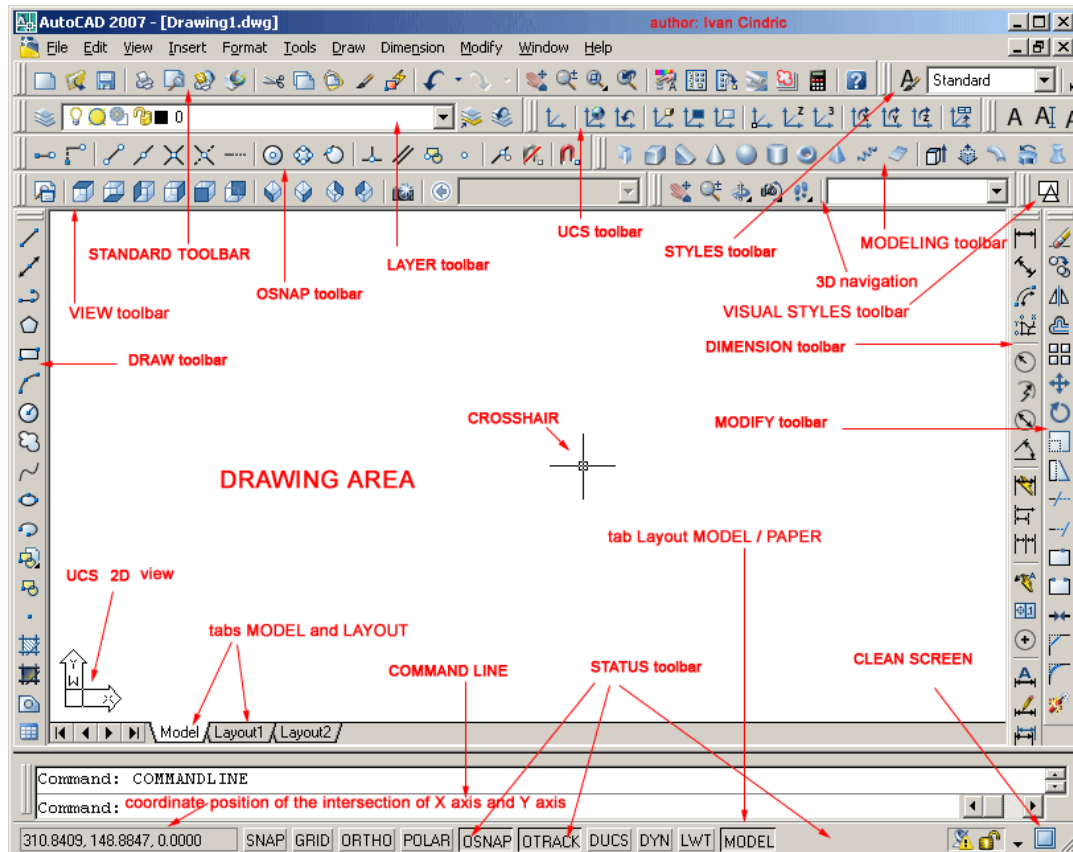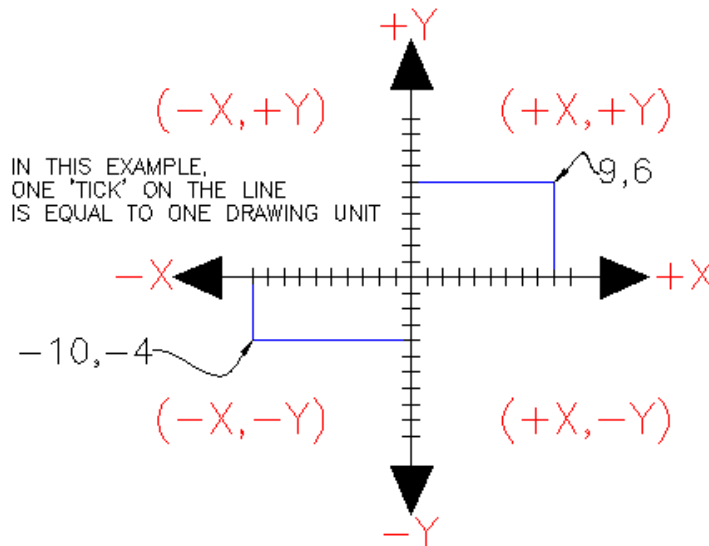# Lab-01

Introduction to AutoCAD Environment

Everything that you draw in AutoCAD is **exact**. It will be more accurate than you will ever need it to be. We're talking 14 decimal points accurate. All objects drawn on the screen are placed there based on a simple X, Y co-ordinate system. In AutoCAD this is known as the World Co-ordinate System (WCS). You must understand this to know how to put things where you want them. *(3-D work has an added axis, the Z-axis, but this is not covered in this lesson.)* Below is a diagram showing you how this system works (place your mouse on the diagram for more info).

AutoCAD 2007 Interface

(−X,+Y)   (+X,+Y)

+Y

IN THIS EXAMPLE,
ONE 'TICK' ON THE LINE
IS EQUAL TO ONE DRAWING UNIT

9,6

−X   +X

−10,−4

(−X,−Y)   (+X,−Y)

−Y

In order to work effectively with AutoCAD, you **have** to work with this system. Until you are comfortable and familiar with it, learning AutoCAD will be more of a chore. My experience in teaching is that the better a student is with co-ordinates, the better CAD draftsperson they will become.

Here is how it works:

AutoCAD uses points to determine where an object is located. There is an origin where it begins counting from. This point is (0,0). Every object is located in relation to the origin. If you were to draw a line straight out to the right from the origin, this would be considered the positive X-axis. If you were to draw a line straight up, this would be the positive Y-axis. The picture above shows a point located at (9,6). This means that the point is 9 units over in the X-axis and 6 units up in the Y-axis. When you are working with points, X **always** comes first. The other point shown is (-10,-4). This means that the point is 10 units in the negative X-axis (left) and 4 units in the negative Y-axis (down).

A line has two points, a start point and an end point. AutoCAD works with the points to display the line on the screen. Move your cursor over the picture above and you will see line drawn from the absolute points of (-10,-4) to (9,6).

Most of the time you will not have an indication of where the origin is. You may need to draw a line from the endpoint of an existing line. To do this you use relative points. These work the same way, but you have to add the @ symbol (shift+2) to tell AutoCAD that this next point is relative from the last point entered.

To review:
ABSOLUTE POINTS are exact points on the drawing drawing space.
RELATIVE POINTS are relative to an OBJECT on the drawing space.

It's a simple system, but mastering it is the key to working with AutoCAD and is explained in more detail further below.

Angular Measurement

AutoCAD measures angles in a particular way also. Look at the diagram below and then place your mouse on it to see how this is done.
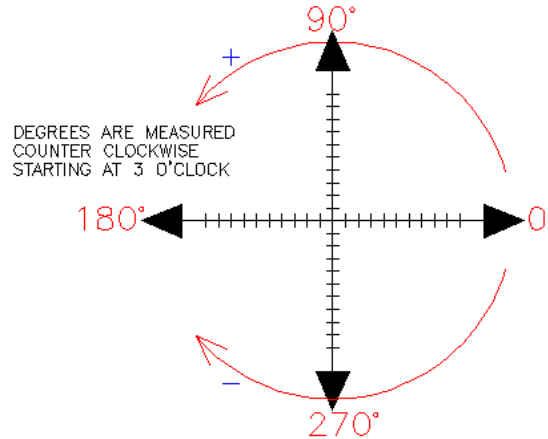
When drawing lines at an angle, you have to begin measuring the angle from 0 degrees, which is at the 3 o'clock position. If you drew a line at 90 degrees, it would go straight up. The example above (when you move your mouse over it) shows a line drawn at +300 degrees (270+30), or -60 degrees.

You might not always have an obvious reference point for 0 degrees. Look at the example below and place your mouse on the image to find out the angle in question.
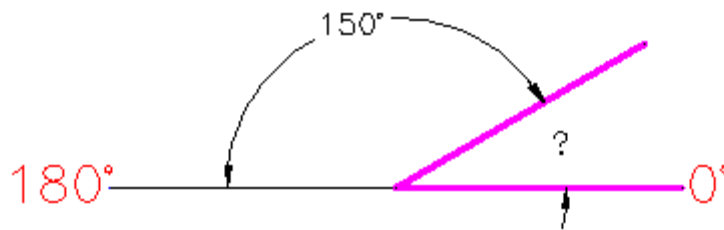
In this example, you are given information about the lines, but not the angle AutoCAD needs to draw the line from the start point. What you are given though, is (a) the knowledge that 0° is at the 3 o'clock position (b) the knowledge that 180° is at the 9 o'clock position and (c) the angle between 180° and the line you want to draw is 150°. With this information, you can figure out what angle you need. Here is a fool-proof way of getting the angle you need:

1.) Start at the 0° position and measure counter-clockwise (+) to 180°.

2.) From 180°, measure clockwise 150° (-)

3.) Consider that you just went +180-150 and use that as an equation: +180-150=30

4.) Now you can draw your line using polar co-ordinates (discussed below)

Entering Points in AutoCAD

You can enter points directly on the command line using three different systems. The one you use will depend on which is more applicable for the situation. The first assignment will get you used to this. The three systems are as follows:

ABSOLUTE CO-ORDINATES - Using this method, you enter the points as they relate to the origin of the WCS. To enter a point just enter in the exact point as **X,Y**.

RELATIVE CO-ORDINATES - This allows you to enter points in relation to the first point you have entered. After you've entered one point, the next would be entered as **@X,Y**. This means that AutoCAD will draw a line from the first point to another point X units over and Y units up relative to the previous point.

POLAR CO-ORDINATES - You would use this system if you know that you want to draw a line a certain distance at a particular angle. You would enter this as **@D<A**. In this case, **D** is the distance and **A** is the angle. Example: @10<90 will draw a line 10 units straight up from the first point.

The three ways of entering co-ordinates shown above are the **ONLY** way AutoCAD accepts input. First decide which style you need to use, and then enter as shown. Remember that **X** is always before **Y** (alphabetical). Don't forget the '**@**' symbol when you are entering relative points. Any typing error or omission will give you results you don't want. If you make a mistake and need to see what you typed, press **F2** to bring up the text screen and check your typing. (press **F2** to get back to your drawing.)

Move your cursor around the image above to find the names of various areas of the screen.

Lab Task.

   a) Draw a line from the origin to the point (10,-12) of the XY plane by Absolute co-ordinates method
   b) Next draw another line from the endpoint of the first line to (-10,12) point using Relative Co-ordinates method
   c) Next draw a third line from the end point of the second line with a magnitude of 10 and having angle of 45 using polar co-ordinate method.

Lab-02

## Command Line, Circle, Erase, Print and Ortho Commands

AutoCAD allows you to have access to a large number of commands. A general rule is that you will use 20% of the commands 80% of the time. The important thing to remember is that AutoCAD will expect you give it information in a very particular order. The most frustrating thing when you begin using this program is that you will try to do something, but AutoCAD will 'not work'. In most cases, it means that you are trying to input information at the wrong time. This is why it is **very important** to be in the habit of looking at the command line.

The command line tells you what information AutoCAD requires to continue.

Your first drawing assignment will be to use the drawing commands in conjunction with the co-ordinate system defined in **Lab-1**. This is a basic assignment, but it is very important to understand how to give the program accurate information. You will use the following commands:

Command	Keystroke	Icon	Location	Result
Line	**Line / L**	Line	Home > LIne	Draw a straight line segment from one point to the next
Circle	**Circle / C**		Home> Circle > Center, Radius	Draws a circle based on a center point and radius.
Erase	**Erase / E**		Modify > Erase	Erases an object.
Print	**Print / Plot CTRL+P**		Quick Access Toolbar > Print	Enables the Print/Plot Configuration Dialog Box
Undo	**U / CTRL+Z**		Quick Access Toolbar> Undo	Undoes the last command.

Consider a set of drawings:
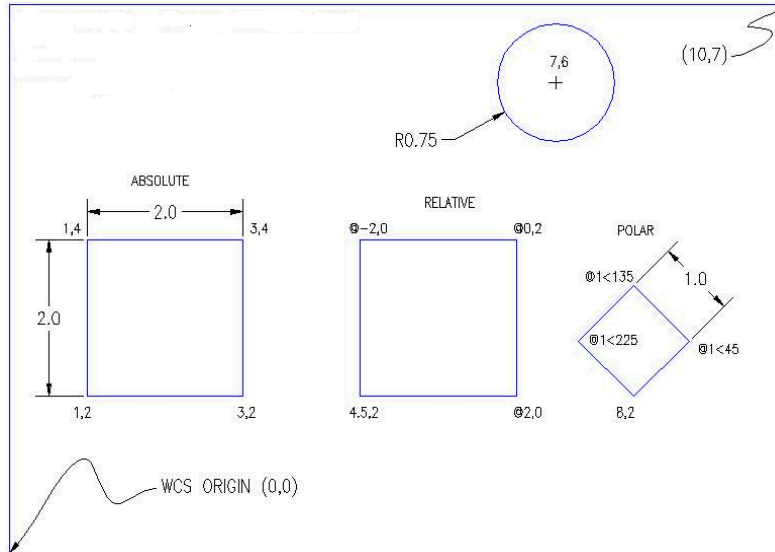
Select the "acad.dwt" template file and press the **Open** button to continue to the drawing screen.

Once there, type in **Z** <ENTER> **E** <ENTER> this will zoom into to the extents of the drawing area and make it easier to see what you are drawing (NOTE: nothing will appear to happen).

Start the **LINE** command (as explained in the table above) and draw a line from **1, 2** to **3, 2** to **3, 4** to **1, 4** Press enter after each point. (***Remember to watch the command line as you do this.**) For the last line, you can either type in **1, 2** or **C** to close the line back to the first point you entered. You have just drawn a 2" square using **absolute co-ordinates**. Your command history (F2 key) should look like this:

Command: L LINE Specify first point: 1, 2

Specify next point or [Undo]: 3, 2

Specify next point or [Undo]: 3, 4

Specify next point or [Close/Undo]: 1, 4

Specify next point or [Close/Undo]: 1, 2

Specify next point or [Close/Undo] : <ENTER>

If you make a mistake, you can use the **undo** icon, press **U** or press **CTRL+Z**.

You can also use the **ERASE** command to get rid of lines you don't want.

Next draw a similar box using **relative co-ordinates**. Start the **LINE** command and begin at point **4.5,2**. From there draw a line two units to the right by typing **@2,0** (this means 2 units in the X

direction, 0 units in the Y direction based on the last point you entered). Next type **@0,2** then **@-2,0** then **@0,-2** to finish the box. (Remember to press enter after each point.)

Now erase the last box you just drew. Start the **ERASE** command and then select the lines you want to erase. Then press <enter>. Now redraw the box for more practice!

Draw a third box using **polar co-ordinate** input. Start the **LINE** command and begin at point **8,2** then enter. Type **@1<45** to draw the first line. Next enter **@1<135** then **@1<225** then **@1<315** (or **C** to close). What you have just done is drawn a line 1 unit long at 45º, then another at 135º and so on. Do the angles you entered make sense to you? If not, review it.

Start the **CIRCLE** command and add a circle that has a center point at **7, 6** with a radius of **.75** (Watch the command line for instructions).

To finish the drawing, try putting a 10"x7" border around the page starting at **0, 0** using the any of the methods shown above (relative, absolute or polar).

Lab Task: Draw the following figure. Also print the command line: