

# Chapter 13

## Drawing an Architectural Floor Plan

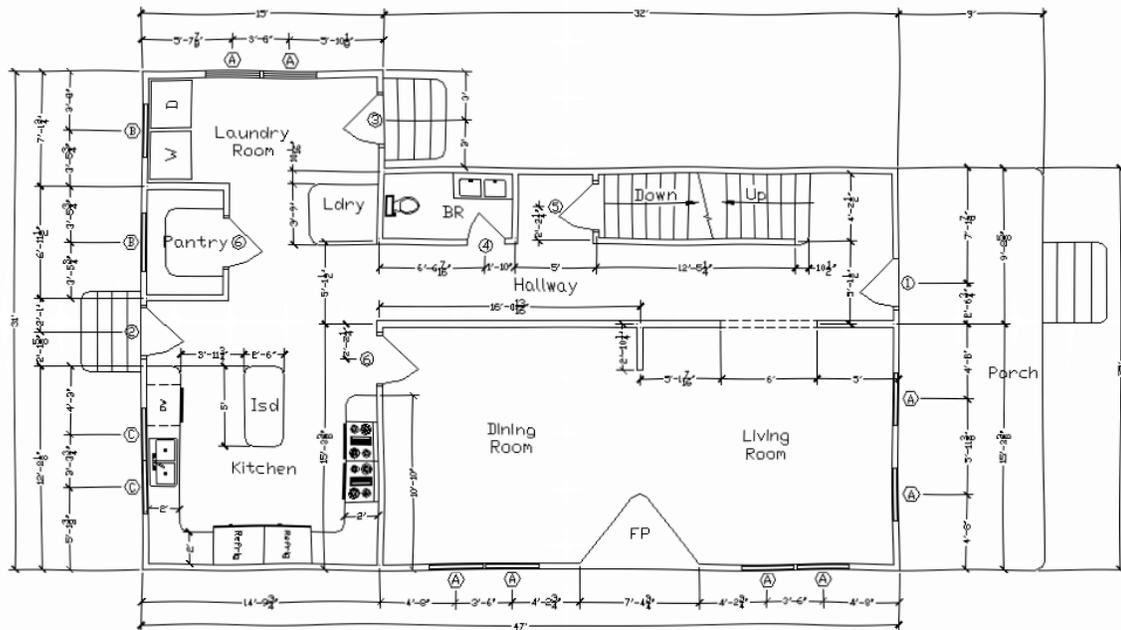
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In this chapter, you will learn the following to World Class standards:

1. Starting a Floor Plan Using an Architectural Sketch
2. Creating a Drawing Using the Architectural Template
3. Creating the Perimeter Wall with a Polyline and Explode It
4. Creating the Interior Walls with Tools on the Modify Toolbar
5. Using the Properties Tool to Modify a Dimension Variable
6. Roughing in a Bathroom, Vestibule and Stairs
7. Using a Door Block on a Floor Plan
8. Using a Window Block on a Floor Plan
9. Drawing a Fireplace
10. Drawing a Kitchen
11. Drawing a Pantry and Laundry Room
12. Finishing the Bathroom
13. Completing the Basement Stairs
14. Labeling the Floor Plan

## Starting a Floor Plan Using an Architectural Sketch

Any drawing is an accumulation of ideas put into written form when you receive them from the customer or the end user with the designer utilizing as many technologies as known presently. Questions come to the designer in many shapes, like “what is the number of rooms in the house?” “How many people will utilize the dwelling or what is the workflow that will exist in the structure?” “Who is the customer?” (always a tricky question). The contractor, who may be building a series of houses along a new street, feels they are the customer, but as all owners soon discover the end user will determine the reputation and the demand for the final product. What does the designer or architect bring to the equation? They bring experience, a center point to collect information from all parties involved, a style using art and creativity, safety from an understanding of ergonomics and convenience. Yes, a good designer will collect all the input, sort through the magnitude of requests, prioritize the output based upon design criteria and create a storyboard or sketch which the CAD operator will place in the computer.

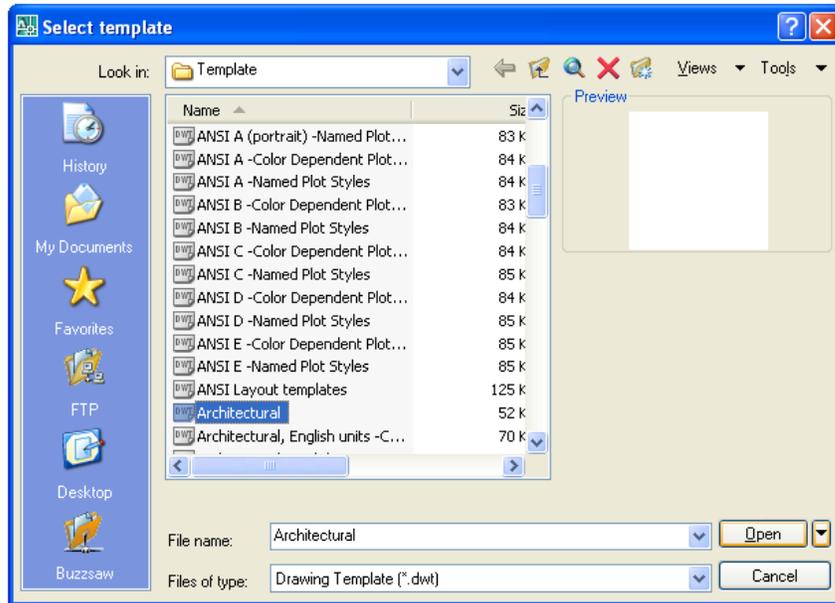


**Figure 13.1 – Receiving a Sketch from the Architect**

The sketch of the first floor can be and is often the first rough draft that demonstrates what can be possibly done with the living space. This floor is the center of work and leisure in most dwellings. The drawing shown in Figure 13.1 is a concept of what can be done with an existing city lot of 40' width by 100' long. Not every home will be the 3000 to 5000 square feet enormously expensive residence that is available to a small percentage of the urban area. Many residential and commercial businesses are small or medium plan sets that employ each spot of the floor space as efficiently as possible, while showing flexibility to withstand the test of time. Many designers receive their initial sketch on paper with rough dimensions, but this detail although rough has 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

In the Architectural Floor Plan problem, you will begin the drawing by selecting the template you created in the previously assignment. In Figure 13.2, the window “Select template” is loaded by selecting the New tool on the Standard Toolbar. A list of templates is loaded in the Select a Template list box. Scroll down the list and select Architectural.dwt.



If you did not create the Architectural template in Appendix C, then you will want to stop now and make the template using the Mechanical template as the guide. In Appendix C, 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 creating explicit Layers and other particulars for each session.

**Figure 13.2 – Starting with the Architectural Template**

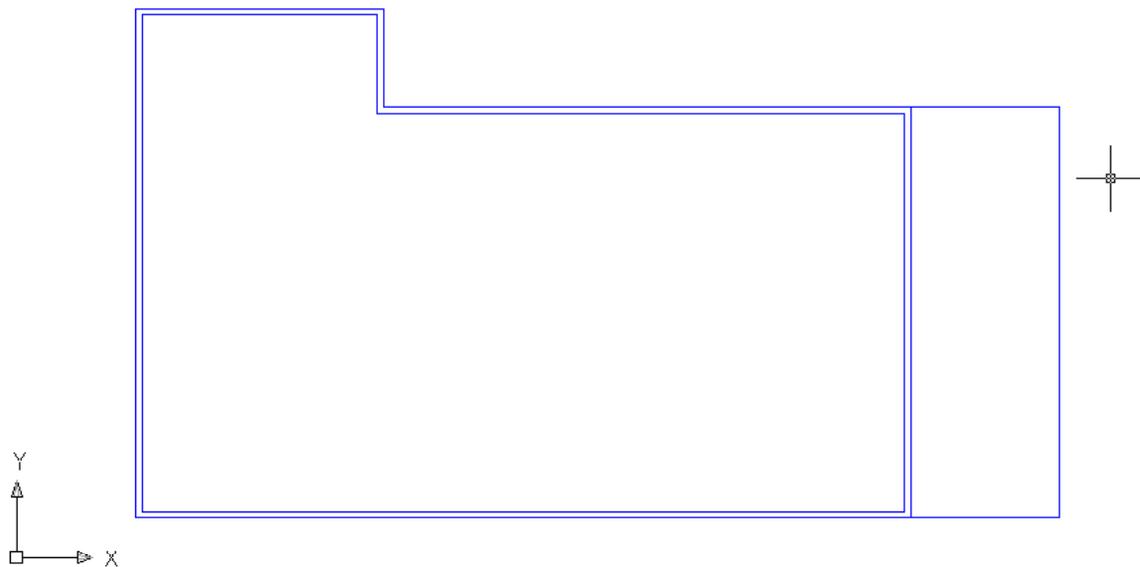
Many professionals ask why the Rectangle problem is so important in developing drawing strategies, a concept so fundamental in every discipline, but often lacking in CAD documentation. After asking them some of the questions listed below, almost all technical experts go right back to work on the Rectangle drawing and labor through the basics of 2D drawing, which presently is 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's 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 a problem when object lines and dimensions are shown incorrectly. The advantage of the computer aided design system over the pencil drawing is that design concepts and drawing

standards are built into the software if the individual knows how to use them. Almost unanimously, CAD users from small, medium and large organizations feel they need to improve in their primary form of communication to the machinist or construction worker, the 2D drawing. They feel they know their CAD commands, but they were never taught how to develop the process and procedures for deploying the style of drawing their company uses.

In the Rectangle problem, you begin to learn tactics along with tools where you use eight lines and three circles to draw 58 entities residing on Layers 0 and Center. From those original eleven building blocks, 81 total entities are made in the computer file explaining each step in constructing the object. Almost all drawings need to begin with the same approach, so in the floor plan, the perimeter of the proposed house is made first.



**Figure 13.3 – Exterior Walls and Porch**

## Creating the Perimeter Wall with a Polyline and Explode It

Select the Polyline tool on the Draw toolbar starting at the lower left hand corner of the graphical display and pick your starting point. The with Ortho (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 and Enter to complete the command. For the architectural units, the format for inputting the feet-inches is simple.

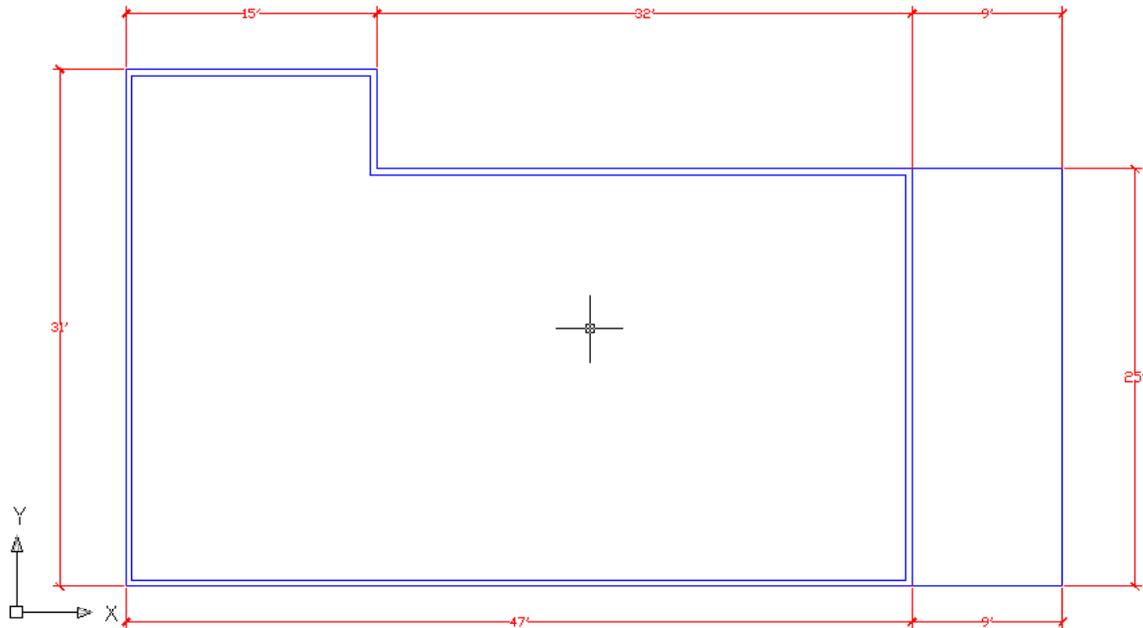


The architectural unit is the most flexible of all Unit formats in the AutoCAD software and you can type the measurement of feet and inches at the command line. Many operators place dashes and inch marks like those at the AutoCAD status bar on their input when drawing lines, but this is only a waste 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 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**

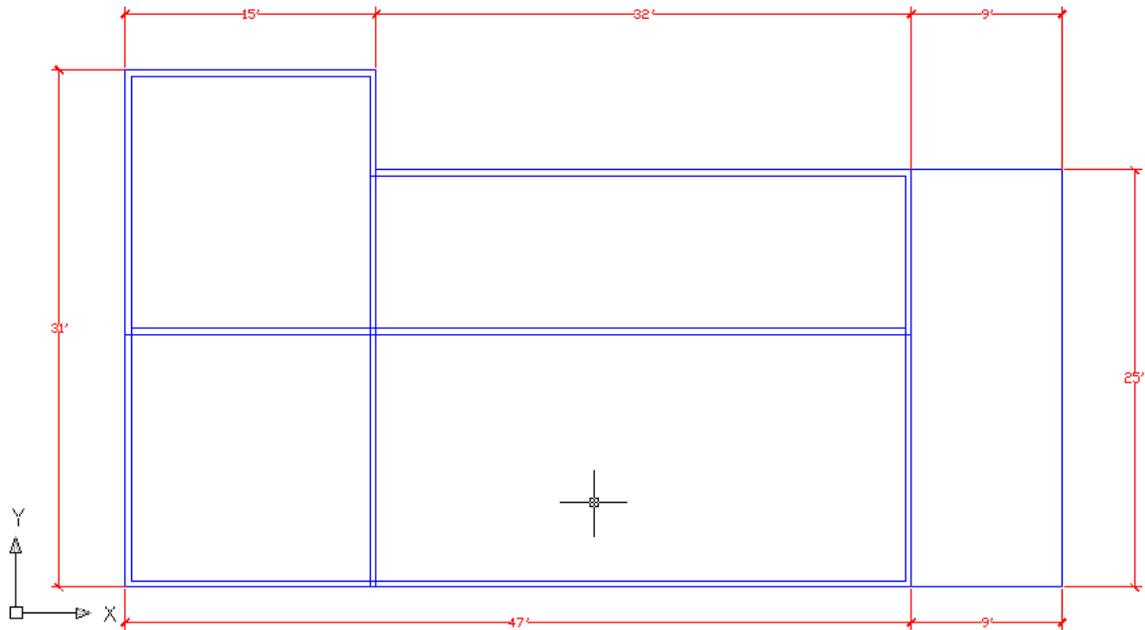
Draw the polyline on the Floor Plan layer and then Offset the line 4.5 inches to the inside creating the inside of the exterior wall. Explode both polylines using the Explode tool on the Modify toolbar, and the polyline will now become individual lines. You can use the Multiline tool to accomplish the same feat, but you learn that subject in the chapter on Foundations.



**Figure 13.4 – Placing Dimensions on the Floor Plan**

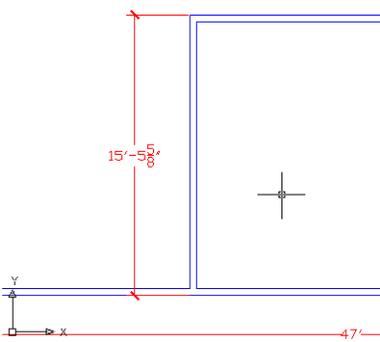
Draw the 9' by 25' porch using the Line tool on the Draw toolbar starting at the lower right corner of the house. Then change over to the Dimension Layer and place the dimensions on the drawing as shown in Figure 13.4, so that you can check your work on a complex design as you create the layout.

## Creating the Interior Walls with Tools on the Modify Toolbar

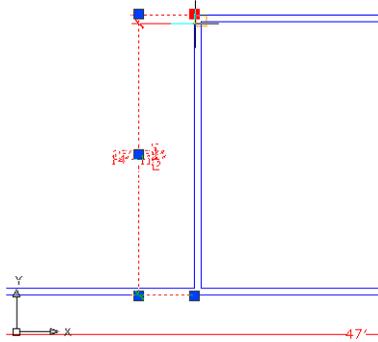


**Figure 13.5 – Extending an Interior Wall and Copying a Wall**

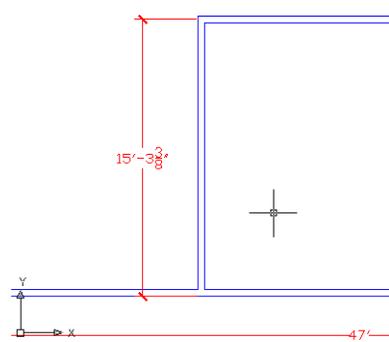
As in the Rectangular problem, the majority of the remaining lines and arcs will come from the original set. Using the Copy tool on the Modify toolbar, replicate the bottom two lines up 15'1.125 and using the Extend tool, lengthen the center horizontal lines to the interior of the bottom wall. (See Figure 13.5) You will probably use Trim and Fillet (radius set at 0) to form the corner of the dining room wall as shown in your 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 as shown in Figure 13.6 from the outside of the exterior wall using the Nearest Osnap setting. Then, as you see in Figure 13.7, grab the Grip, move the top extension line straight down, and type 2.25, which is half of width of the wall. The final dimension is 15' - 3 3/8" and measures from the outside wall to the center of the interior wall.

## Using the Properties Tool to Modify a Dimension Variable

Select the Properties tool on the Standard toolbar and select the 15'-3 3/8" dimension. The variables that represent the 15'-3 3/8" dimension list the categories General, Misc, Lines and Arrows, Text, Fit, Primary Units, Alternate Units and Tolerances in the Properties window.



To remove the dimension extension line that is covering the exterior wall, select the Lines and Arrows category and double click over the "On" text to the right of the Ext Line 2 label to turn the extension line off. (See Figure 13.9)

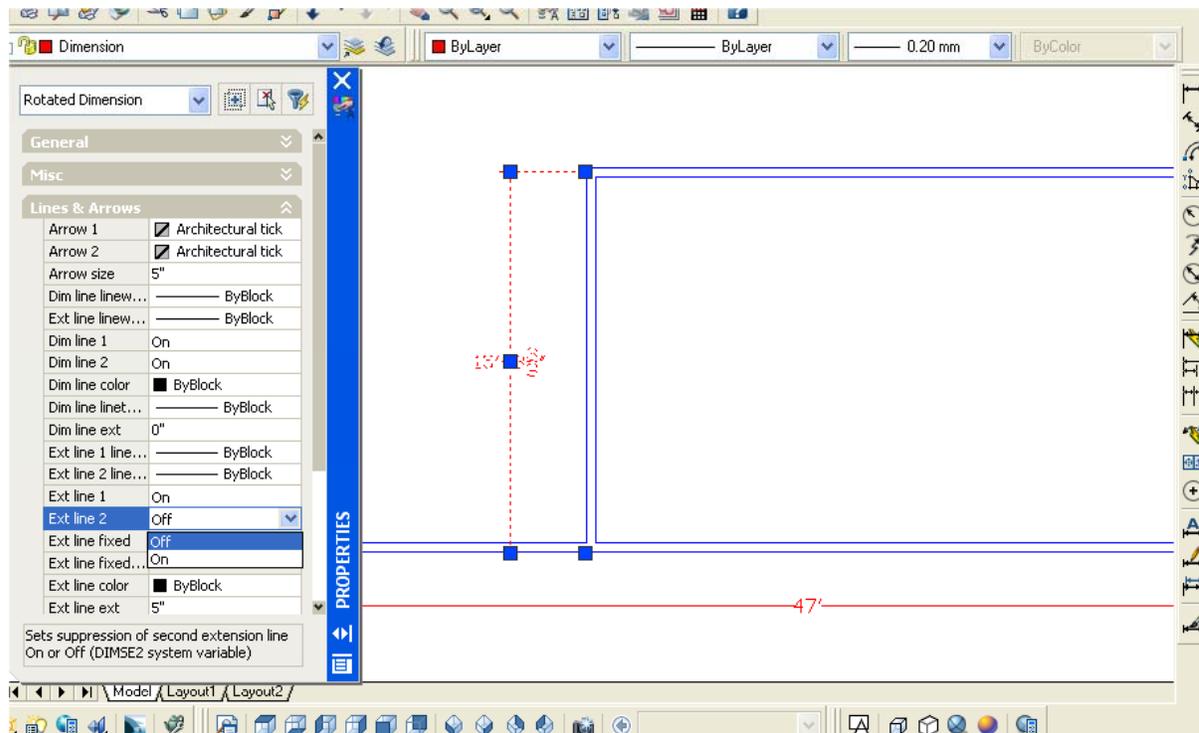
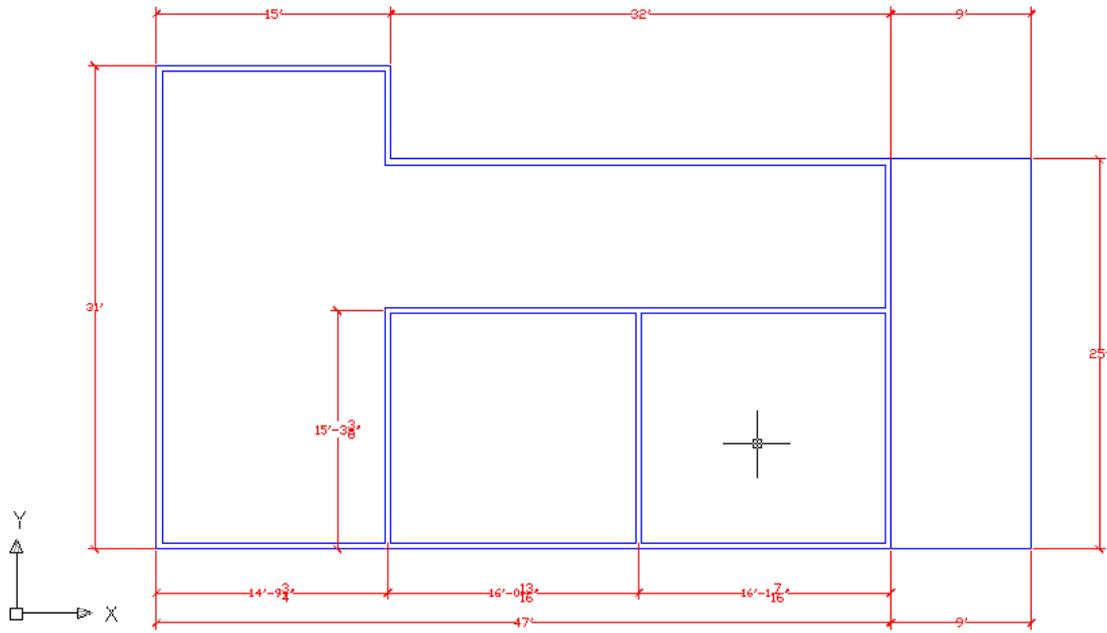


Figure 13.9 – Turning Off a Dimension Extension Line

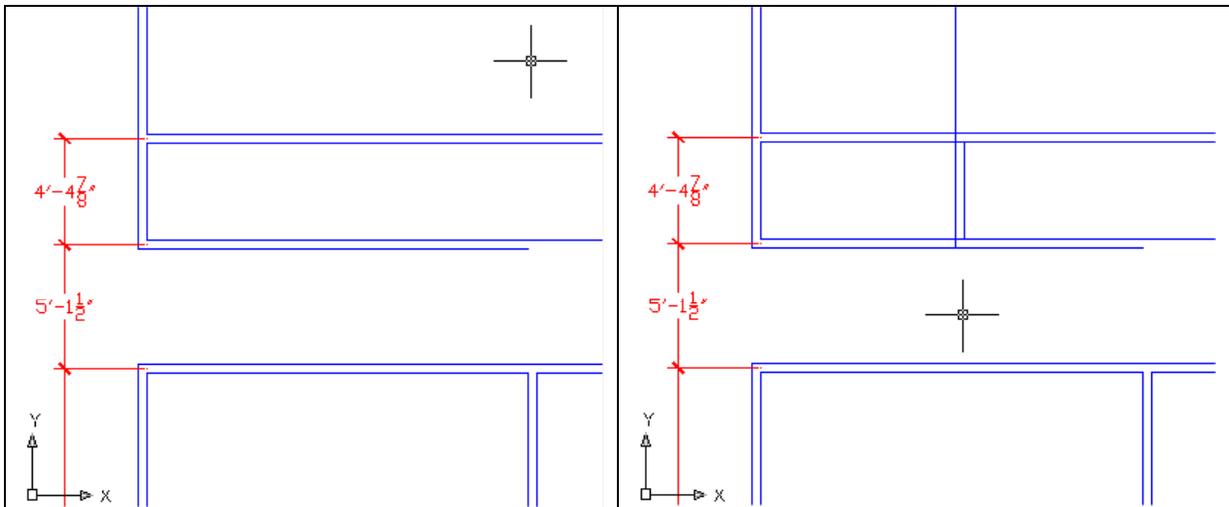
## Roughing in a Bathroom, Vestibule and Stairs

Once you place one vertical and one horizontal interior wall in the drawing, everything becomes very simple both mathematically and drawing-wise. Copy the left dining room wall to the right a distance of 16'13/16. Clean up the wall intersections using the Extend, Trim and Fillet tools. The process of copying walls will quickly create the main rooms in the interior of the floor plan. Dimensioning for the interior walls go 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. Your drawing should look like that shown in Figure 13.10.



**Figure 13.10 – Detailing the Dining And Living Rooms**

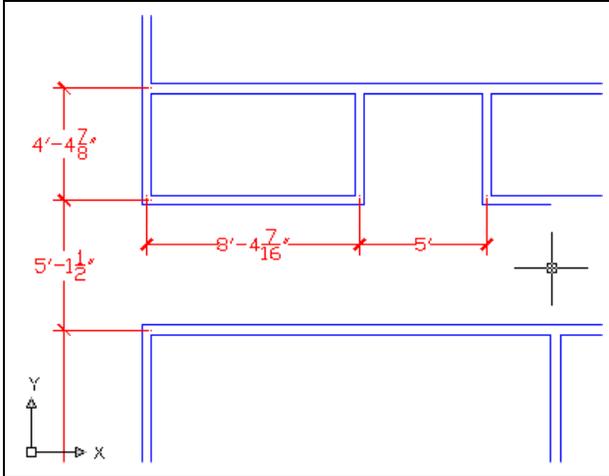
Copy the wall at the top of the dining room 5'1-1/2 up to form the hallway. Extend the exterior wall out to the hallway, then trim, and fillet the corners as shown in Figure 13.11. Now copy the left side of the bathroom wall 8'4-7/16 to the right to make the opposite wall of the bathroom as shown in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



**Figure 13.11 – Creating the Hallway**

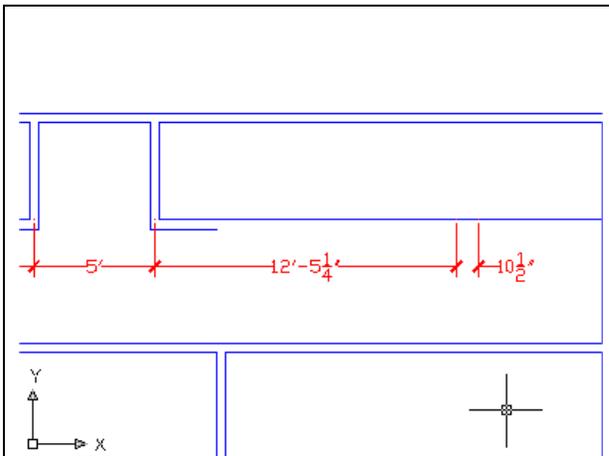
**Figure 13.12 – Creating the Bathroom**

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. Floors are built from on edge of the floor joist to the other end and a finished room will vary in fractions from one construction site to another for the same design.



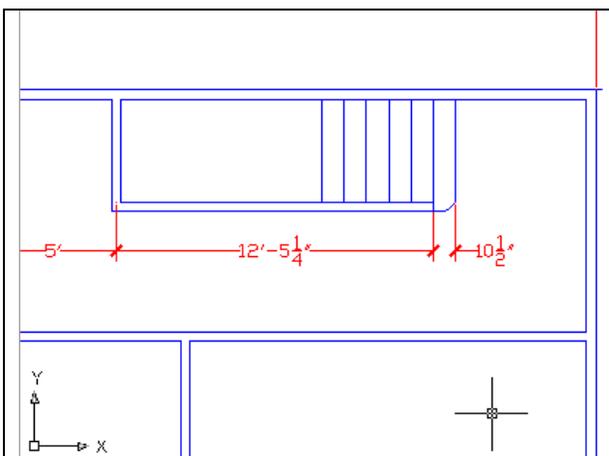
**Figure 13.13 – Creating the Vestibule to the Basement Stairs**

After walling in the first floor bathroom, you can copy the right bathroom wall 5' to the right to create the vestibule leading to the basement stairs as shown in Figure 13.13. Sometimes in cases like the vestibule, you can try a different drawing method by using the dimension as a reference point. Select the Linear Dimension tool, pick the endpoint of the right bathroom wall and for the second point, push the mouse to the right and type 5'. For the third selection, pick a point on the 8'4-7/16 dimension to align the 5' measurement. Move the dimension 2.25 to center the extension lines in the walls.



**Figure 13.14 – Dimensioning the Stairs**

You can mirror the bathroom wall instead of copying the lines, selecting the Mirror tool and the right bathroom wall. Pick the midpoint of the dimension and just above for the second point to create the mirror line. Finish the command and the lines will be perfectly placed. In Figure 13.14, you draw the 12'5-1/4 and 10-1/2 dimensions off the 5' dimension and then you can modify any set of lines using the dimension endpoints, nodes or midpoints.



**Figure 13.15 – Drawing the Stairs**

Now that all the interior rooms are done, 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 using 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 need to stop after six steps. You will show a break then the downstairs steps to the basement in a short while.

## Using a Door Block on a Floor Plan

To insert the 36-inch wide exterior door into the outside wall, select the Insert Block tool on the Draw toolbar. If you haven't already, go to [www.worldclasscad.com](http://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**.

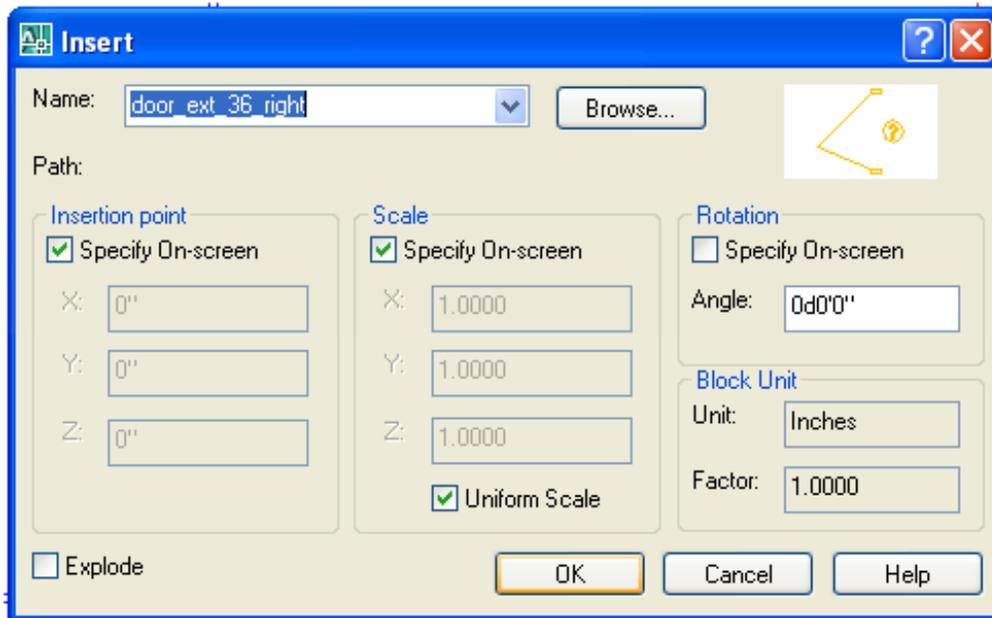
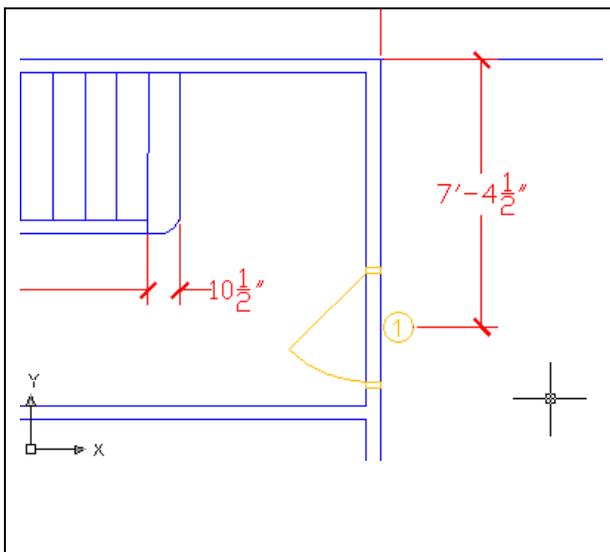
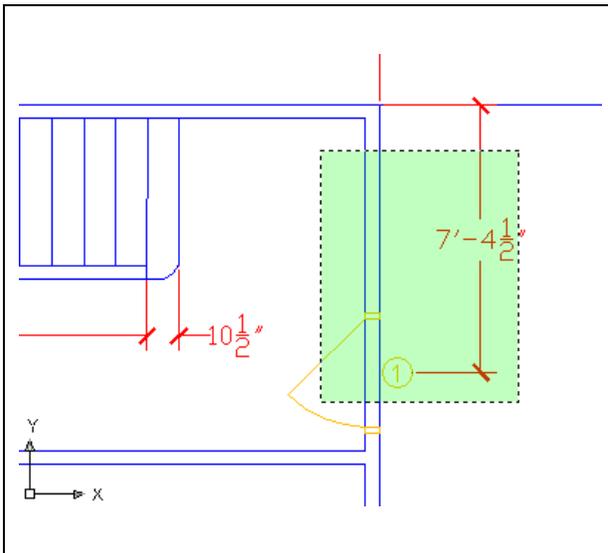


Figure 13.16 – Selecting the 36-Inch Door in the Insert Window



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, there will be a prompt on the Command line asking you to enter the scale of the block. Type “1” to enter the door at its normal scale. You will then be prompted 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 toolbar, pick to the right of the dimension and go 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, 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 3.375 (7'4-1/2 minus 7'1-1/8) and Enter to move the door into exact position.

**Figure 13.18 – Stretching the Door into Position**

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 end or mid point of a reference, and then move the door into position from there. Add the 2'6-3/4 dimension as shown in Figure 13.19.

You can use the Break tool that you first used in the Rectangular problem to trim the lines on the exterior wall as shown in Figure 13.20.

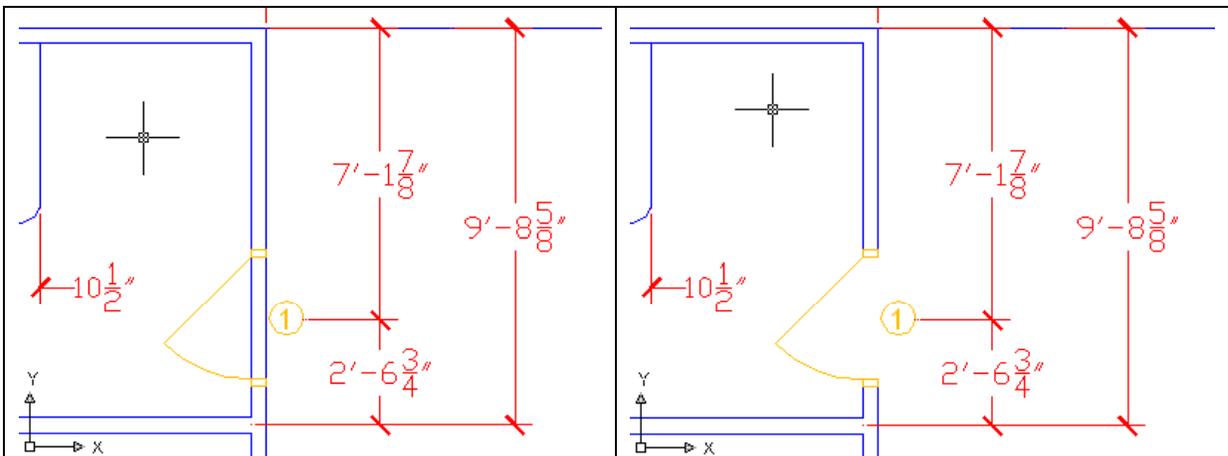
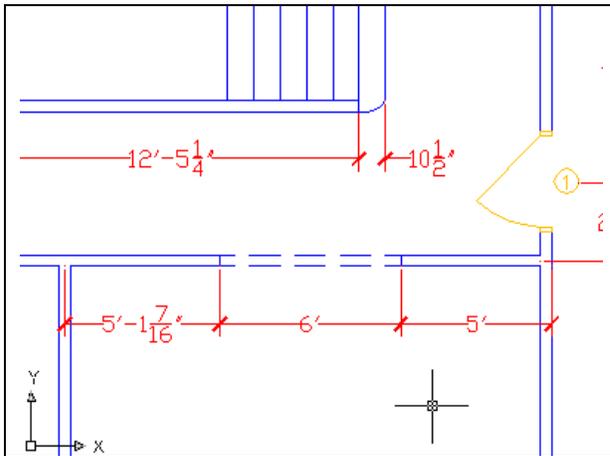


Figure 13.19 – Adding a Dimension

Figure 13.20 – Trimming the Wall

## Making an Opening in the Living Room Wall



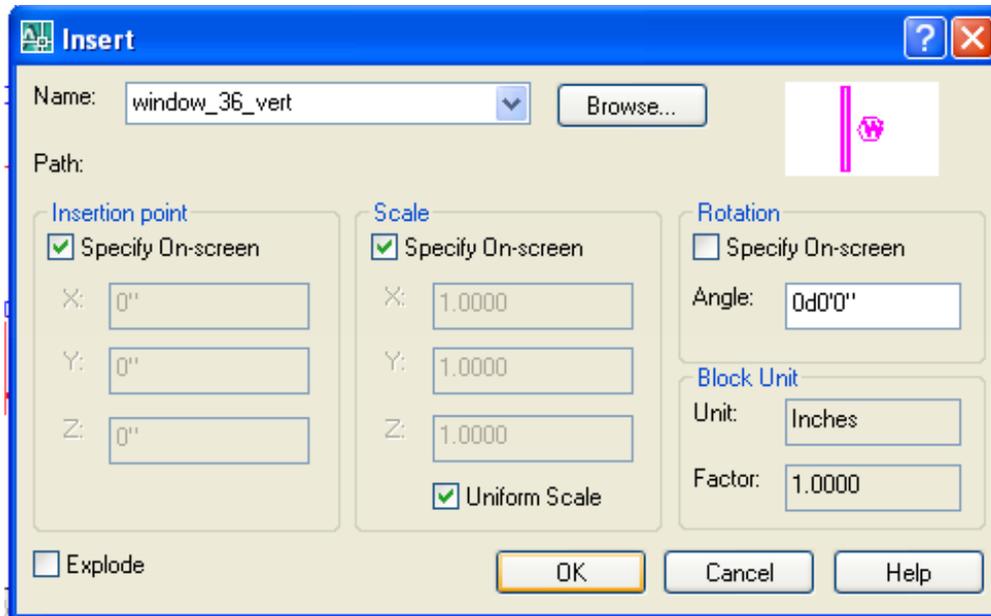
With the door and entry well on their way to completion, you can add the 6-foot opening from the hall to the living room. Offset the outside line 5' to the left and the newly drawn line 6' to the left again. Use the tools on the Modify toolbar to trim the longer lines to length. Trim away the lines in 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 and pan into the living room.

Figure 13.21 – Making an Entrance

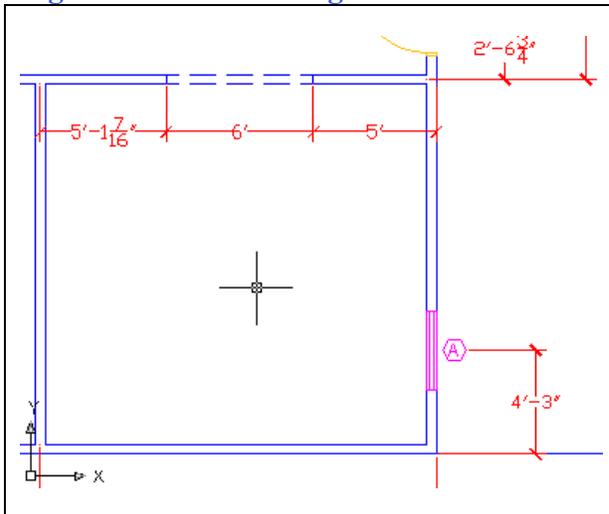
## Using a Window Block on a Floor Plan

To insert the 36-inch wide window into the outside wall, select the Insert Block tool on the Draw toolbar. In the Insert window on the graphical display as shown in Figure 13.22, select the block named **window\_36\_vert**.





**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, there will be a prompt on the Command line asking you to enter the scale of the block. Type “1” to enter the window at its normal scale. You will then be prompted to supply a “Window letter?” According to the sketch, the front entry window is “A”. Type “A” and Enter. Place a dimension on the drawing as shown in the figure.

**Figure 13.23 – Inserting a Window Block**

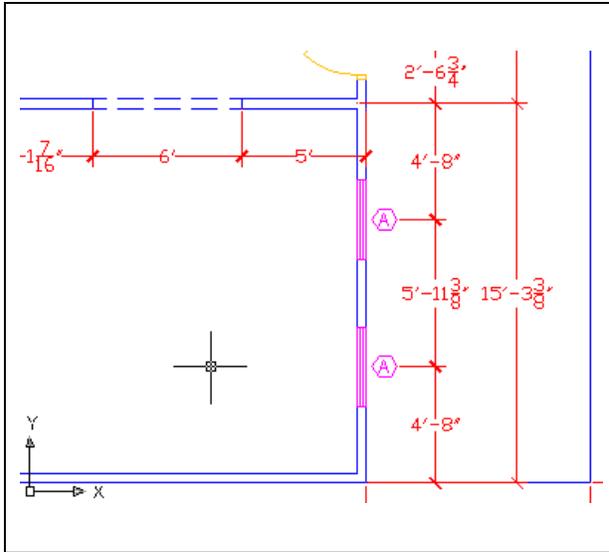


Figure 13.24 – Front Windows

To move both the dimension and the window into a proper location of 4'-8 choose the Stretch tool on the Modify toolbar, pick to the right of the dimension and go across the door, wall and dimension 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 4'-8 measurement and in the case shown type 5 (4'3 minus 4'8) and Enter to move the door into exact position.

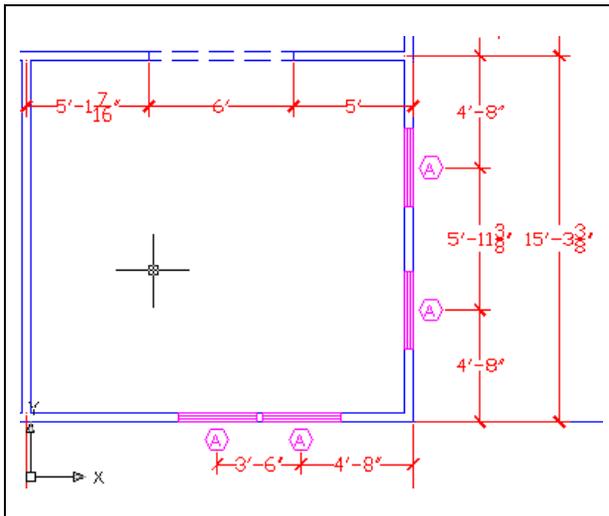
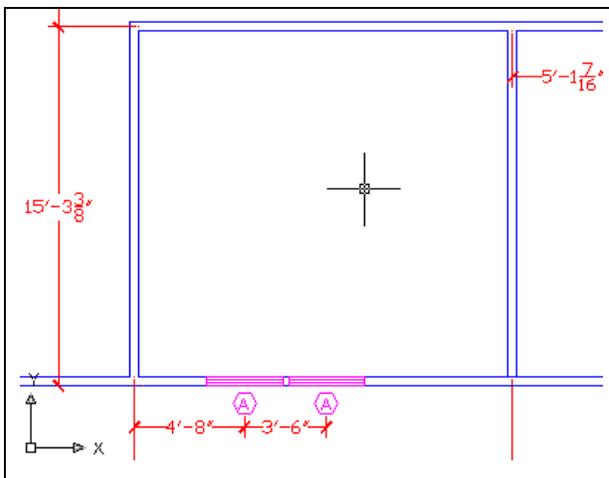


Figure 13.25 – Adding Two Windows

Copy the first window up 5'-11-3/8 to create the second front window. Place dimensions from the exterior wall to window-to-window to the midpoint of the interior wall as shown in Figure 13.24. Place a dimension (15'-3-3/8) from the exterior wall to the midpoint of the interior wall. Repeat the process using the **window\_36\_horiz** block on the bottom exterior wall. Place the dimension as shown in Figure 13.25. Next, you will create the double-sided fireplace and move to detail the dining room. Once you start your precise detail of the rough layout, follow some pattern when working on the print.



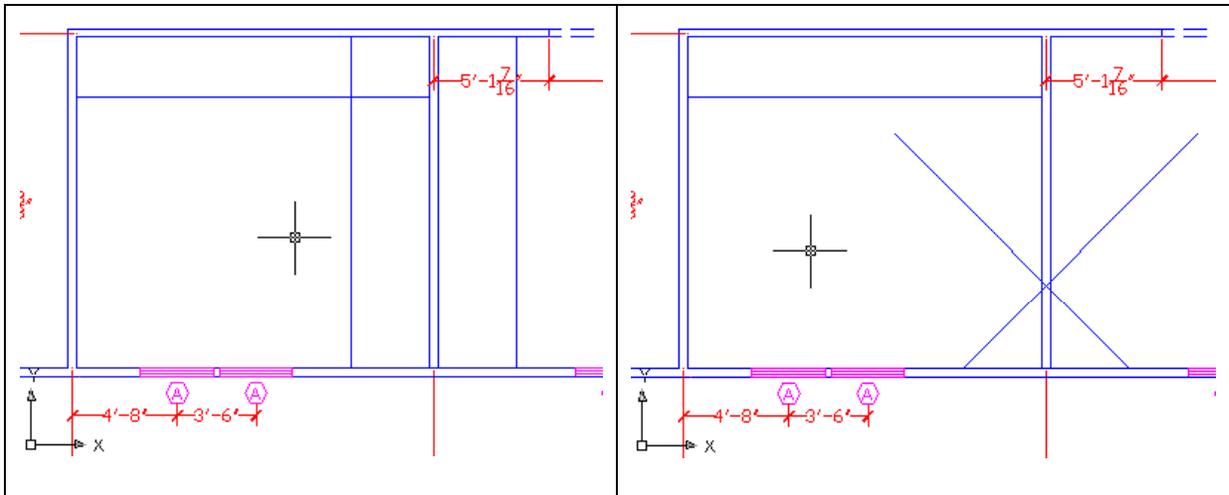
Copy the last two windows, along with the 3'-6 dimension over to the dining room exterior wall. After replicating the two windows into their approximate position, place a new dimension from the center of the left dining room wall to the left dimension extension line on the 3'-6 measurement as shown in Figure 13.26. Now, according to your floor plan sketch this new dimension should gauge 4'-8. Use the Stretch tool on the Modify toolbar to bring the dimension to the correct figure. This approach is excellent for a CAD operator, because whenever possible,

you can copy entire sets of entities to reduce your drawing times.

**Figure 13.26 – Copying Two Windows**

## Drawing a Fireplace

To make the fireplace that has the hearth projecting 45 degrees into both the living and dining room, you need to offset the wall 3'6-1/8 to both sides (See Figure 13.27). Then reset the Offset command by pressing the Enter twice and place the offset distance to 2'8 and offset the inside top wall down. Rotate the lines, using the bottom endpoint as the reference point, as shown in Figure 13.28, forty-five degrees inward and fillet the two crossing lines with a seven-inch radius.

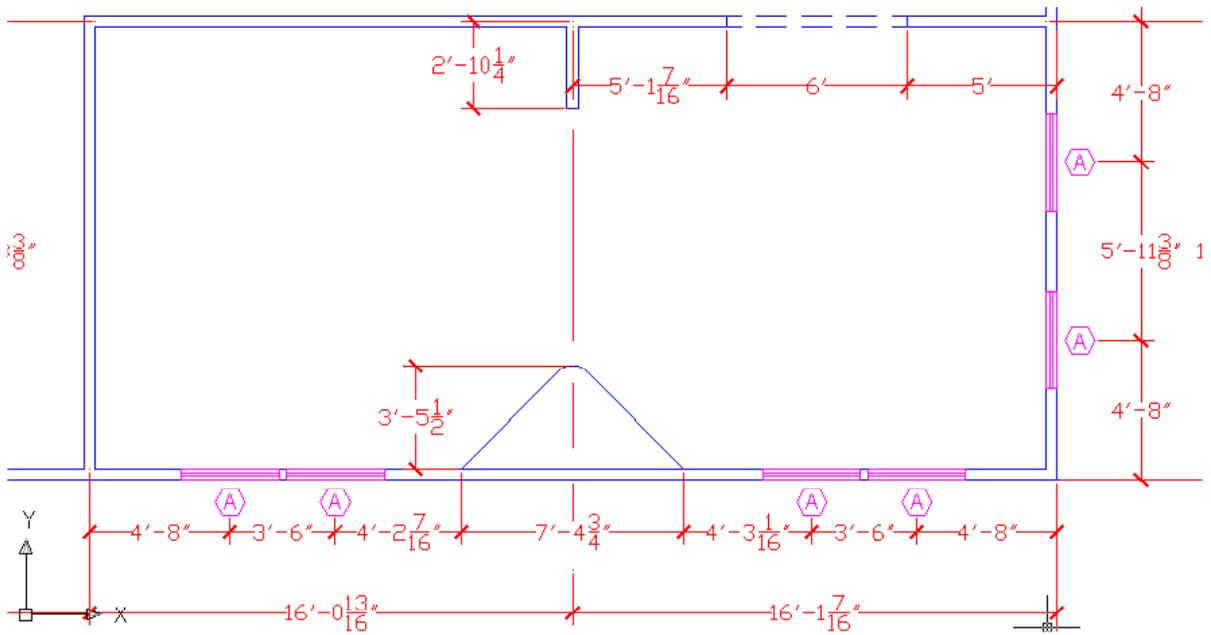


**Figure 13.27 – Offset Lines**

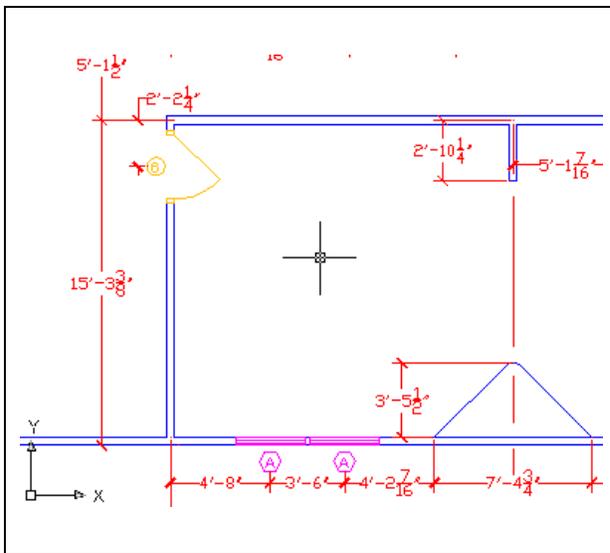
**Figure 13.28 – Rotating Lines**

Now trim the lines as shown in Figure 13.29. You then need to place the 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 be 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 wide interior door into the wall separating the kitchen and the dining room, select the Insert Block tool on the Draw toolbar. 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 door again has preset attributes, so after inserting the door, enter 1 for the scale. Then there will be a prompt on the Command line asking you what “Door number?” According to the sketch, the front entry is “6”. Type “6” and Enter. Place a dimension on the drawing as shown

**Figure 13.30 – Placing a Door in a Wall**

## Drawing a Kitchen

When drawing each room in a floor plan, you will discover the kitchen contains countless details that you do not illustrate in the other parts of the house. Since there is a counter that wraps around three sides of the kitchen, the first step you will take is to offset the inside of each wall 24 inches (2 feet) as shown in Figure 13.31. Fillet the rounded edges with a seven-inch radius. Dimension the counters as shown in Figure 13.32. A good rule of thumb is to highlight each dimension on a copy of the sketch from Appendix E to account for all the

measurements in the drawing. If the red dimension extension line covers the blue floor plan line then you will need to go to the Properties tool on the Standard toolbar to turn off one or both of the extension lines.

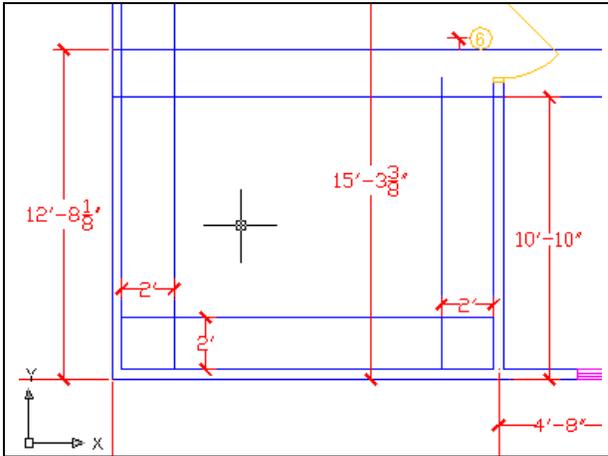


Figure 13.31 – Offset for the Counter

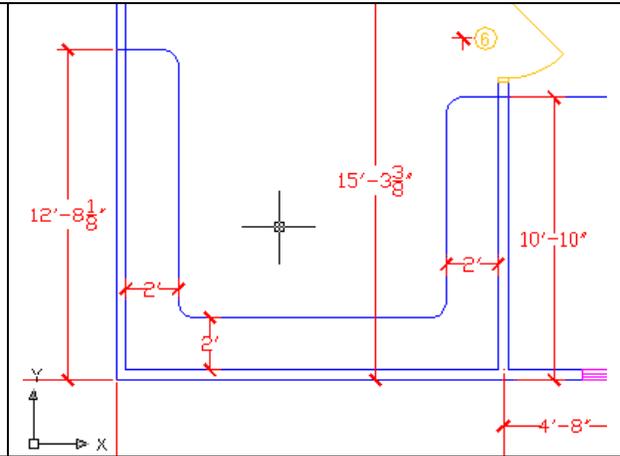


Figure 13.32 – Fillet and Trim

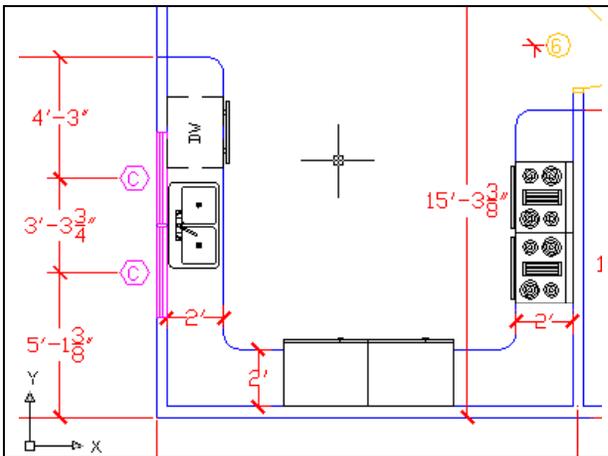


Figure 13.33 – Inserting the Appliances

You now need to use the Insert tool on the Draw toolbar 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, labeled “C”, as shown in Figure 13.33. Next, you will insert the kitchen sink and center the apparatus between the two windows. The two range-ovens are directly across from the sink. Locate the two refrigerators at the midpoint of the counter.

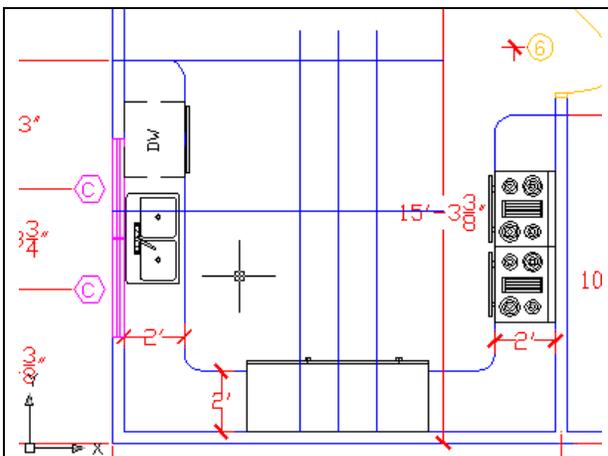


Figure 13.34 – Making an Island

Position the dishwasher just to the right of the sink and now you are ready to place an island in the kitchen. Many food preparation areas are too small for a middle work area, but this kitchen is large enough. Making the table to match the counter and to be movable is an advantage. 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. Erase the center construction line.



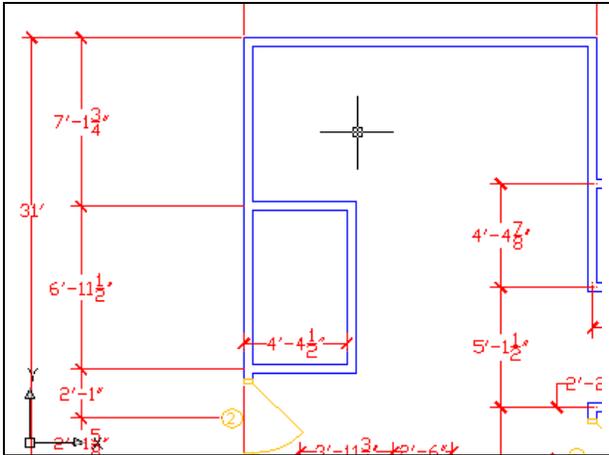


Figure 13.37 – Making a Pantry

To insert the 36-inch wide interior door into the pantry wall, select the Insert Block tool on the Draw toolbar. 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 at the Command line asking you what “Door number?” According to the sketch, the pantry door is “6”. Type “6” and Enter.

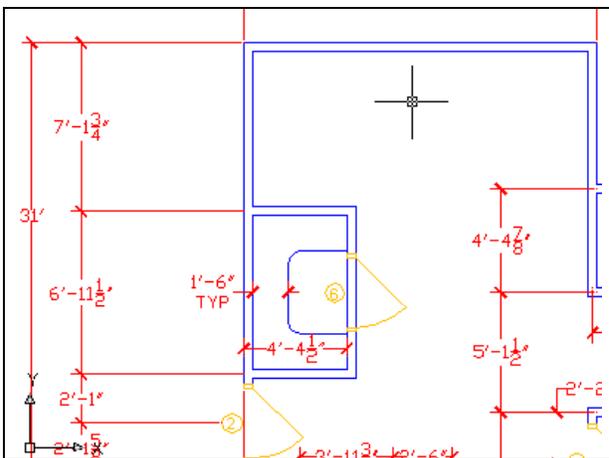


Figure 13.38 – Offset Shelves in Pantry

Offset the pantry shelves 18 inches from three walls. Fillet the shelves with the seven-inch radius corners that are the standard in the house design (Figure 13.38). If you place a pantry in a house, add a storage system to your design and many people will admire your plan. Leave the pantry walls empty and the approximately 4’ by 6’ area will likely become a cluttered closet. Organization of small regions is an important as large ones. Dimension the walls and shelves to check your accuracy.

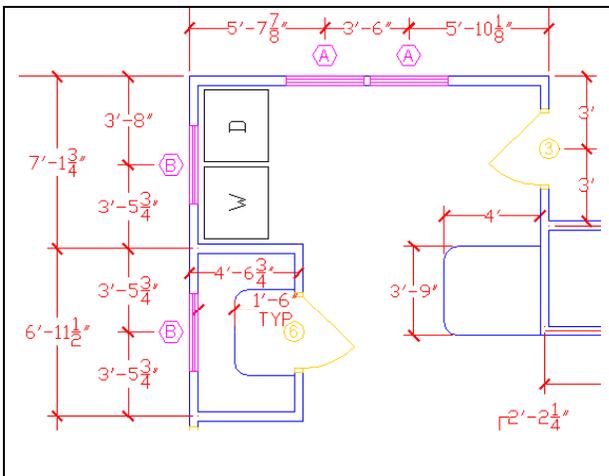
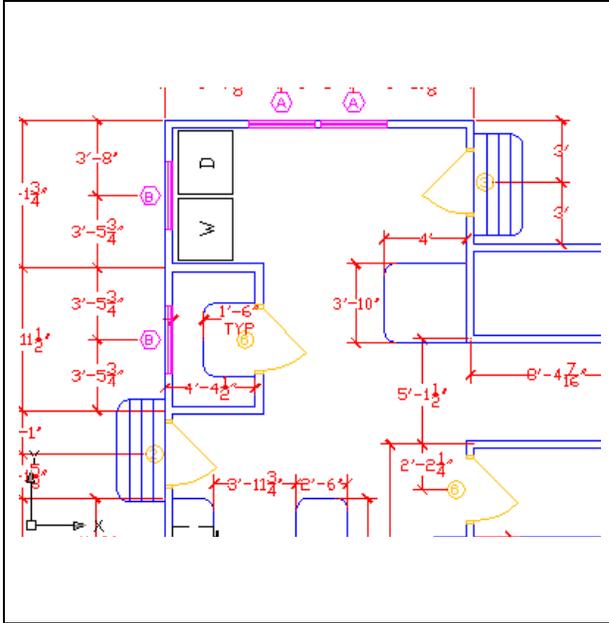


Figure 13.39 – Add Details

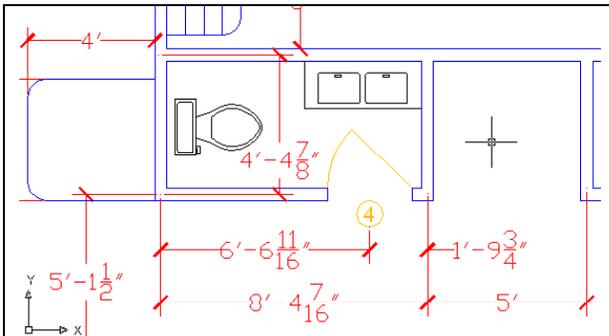
Insert the “B” labeled **window\_36\_vert\_left** block for the small windows, which will add natural light into the laundry and pantry. Add the “A” tagged **window\_36\_horiz\_top** block as shown in Figure 13.39. The side door, marked “3” is the **door\_ext 36\_right** block, which you need to insert 3 feet off the outside wall. Add the block **washer** and **dryer** in the nook behind the pantry. Lastly draw a line off the hallway wall 48 inches to the left, go up 45 inches and back 48 inches. Place two seven-inch radius corners on the laundry table.



Insert two four-step stairs at the midpoint of the back and side doors. Each stair is 7 inches wide, with the last stair's edges filleted with a 7" radius edge. They can be any width. You can also add a third set that will come off the front porch, which you need to center on the door. You can replace the blocks with a better detail of the stairs when the customer determines whether they want to do with the yard or add a deck. Handrails are an important feature and do not forget them. Usually, you will show exact particulars of the dwelling on separate sheets where you can display multiple views of the construction. When you add the additional details, you will note the view letter and sheet number next to the feature in the floor plan.

Figure 13.40 – Adding Stairs

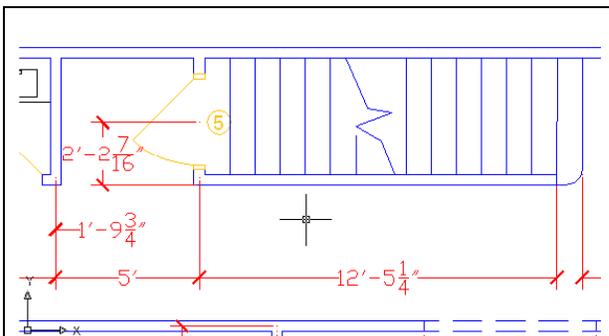
## Finishing the Bathroom



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, which you need to insert 6’6-11/16 off the left wall. Move the hallway dimension that may interfere with the new bathroom measurements.

Figure 13.41 – Completing the Bathroom

## Completing the Basement Stairs

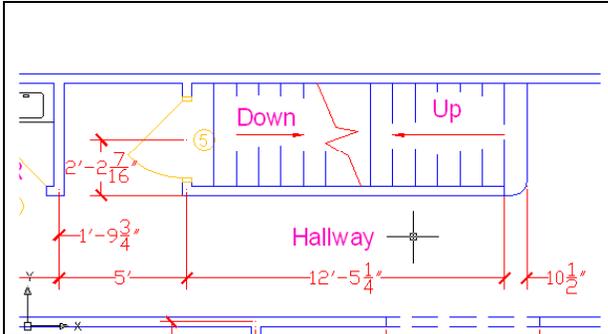


The basement door, marked “5” is the **door\_ext\_36\_right** block, which you need to insert 2’2-7/16 feet off the hallway wall. Start the first step 10.5 inches from the inside of the basement door and offset each step 10.5 inches seven times. Free hand draw a line as shown in figure 13.42 which indicates a cut line separating the up and down stairs. Place the cutting line on the dimension layer.

## Figure 13.42 – Completing the Basement Stairs

### Labeling the Drawing

Choose the Quick Leader tool from the Dimension toolbar and draw two leaders as shown in Figure 13.43. When dimensioning you are looking for a clear and concise explanation of a drawing element and the leader do not have to line up perfectly.



After choosing the Quick Leader tool, the first selection point is the placement of the arrow on the leader, and then you draw the line by placing the second point. Enter three times to get to the Multiline Text Editor. Press the Cancel button so you will not be adding any notes. Use the Break tool on the Draw toolbar to remove lines from around the text area.

Figure 13.43 – The Up and Down Labels

When labeling the floor plan with text, you may want to learn one more of the three text tools available. The first one you learn is obviously the **Mtext** tool where you 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, where there are easy features for adding text automatically with a coded routine.



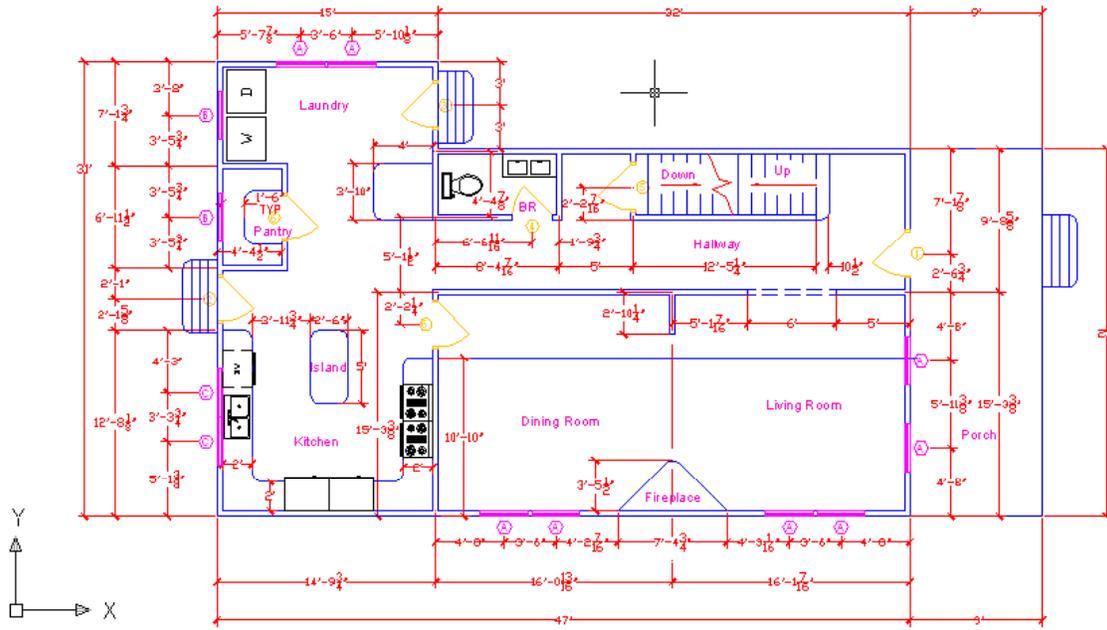
Figure 13.45 – The Text Toolbar

Choose the Single Line Text tool on the Draw toolbar. Select a point to start your text, and then select a text height in inches; for this case, use 8". 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 Enter after you have placed all the labels as shown in Figure 13.46.

**Command:** `_dtext`  
**Current text style:** "mechanical" **Text height:** 0'-6"  
**Specify start point of text or [Justify/Style]:**  
**Specify height <0'-6">:**  
**Specify rotation angle of text <0d0'0">:**  
**Enter text:** Down  
**Enter text:**

**Figure 13.45 – The Command Line Information for Dtext**

Label all the rooms, hallway, porch, fireplace and other features as you see in the floor plan sketch. The drawing is done, save the file in the Fundamentals of 2D Drawing folder as “First Floor Plan”. Make time in the two hours to check the drawing, since 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 under 120 minutes to maintain your World Class ranking.**