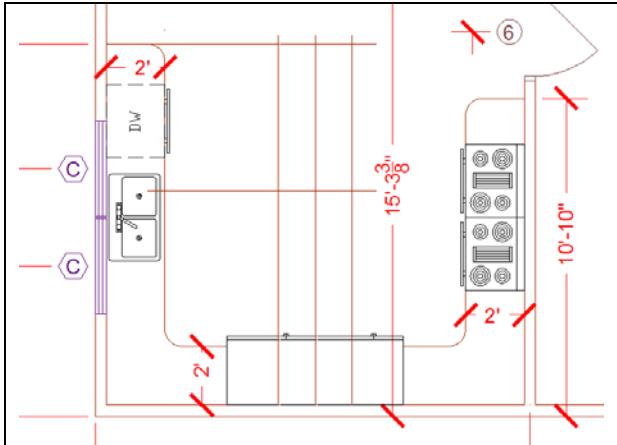


Figure 13.34 – Making an island

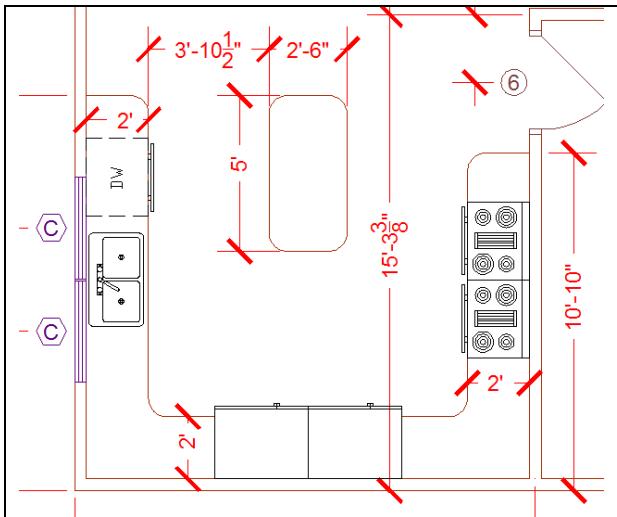


Figure 13.35 – Fillet and dimension

Position the dishwasher just to the right of the sink. Now you are ready to place an island in the kitchen. Many food preparation areas are too small for a centrally located, but this kitchen is large enough. Draw a line up from the center of the two refrigerators and offset lines on either side 15 inches each way. Draw a line off the upper left of the counter and offset the line down 60 inches as shown in Figure 13.34. Erase the center construction line.

Fillet the island with 7-inch radius corners (the standard rounded edge in this house design) as shown in Figure 13.35. Although you will lose work area by rounding the corners, the island will be much safer. Inhabitants of a house will eventually find every sharp corner in your design. The curvature in the design allows for easy movement from refrigerator to sink, around preparation table and the cooking surface. Dimension the island as shown.

Drawing a Pantry and Laundry Room

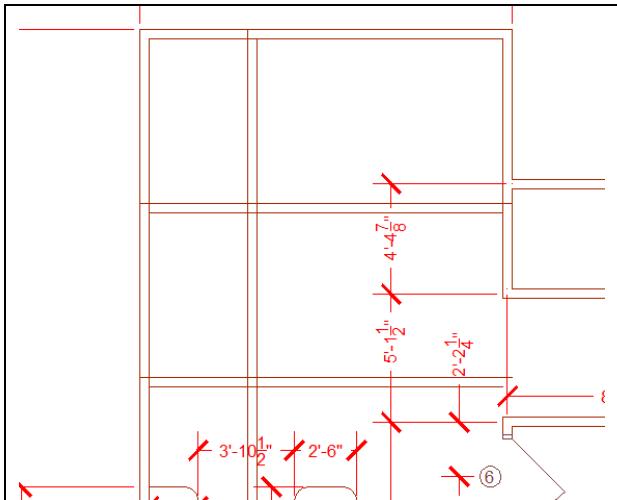


Figure 13.36 – Inserting the back door

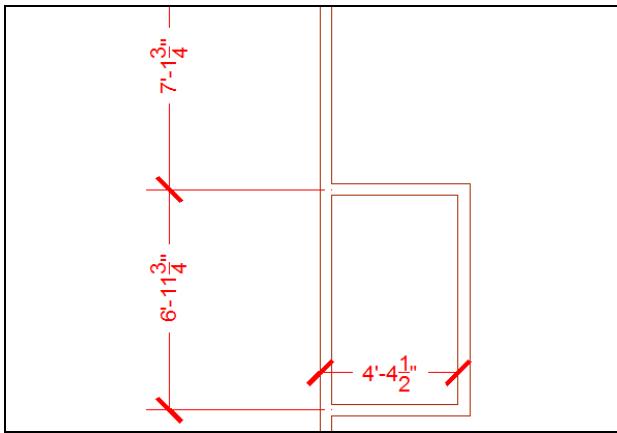


Figure 13.37 – Making a pantry

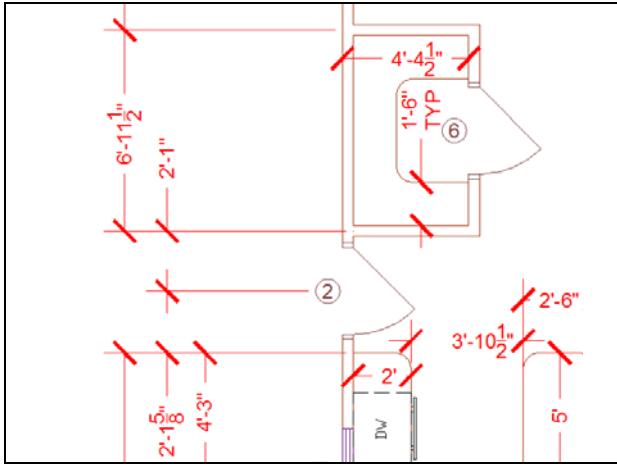


Figure 13.38 – Offset shelves in pantry

Again, use the Insert tool on the Block panel to add a back door, labeling it door number 2. Copy the two exterior wall lines from the top down 6'11-1/2 to make a wall for the pantry. Copy that wall down 6'11-1/2 to make the other wall of the pantry. Making a pantry and laundry close to the kitchen is a plus for a workspace because it groups together rooms designated for household tasks. Copy the vertical exterior wall 4'4-1/2" to the right (Figure 13.36).

Use the Trim and Fillet tools as necessary to detail the pantry as shown in Figure 13.37. To insert the 36-inch interior door into the pantry wall, select the Insert tool on the Block panel. In the Insert window, select the block named door_ext_36_left from the list of blocks. Select the OK button and insert the door in the drawing, placing the insertion point on the wall and labeling the door number 6.

Offset the pantry shelves 18 inches from three walls. Fillet the shelf corners with seven-inch radius corners (Figure 13.38). Adding a storage system to the design of a pantry can add another level of quality to your design. Organization of small regions is as important as large ones. Add the back door to the house (door number 2) and dimension all details. Add a "TYP" label to the 1'6" dimension rather than dimensioning all three sides of the shelf (Figure 13.38).

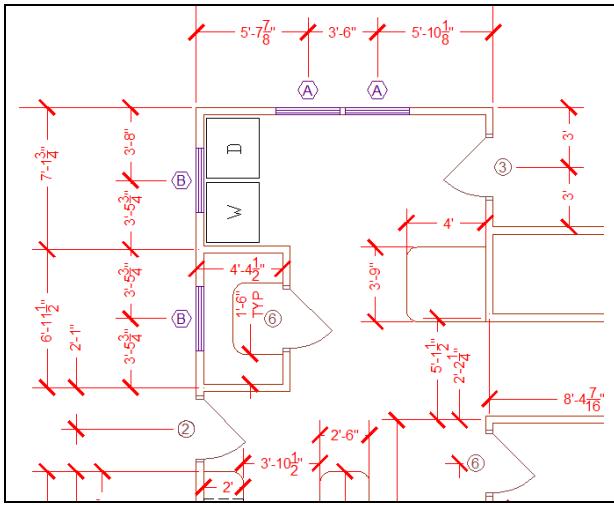


Figure 13.39 – Added details

Insert the “B” labeled window_36_vert_left block for the small windows to add natural light into the laundry and pantry. Add the “A” tagged window_36_horiz_top block as shown in Figure 13.39. The side door, marked “3,” is the door_ext_36_right block that you need to insert 3 feet from the outside wall. Add the washer and dryer blocks in the nook behind the pantry. Lastly, draw a line from the hallway wall corner 48 inches to the left, then up 45 inches and back 48 inches. Place two seven-inch radius corners on the detail, which will be a laundry table.

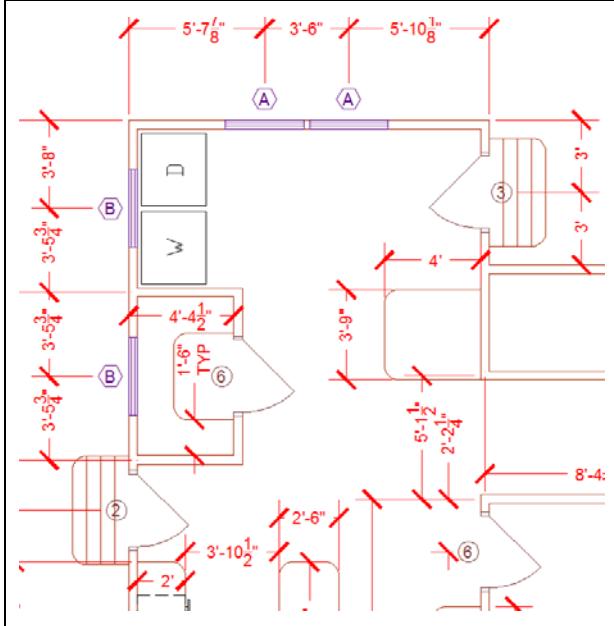
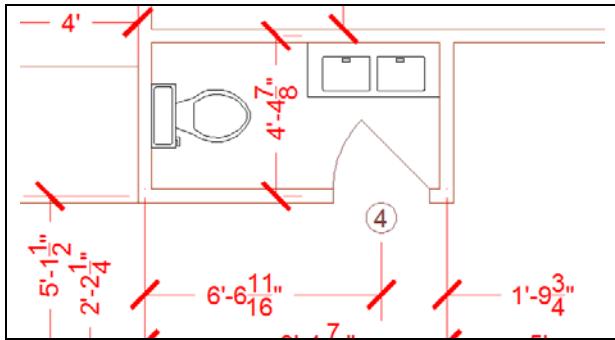


Figure 13.40 – Adding stairs

Insert two four-step stairs at the midpoints of the back and side doors. Draw each stair 7 inches long, with the last stair’s edges filleted with a 7" radius edge. They can be any width. You can also add a third set centered on the midpoint of the front door but extending from the porch. You can replace these rough drawings with a better detail of the stairs when the customer determines whether they want the yard or a deck. Handrails are an important feature to remember. Usually you will show exact details of the dwelling on separate sheets showing multiple views of the construction. When you add the additional details, remember to note the view letter and sheet number of the feature in the floor plan.

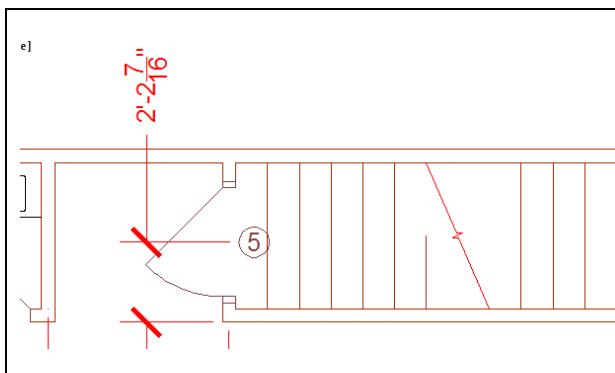
Finishing the Bathroom



Insert the **Toilet – top** block in the middle of the left wall of the bathroom. Add the **bathroom sink** block in the corner as shown in Figure 13.41. The bathroom door, marked “4,” is the **door_32_right** block. Insert it 6'6-11/16 off the left wall. Move any hallway dimensions that may interfere with the new bathroom measurements.

Figure 13.41 – Completing the bathroom

Completing the Basement Stairs

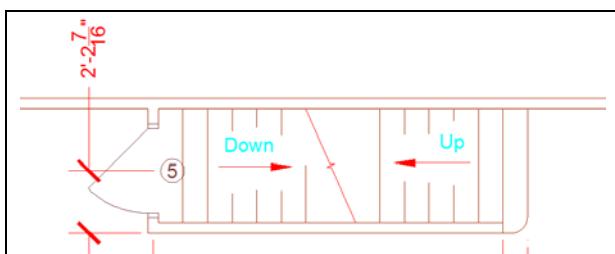


The basement door, marked “5,” is the **door_ext_36_right** block. You need to insert it 2'2-7/16 feet from the hallway wall. Start the first step 10.5 inches from the inside of the basement door and offset each step 10.5 inches, seven times. Freehand draw a line as shown in Figure 13.42, which indicates a cut line separating the up and down stairs. Place the cutting line on the dimension layer.

Figure 13.42 – The basement stairs

Labeling the Drawing

Type QLEADER in the command line to enter the Quick Leader command. Draw two leaders as shown in Figure 13.43.



Use the Single Line Text tool to add “Up” and “Down” labels to the stairs. Finally, use the Break tool on the Draw panel to remove lines from around the text and leaders.

Figure 13.43 – The Up and Down labels

When labeling the floor plan with text, it may be valuable to understand a few different ways of adding text to a drawing. The first one you learned is obviously the **Mtext** tool that allowed you to add notes similar to a simple word processing application. The second tool is **Dtext**, which you will use for single line text, like labels on floor plans. The third text tool you will learn when you venture towards the world of programming in Visual AutoLISP: the **Text** command, used for adding text automatically with a coded routine.

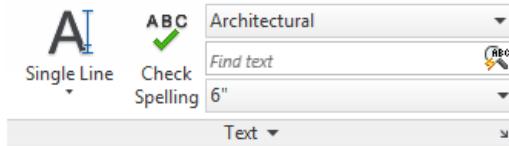


Figure 13.45 – The Text panel

Choose the Single Line Text tool on the Text panel. Select a point to start your text, and then select a text height in inches; for this case, use 6". Hit ENTER, and then hit ENTER again to set your text rotation to 0. You now have a text box to enter your labels. Click anywhere to start a new box, and hit Escape after you have placed all the labels as shown in Figure 13.46.

```
Command: _text
Current text style: "Architectural" Text height: 0'-6" Annotative: No
Specify start point of text or [Justify/Style]:
Specify height <0'-6">:
Specify rotation angle of text <0d0'0">:
Command:
```

Figure 13.45 – The command line information for Dtext

Label the rooms, hallway, porch, fireplace and other features as shown in the floor plan sketch. When you are finished labeling the drawing you are finished. Save the file in the Fundamentals of 2D Drawing folder as “First Floor Plan.” Make time in the allotted two hours to check the drawing because missing dimensions and details do not reflect well on you professionally.

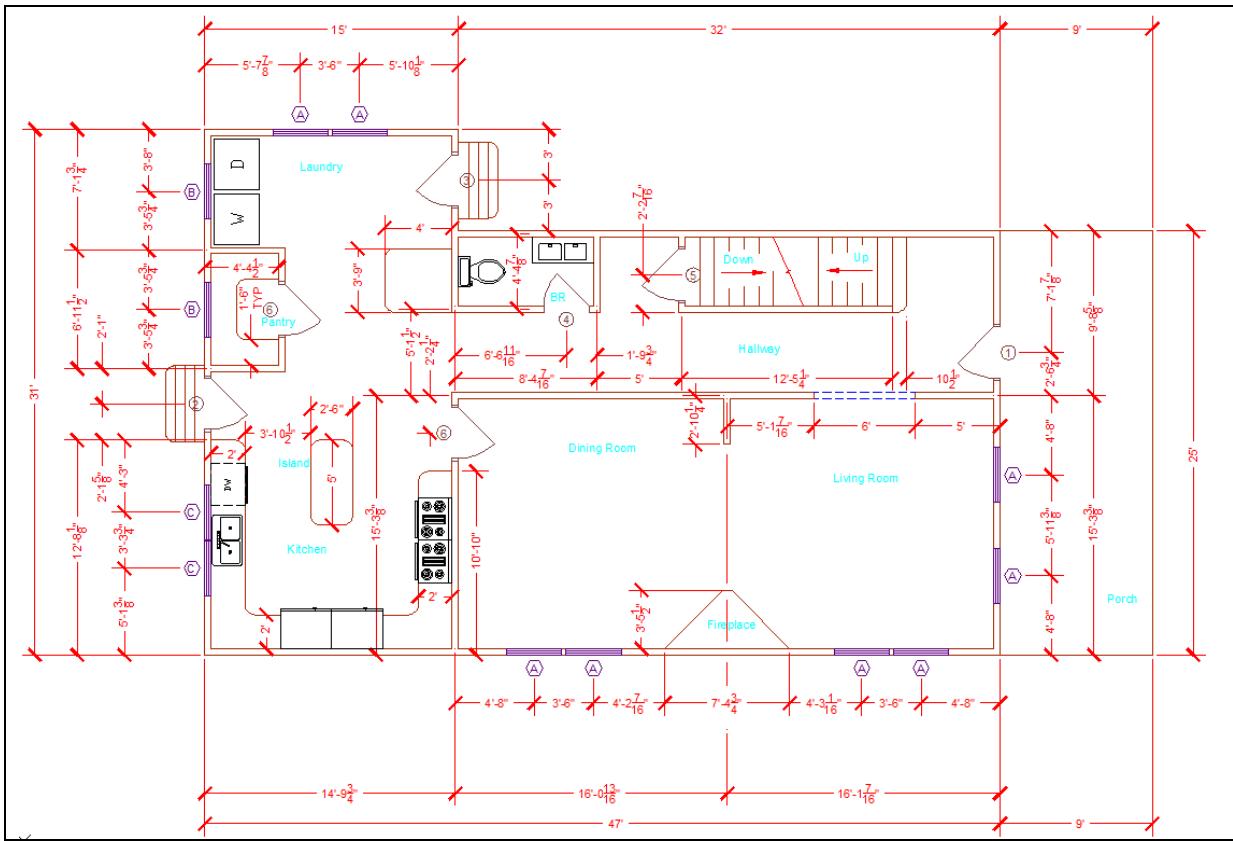


Figure 13.46 – Labeling and finishing the floor plan

* World Class CAD Challenge 02-24 * - Create a new file using the Chapter 13 Architectural template provided with this text and draw the First Floor Plan in 120 minutes. Continue this drill four times, each time completing the drawing in less than 120 minutes to maintain your World Class ranking.

