

LEARNING OBJECTIVES

After completing this lesson, you will be able to:

1. Understand Scaled Drawings
2. Adjust the scale within a Viewport
3. Understand Annotative Objects
4. Understand Paper space vs. Model Space dimensioning

LESSON 27

CREATING SCALED DRAWINGS

In the lessons previous to Lesson 26 you worked only in Model space. Then in Lesson 26 you learned that AutoCAD actually has another environment called Paper Space, or Layout. In this lesson we need to learn more about why we need 2 environments and how they make it easier to display and plot your drawings.

A very important rule in CAD you must understand is:

“All objects are drawn full size”.

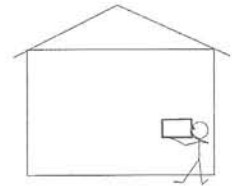
In other words, if you want to draw a line 20 feet long, you actually draw it 20 feet long. If the line is 1/8” long, you actually draw it 1/8” long.

Drawing and Plotting objects that are very large or very small.

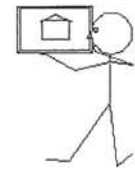
In the previous lessons you created medium sized drawings. Not too big, not too small. But what if you wanted to draw a house? Could you print it to scale on an 8-1/2 X 11 piece of paper? How about a small paper clip. Could you make it big enough to dimension? Let's start with the house.

How to print an entire house on an 8-1/2 X 11 sheet of paper.

Remember the photo and picture frame example I suggested in lesson 26? (Refer to 26-5) This time try to picture yourself standing at the front door of your house with an empty picture frame in your hands. Look at your house through the picture frame. Of course the house is way too big to fit in the frame. Or is it because you are standing too close to the house?



Now walk across the street and look through the picture frame in your hands again. Does the house appear smaller? Can you see all of it in the frame? If you could walk far enough away from the house it would eventually appear small enough to fit in the picture frame in your hands. But...the house did not actually change size, did it? It only appears smaller because you and the picture frame are farther away from it.



Adjusting the Viewport scale.

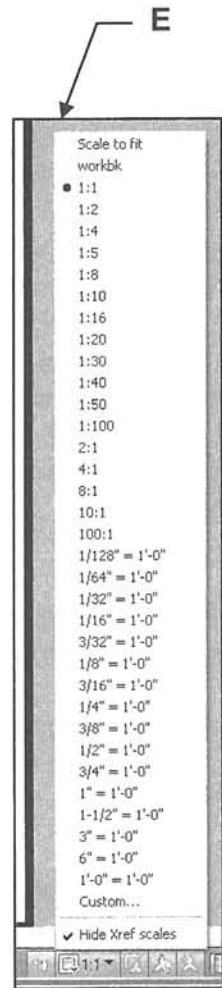
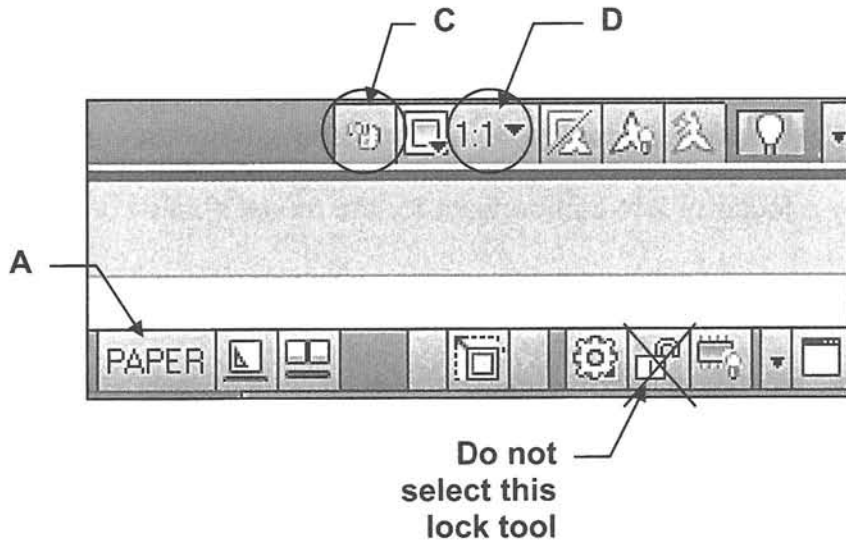
When using AutoCAD, walking across the street with the frame in your hands is called **Adjusting the Viewport scale**. You are increasing the distance between model space (your drawing) and Paper space (Layout) and that makes the drawing appear smaller. For example: A viewport scale of 1/4" = 1' would make model space appear 48 times smaller. But, when you dimension the house, the dimension values will be the actual measurement of the house. In other words, a 30 ft. line will have a dimension of 30'-0".

When plotting something smaller, like a paperclip, you have to move the picture frame closer to model space to make it appear larger. For example: 8 = 1

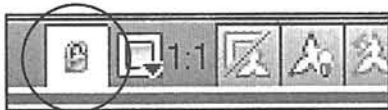
ADJUSTING THE VIEWPORT SCALE

The following will take you through the process of adjusting the scale within a viewport.

1. **Open** a drawing.
2. Select a **Layout** tab. (paper space)
3. Create a new **Page Setup**
4. Cut a new Viewport or unlock an existing Viewport.
5. Adjust the scale
 - A. You must be in Paper Space. (See below)
 - B. Select the Viewport Frame.
 - C. Unlock Viewport, if locked.
 - D. Select the Viewport Scale down arrow.
 - E. Select the scale from the list of scales.

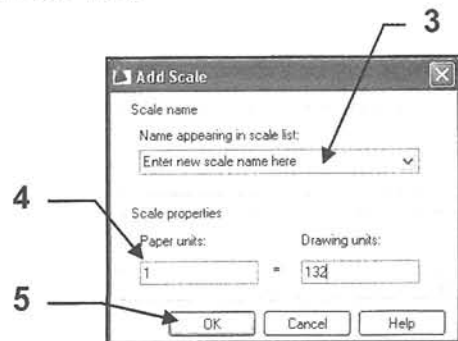
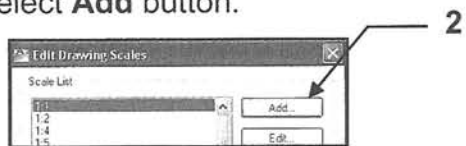


6. Lock the Viewport



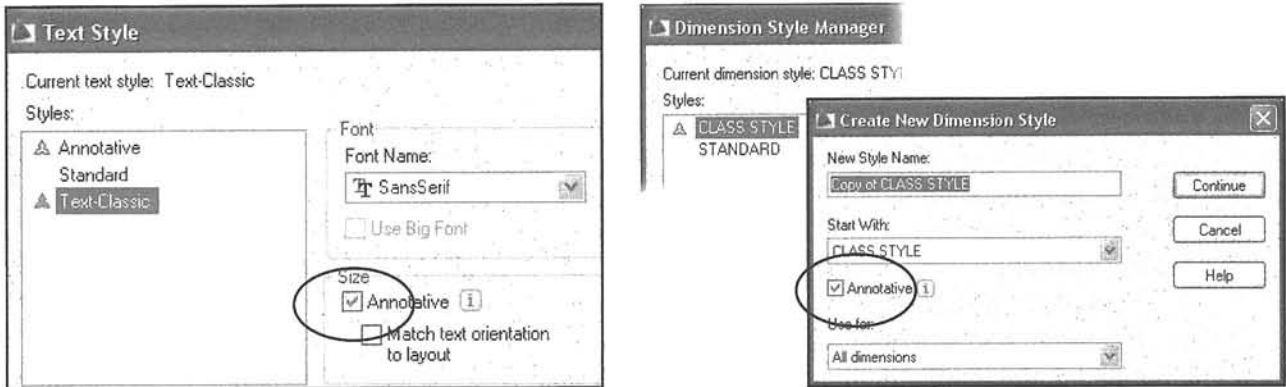
Note: If you would like to add a scale that is not on the list:


1. Type **Scalelistedit**
2. Select **Add** button.
3. Enter Scale name to display in scale list.
4. Enter Paper and drawing units.
5. Select the **OK** button.



ANNOTATIVE OBJECTS

In lesson 26 you created a new text style and dimension style. You also added the “**Annotative**” property to both simply by placing a check mark in the Annotative box.

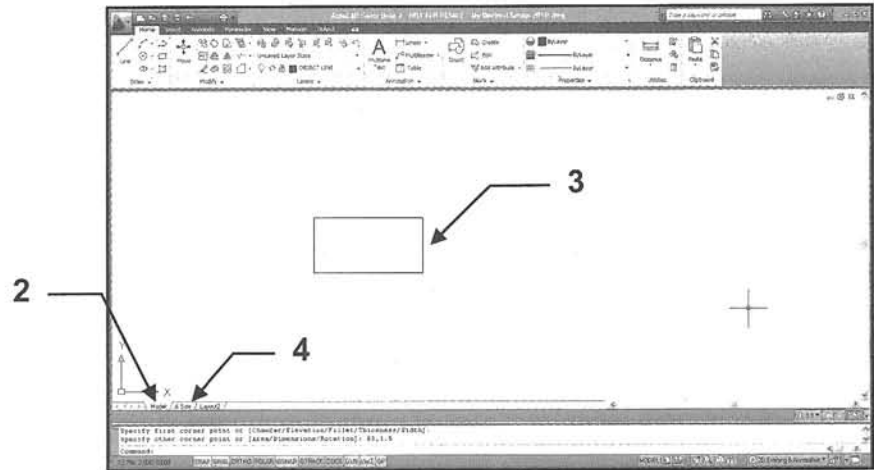


The Text style and Dimension Style shown above are now **Annotative**. Notice the Annotative symbol  beside the Style Name. (No symbol by “Standard”).

“**Annotative objects**” are scaled automatically to match the scale of the viewport. For example, if you want the text, inside the viewport, to print .200 in height and the viewport scale is 1:2 AutoCAD will automatically scale the text height to .400. The text height needs to be scaled by a factor of 2 to compensate for the model space contents appearing smaller.

The easiest way to understand how **Annotative property** works is to do it. **So try this example. (When complete you will save this file for use with Lesson 28.)**

1. Start a New file using **My Decimal Setup.dwt**
2. Select the **Model** tab.
3. Draw a rectangle 3.00 Lg X 1.50 wide **Use layer Object line.**

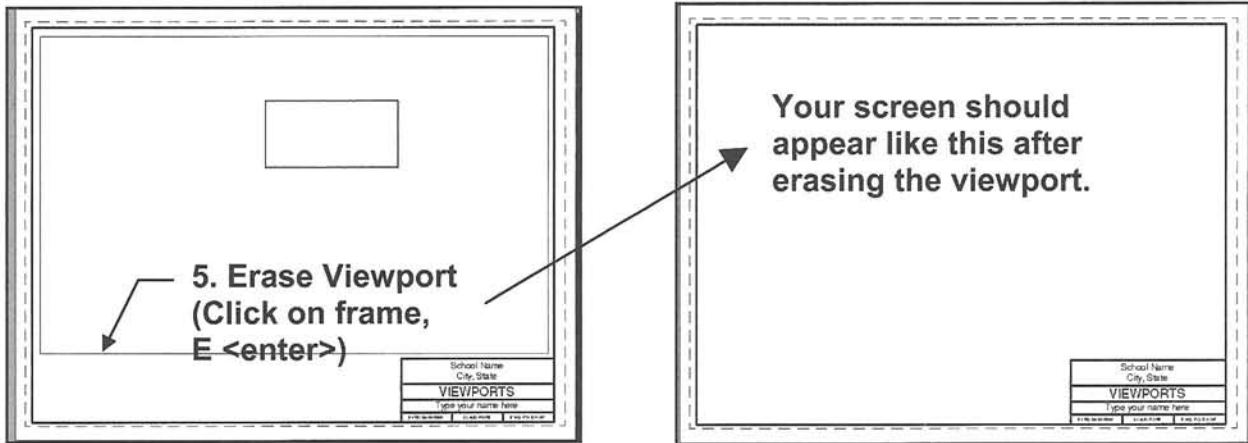


4. Select the **A Size** tab.

Continued on the next page...

ANNOTATIVE OBJECTS....continued

5. Erase the existing single viewport frame.



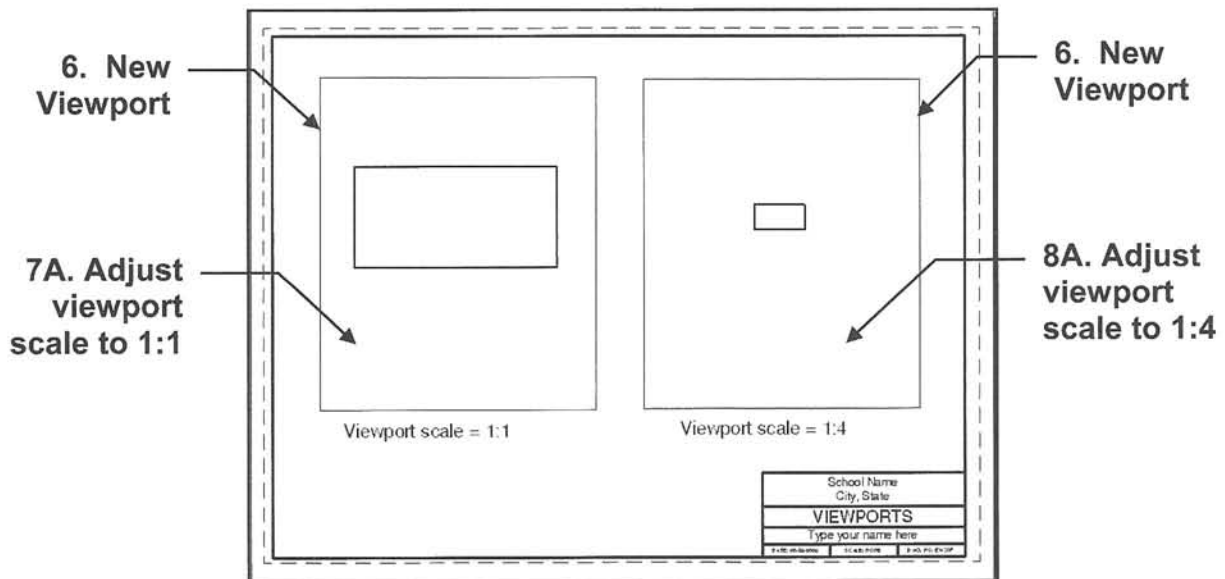
6. Change current layer to Viewport and cut 2 new viewports as shown below. (See 26-7)

7. Activate the left viewport (double click inside the viewport frame) and do the following:

- A. Adjust the scale of the viewport to 1 : 1 (Refer to page 27-3)
- B. PAN to place rectangle in the center of the viewport. (Refer to page 26-10)
- C. Lock the viewport (Refer to page 27-3)

8. Activate the right viewport (click inside the viewport frame) and do the following:

- A. Adjust the scale of the viewport to 1 : 4 (Refer to page 27-3)
- B. PAN to place rectangle in the center of the viewport. (Refer to page 26-10)
- C. Lock the viewport (Refer to page 27-3)

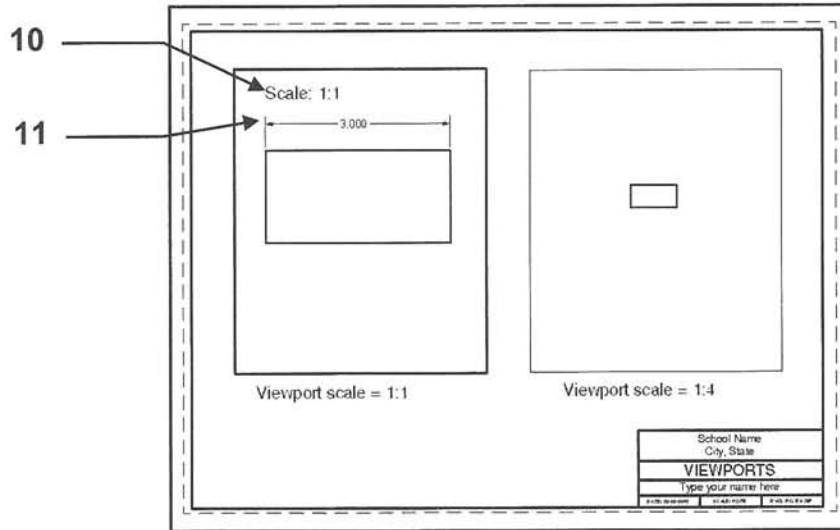


*Your screen should appear approximately like this.
Note: My grids are off.*

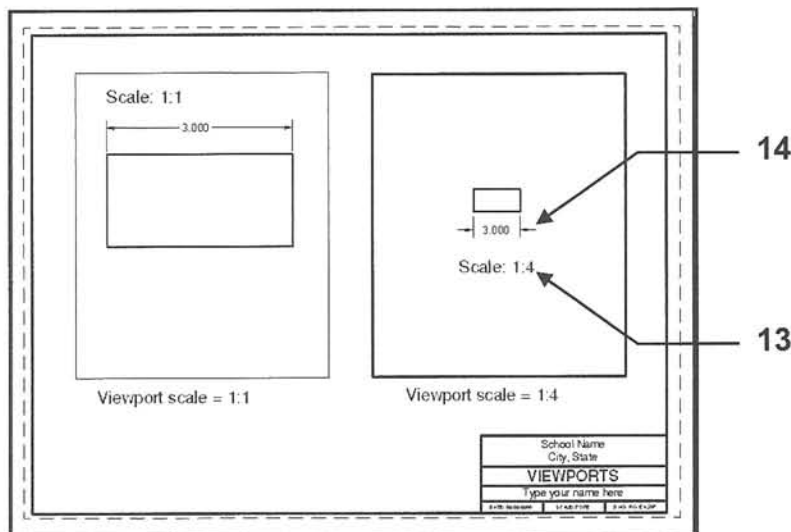
Continued on the next page...

ANNOTATIVE OBJECTS....continued

9. Activate the left hand viewport. (Double click inside left hand viewport)
10. Change current layer to **Text** and add .200 height text **Scale 1:1** as shown using text style "Text-Classic". (Note: Text style "Text-Classic" is annotative)
11. Change current layer to **Dimension** and add the dimension shown using dimension style "Dim-Decimal". (Note: Dimension style "Dim-Decimal" is annotative)



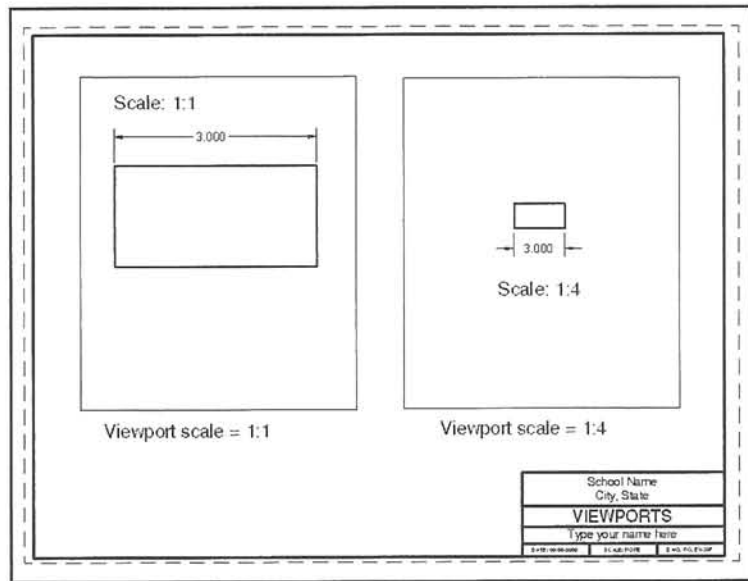
12. Activate the right hand viewport. (Click inside right hand viewport)
13. Change current layer to **Text** and add .200 height text **Scale 1:4** as shown using text style "Text-Classic". (Note: Text style "Text-Classic" is annotative)
14. Change current layer to **Dimension** and add the dimension shown using dimension style "Dim-Decimal". (Note: Dimension style "Dim-Decimal" is annotative)



Continued on the next page...

ANNOTATIVE OBJECTS....continued

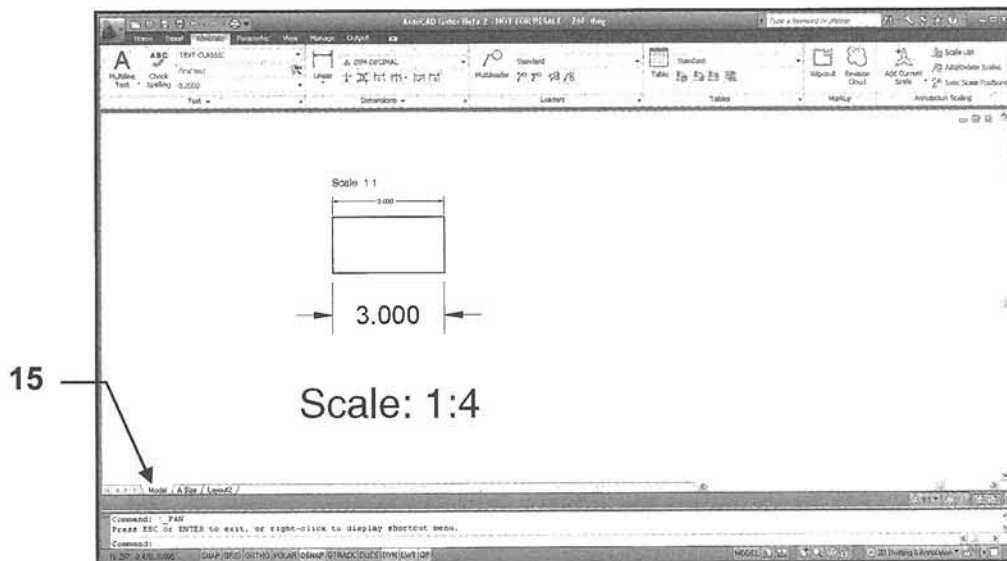
Notice that the text and dimensions appear the same size in both viewports.



15. Now select the **Model** tab.

Notice there are 2 sets of text and dimensions.


One set has the annotative scale of 1:1 and will be visible only in a 1:1 viewport.
One set has the annotative scale of 1:4 and will be visible only in a 1:4 viewport.
But you see both sets when you select the model tab.

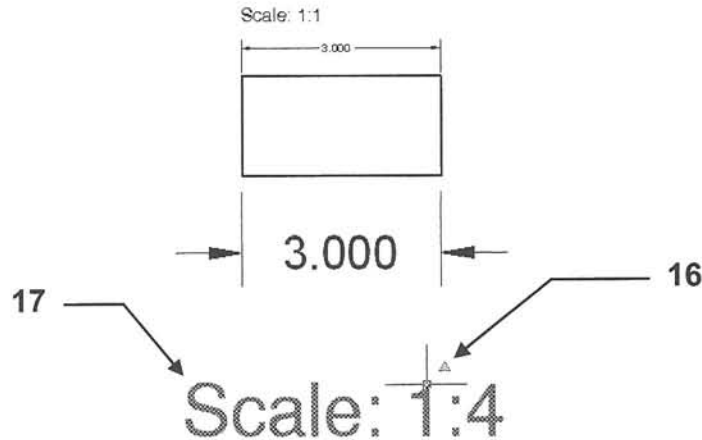


(In Lesson 28 you will learn how to assign multiple annotative scales to one set of text or dimensions so you will not have duplicate sets in the model tab.)

Continued on the next page...

ANNOTATIVE OBJECTS....continued

16. Place your cursor on any of the text or dimensions. An “Annotative symbol”  will appear. This indicates this object is annotative and it has only one annotative scale. (In lesson 28 you will learn how to assign multiple annotative scales to a single annotative object so it will be visible in multiple viewports.)



17. Click once on the **Scale: 1:4** text. The Quick properties box should appear. (QP button on the status bar must ON.)

Notice the text height is listed twice.

Paper text height = .200 This is the height that you selected when placing the text. When the drawing is printed the text will print .200.

Model text height = .800 This is the desired height of the text (.200) factored by the viewport scale (1:4). The viewport scale is a factor of 4. ($4 \times .200 = .800$)

Scale: 1:4

MText	
Layer	TEXT
Contents	Scale: 1:4
Style	△ TEXT-CLASSIC
Annotative	Yes
Annotative scale	1:4
Justify	Top left
Paper text height	.200
Model text height	.800
Match orientation to	No
Rotation	0

Quick Properties Box

18. **IMPORTANT:** Save this drawing as: **Annotative objects**
(You will need it for Lesson 28)

Summary:

If an object is annotative AutoCAD automatically adjusts the scale of the object to the viewport scale. The most commonly used Annotative Objects are: Dimensions, Text, Hatch and Multileaders. Refer to the Help menu for more.

In lesson 28 you will learn how to assign multiple annotative scales to a single annotative object.)

PAPER SPACE DIMENSIONING

Some people prefer to dimension in paper space. Paper space dimensions are Trans-spatial. Trans-spatial means that you may place the dimension in paper space while the object you are dimensioning is in model space. Even though the dimension is in paper space it is actually attached to the object in model space.

For example,

1. You draw a house in model space.
2. Now select the layout tab.
3. Cut a viewport so you can see the drawing of the house.
4. Go to model space, adjust the scale of the viewport (model space) and lock it.
5. Now go to paper space and dimension the house.

SHOULD YOU DIMENSION IN PAPER SPACE OR MODEL SPACE?

This is your choice. Personally, I dimension in either space depending on the situation. Here are some things to consider.

Paper Space dimensioning

Pro's

1. You never have to worry about the viewport scale.
2. All dimensions will have the same appearance in all viewports.
3. If you Xref the drawing the dimensions do not come with it.
(Xref is not discussed in this workbook)

Con's

1. If you move the objects in model space, or adjust the viewport scale, sometimes the dimensions do not move with them. (If this happens type Dimregen <enter>)
3. Dimensions will not appear in the Model tab. They appear only in the layout tab in which they were placed. If you go to another layout tab they will not appear.

Annotative dimensioning in Model Space

Pro's

1. Dimensions always appear and move with the objects.
2. Dimensions will appear in all layout tabs within viewports.

Con's

1. If you Xref the drawing the dimensions come also.

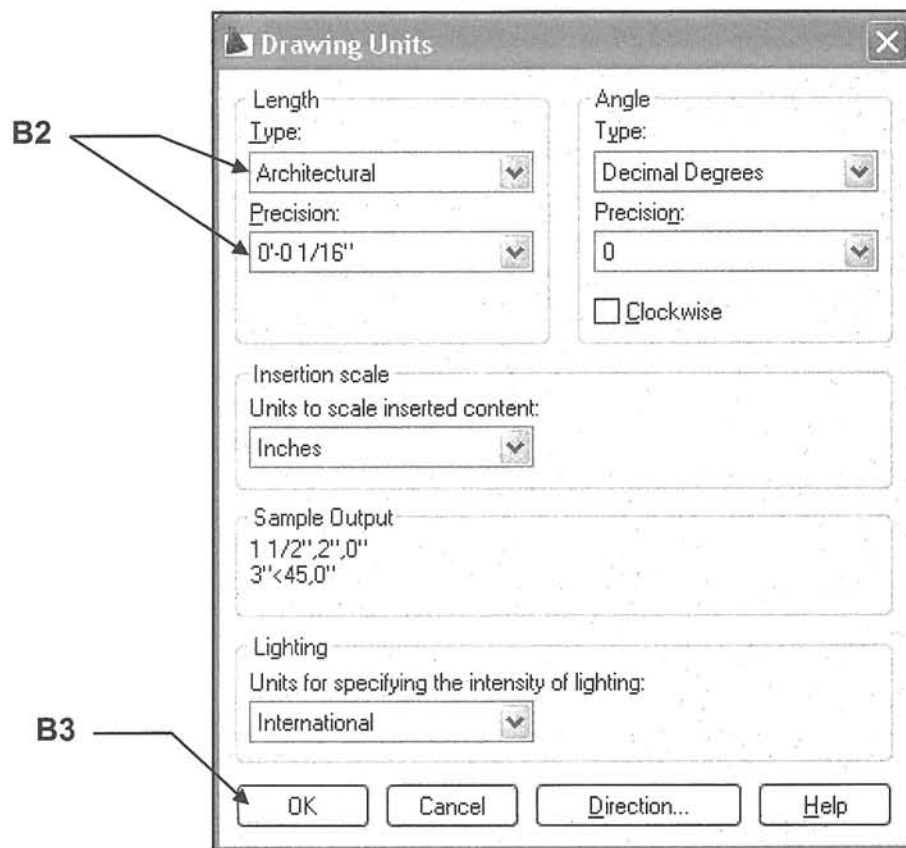
EXERCISE 27A

CREATE A MASTER FEET-INCHES SETUP TEMPLATE

The following instructions will guide you through creating a “Master” Feet-inches setup template. The “2013-Workbook Helper” is an example of a Master setup template. Once you have created this “Master” template, you just open it and draw. No more repetitive inputting of settings.

NEW SETTINGS

- A. Begin your drawing with a different template as follows:
1. Select the **NEW** command.
 2. Select template file **acad.dwt** from the list of templates. (**Not acad3D.dwt**)
- B. Set the drawing **Units** as follows:
1. Type **UNITS <enter>**
 2. Change the **Type** and **Precision** as shown
 3. Select **OK** button

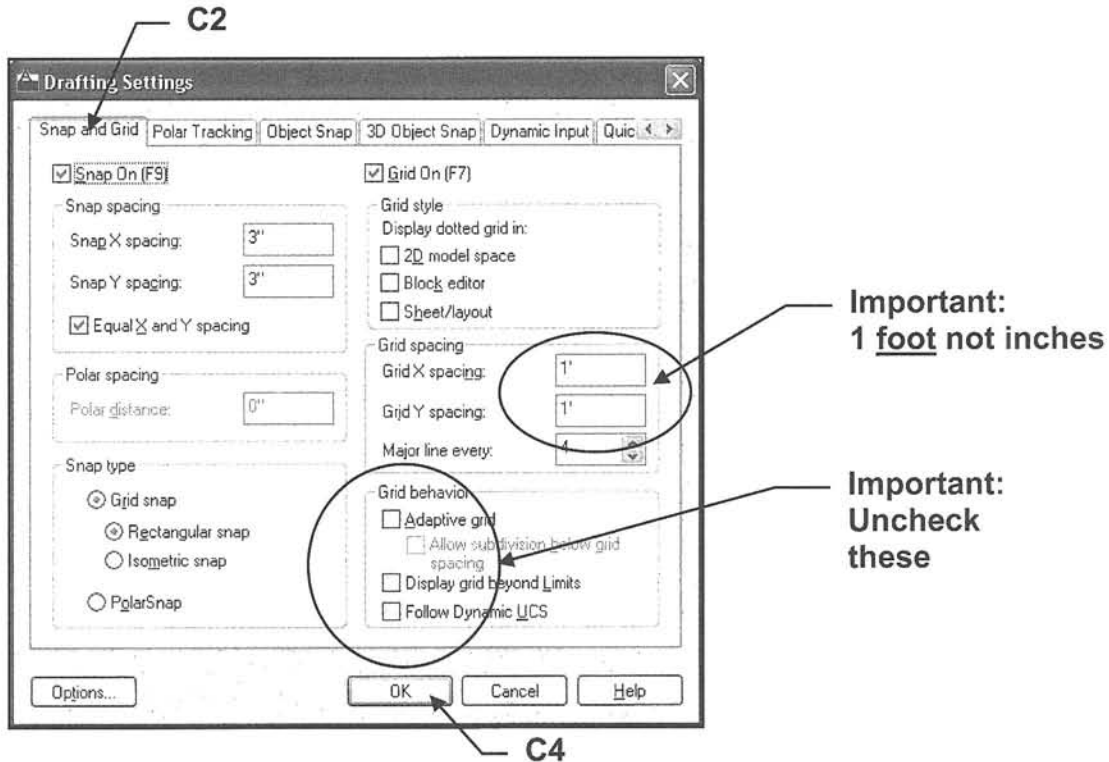


Continued on the next page...

EXERCISE 27A continued

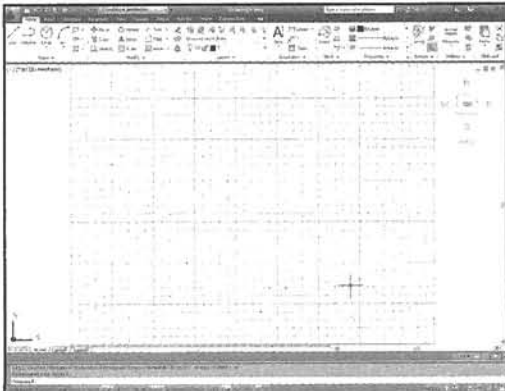
C. Set the Grids and Snap as follows:

1. Type **DS<enter>**
2. Select the **Snap and Grid** tab
3. Change the settings as shown below.
4. Select the **OK** button.



D. Set the **Drawing Limits** (Size of the drawing area) as follows:

1. Type **Limits <enter>**
2. Enter Lower left corner = 0'-0", 0'-0"
3. Enter Upper right corner = **44' , 34'** (Notice this is feet, not inches)
4. Use "**ZOOM / ALL**" to view the new limits
5. Set your **Grids** to **ON** to display the limits (drawing area).



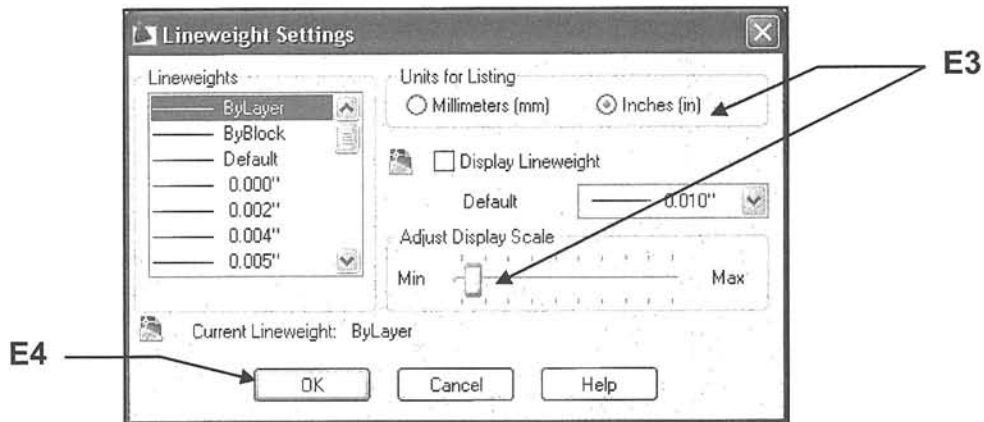
If your screen does not appear as shown here check these:

- Did you use, **Zoom / All (D4)**?
- Is your grid spacing feet or inches?
- Is the **Grid ON**?

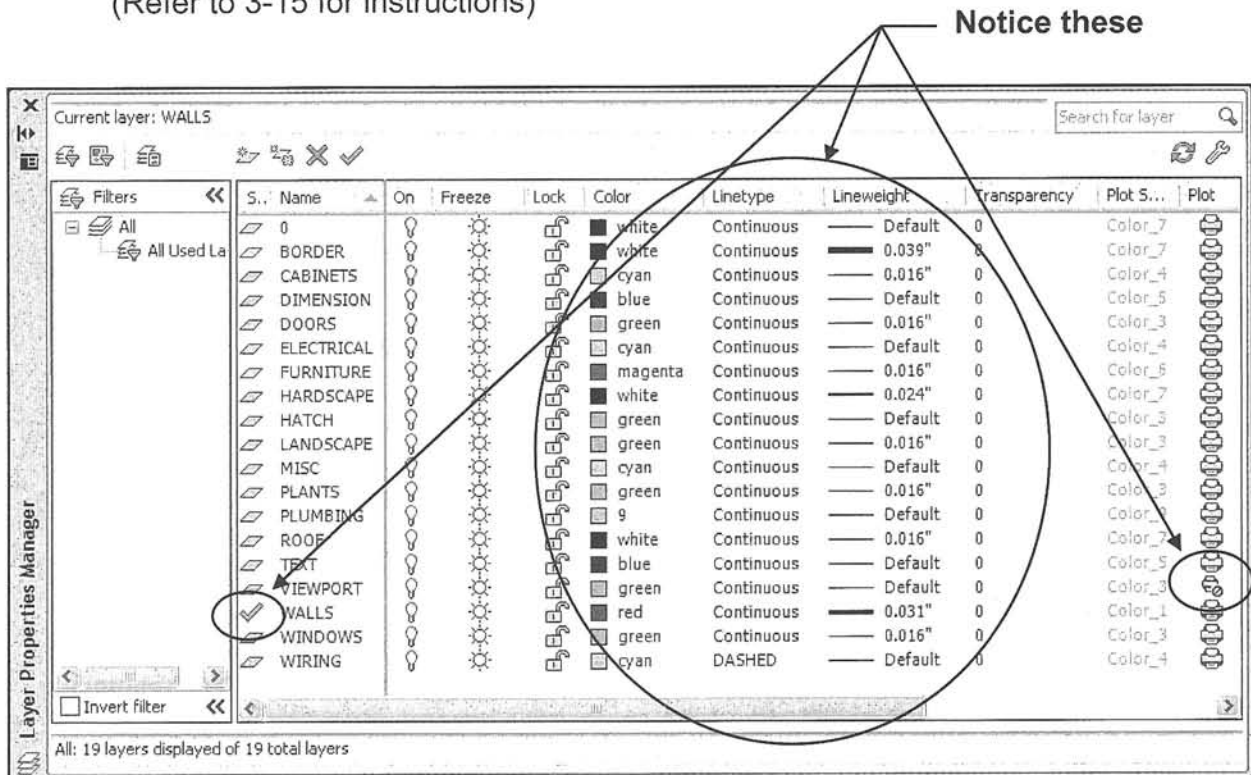
Continued on the next page...

EXERCISE 27A continued

- E. Change **Lineweight** settings as follows:
1. Right click on Lineweight button on status line
 2. Select **Settings**
 3. Change to inches and adjust the Display scale as shown below.
 4. Select the **OK** button.



- F. Create **new Layers** as follows:
1. Load the linetype **Dashed**. (Refer to page 3-16 for instructions)
 2. Assign names, colors, linetypes, lineweights and plotability as shown below: (Refer to 3-15 for instructions)

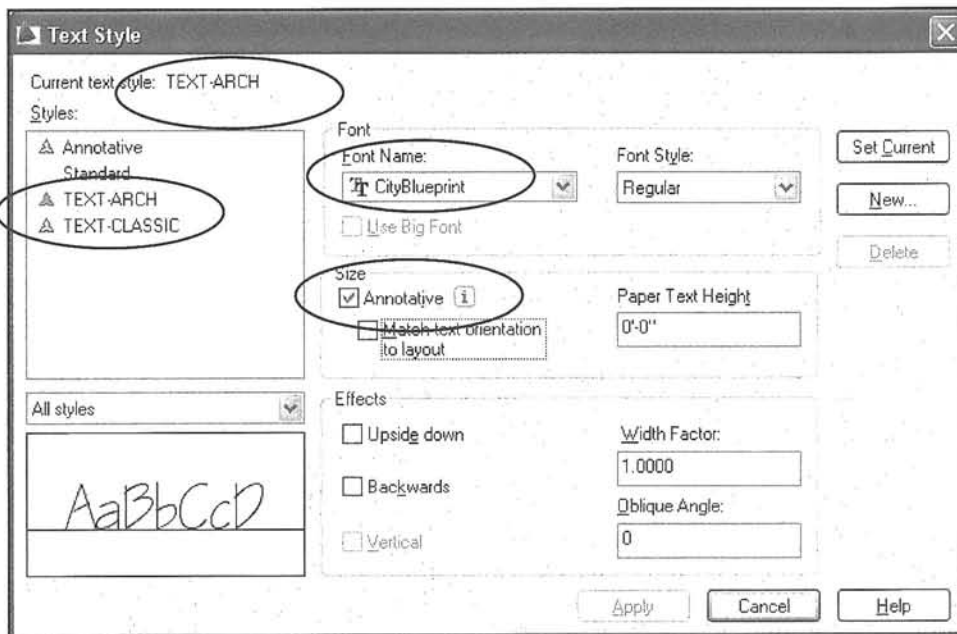
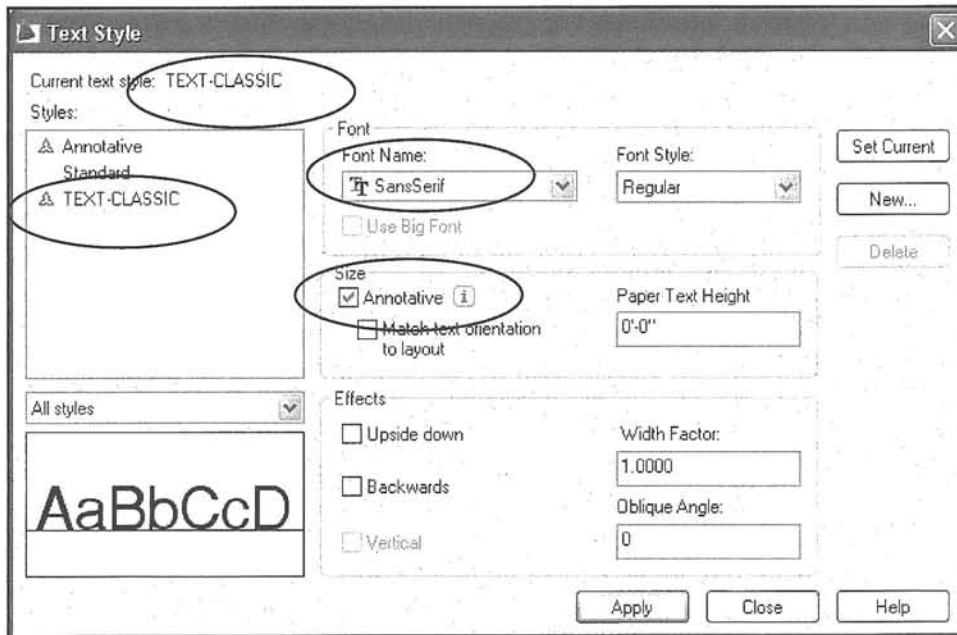


Continued on the next page...

EXERCISE 27A continued

G. Create 2 new **Text Styles** as follows:

1. Select **Text Style** (Refer to page 25-2)
2. Create the text style **Text-Classic** and **Text-Arch** using the settings shown below.



THIS NEXT STEP IS VERY IMPORTANT

H. **Save** all the settings you just created as follows:

1. Save as: **My Feet-Inches Setup**

I. Now continue on to **Exercise 27B**...you are not done yet.

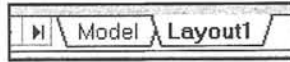
EXERCISE 27B

PAGE SETUP

Now you will select the printer and the paper size to use for printing.
You will use the Layout1 tab (Paper space).

A. Open **My Feet-Inches Setup** (If not already open)

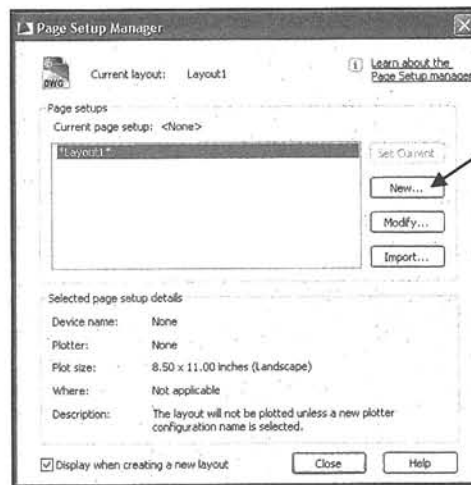
B. Select **Layout1** tab.



Refer to page 26-3 if you do not have these tabs.

Note: If the “Page Setup Manager” dialog box shown below does not appear automatically, right click on the **Layout** tab and select **Page Setup Manager**.

C. Select the **New...** button.

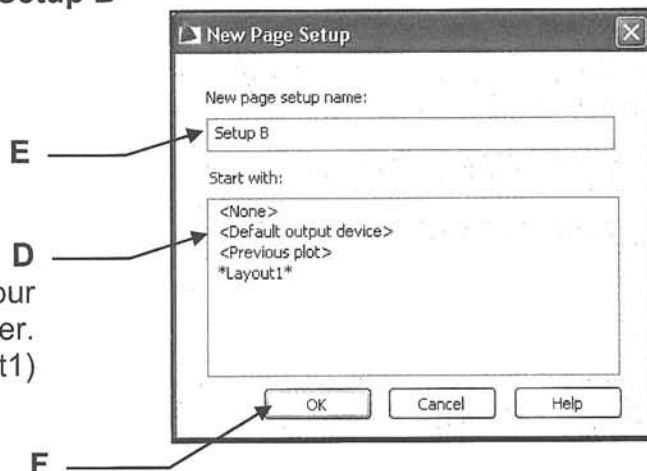


D. Select the **<Default output device>** in the Start with: list.

E. Enter the New page setup name: **Setup B**

F. Select **OK** button.

(I am assuming that your computer is attached to a printer.
If not select Layout1)



Continued on the next page...

EXERCISE 27B continued

This is where you will select the **print device**, **paper size** and the **plot offset**.

G. Select the **Printer / Plotter**

Note: Your current system printer should already be displayed here. If you prefer another select the down arrow and select from the list. If the preferred printer is not in the list you must configure the printer. Refer to Appendix-A for instructions.)

H. Select the **Paper Size**

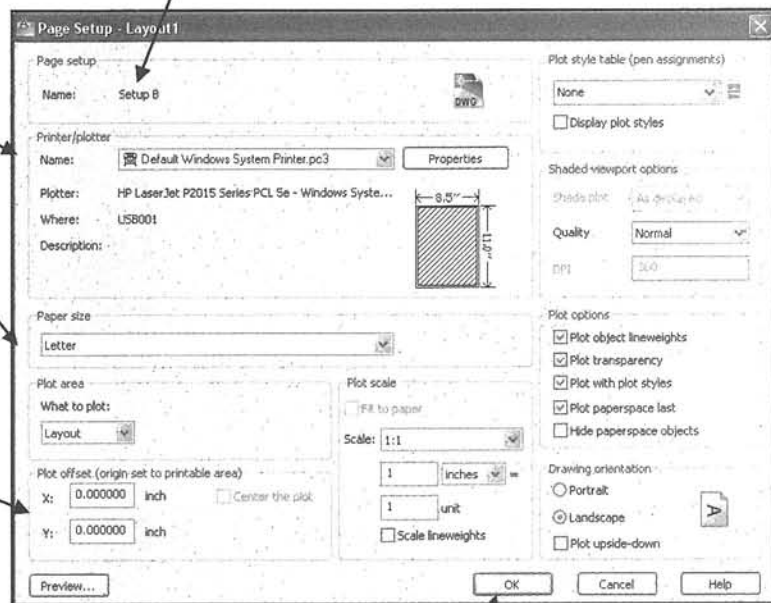
I. Select **Plot Offset**

Notice the name you entered is now displayed as the page setup name.

G
(Yours will be different)

H
(Yours may be 8-1/2 x 11)

I
(Should stay at 0.00000)

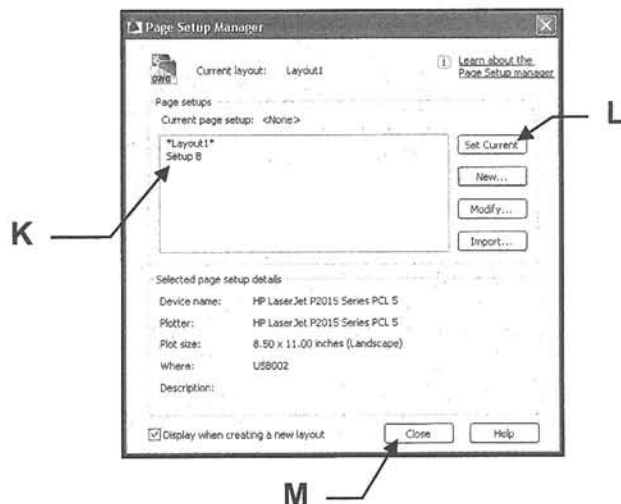


J. Select **OK** button.

K. Select **Setup B**.

L. Select the **Set Current** button.

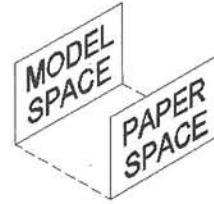
M. Select the **Close** button.



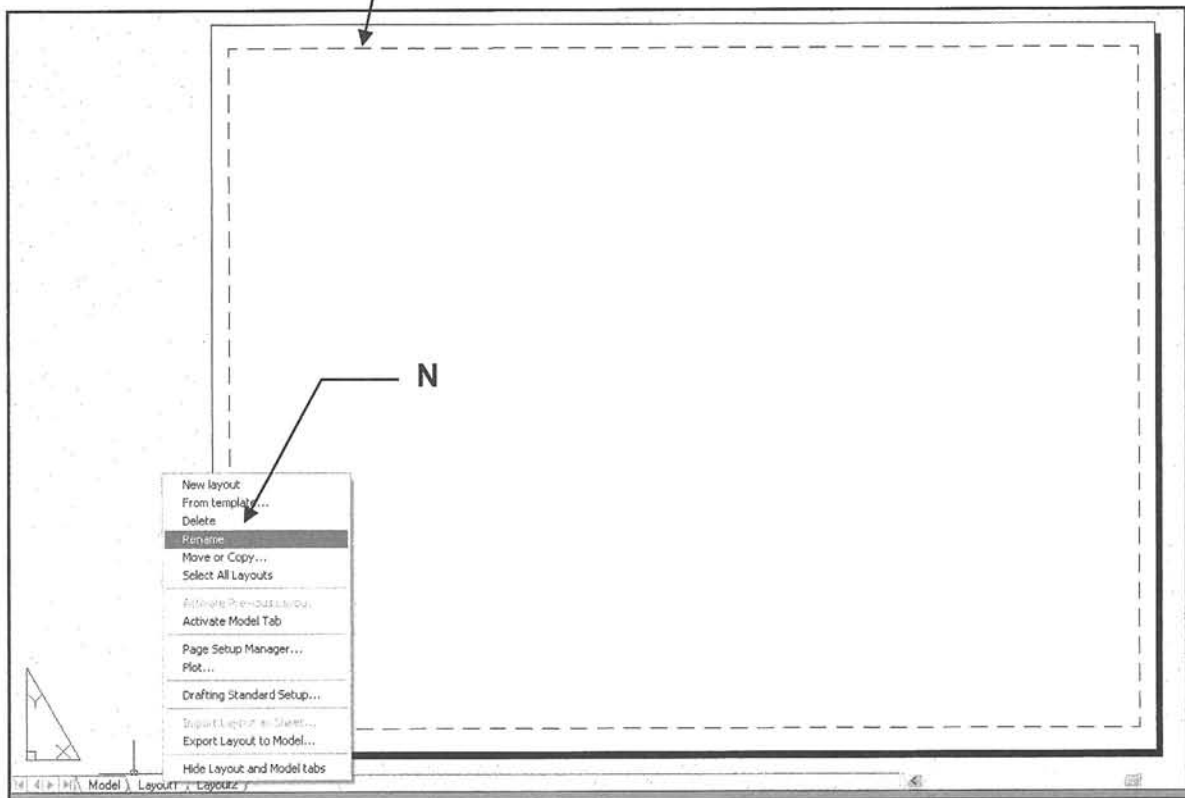
Continued on the next page...

EXERCISE 27B continued

You should now have a sheet of paper displayed on the screen. This sheet is the size you specified in the "Page Setup". This sheet is in front of Model Space.



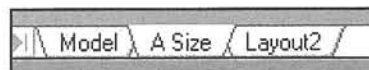
The dashed line represents the maximum printing area for the printing device that you selected. Any object outside of this area will not print.



Rename the Layout tab

N. Right click on the Layout1 tab and select **Rename** from the list.

O. Enter the New Layout name **A Size**



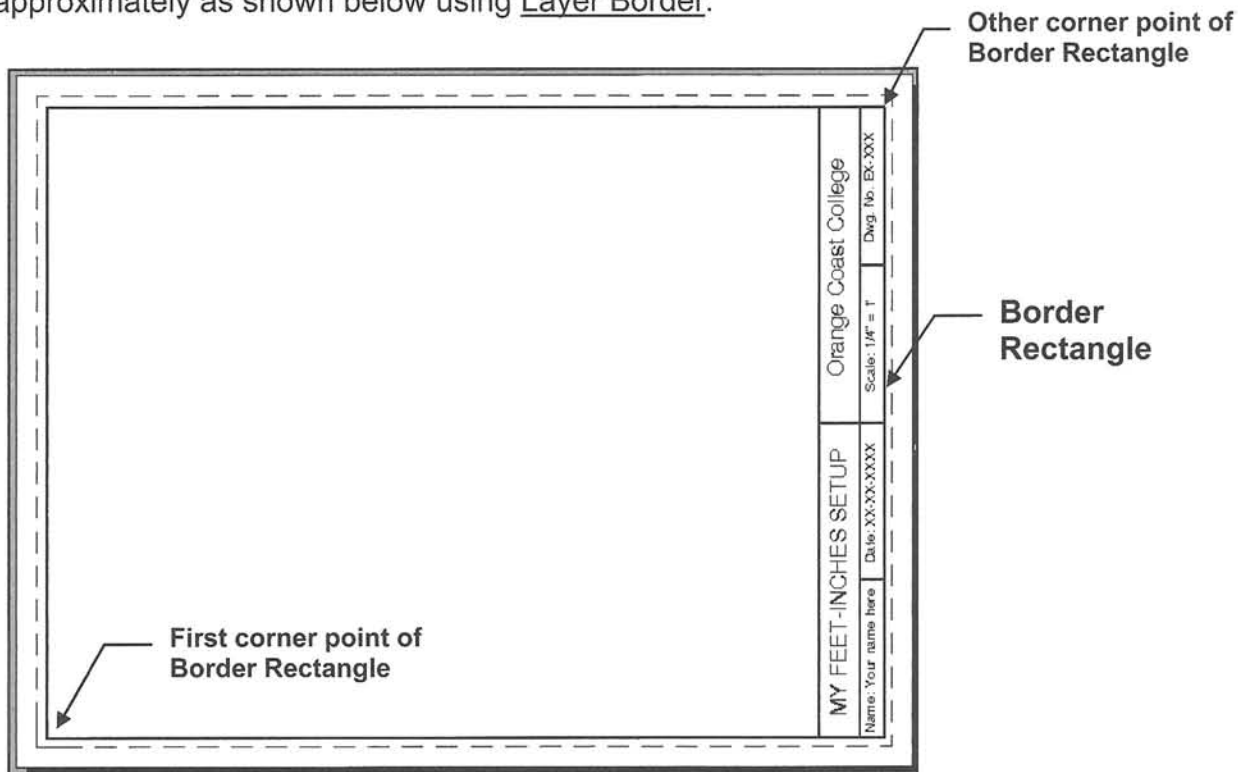
P. **Very important:** Save as **My Feet-Inches Setup** again.

Q. Continue on to **Exercise 27C**.....you are not done yet.

EXERCISE 27C

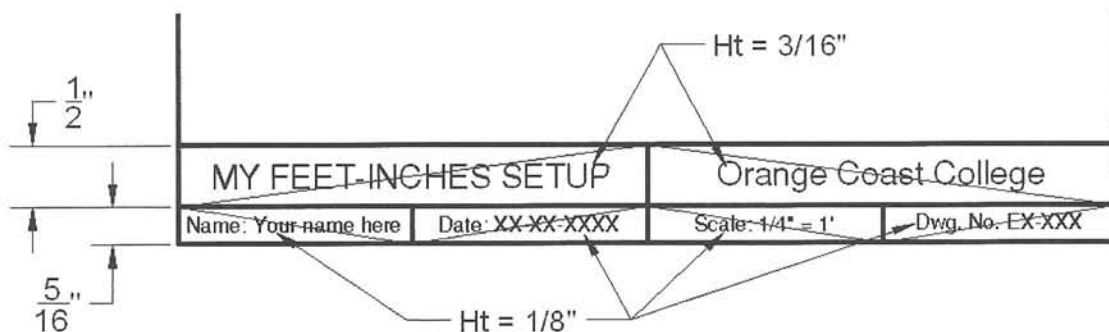
CREATE A BORDER AND TITLE BLOCK

- A. Draw the Border rectangle as large as you can within the dashed lines approximately as shown below using Layer Border.



- B. Draw the Title Block as shown using:

1. Layers Border and Text.
2. **Single Line Text** ; Justify **Middle** in each rectangular area.
(Hint: Draw diagonal lines to find the middle of each area, as shown)
3. Text Style= Text-Classic Text height varies.



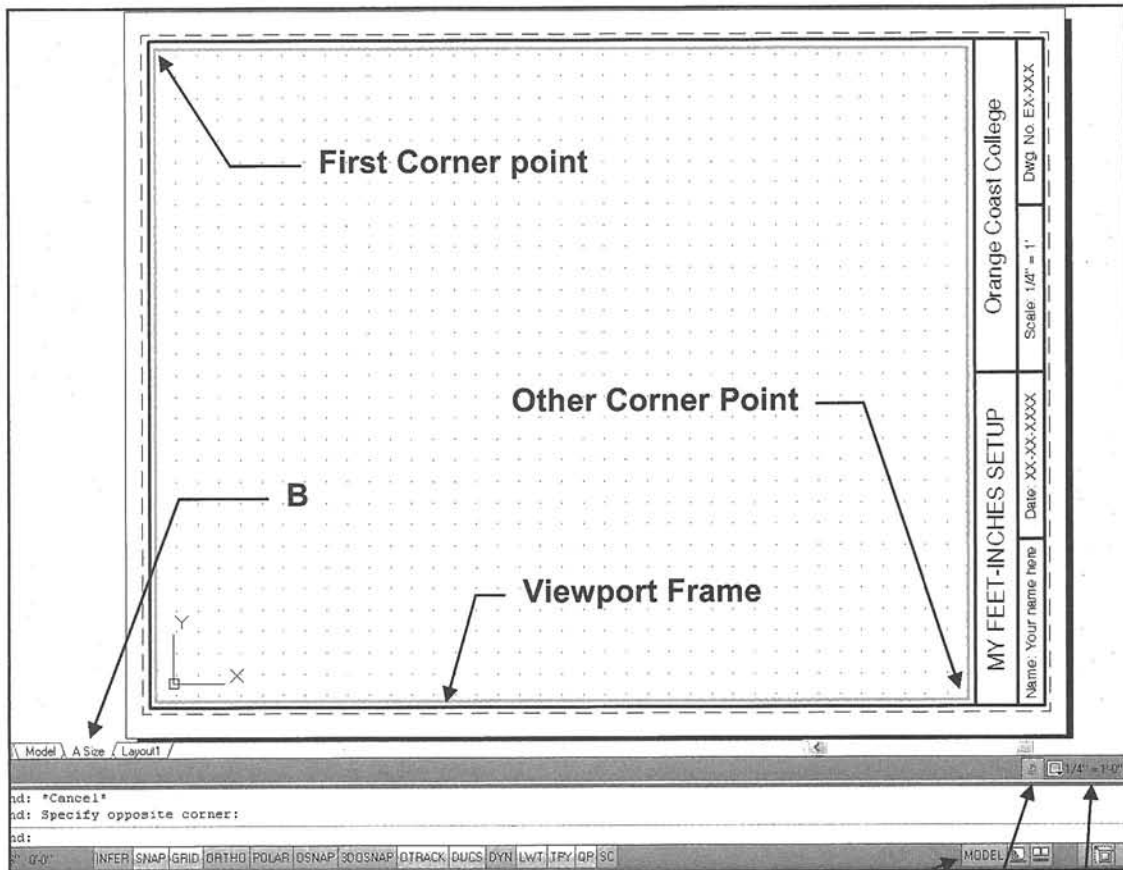
- C. **Very important:** Save as **My Feet-Inches Setup** again.
- D. Continue on to **Exercise 27D**.....you are not done yet.

EXERCISE 27D

CREATE A VIEWPORT

The following instructions will guide you through creating a VIEWPORT in the Border Layout sheet. Creating a viewport has the same effect as cutting a hole in the sheet of paper. You will be able to see through the viewport frame (hole) to Modelspace.

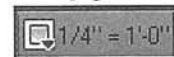
- Open **My Feet-Inches Setup** (If not already open)
- Select the **A Size** tab.
- Change Current layer to: **Viewport**
- Type: **MV <enter>** (Refer to page 26-7)
- Draw a Single viewport approximately as shown. (Turn off OSNAP temporarily)



- Adjust the Viewport Scale as follows:
 - Confirm **Model** button showing.
 - Select **Zoom / All**
 - Select the **Viewport Scale** of **1/4" = 1'-0"** (Note: inches = feet)



F3



- Lock** the Viewport (Refer to page 27-3)
- Very important....** Save as **My Feet-Inches Setup** again.
- Continue on to **Exercise 27E....**you are not done yet.

EXERCISE 27E

PLOTTING FROM THE LAYOUT

The following instructions will guide you through the final steps for setting up the master template for plotting. These settings will stay with **My Feet-Inches Setup** and you will be able to use it over and over again.

In this exercise you will take a short cut by **importing** the **Plot Setup A** from **My Decimal Setup**. (Note: If the Printer, Paper size and Plot Scale is the same you can use the same Page Setup.)

Note: If you prefer not to use Import, you may go to 26-33 and follow the instructions for creating the Plot- page setup.

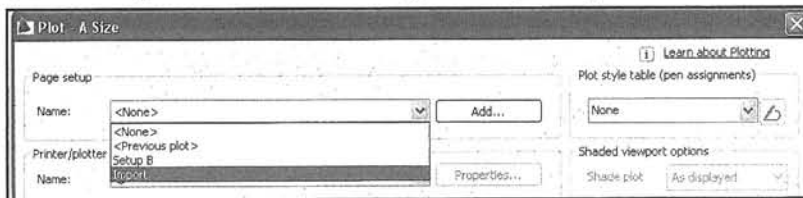
A. Open **My Feet-Inches Setup** (If not already open)

B. Select the **A Size** layout tab.

You should be seeing your Border and Title Block now.

C. Select **Plot** command.

D. Select **Import...** from the Page Setup drop down menu

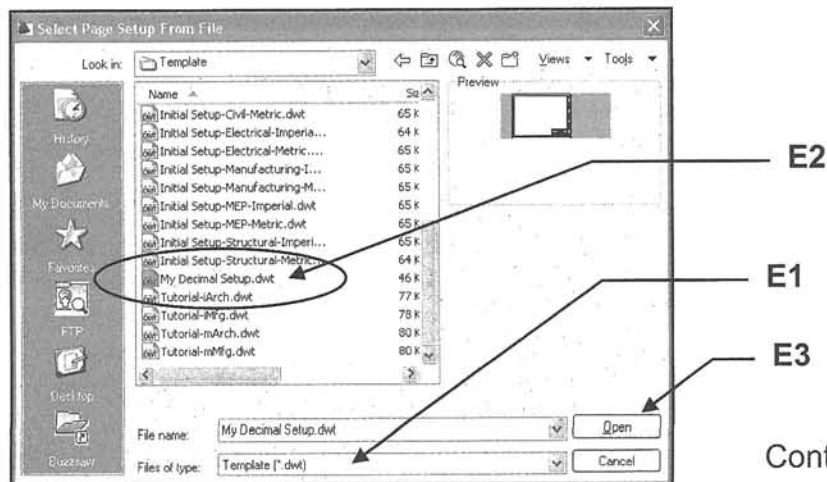


E. Find **My Decimal Setup.dwt** as follows:

E1. Select Files of type: **Template [.dwt]**

E2. Select **My Decimal Setup.dwt**

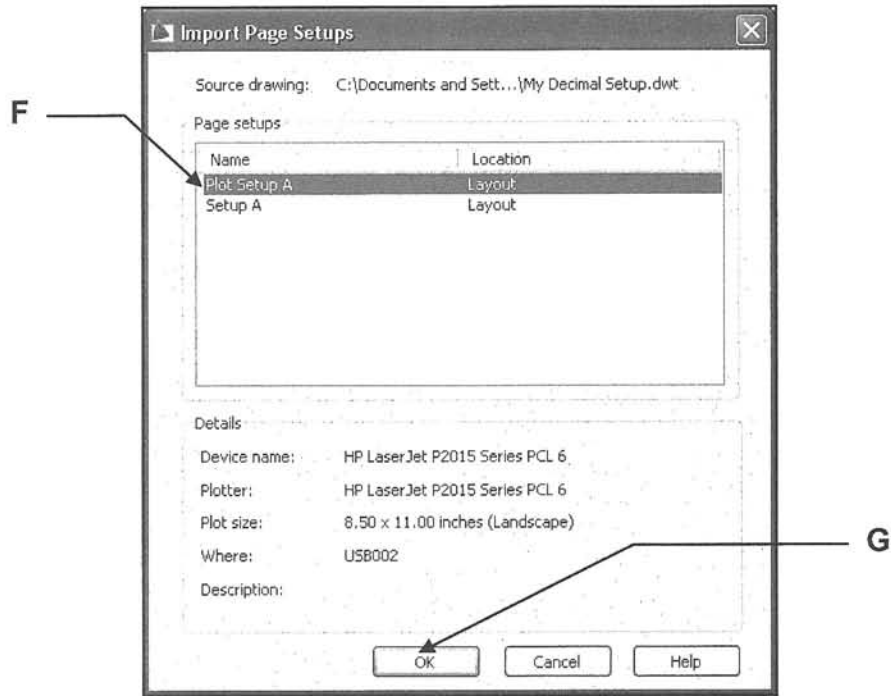
E3. Select **Open** button.



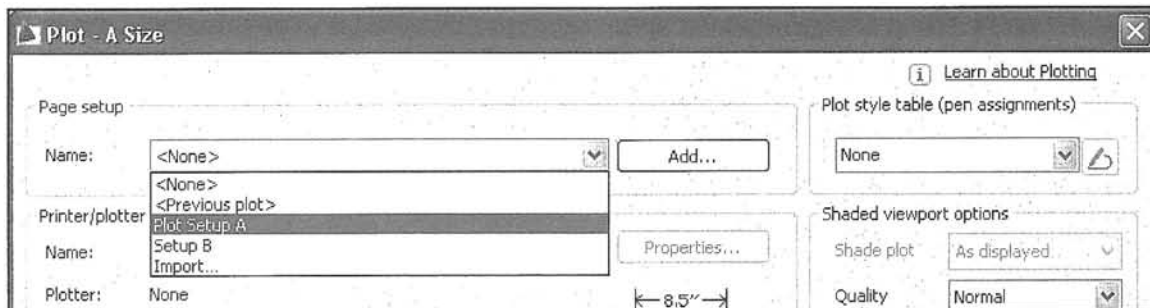
Continued on the next page...

EXERCISE 27E continued

- F. Select **Plot Setup A** from the Page Setups list. (Note: If you do not have a “Plot Setup A” in My Decimal Setup refer to page 26-33)
- G. Select the **OK** button.



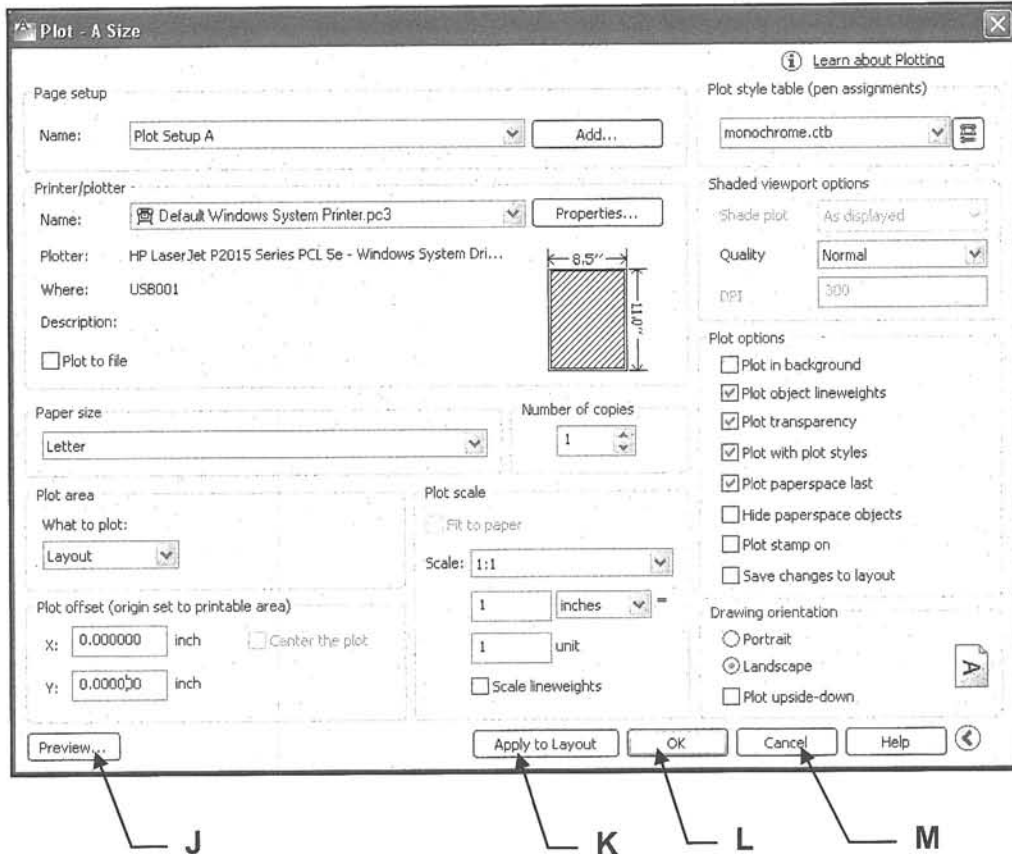
- H. Select **Plot Setup A** from the Page Setup drop down list. (Note: It was not there before. You just imported it in from My Decimal Setup)



Continued on the next page...

EXERCISE 27E continued

I. Check all the setting.



J. Select **Preview** button.

If the drawing appears as you would like it, press the **Esc** key and continue

If the drawing does not look correct, press the **Esc** key and check all your settings, then preview again.

Note:

The Viewport frame and the grids will not appear in the Preview because because the viewport is on a no plot layer and grids never plot.

K. Select the **Apply to Layout** button.

(The settings are now saved to the layout tab for future use.)

L. If your computer is **is** connected to the plotter / printer selected, select the **OK** button to plot, then proceed to **N**.

M. If your computer is **not** connected to the plotter / printer selected, select the **Cancel** button to close the Plot dialog box and proceed to **N**.

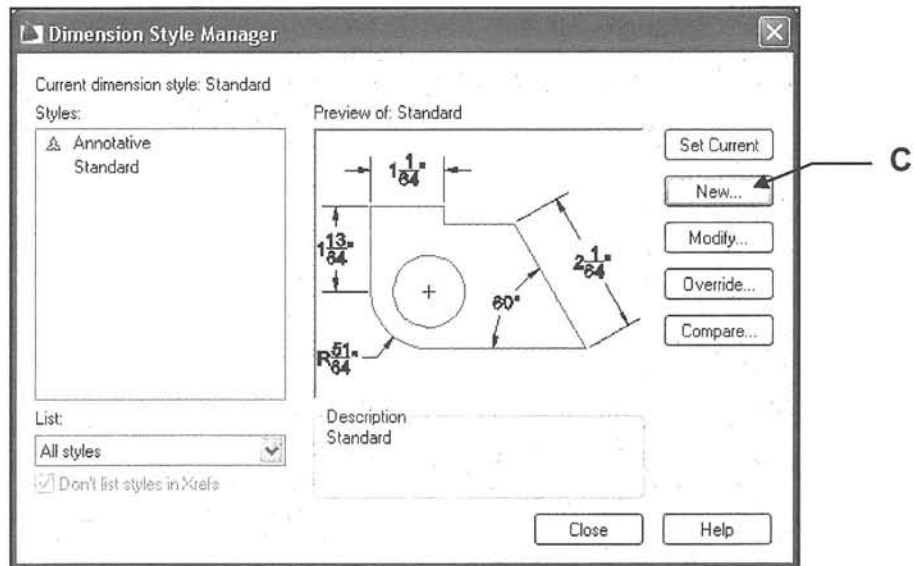
N. **Very important....** Save as **My Feet-Inches Setup** again.

O. Continue on to **Exercise 27F**....you are not done yet.

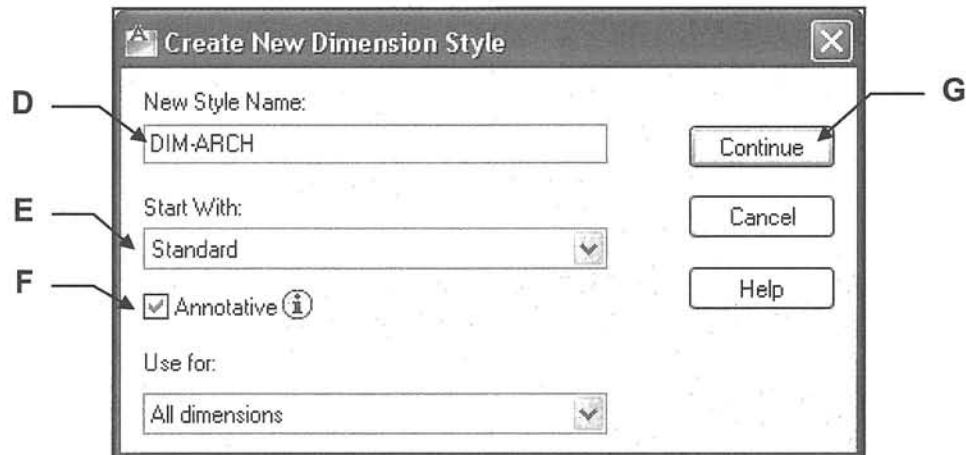
EXERCISE 27F

CREATE A NEW DIMENSION STYLE

- A. Open **My Feet-Inches Setup** (If not already open)
- B. Select the **Dimension Style Manager** command (Refer to 16-8)



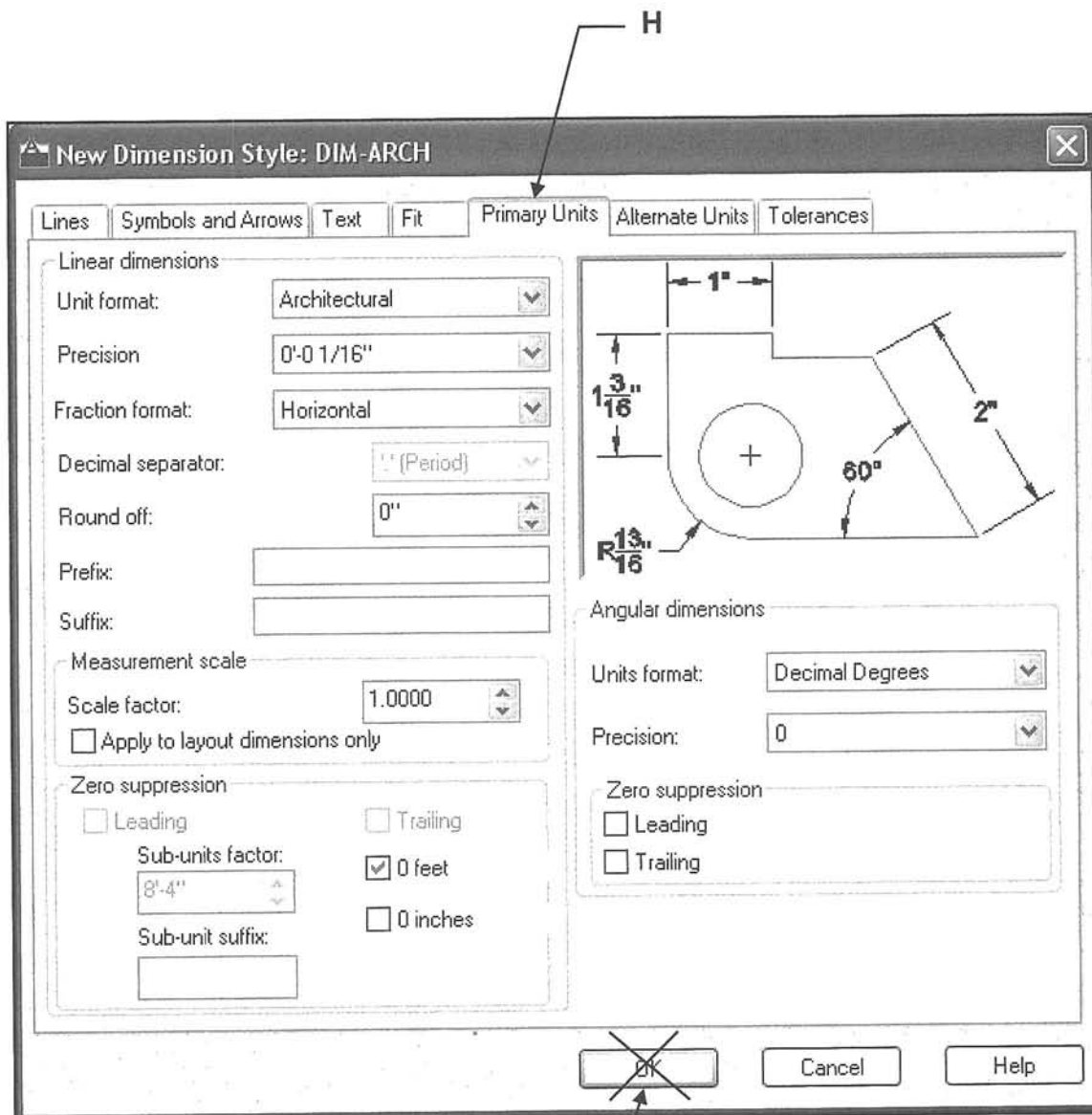
- C. Select the **NEW** button.



- D. Enter **DIM-ARCH** in the “New Style Name” box.
- E. Select **STANDARD** in the “Start With:” box.
- F. Select **Annotative** box.
- G. Select the **CONTINUE** button.

EXERCISE 27F continued

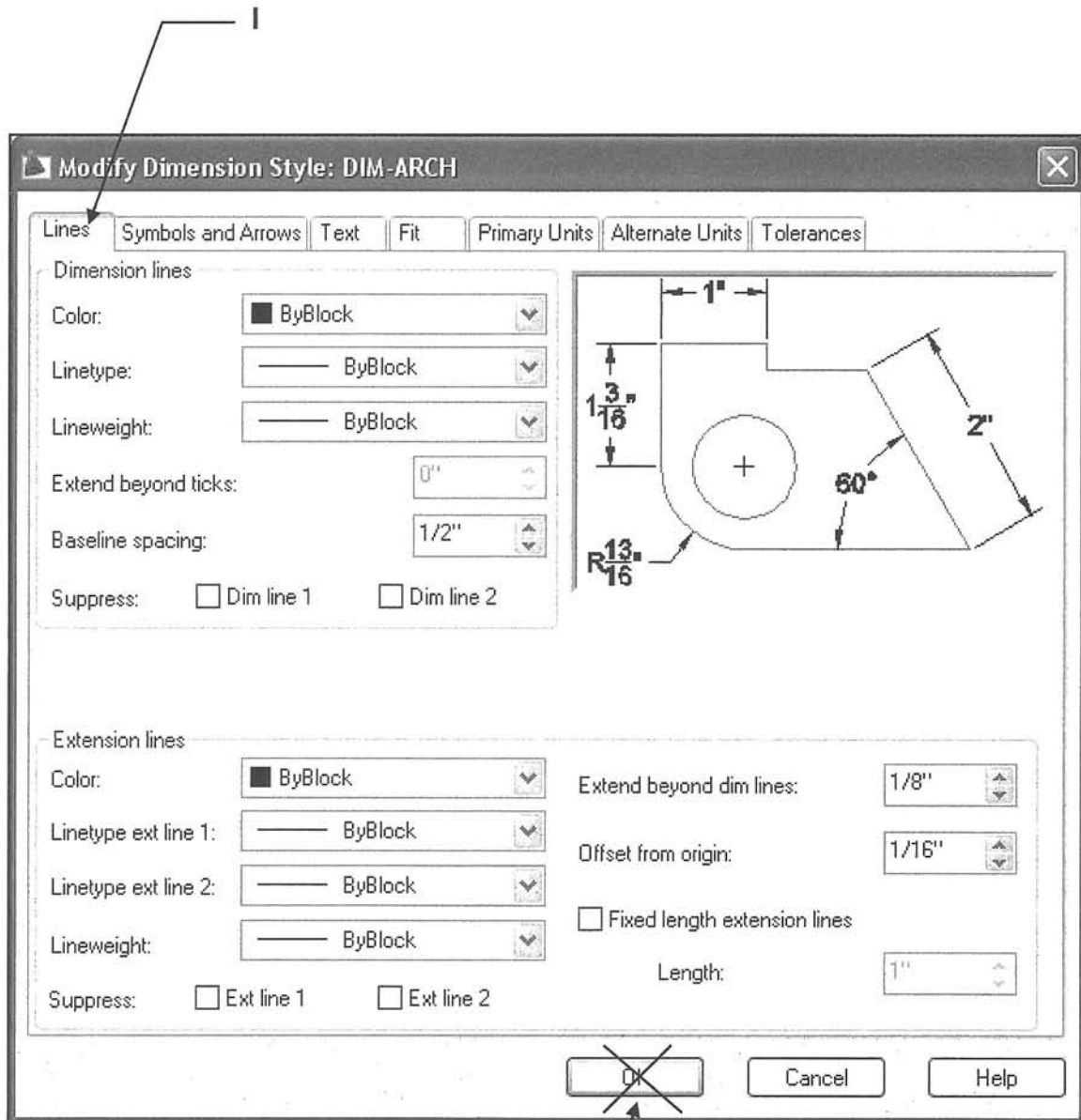
- H. Select the **Primary Units** tab and change your settings to match the settings shown below.



Do not select the OK button yet

EXERCISE 27F continued

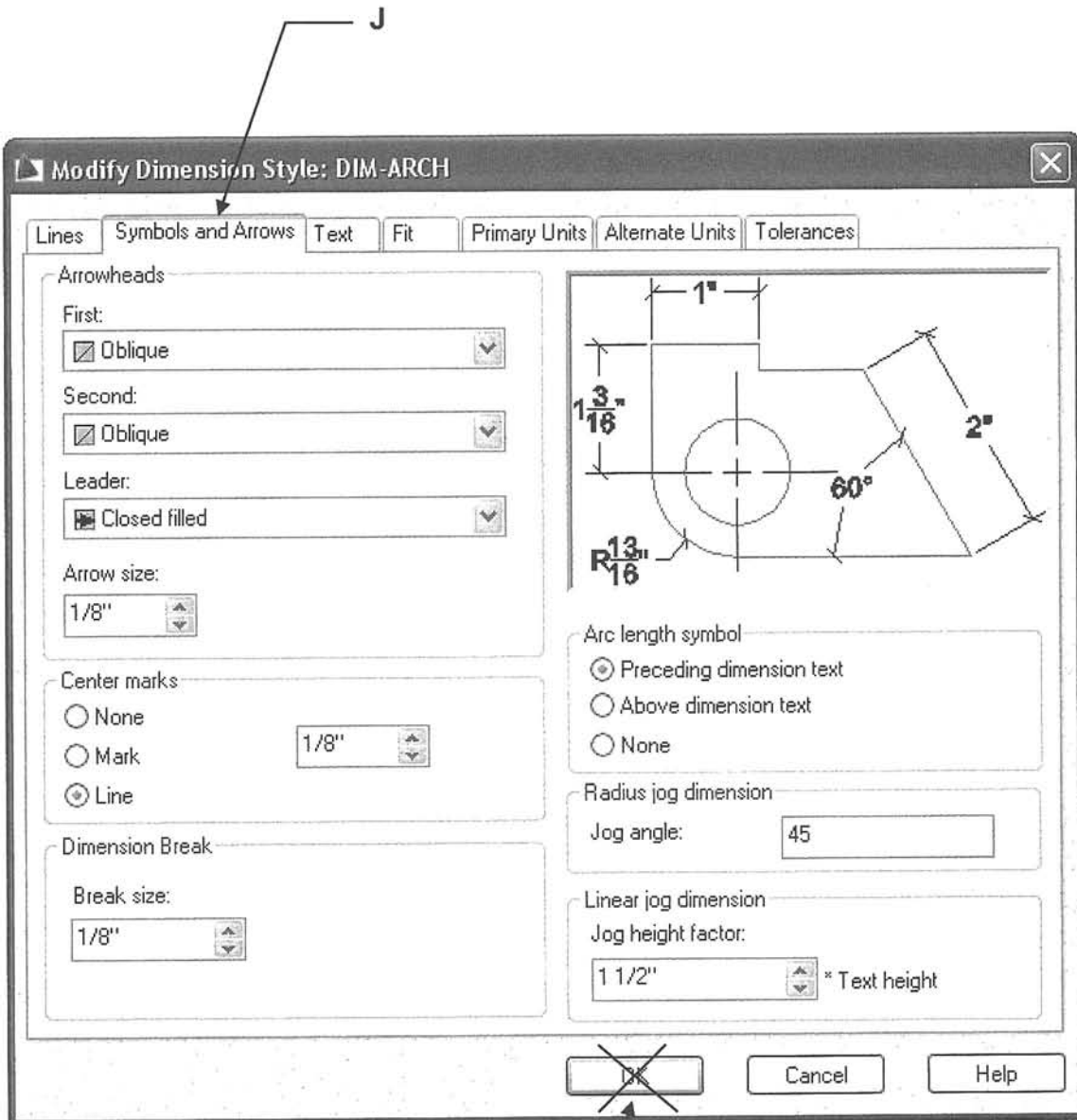
I. Select the **Lines** tab and change your settings to match the settings shown below.



Do not select the OK button yet

EXERCISE 27F continued

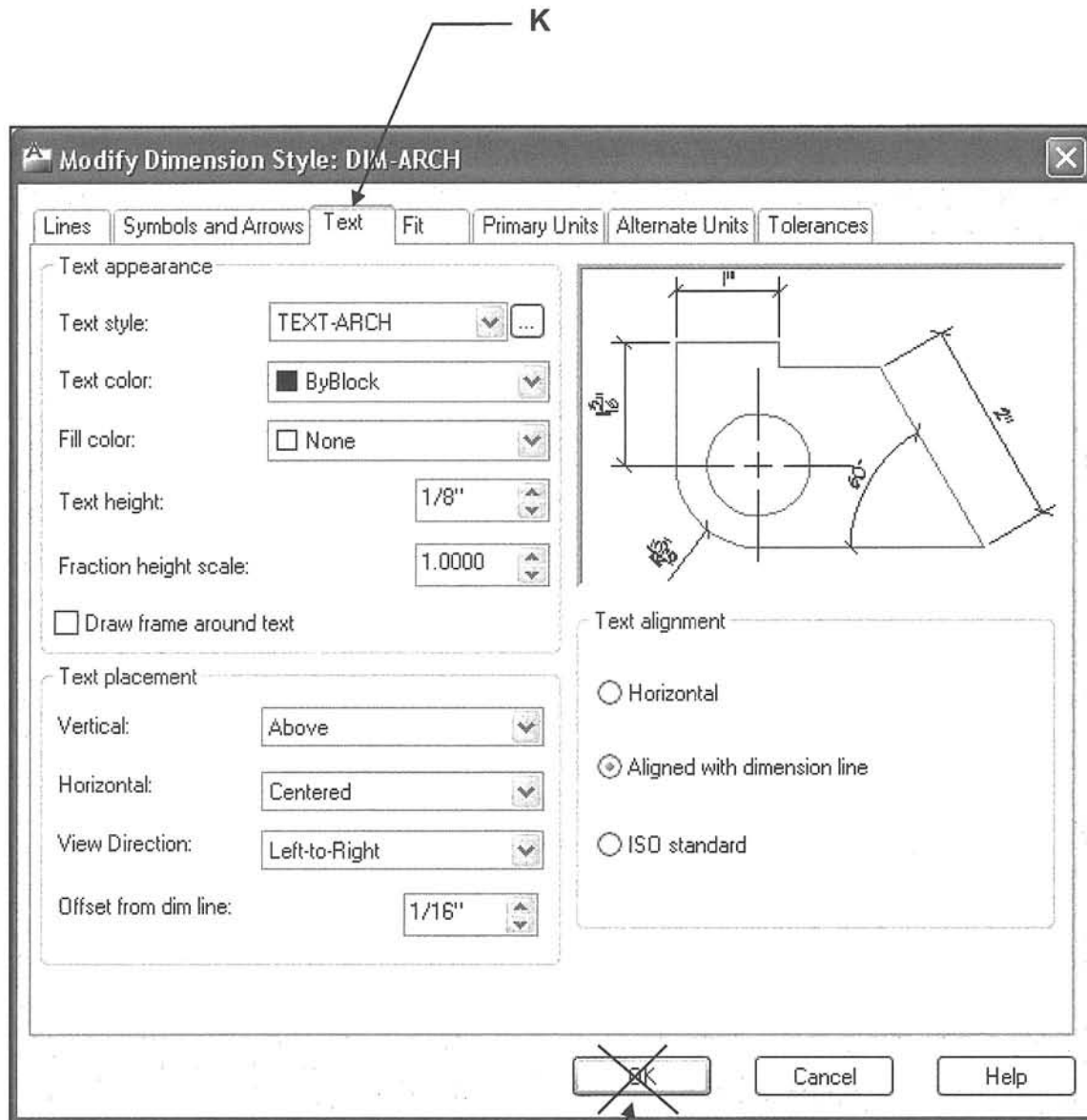
- J. Select the **Symbols and Arrows** tab and change your settings to match the settings shown below.



Do not select the OK button yet

EXERCISE 27F continued

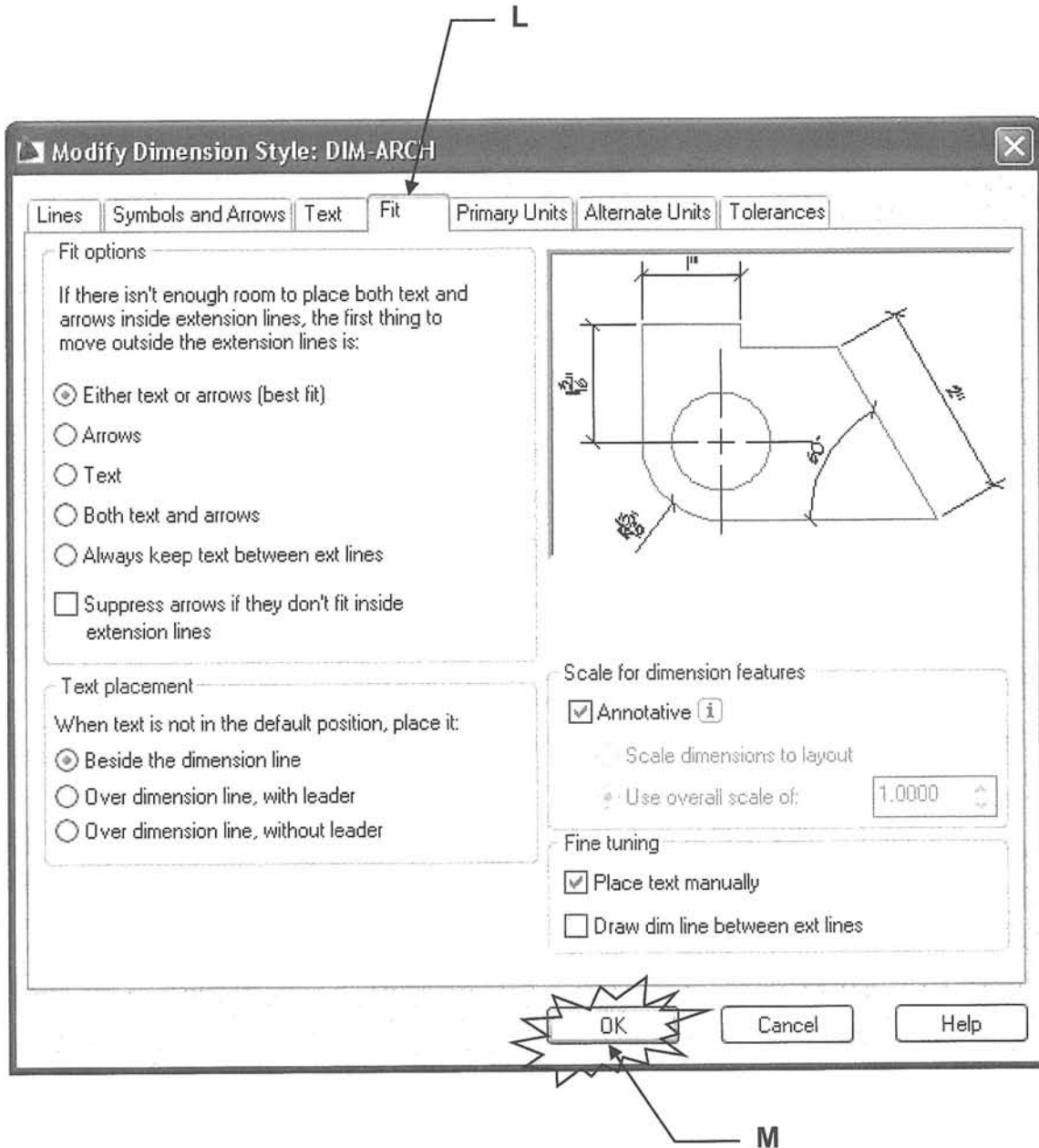
K. Select the **Text** tab and change your settings to match the settings shown below.



Do not select the OK button yet

EXERCISE 27F continued

L. Select the **Fit** tab and change your settings to match the settings shown below.

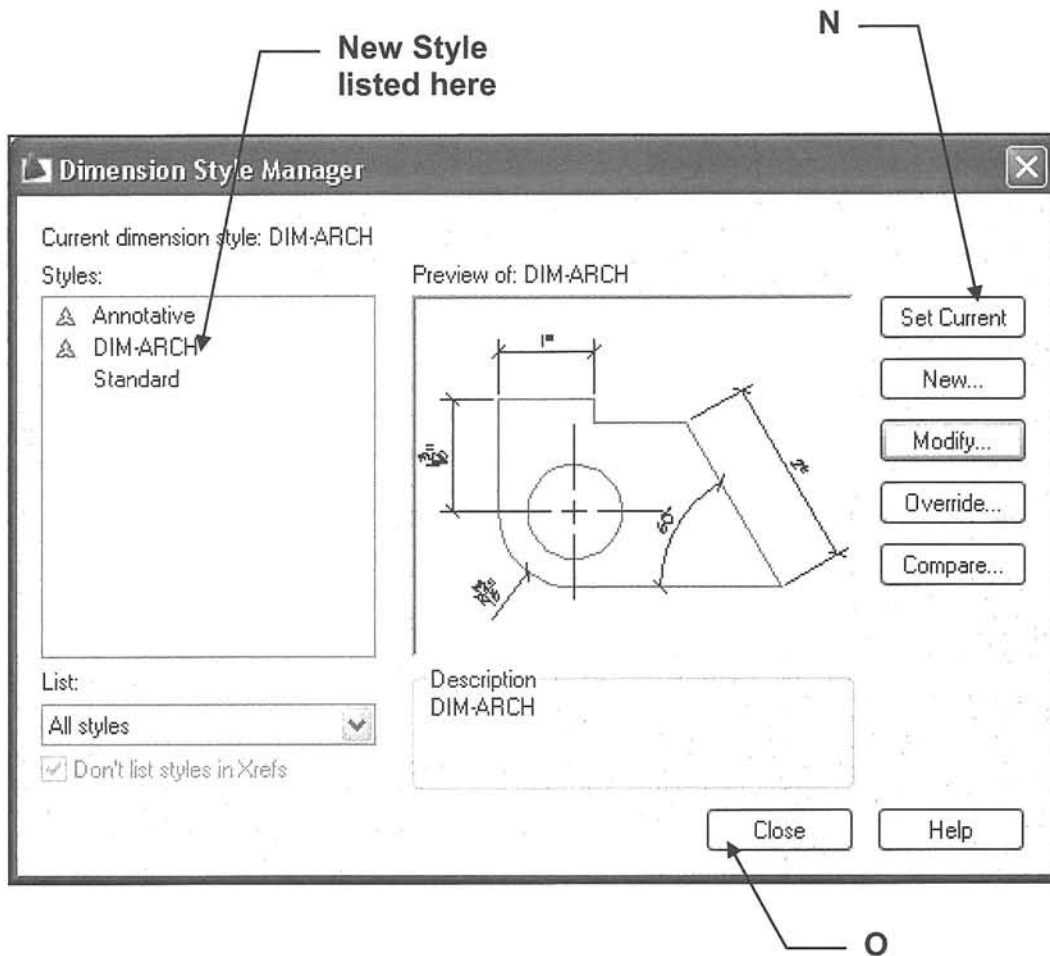


M. Now select the **OK** button.

EXERCISE 27F continued

Your new **DIM-ARCH** dimension style should now be in the list.

- N. Select the **Set Current** button to make your new style **DIM-ARCH** the style that will be used.



- O. Select the **Close** button.

P. **Important:**

Save your drawing as **My Feet-Inches Setup** again.

- Q. Change the Current Layer to **Walls**. (So layer Walls will always be the current layer when you start a New file)

R. You are almost done. Now Save all of this work as a **Template**. (Refer to 2-3)

- Select **Application Menu / Save As / AutoCAD Drawing Template**
- Type: **My Feet-Inches Setup**
- Select **Save** button.

Again, I know that seemed like a lot of work but you are now ready to use this master setup template to create and plot many drawings in the future.

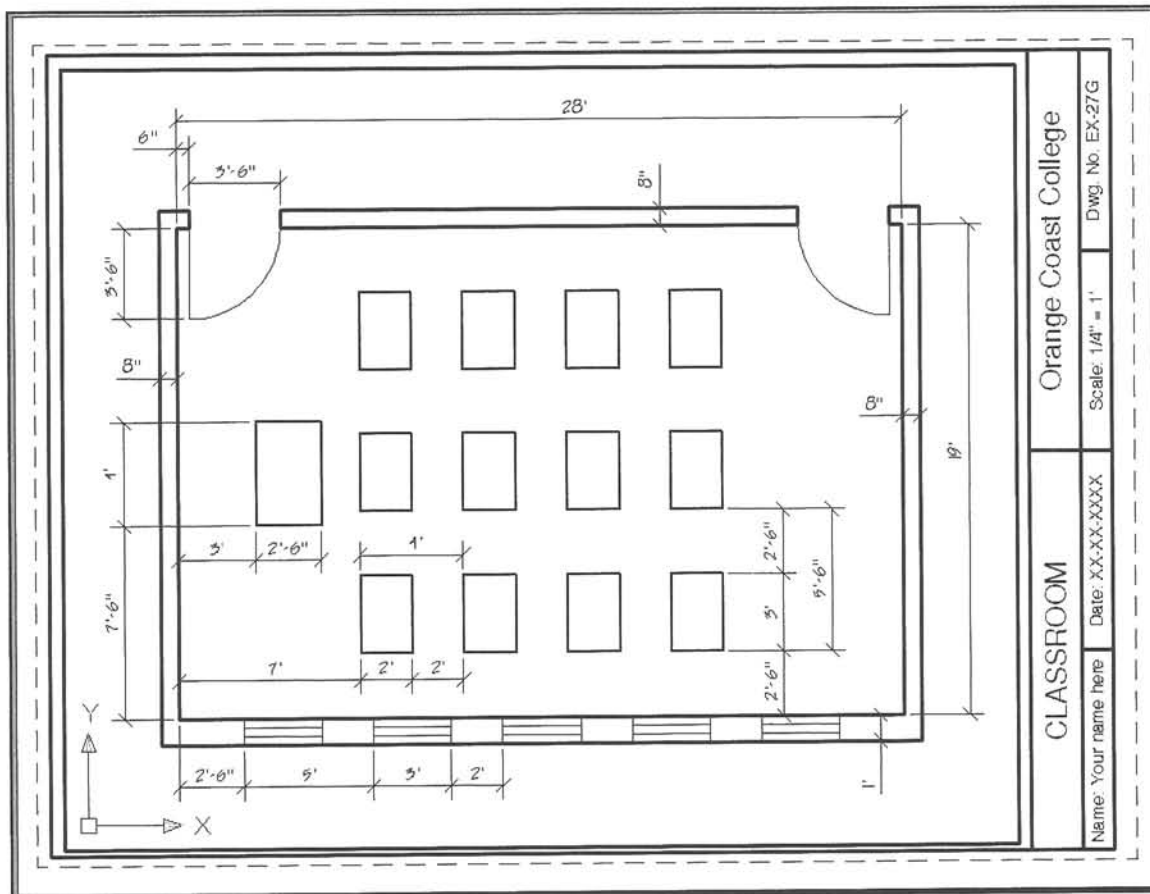
EXERCISE 27G

INSTRUCTIONS:

1. Select **New** and select **My Feet-Inches Setup.dwt** (template)
2. Draw the classroom shown below.
3. Use Layers Walls, Furniture, Doors and Windows.
4. Dimension as shown inside the viewport.
5. Use Dimension Style "Dim-Arch" and Layer: Dimension
6. Edit the Title and Ex-XX by double clicking on the text. Do not erase and replace.
7. Save as **EX27G**
8. Plot using Page Setup **Plot Setup A** (Refer to page 27-21)

Drawing hints:


1. Consider using **Array** (Lesson 13) and **Offset** (Lesson 12).
2. Remember you have to **Unlock** the Viewport to use Pan inside the Viewport.
3. If you change the scale of the Viewport, change the viewport scale back to $1/4"=1'$ and lock the viewport.
4. If your dimensions are gigantic, you are not inside the viewport.



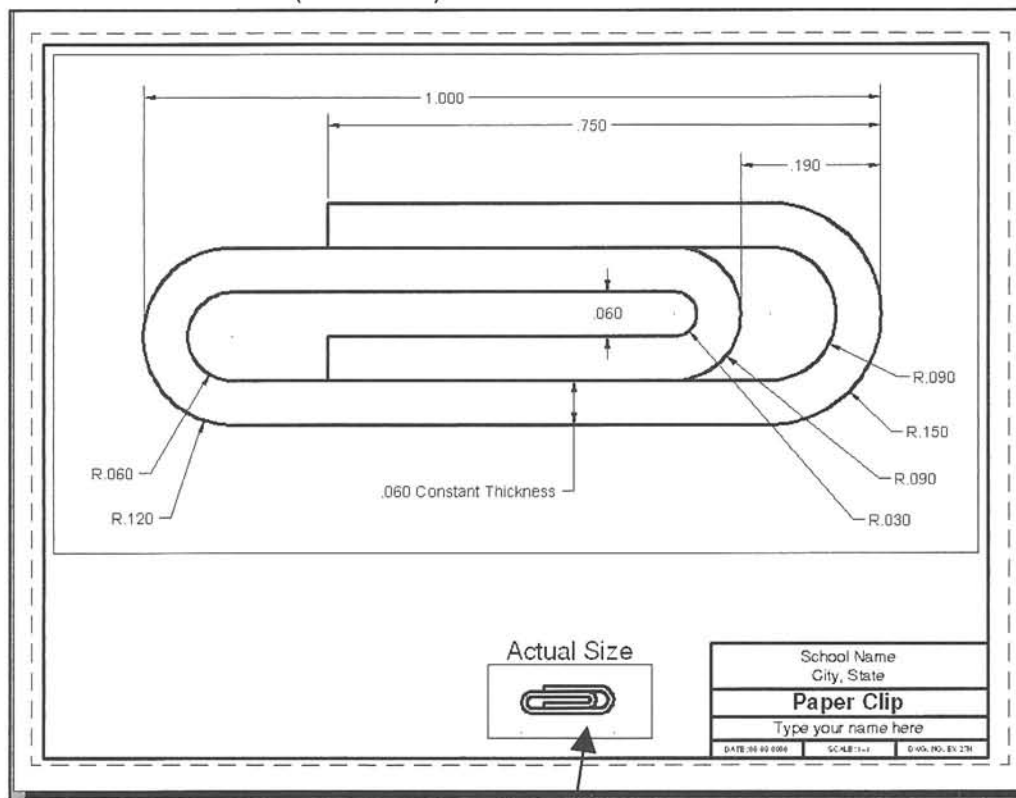
EXERCISE 27H

INSTRUCTIONS:




Step 1.

1. Select **New** and select **My Decimal Setup.dwt** (template)
2. Unlock the Viewport.
3. Change the Viewport Scale to 8 : 1 (Important: not 1:8)
4. Lock the Viewport
5. Turn **Snap** and **Grids** off or change your grid and snap relative to the new viewport scale.
6. Draw the Paperclip on layer Object line.
7. Dimension as shown using Dimension Style: Dim-Decimal
(Dimensions should be inside the viewport, in Model space.
Confirm "Model" button  is displayed.)

Drawing hints: The entire Paper clip can easily be drawn using Offset (Lesson 12) and Fillet (Lesson 7) or Circles and trim.



Step 2

1. Select Paper space. 
2. Select the Viewport layer and cut a second small viewport next to the Title Block
3. Double click inside the small viewport to make it active. 
Use **Zoom / All** (You should now see the paper clip)
4. Change the Viewport Scale of the **small** Viewport to **1 = 1** and Lock.
5. Add "**Actual Size**" text .200 ht in Paper Space  Use: layer Text.
6. Edit the Title and Ex-XX by double clicking on the text. Do not erase and replace.
7. Save as **EX27H**
8. Plot using Page Setup **Plot Setup A** (Refer to page 26-34)