

Adobe Illustrator Class

A little back story

Around 1970, Xerox Corp, headquartered in New York, established a research center in the Stanford Industrial park and called it PARC (Palo Alto Research Center).

In the mid 70's, the scientists/engineers at PARC invented Laser Printing. This allowed high resolution graphics to be printed easily (500 dots per inch in the prototype). They defined a page description language call "Press" that could be sent to the printer controller. A downside, if you wanted to print with a font of a given size, there had to be a set of bitmaps (at 500 dpi) for each of the characters of that font.

In 1978, John Warnock joined PARC. Based partially on work that he had done in Utah, where he received his PhD, he created a committee to design a language for describing page contents that was resolution independent and could be used to print on a multiplicity of devices. It was called InterPress. John and his team wanted to publish the language so that everybody would describe pages in the same way. Unfortunately, the corporate legal staff didn't approve of the idea.

In frustration, Warnock and another researcher, Chuck Geschke, decided to leave Xerox in 1982 and found their own company. They named it Adobe Systems after the creek that ran behind John's house. For legal reasons, they had to create a new page description language, which wasn't a bad ideal since InterPress had a number of "designed by a committee" inefficiencies. They designed PostScript, again largely influenced by Warnock's work in Utah.

PostScript is essentially a programming language that has built-in functions for marking information on pages. You can define lines, straight or curved, you can do strokes and fills. Bitmap images can be scaled (but if scaled too large, the "bits" of the original can be seen). Fonts describe their characters as filled outlines, so they can be scaled to any desired size.

In the early to mid 80's some Japanese manufacturers produced small laser printers. In '84, Hewlett Packard began selling the LaserJet based on a Canon printer engine (300 dpi). In '85, Apple released the LaserWriter based on the same Canon printer.

In 1983, Adobe was hired by Apple to produce the LaserWriter, the first PostScript printer. Around that time, Adobe also had an agreement with Linotype to create a PostScript engine to produce very high resolution page images.

Having PostScript was a great improvement to the printing industry. In the early days, writing a PostScript print driver for simple things like a text editor wasn't too hard. Creating complicated graphics was a serious pain. With Apple selling a PostScript printer, there was a perceived need for a graphics editor for the Mac to produce PostScript.

Largely the work of programmer Mike Schuster, Adobe Illustrator came out on the Mac in 1987. Several years later, a version came out for Windows, though it had to go through several generations before it was as well received as the Mac version.

Class Goals

Adobe Illustrator has been around for more than 30 years. It has gone through many releases and acquired many features in that time. The goal of this course is to teach you the basics. In particular, the features you will find useful when producing projects to be sent to the CraterWorks Laser Cutter. When you get down to the basics, an Illustrator file consists of many lines, some closed figures defined by outlines, text, and some embedded raster images. We will not talk about all of the ways to create content, but will hopefully cover enough to be useful. After the overview, we will make a small project from start to finish.

For this class, I am using a PC. The description below uses the designation **Ctrl** and **Alt** for the keys used in many shortcuts. On a Mac, those would correspond to **Command** (⌘) and **Option** (⌥). The Mac also has a **Control** key, but it is not used for the keyboard shortcuts.

One thing that is definitely true about Illustrator is that there are multiple ways of doing just about any task. If you have an afternoon or two to spare, you should consider going to <http://helpx.adobe.com/illustrator/tutorials.html> and looking at some of the tutorials. In particular, the page entitled “Get to know Illustrator” is linked to nine other pages with a total of 41 videos to watch. Each video comes with a downloadable zip file of documents you can use to follow along in your own copy of Illustrator. Some of the more advanced topics do not have videos, but step-by-step instructions and illustrations.

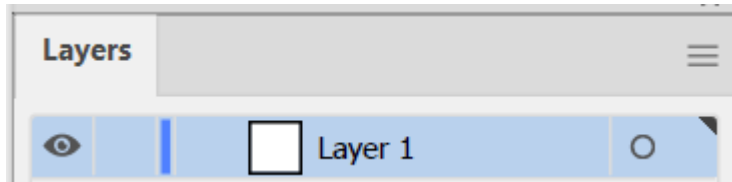
First Approach to Illustrator

When you first start Illustrator, you are prompted to either open an existing document or to create a new one. A document consists of one or more “artboards”. There are a number of pre-defined choices of size, orientation, and other parameters, or you can specify your own. These choices can be modified once the artboard is created.

The preference that I typically change is “Units”. While Points (1/72 inch) are fine with me for Stroke widths and font sizes, I find them pretty annoying for dimensioning something that I’m going to cut on the laser cutter. I’m in the habit of using metric measurements for projects so I use millimeters for my units.

You have 10 choices of units, including inches, feet, etc. You can also change the default units later using the Properties window for document properties. If you want to use other than points for font sizes and stroke widths, the “Units” menu item under the “Preferences” menu (under “Edit” at the top of the window) can be used to modify those units as well. In the remainder of this document, I will denote such multiple selections through the top window menus as “Edit”->“Preferences”->“Units”. For this particular set of menus, you can type **Ctrl+k** then choose your final menu from a list of the left of the page.

Independent of what the default document units are defined to be, you can enter values into various widgets in whatever unit you please. So if you specify a size as 1in (or 1") in a dialog box but your default unit is millimeters, when you **Tab** to the next field, the value will be displayed as 25.4 mm. The space between the number and the units is optional, i.e. 1 in or 1in will both work.



One of the more useful features is the ability to have multiple “layers” on your artboard. Layers can have controlled visibility and can be “locked” so that the artwork on that layer is protected. The

three bars at the top right lead to a menu for doing things like creating new layers. Once you have multiple layers, anything on a given layer is rendered on top of anything in layers below. The order of the layers can be modified by dragging a layer in the Layers window to a new position in the depth hierarchy.

Navigation

You may zoom in and out on the artboard. This allows you to better see the portion that you are modifying. There are several ways to do this. At the bottom left corner of the window, there is a widget to specify a zoom percent. You can choose a zoom value from the pop-up menu, or you can type in an exact number. In the “View” menu at the top of the window, there are “Zoom in” and “Zoom out” menu items. They change the magnification to the next value in that widget’s list of values. In the Tool Window, you can choose the “Zoom Tool” (a magnifying glass). When you choose the tool, the cursor becomes a magnifying glass with a “+” in the middle. If you click on the artboard, it will be zoomed to the next larger magnification, centered on where you clicked. Holding down **Alt** with the Zoom Tool changes the “+” in the magnifying glass changes to a “-”. Clicking the tool will zoom out, centered on where you click.

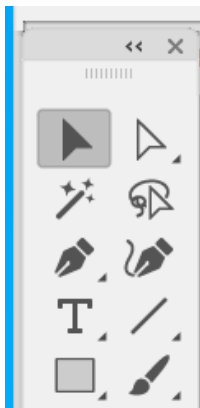
There are some useful keyboard shortcuts. If you type **Ctrl+1**, you will zoom to 100%, i.e., actual size. If you type **Ctrl+0**, you will zoom to whatever magnification is required to show the entire artboard in the window. **Ctrl** with the “+” key will zoom in and **Ctrl** with the “-” key will zoom out.

If you are zoomed in on a portion of the drawing, you may wish to scroll the content to get to a portion that is not currently on screen. There are scroll bars at the bottom and right side of the sub-window containing the artboard that can be used for this purpose. In the Tool Window, you can choose the “Hand Tool”. The Hand Tool allows you to mouse down at any place on the artboard and drag that part of the board to another part of the window, allowing “scrolling” horizontally and vertically at once.

Unless you are actively entering text, pressing the **Space-bar** temporarily selects the Hand Tool. When you release the **Space-bar**, the selected tool goes back to whatever it was before. Again, while not entering text, pressing the **Space-bar** and **Ctrl** together temporarily selects the “Zoom Tool”

If you mouse down and drag the Zoom Tool, the behavior depends on the setting of a global parameter. Historically, one dragged the mouse across the screen and the rectangle defined by mouse down and mouse up was zoomed as large as possible in the window. Newer versions have a second option. In the menu item “Edit”->“Preferences”->“Performance”, there is a checkbox entitled “Animated Zoom”. If this box is checked, dragging the zoom tool causes the drawing to grow or shrink as you drag. If you drag to the right, you zoom in; if you drag to the left, you zoom out. Because I’ve been using the original behavior for over 30 years, I uncheck the Animated Zoom checkbox (old dog, old tricks).

Drawing in Illustrator



Typically on the left side of the window is the “Tool Window”. It contains icons for many tools, some of which we will talk about below. To conserve screen real estate, similar tools are grouped together with the most recently used one showing. If there is a small triangle in the lower right corner of the tool icon, it indicates that there are similar tools “below”. If you mouse down on the triangle and hover there, the complete set of tools will be shown in a pop-up menu. Choose the one you wish to use. A gray background designates the currently selected tool. In the example here, the Selection Tool is chosen. If a tool that you want to use isn’t currently in the Tool Window, you can click on the three dots at the bottom of the Tool Window and drag that tool back in. Alas, I have no wisdom to impart about how to find a tool that is stacked below some other tool. Look for the tool that is closest to what you want and mouse down on the triangle to see if your desired tool is hiding under there.



Objects created in Illustrator have the option of stroke and fill colors. Typically in the toolbar on the left there is a pair of boxes that are used to specify those colors. We will get into the details of color later, but for now, the specification depicted here is for objects that have a black stroke on their outline and no fill.

Grid and Guides

Illustrator provides several useful mechanisms for drawing objects of exact dimensions. One such mechanism is the “Grid”. If the grid is turned on, it is displayed in the background of the artboard. If “Snap to Grid” is selected, all objects will have their control points at some intersection of grid lines. The default grid is major lines every inch and minor ones every eighth of an inch. That can be changed using “Edit”->“Preferences”->“Guides & Grid” from the menus at the top of the window. One way to turn the grid on and off (and to specify Snap to Grid) is via the “View” menu at the top of the window.

While the grid can be useful for some drawings, I prefer the use of “Guides”. They are created by drawing a line and then turning it into a Guide. This is done either by the top menu “View”->“Guides”->“Make Guides” or by the keyboard shortcut **Ctrl+5**. The “View”->“Guides” menu also allows you to lock and unlock the guides. Typically they should be locked, but if you want to move

one, they need to be unlocked while you are doing that. I tend to have a special layer for guides and lock that layer rather than lock the guides. We will see the use of guides below. You can think of a collection of guides as forming a grid that is specific to the dimensions of the art you wish to draw.

Simple Shapes

There are lots of ways to draw objects in Illustrator. The original version had basic capabilities, but later versions have added many tools for drawing common shapes. If you select one of these tools, you can “mouse down” and drag, creating that shape of a size determined by how far you drag the mouse before letting go of the mouse button.

Another way is to “click” the mouse at a location on the artboard (without moving it). This will bring up a dialog box that will allow you to specify the dimensions (and perhaps other parameters) explicitly. This is handy if, say, you want a rectangle that is 25mm by 50mm. Also, for the Polygon and Star tools, the dialog box has a field for specifying the number of sides or points. It is worth noting that when you change the shape of a star or polygon, that new shape persists for future invocations of the tool. Let’s look at bit further at each of these simple shape tools.



Rectangle Tool

If you simply use this tool, you will draw a rectangle with a corner point where you first pressed the mouse button. There are additional options.

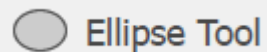
If you hold down the **Shift** key while you are “dragging”, the rectangle will be restricted to being a square. If you hold down the **Alt** key, the position of the initial mouse press becomes the center of the rectangle, not one of the corners. This is true even if you simply click the mouse with **Alt** down. In that case you can specify the dimensions of the rectangle that is centered on where you clicked the mouse.



Rounded Rectangle Tool

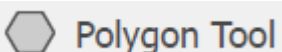
This tool allows you to create rectangles with rounded corners. You can specify the radius if you “click” this tool and

you can always go back and modify the radius after drawing the rectangle. Again, **Shift** and **Alt** behave the same as they do for the Rectangle Tool.



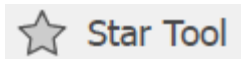
Ellipse Tool

This tool draws ellipses. If you hold down **Shift**, you get a circle. If you hold down **Alt**, the ellipse/circle is centered about the point where you pressed the mouse button. If you “click”, you can specify the height and width of the ellipse.



Polygon Tool

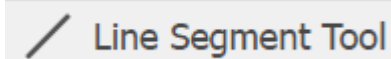
This tool creates multi-sided (regular) polygons. The polygons are centered on the location of mouse down. Holding down **Shift** keeps the polygon in upright alignment. If you use the **Up-Arrow** and **Down-Arrow** keys while the mouse is still down, you change the number of sides in the polygon. I’m not aware of any effect from the **Alt** key on this tool since you are always drawing with the center at mouse down. If you “click”, you can specify the number of sides and the radius (which is the radius of a circle that would exactly enclose the polygon).



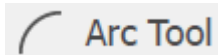
This tool creates stars centered on the position of mouse down. By holding down **Ctrl**, you can adjust the “pointiness” of the star. Holding down **Shift** constrains the orientation to be upright. Holding down **Alt**, if the star has 5 or more points, constrains the shape of the star to be the shape you’re used to seeing in things like the American flag, i.e., the sides of star points two apart are in a straight line; with 6 sides, it will be a Star of David. While the mouse is down, the **Up-Arrow** and **Down-Arrow** keys control the number of points on the star. If you “click” this tool, you get a dialog box that lets you specify details of the star to create.

Drawing Lines

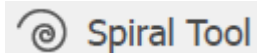
There are a number of tool for drawing lines.



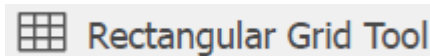
Use this tool to draw a single straight line. If you hold down **Shift**, the direction is constrained to horizontal, vertical, or 45° away from one of those directions. If you hold down **Alt**, you get a straight line centered upon the location of mouse down. If you “click”, you can specify the length and the angle.



This tool draws a quarter of an ellipse. If **Shift** is down, it’s a quarter-circle. If **Alt** is down, it draws the arc such that the mouse down point is at the center of a straight line joining the two ends of the arc. If you “click”, you can specify lots of parameters.



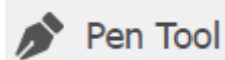
This tool draws a spiral. While the mouse is down, the **Up-Arrow** and **Down-Arrow** keys control the number of segments in the spiral. The **Shift** key constrains the orientation, the **Ctrl** key lets you turn the spiral inside out, changing it from clockwise to counter-clockwise. **Alt** causes it to add and subtract segments as the spiral gets larger or smaller. If you “click”, you can specify lots of parameters.



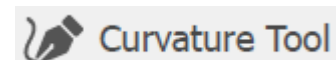
and



These tools draw grids. You can play with them and see what they do. The **Up-Arrow**, **Left-Arrow**, **Right-Arrow**, and **Down-Arrow** keys control the number elements in the grid.



This is the granddaddy of line creation tools. It is not particularly easy to explain. Lines created with the pen tool have a sequence of anchor points. Line segment directions either terminate at the anchor point or this segment and the segment on the other side of the anchor have a coordinated shape that is controlled by direction lines that appear when the anchor is directly selected. The tool keeps adding to a line until you reach back to your starting anchor (or change to another tool). When you have a closed figure, the Pen Tool is now ready to start another object. There are also tools in this stack for adding and subtracting anchor points from a line.



This tool is a simpler version of the Pen Tool. It was not part of the original Illustrator, but has been added to make you life easier for

making smooth curves. Try it for yourself. If you double-click at a point, the current curve will terminate there. It can also be used to add control points to an existing line.



This tool allows you to draw a curve free-hand, and have Illustrator convert it into a line with control points. If you double-click on this tool in the Tool Window, it will open the “Pencil Tool Options” window that has several options for affecting the conversion process.

Images

Sometimes you wish to place an image on the artboard. This is done using the “File” menu at the top of the window. Choose the “Place” menu item. You will be prompted for a file. Choose an image file and click the “Place” button. You will now see a miniature version of the image and an arrow. Position the arrow where you want the upper left corner of the image and click the mouse, or drag it to set the initial scaling of the image. Images are by default “linked”, meaning that the Illustrator file has a link to the image. If the image is altered, the changes are reflected in the Illustrator file next time it is opened. One can “Embed” the image in the Illustrator file, and must do so if you crop the image.

If an image is selected, the Properties Window has a number of “Quick Actions”. For some images, the “Image Trace” button can turn the selected image into scalable objects. After you select “Image Trace”, you can open “Window”->“Image Trace” to allow you to set various parameters for the process and preview their effects. When you are happy with the results, you can click “Expand” to convert to a group of editable objects.

Clipping Masks

There are times when you only want to use a portion of an illustration. This is common for placed images but can be used also with collections of other object that you have drawn. This is simply done by selecting a group of two or more objects. Then choose from the window top menu “Object”->“Clipping Mask”->“Make”, or simply type **Ctrl+7**. The topmost object in the selection is used as a clipping mask and anything below that falls outside of the mask is no longer visible. It is helpful to select the desired mask object, then type **Ctrl+x**, **Ctrl+f** to ensure that it is front of the other objects.

Text

There are a number of ways to add text to an Illustrator artboard. We will discuss several of them below. You can play with the options and see for yourself. More recent versions of Illustrator start new text entries with (pseudo?) Latin contents which is selected so as soon as you enter something the Latin is replaced. If you find this annoying, go to “Edit”->“Preferences”->“Type” and uncheck the box labeled “Fill New Type Objects With Placeholder Text”.

When entering text, holding down **Ctrl** gets you Selection Tool. Clicking on the artboard with that Selection tool finishes the current text input but stays in text mode when you release **Ctrl**. Typing **Esc** finishes the input and goes to the Selection Tool.

Type Tool

This is the simplest way of entering text. You click somewhere on the artboard and then start typing. If you hit **Carriage-return**, the new line is directly below the previous one. There are many properties that you can modify such as typeface, size, weight, etc. There are also paragraph styles such as centered text, line spacing, etc.

The Type Tool is also the tool you want to use for editing text on the artboard, even text that was entered using one of the more sophisticated tools. Using the Type Tool, you can select characters (or between two characters) in an existing string and then start typing.

Area Type Tool

To use this tool, you first create an object. Typically one uses a rectangle, but the shape can be arbitrary. I once produced a Christmas letter that was in an area the shape of a Christmas tree. You select the object with this tool and the object disappears, but its outline remains and any characters that you type stay within that outline. If a word won't fit on a line, it is placed on the next line. If there is more text than will fit in the area, it is still there but not visible, but if you resize the area larger, the text will reappear if the new area is large enough to contain it.

Type on a Path Tool

You can create an arbitrarily shaped path (typically using the Pen Tool) and then have text appear along the path always perpendicular to the portion of the path where the character lies.

Vertical Type Tool

When you use this tool, characters are placed in a vertical line, each one below the previous.

Properties



One of the most useful windows is the Properties window. The properties shown depend on whatever is the current selection. One property shown if an object is selected gives the x and y coordinates of the object and its width and height. The little matrix shown to the left lets you decided which x and y coordinates you want to see: one of the corners, the center, or the center of one of the sides. You can edit those numbers to place the object at an exact location. If nothing is selected, you are shown the properties of the artboard, allowing you to do things like show and hide the grid, lock and unlock guides, etc.

Selecting



At the top of the tool window are the “Selection Tool” (black inside) and the “Direct Selection Tool” (white inside). You will use these tools a lot. It's probably worth learning the shortcut to choose them. Unless you are entering text, if you hit **v** on the keyboard, you will choose the selection tool, hitting **a** will choose the direct selection tool. If you are typing in text, or using pretty much any other tool, holding down the **Ctrl** key will make the Selection Tool active.

We will first discuss the “Selection Tool”. To select an object, you can click with the selection tool at any point on the object to select it. You can also drag a rectangle with the tool and select everything that is partially in that rectangle. You can add or subtract an object from the total selection by holding down **Shift** and selecting that object.

Moving and Copying

If you select an object (or group of objects), you can use the selection tool to move them. Simply mouse down with the cursor over a portion the object (but not a control point) and drag the object to the desired destination before you release the mouse button. If you hold down the **Alt** key during this process, the object is copied, leaving the existing object where it was and placing the copy where you let up the mouse button. If you hold down **Shift**, the direction of movement is limited to horizontal, vertical, or 45° away from one of those directions.

If you wish to move an object a specific distance in x and y, this is accomplished by first selecting the object and then double-clicking the selection tool in the Tool Window. This brings up a dialog box that allows you to specify the move as exact x and y amounts or as an angle and a distance. It also allows you to copy the object rather than just move it. If you’re a mathematician and are used to positive “y” values increasing as you go “up”, you’ll just have to get used to the fact that in Illustrator coordinates, y values increase as you go toward the bottom of the page. At least “x” values increase as you move to the right.

If you have made a copy of an object by dragging or specifying a distance in x and y for the copy, there is a very useful shortcut for making more copies. If you type **Ctrl+d**, which I think of as “do it again”, another copy will be made, the same distance away from the one previously made.

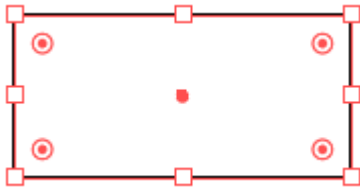
Another way to move a selection is via the arrow keys on your keyboard. The default distance to move the selection is 1 pt (1/72 inch). The movement value can be changed by going to the “Edit”->“Preferences”->“General” window and changing the value of “Keyboard Increment”.

Cutting and Pasting

Once you have made a selection, you may delete it from the drawing with the **Delete** key. You can cut to the clipboard with **Ctrl+x**, or simply copy to the clipboard with **Ctrl+c**. Once the artwork is on the clipboard, it can be pasted back onto the artboard in three ways. The typical shortcut for pasting, **Ctrl+v**, will paste the artwork somewhere near the middle of the showing page. This is fine if you’re going to then move it where you want it. The other two options are quite powerful. **Ctrl+f** will paste it to the “front” of the illustration; **Ctrl+b** will paste it to the back, but most importantly, at the exact same x and y coordinates as the original object. Layer position is particularly important for opaque objects. It is also important for clipping where the clipping mask needs to be on top of what it is clipping. Selecting an object and then typing **Ctrl+x**, **Ctrl+f** is often used to make sure that the object is in front of other objects.

Modifying Objects

Once you have drawn an object, you will likely want to make changes to it. Let us consider a few examples.



Here is an example of a rectangle that has been selected with the (black) selection tool. There are “control points” in each of the corners and the center of each side. If you mouse down on one of the control point and drag, the rectangle will be resized. If you hold down **Shift**, it will keep the same ratio of side lengths. In each corner

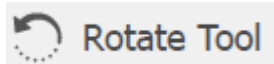
is a circular widget that allows you to convert this rectangle to one with rounded corners. If you mouse down and drag one of the circles, you will change the corner radius for all four corners.



This is an alternative way to scale an object or group of objects. With this tool, you already have a selection. You first click the mouse to establish the point about which the objects will be scaled. Then you mouse down and drag to scale the selection. Alternatively, you can make a selection and then double-click the Scale Tool in the Tool Window. The scaling will be relative to the center of the selection and you can specify exact amounts of horizontal and vertical scaling.



If you move the mouse just outside of a control point of a selected object, the cursor will change into a line with arrows, similar to the figure shown here. If you mouse down and drag, you can rotate the object. If you hold down **Shift**, you are constrained as to the angle of rotation.



This is another way to rotate a selection. You can simply drag the selection around its center or you can first click somewhere on the artboard and rotate around that point when you drag.

If you hold the **Alt** key down while you are dragging the rotation, you make a copy. If you hold the **Shift** key down, you are constrained to multiples of 45°.

If you click with the **Alt** key down, that sets the rotation point and brings up a dialog box to allow specification of an exact rotation amount.

If you double-click on the Rotate Tool in the Tool Window, you can specify the rotation of the current selection about its center.

Direct Selection

Sometimes you want to modify only a portion of an object. This is where the “direct selection tool” comes into use.

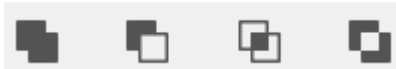


Here the direct selection tool was used to select just the lower right anchor point. We have the little circle for changing the corner radius, but in this case, it will change the radius for just that corner. Likewise, if we drag that anchor point elsewhere on the artboard we will distort the shape from a rectangle to some other quadrilateral figure.

With lines created using the Pen Tool, the direct selection tool can be used to select a single anchor point and you can then play with the control lines to adjust the shape. If you have two lines that are not closed paths, you can select an end anchor point of both lines and join them together into a single line. This is done by typing **Ctrl+j**. If the two anchor points are not on top of one another, a line is drawn between them.

There is a non-obvious but quite handy use for the direct selection tool. Suppose you have a relatively small object, say a rectangle, and you want to move or copy it without changing its size. When you select it with the selection tool, there are control points in every corner and the middle of every side. Finding some place to drag the object from can be a pain unless you are highly zoomed in. After you select the object with the selection tool, you can then choose the direct selection tool and use that to drag the object. You can even drag from an anchor point without modifying the shape of the object.

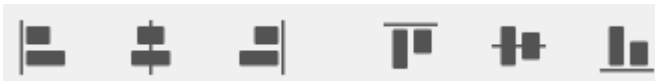
Pathfinder



The Pathfinder Tool appears in the Properties window when two or more objects are selected, You can also open it by using the

“Window” menu at the top of the page. The Shape Modes collection of icons, shown here, allow you to take two shapes and create a resulting shape that is the union of the two shapes, the lower one minus the top shape, the intersection of the two shapes or the two shapes minus their intersection. There are a number of other options but these are the most useful.

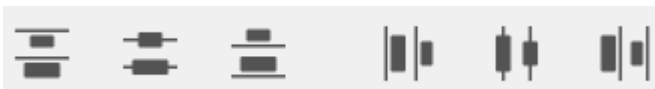
Aligning Objects



These icons allow you to take a collection of objects and rearrange them such that they are

either aligned vertically or horizontally. You can choose to have the left sides, the centers, or the right sides aligned. These icons are typically in the Properties window, but you can always open them from the “Window” menu at the top of the Illustrator window.

Distributing Objects



If you have a collection of objects, probably aligned, but the spacing between them differs, you can redistribute those object so that the

spacing is uniform. Simply select the collection and then click on the relevant icon.

Color



Objects in Illustrator can have both a stroke color and a fill color (or in the case of a masking object, no color at all). There are color patches on the Tool Window that show the fill and stroke values for the current selection. To change a color, select the fill or stroke box (it will come to the front) and then use one of the many color related sub-windows, typically on the right of the workspace, or available from the “Window” menu.



Another useful way to pick a color is to use the “eyedropper” tool. You use this tool to copy an existing color. Simply use the mouse to position the eyedropper over something on the artboard of the desired color and click. This can be quite useful if you have placed a photograph on the artboard and want to match one of the colors in the picture.

The stroke and fill colors can be more sophisticated using things like gradients, but we are not going to deal with that today.

If you are primarily using Illustrator to cut things on the laser cutter, your use of color will be somewhat limited, although there are options on laser cutter to cut different colors with different speed and power parameters. If you are using this feature, it’s probably a good idea stick to simple primary colors like “red”, “green”, etc. in order to make your life simpler when telling the laser printer which colors you used.

Example

I’m going to walk you through a project for the laser cutter in order to show you the use of a number of the tools described above. If you are reading this at home and have Illustrator, you could follow along and produce a similar drawing. Alternatively, <http://helpx.adobe.com/illustrator/tutorials.html>, mentioned above, has many videos you can watch and files supplied so that you can reproduce the video’s behavior.

The project is to cut a small decorative box to hold a votive candle. We are going to cut it out of 3mm Baltic Birch plywood.

Step 1, Create Document

First, we create a new document with the “File”->“New” menu item (or type **Ctrl+n**). This brings up a dialog box with a number of parameters. We’ll chose a width of “24 in” and a height of “18 in”, that being the size of the bed of the laser cutter. I’m also changing the units from “Points” to “Millimeters” because I feel more comfortable working in metric measurements.

Step 2, Create Layers

Having done this exercise already, I’m planning on two layers. I’ll call the layers “guides” and “box”. Typically, I’m working on a document and say “gee, I think I want another layer” so I create it then.

Step 3, Choose Dimensions

I found a glass votive candle holder in a closet in my garage. I took a few measurements and decided that the interior of my box should be 75mm x 75mm x 80mm. This will hold the glass unit without it sticking out the top. I'm going to decorate the sides with holes that the light will shine through. I need a little space below the decorations, and I want to have "feet" in the corners, so I'll have another 20mm of side with most of the side 10mm off the ground.

Step 3, Create Guides for sides

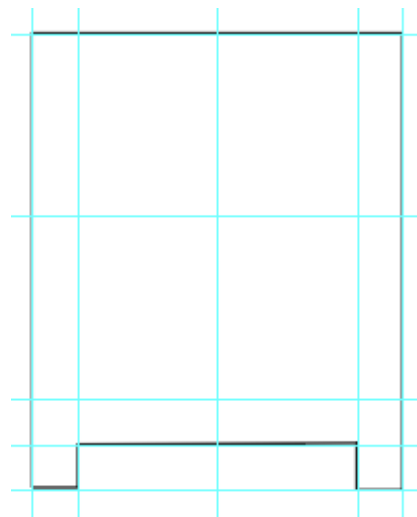
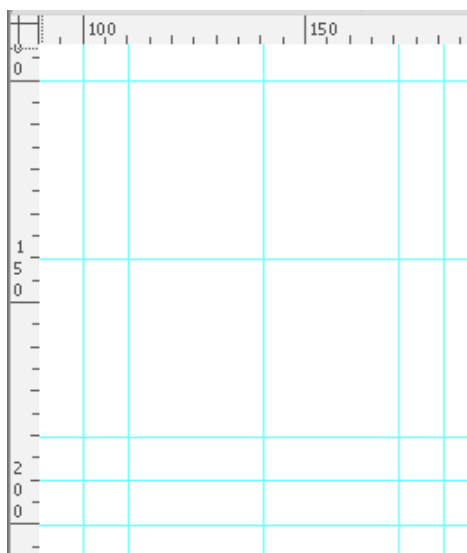
I've decided to put all of my guides in the layer named "guides" so I choose that layer in the "Layers" sub-window. I start out with a horizontal line that will be the guide for the top of the side. I need another one 80mm down for placement of the board that holds the votive candle glass, and since I'm going to do a symmetric set of cutouts on the side, another line halfway between them is useful. Below the lower (80mm down) line, I draw two more lines 10mm apart.

Now for the vertical guides. The first one locates the left edge of the side. I want the inside of the box to be 75mm, so the outside will be $75+3+3$ or 81mm. Copy the left line 81mm to the right. I'll want the midpoint for my decoration so I'll also copy the left line 40.5mm to the right. I'll add a couple more vertical lines 10mm toward the center from each side to make it easier to draw my "feet".

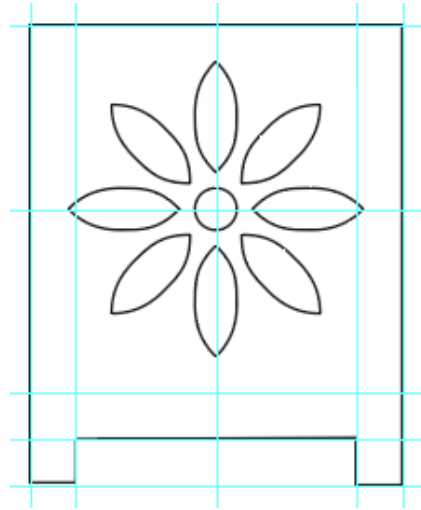
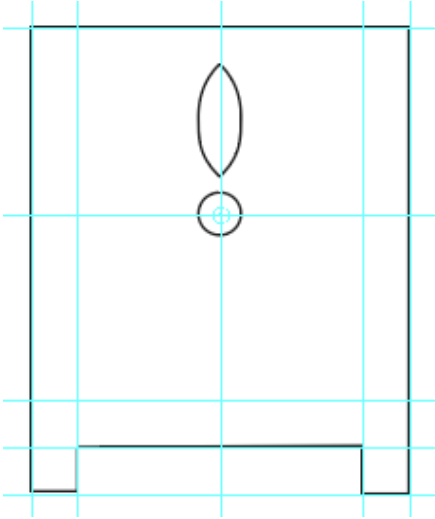
Next we turn this collection lines into guides by selecting them and typing **Ctrl+5**. We could also use the "View" -> "Guides" -> "Make Guides" menu. At this point, I will lock the "guides" layer and click on the "box" layer to make that the active drawing layer. In the left picture below, I placed the upper corner of the set of guides at location 100mm, 100mm and turned on the ruler so that you can see the spacing of the guide lines. We will make additional guides later, before we draw the bottom piece that the votive candle rests on.

Drawing the sides

Using the guide shown below, I can draw the outline of the side using the Pen Tool and clicking on the various intersections of guides



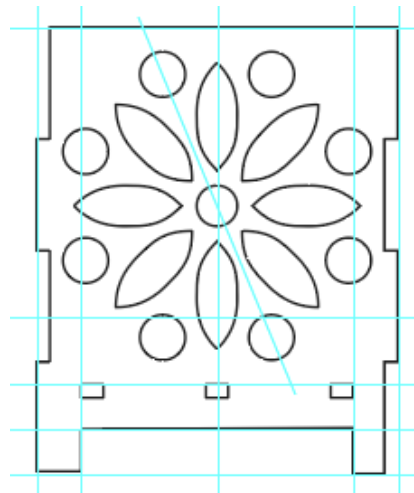
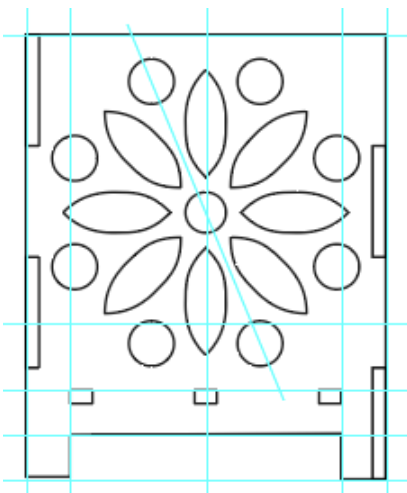
I'm going to make the side somewhat flower-like so I draw a circle in the middle and then use the Curvature Tool to draw a "petal". I draw a curve, then reflect it about the vertical axis. Join the top and bottom control points with **Ctrl+j**. Then use the rotate tool (with **Shift** down) to make a copy 45° away, then **Ctrl+d** six times for a total of 8 copies of the petal, symmetric around the circle in the center.



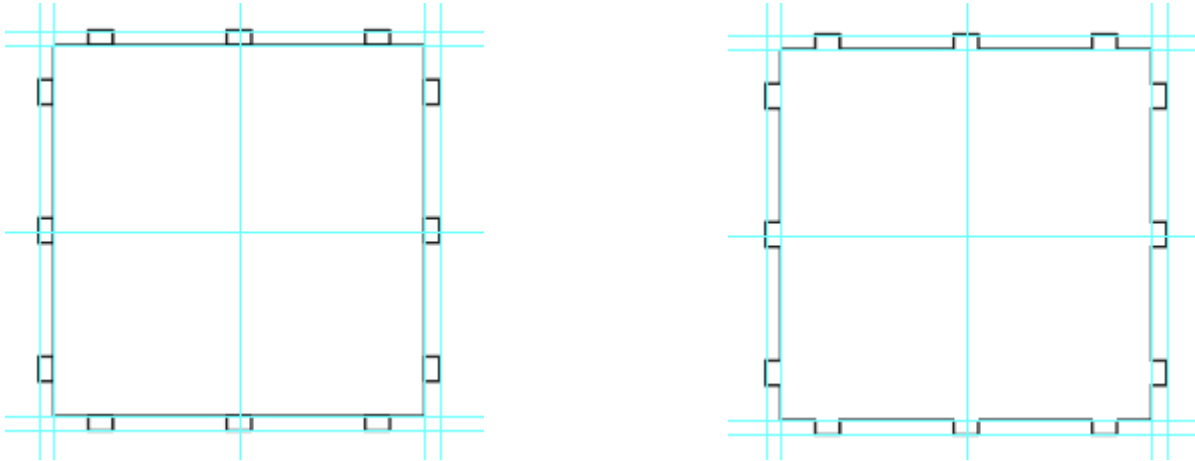
To dress up the side a little more, I create a new guide through the center but 22.5° away from vertical (to place it between two petals). I use that guide and the Rotate Tool to put some extra circles around the petals. I also need a way to attach the sides together and to attach the bottom (which is 20mm up from the bottom of the feet).

For the sides, which are 100mm tall and 3mm thick, I'm going to cut tabs 25mm tall by 3mm wide on both sides that will mesh with one another. For the bottom I'm going to cut 5mm by 3mm holes that will accept tabs of that shape in the bottom.

From a standpoint of laser cutting, this will cut out the sides as the skinny rectangles will fall off, but to make things look prettier and eliminate a few cuts, I used the Pathfinder Tool (Minus Front function) to simply cut the rectangles out of the shape of the side.



Now for the bottom. I create a new set of guides that allow me to draw a 75mm square and then copy the 3x5 rectangles from the side and place them around all sides, carefully aligning the rectangles so that the tabs will line up with the holes that are cut in the sides. In this case, I really need to use the Pathfinder Tool so that the tabs won't just fall off. I use the Unite function to combine the tab shapes with the bottom shape.



Step 6, Preparing for the Laser Cutter

We need four copies of the side and one bottom. This is simply done with the Selection Tool, and **Alt**+drag. The print driver for the Laser Cutter uses the stroke width to decide whether to cut a line so we select everything and use the selector at the top of the window to set stroke width to 0.07pt.

Now we can head to the Laser Cutter.