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## 1.1 - THESE ARE THE BASICS YOU NEED TO START WITH

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### Topics covered in this Lesson:

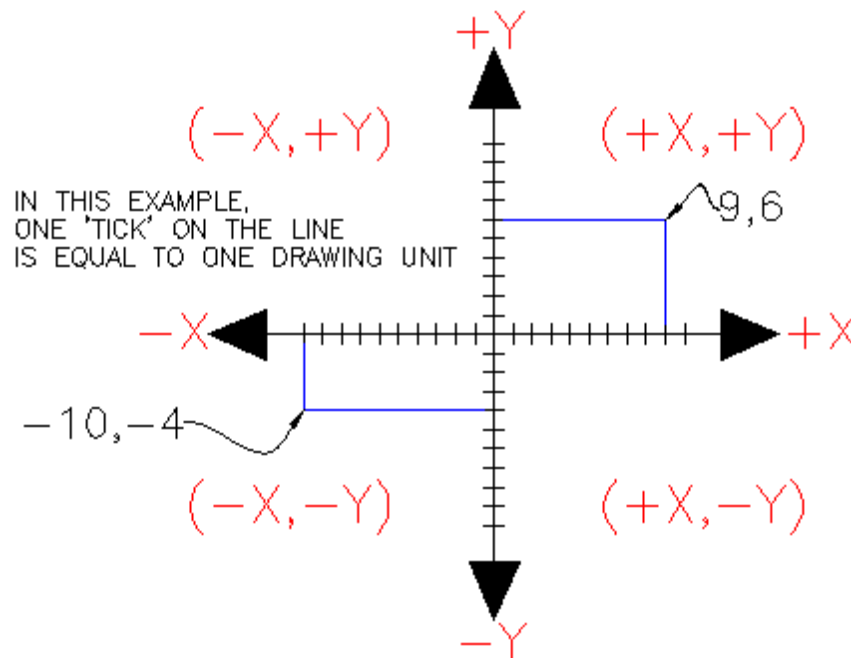
[The X-Y Co-ordinate System](#) | [Angular Measurement](#) | [Entering Points in AutoCAD](#)  
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Welcome to the world of CAD - In this tutorial you will be learning the basics of AutoCAD. The course is designed so that the commands and instructions should work on almost any version of AutoCAD, although this version is designed specifically for AutoCAD 2008. By the end of this level you will have the skills to develop basic 2D drawings and print them out to scale.

Let's start at the beginning, these things you need to know, or the rest of it won't make any sense at all. Make sure you have a very good understanding of this lesson before continuing. This lesson is longer than most, but will cover important topics.

### The X,Y co-ordinate system

Everything that you draw in AutoCAD is **exact**. It will be more accurate than you will ever need it to be. 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). 



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 draftsman 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 space.

**RELATIVE POINTS** are relative to an **OBJECT** on the drawing space.

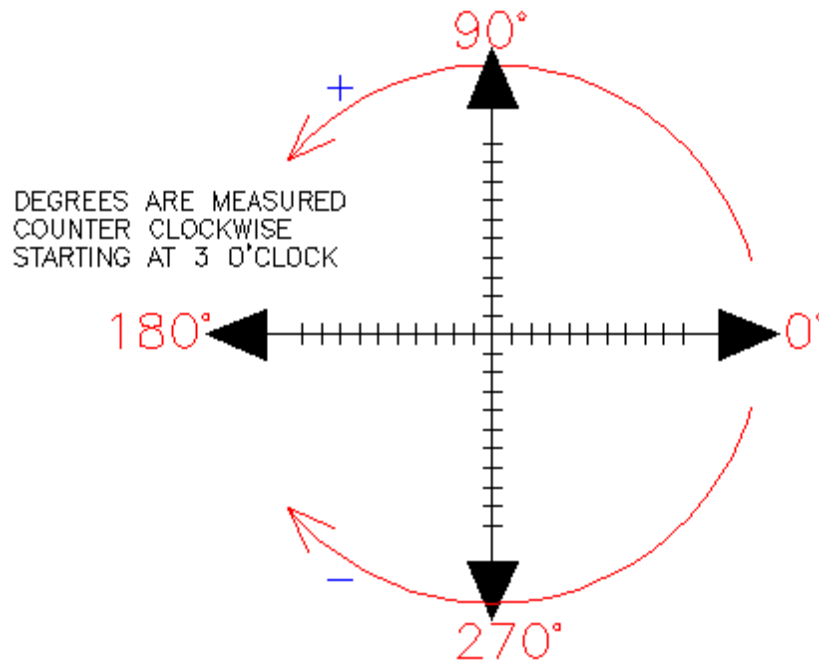
Its a simple system, but mastering it is the key to working with AutoCAD and is explained in more detail further below.

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### Angular Measurement

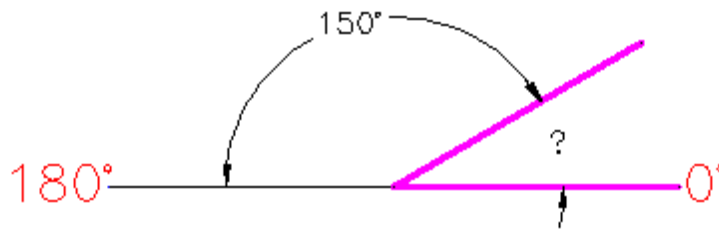
AutoCAD measures angles in a particular way also. Look at the diagram below and then place your mouse on it to see how this is done.





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 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  $0^\circ$  is at the 3 o'clock position (b) the knowledge that  $180^\circ$  is at the 9 o'clock position and (c) the angle between  $180^\circ$  and the line you want to draw is  $150^\circ$ . 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  $0^\circ$  position and measure counter-clockwise (+) to  $180^\circ$ .
- 2.) From  $180^\circ$ , measure clockwise  $150^\circ$ .
- 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)

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### 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.)

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### More AutoCAD Basics

Subjects covered in this section:

[Starting Commands](#) - [The AutoCAD screen](#) - [Terminology](#)


### Icons, Keystrokes and Menus

There are many ways to do things in most Windows programs. AutoCAD is no exception. Everyone will develop a way that works best for him or her. In this course, we will primarily be working with the keystroke commands. The reason for this is because they will work in most AutoCAD versions (including DOS versions), and in some other CAD programs. The icons work well, but as you will see, icons can be placed anywhere on the screen and can be difficult to find quickly. You may be working on another employee's computer that is set up differently than what you're used to. The pull-down menus will access almost all commands, but are a slower way of doing things.

Example: If you want to draw a line, you can do it a few ways:

- At the command line type: **LINE** (or) **L** and press the ENTER key.

- Select the line icon  from the DRAW toolbar.

- Select Draw > Line from the pull-down menu. 

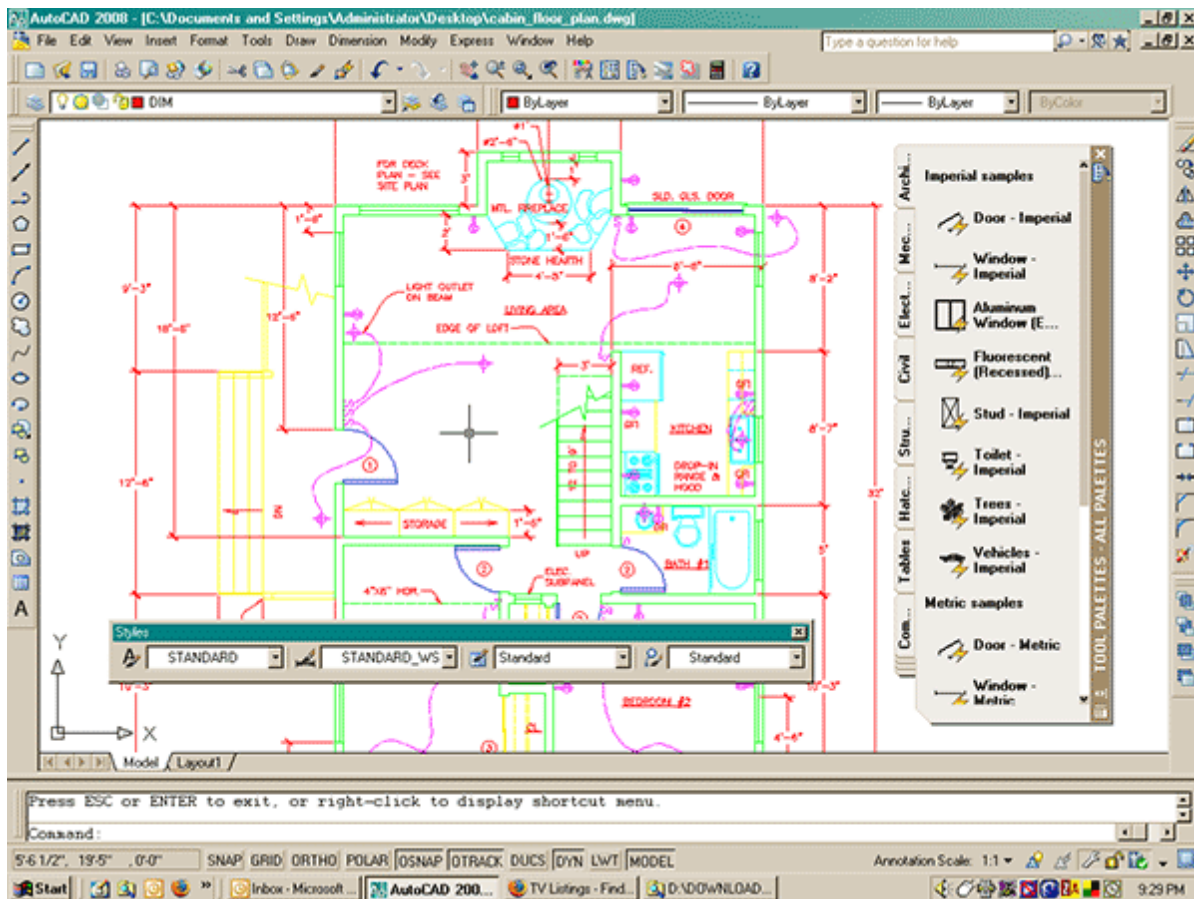
All three approaches will do the same thing: prepare AutoCAD to draw a line where you tell it.



[Click here to see a video](#) showing how to start commands in AutoCAD.

AutoCAD is a popular program because it can be customized to suit an individual's needs. The toolbars are a good example of this. You can have the toolbars you use most often on the screen all the time. You can easily make them go away so that you have more drawing space. You can also customize them so you have the most common commands on one toolbar. For example, the dimensioning toolbar is one that you will not want taking up space on your screen while drawing, but is very handy when you're dimensioning your drawing.

## The AutoCAD Screen



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

- **Title Bar** - This will show you what program you are running and what the current filename is.
- **Pull-down menus** - These are the standard pull-down menus through which you can access almost all commands.
- **Main toolbar** - This has most of the standard Windows icons, as well as the most common AutoCAD commands.
- **Property toolbar** - This toolbar gives a way to quickly modify an object's properties, such as layer and linetype.
- **Floating toolbar** - This is a toolbar that can be moved around the screen, or 'docked' as the main toolbar is.
- **Drawing space** - This is where you draw. You have an almost infinite area to draw and this is just a 'section' of the entire space.
- **Scrollbars** - These work like in other windows programs. You can also use the PAN command to move around your drawing.
- **WCS Icon** - This is here to show you which direction positive X and positive Y go. The W means you're in the World Co-ordinate System. (It can be changed to a User Co-ordinate System.)
- **Status Bar Tray Icons** - These icons give you updates on items like reference files program updates


and print status.




- **Command line** - When you type a command, you will see it here. AutoCAD uses this space to 'prompt' you for information. It will give you a lot of information and tell you where you are in the command. **Watch this line while learning.**
- **Status bar** - This allows to see and change different modes of drawing such as Ortho, Osnaps, Grid, Otrack, etc.
- **Tool Palette** - Collection of tools in one area that can be organized into common categories.

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### Basic AutoCAD Terminology

Here are some basic terms that you will want to review before using AutoCAD. Some terms have links to give you more information (but it is not necessary to memorize them all now).

<a href="#">Absolute co-ordinates</a>	A way of inputting points based on AutoCAD's origin.
<b>Acad.dwt</b>	This is the default template that automatically loads whenever you start a drawing session. It can be customized to suit your needs.
<b>Associated Dimensioning</b>	Dimensions that are associated with specific points will update as that point is moved.
<b>Backup file</b>	AutoCAD can be set to automatically backup your drawing and save it. This is a safeguard in case your file gets corrupted. It is saved with a .BAK extension
<a href="#">Block</a>	A pre-drawn image you can insert in your drawing to save time and make your file size smaller.
<b>Crosshairs</b>	This is your cursor when it is in the drawing space.
<b>Cursor</b>	Your cursor will change depending on where it is in the program.
<b>Database</b>	An AutoCAD drawing file is actually one large database containing all the information needed to reproduce the objects when the file is opened. Info for layers and linetypes, etc are stored in this manner.
<b>Dialog box</b>	AutoCAD uses a large number of dialog boxes to get information from you. You must know how input the information that it asks for.
<a href="#">Drawing template file</a>	This is a file that contains preset values for frequently used settings. AKA a prototype drawing. The file extension is DWT.
<b>Extents</b>	The outer boundaries of the objects you have drawn.
<b>Grid</b>	This is pattern of dots displayed on the screen to guide you. It can be toggled on and off by pressing the F7 key.
<a href="#">Grips</a>	Small 'handles' on objects that allow for quick editing.
<b>Layer</b>	All objects are drawn on a layer. You can group objects (such as electrical) on a single layer and organize your drawing.
<b>Layout Tabs</b> 	A space used for plotting your drawings (formerly called Paper Space).
<b>Limits (Grid)</b>	A setting to impose an 'artificial' boundary on your drawing that sets the area of the grid, and when turned on, limits you to drawing in the grid area.

<a href="#">Linetype</a>	All objects are drawn with a particular linetype. Examples would be solid, center, dashed, etc.
<b>Model space</b>	The drawing space where you 'model' the objects.
<b>Modify</b>	A generic term used for changing your objects
<b>Object</b>	Any item that is in the AutoCAD database. Also known as an entity.
<a href="#">Origin</a>	The (0,0) point of your current co-ordinate system.
<b>Ortho mode</b>	This is a drawing mode that allows you to draw only perpendicular lines. It is toggled on and off by pressing the F8 key.
<a href="#">Osnap - Object Snap</a>	This is a method of 'snapping' to certain, precise points on an object.
<a href="#">Pan</a>	To move around drawing by dragging the drawing area around your screen.
<b>Path</b>	The specific folder where AutoCAD looks for, or saves files.
<b>Pick</b>	To select an object by 'left-clicking' on it.
<b>Plot</b>	Also known as print. To make a hard copy of your drawing.
<a href="#">Polar co-ordinates</a>	A way of inputting points based on distance and angle.
<b>Property</b>	Any specific characteristic of an object such as layer, scale, linetype, start point, etc.
<a href="#">Relative co-ordinates</a>	A way of inputting points based on a starting point.
<a href="#">Selection set</a>	The current group of objects selected for modifying.
<b>Snap</b>	This is a drawing mode that allows you to snap your cursor to precise points laid out in a grid pattern. Toggle with the F9 key.
<b>Styles</b>	Formatting that defines the look of text, dimensions, etc.
<b>Units</b> 	The basic drawing unit set for you drawing. For example, you can use inches or millimeters depending on your needs. You can also set the precision you want displayed, such nearest 1/4", 1/2" 1/64", etc.
<b>User co-ordinate system (UCS)</b> 	Modifications made to the World Co-ordinate System (WCS) results in a User Co-ordinate System (UCS)
<b>View</b>	A particular area of your drawing.
<a href="#">Viewport</a>	A separate 'window' on your drawing. You may have more than one viewport visible to see different areas of your drawing at the same time.
<b>Wizard</b> 	An easy step-by-step instruction set to help you set-up certain aspects of your drawing.
<a href="#">World Co-ordinate System (WCS)</a>	This is the common X-Y co-ordinate system that is the default. If it is modified, it becomes a User co-ordinate System (UCS)
<a href="#">Zoom</a>	To view either a smaller section of your drawing (zoom in) or a larger section (zoom out)



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