

# **Advanced FX Draw Concepts**

**The Mathematics Teacher's Drawing Program**

# **Advanced FX Draw Concepts**

**User's Guide**

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*by Efofex Software*

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# Advanced FX Draw Concepts

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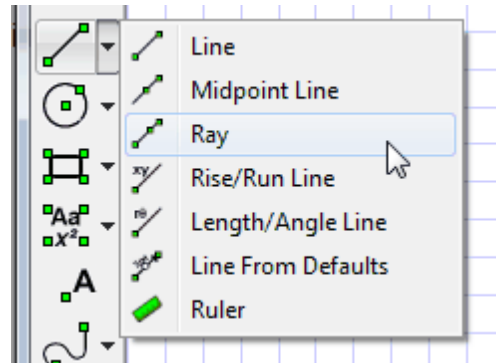
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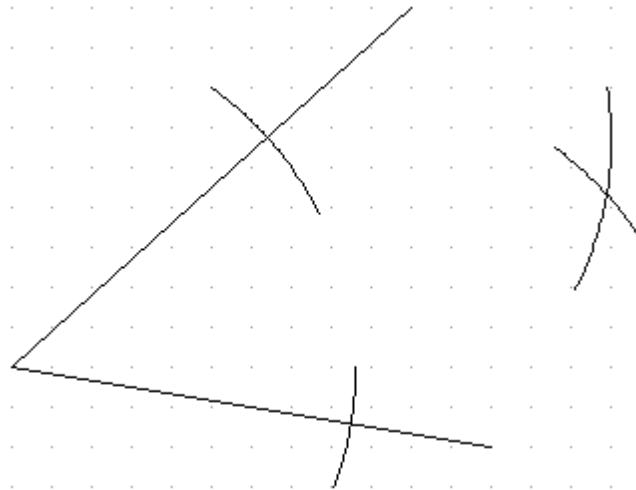
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## 1 The Ray Tool

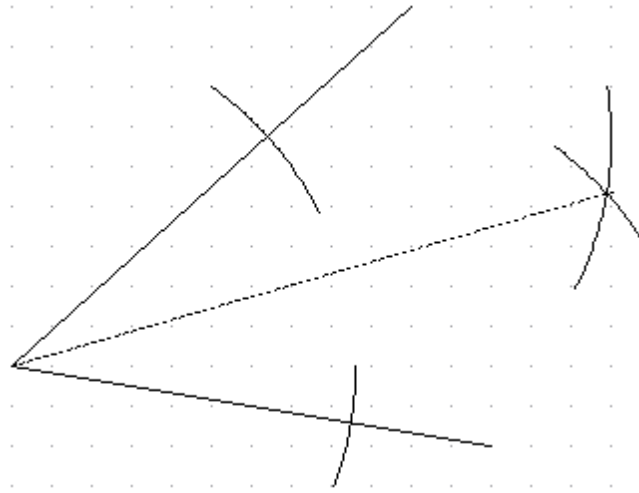


The ray defines a line using **three** points - which is a bit unusual for a line! A good use for this tool is for drawing constructions.

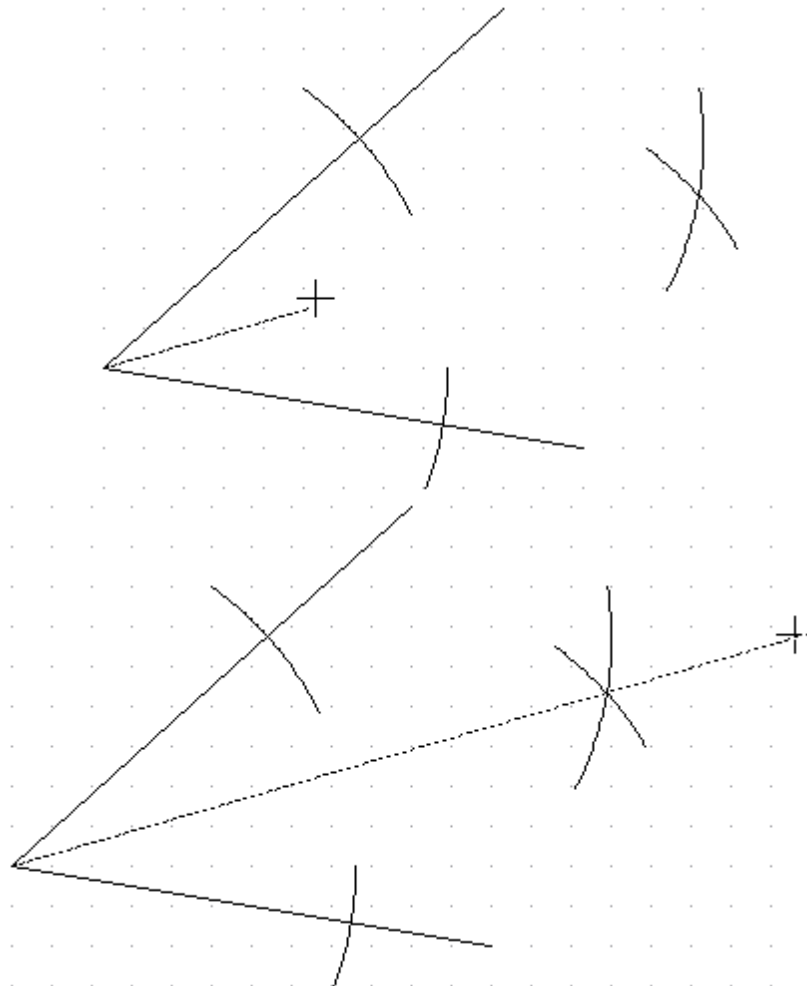


When drawing in the angle bisector, you are likely to want to extend the line past the intersection which is a little difficult with the standard line tools. This is a great time to use the ray tool.

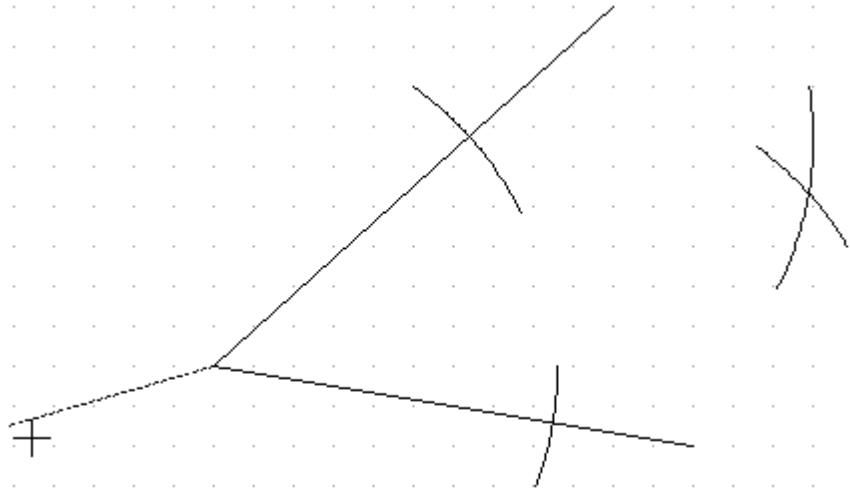
The ray tool is easier to use than to describe. To begin with, you draw a line to the intersection. This defines the angle of the line.



Now that you have defined the angle, if you move the mouse you should notice that the line changes length. It is always on the same angle - just the length has changed.

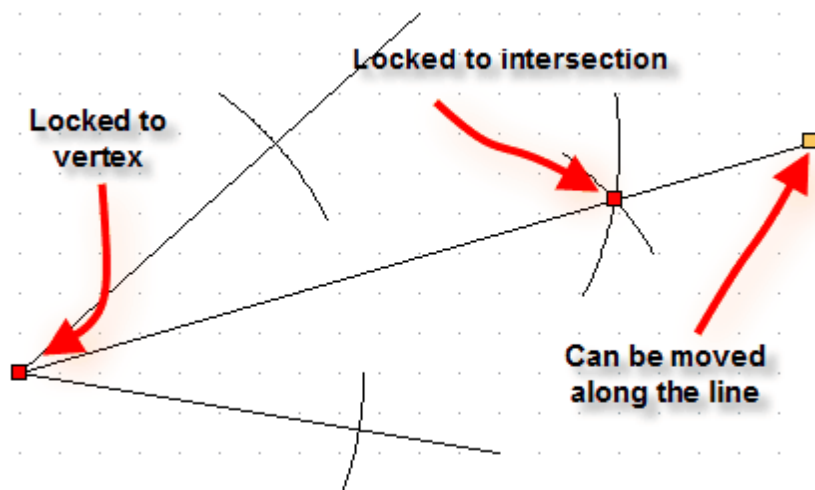


The line does not even need to be in the same direction.



Click again and your ray will appear.

If we select the ray you will see three selection squares.



## 2 Drawing a Square

One thing we are often asked is how to draw a square.

The answer is simple. When drawing many figures, holding down the SHIFT key forces the figure to a square.

Try it. Select the rectangle tool and start drawing a rectangle. Move the mouse around *WITHOUT* releasing the button and you will see the rectangle being dotted out. Now push the SHIFT button (still holding on to the mouse) and you will *NOT* be able to draw anything but a square.

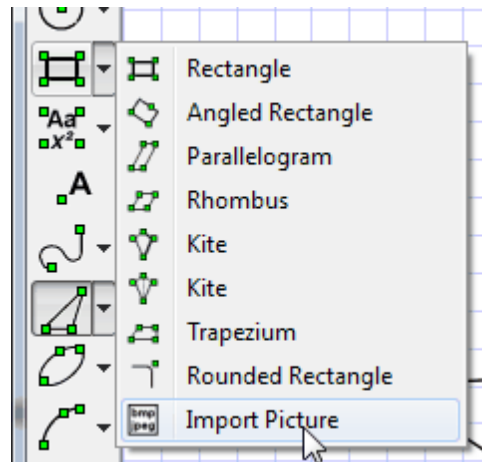
The same principle applies when drawing

Function Graphs

Statistics Graphs  
Grids  
Normal Distribution Curves  
Venn Diagrams (slightly modified for 2 circle Venn diagrams)

Holding down the SHIFT key has another important use that we will discuss later.

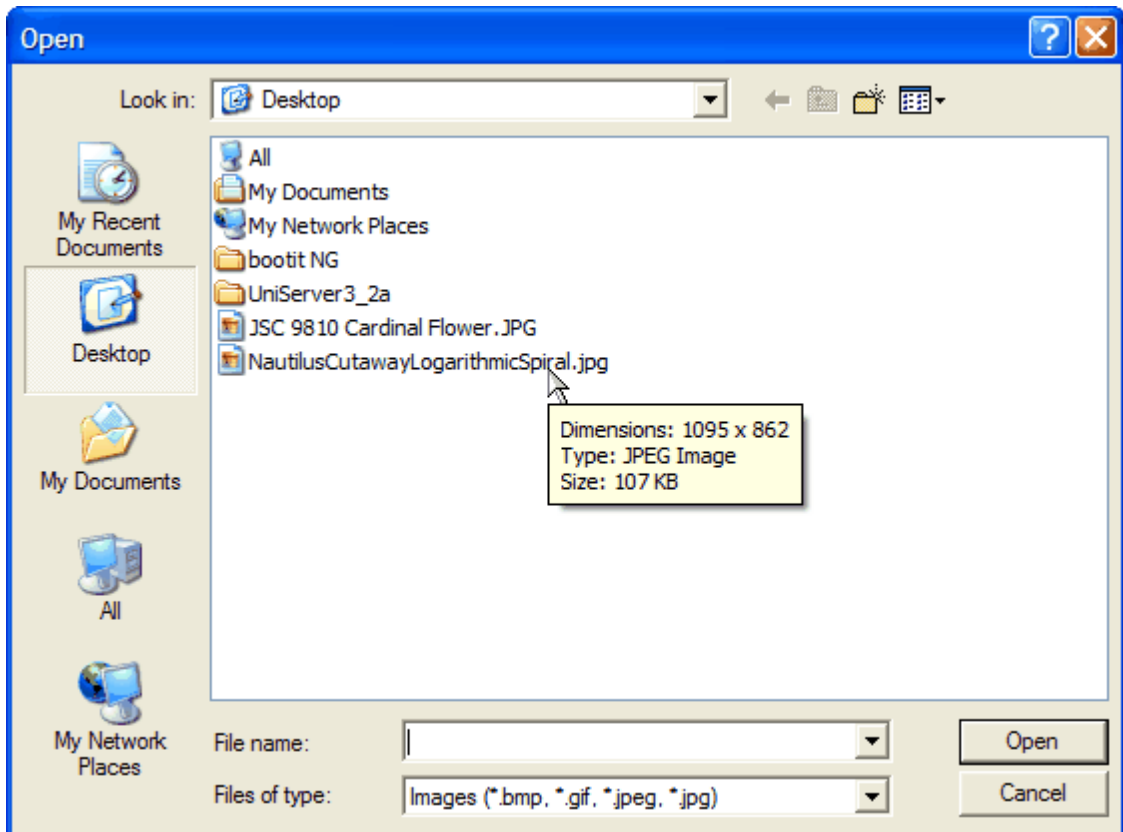
### 3 Using Bitmaps



Sketch out a rectangle that the bitmap will be placed into.

FX Draw will display a dialog box so you can choose a bitmap.



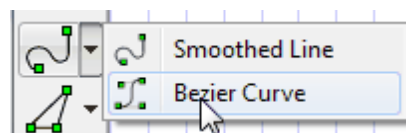


Select a file and click on Open

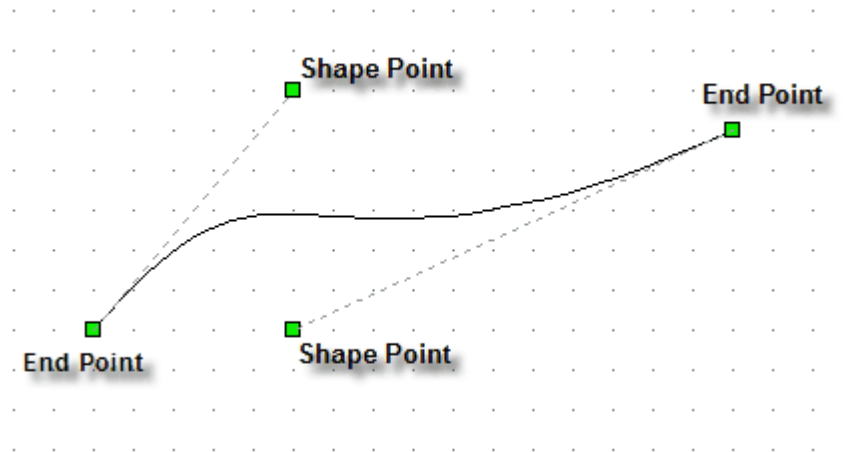
FX Draw will adjust your rectangle size so that the loaded bitmap maintains its original aspect ratio. Once loaded, you can select and resize the bitmap.

Alternatively you can PASTE a bitmap directly into FX Draw.

## 4 The Bezier Curve Tool

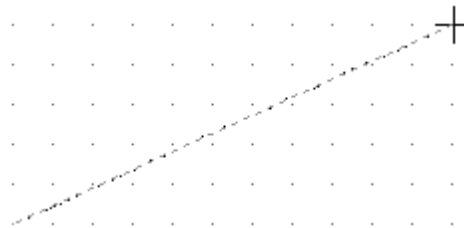


Bezier curves allow you to draw most curves. Four points define a Bezier curve. The first two points define the beginning and the end of the curve. The second two points define the shape of the curve.



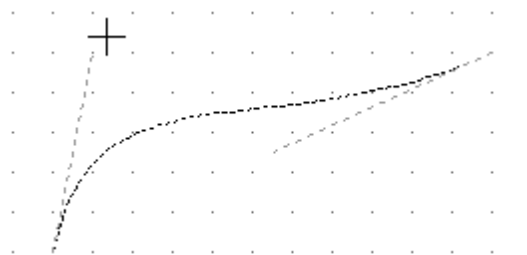
To draw a Bezier curve:

Mark the two end points in the same way you would draw a line.

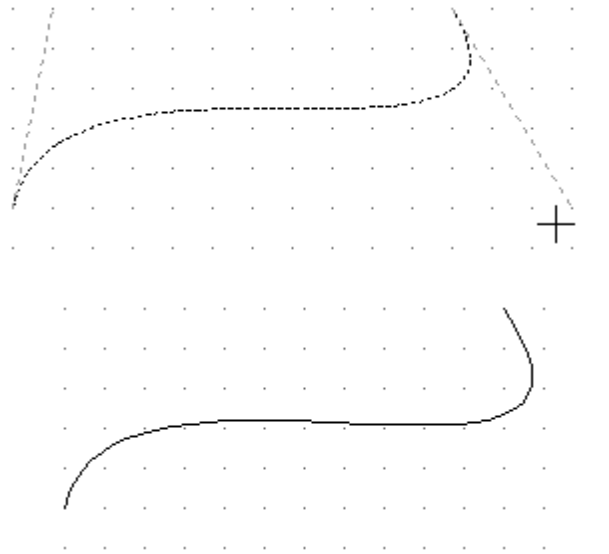


You should now have a line on the screen – but you haven't finished yet. You need to define the last two points.

Click and HOLD the left mouse button and start moving the mouse. You will see a line from your start point to the mouse location. This line helps you define the curve – it will NOT be show when you have finished.



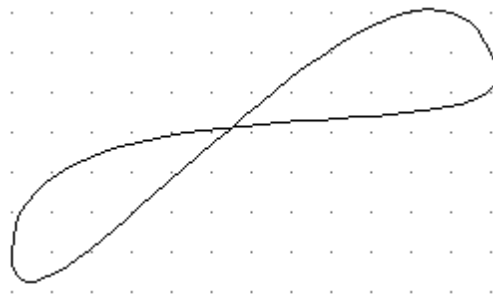
Now repeat for the second line going to the other end of the curve.



Now for the technical parts:

The curve will be tangential to the two lines at the two end points. The amount of “curve” is dependent on the length of the tangents at each point. By moving the two tangent lines you can define just about any curve.

If you want to join two Bezier curves together, you can make the two tangent lines parallel at the join and the join will be smooth.

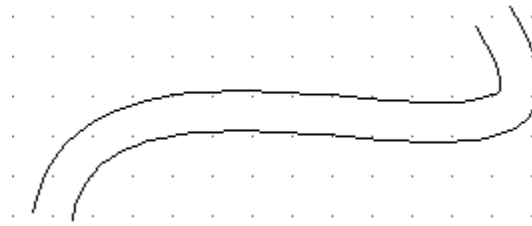


Draw a few Bezier curves to get a feel for the tool.

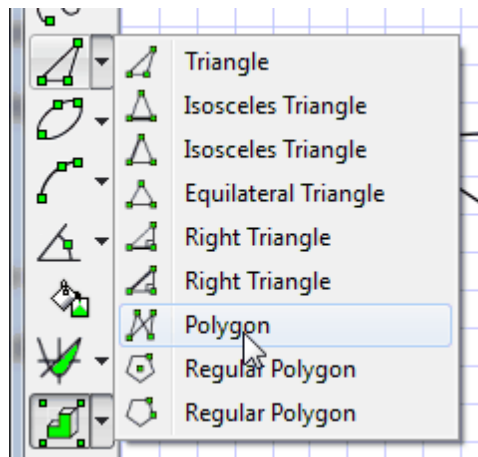
Right click on a Bezier curve to see the properties. The main properties are arrowheads and double or triple lines.

Arrowheads operate identically to arrows for lines with one important difference – finding the middle of a Bezier curve is VERY computationally intensive. If you have arrowheads in the middle of a lot of lines things will get VERY slow.

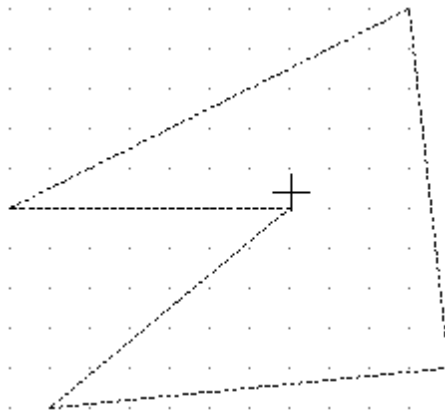
You can also ask FX Draw to draw the Bezier curve as a double or triple line. This allows you to draw “roads”



## 5 Polygons



Select the tool and start drawing. Every time you click the mouse, you define a vertex. FX Draw will always close the polygon automatically for you.

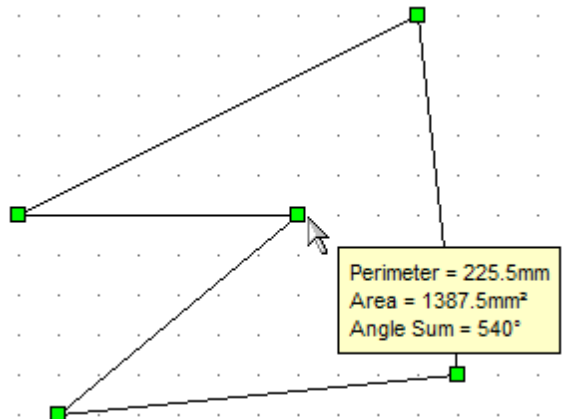


There are two ways of telling FX Draw you have finished. You can either double click on the LAST vertex or you can right click ANYWHERE. Right clicking has the advantage of keeping the polygon tool selected.

Try drawing a few polygons to get the feel for the tool.

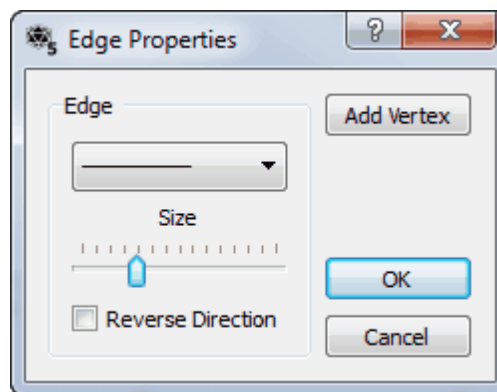
You can change your polygon by selecting it. When selected, you should see a selection square on each vertex. These squares can be moved to change the

polygon's shape.



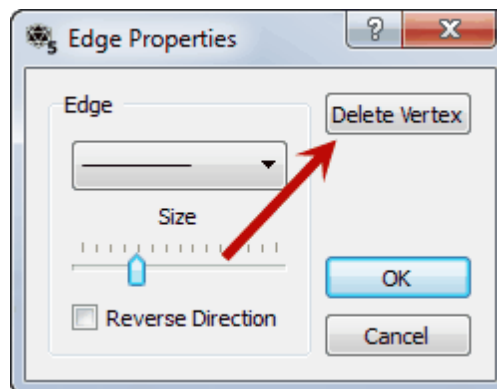
You can add and remove vertices from an existing polygon.

To add a vertex, RIGHT click anywhere on the polygon where there is no existing vertex - then press the Add Vertex button.



You can also add a mark to the edge - just like a rectangle.

To remove a vertex, RIGHT click on it.



## 6 Setting the Default Line Style and Fill



You are probably already adept at using the Line Styles and Fills controls. If you select an object, these controls allow you to adjust how the object is drawn.

What you may not know is how to set a default line/fill style.

Simple.

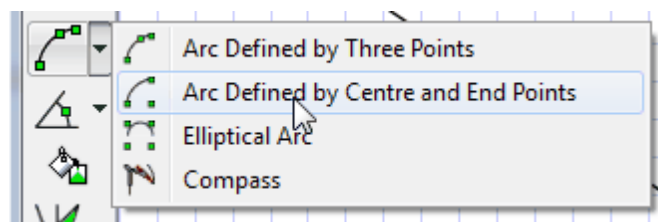
Choose the select tool and click on the canvas in a location where there is nothing to select. In other words, select NOTHING.

Now any changes made to the line and fill controls will become the new default settings for any new objects.

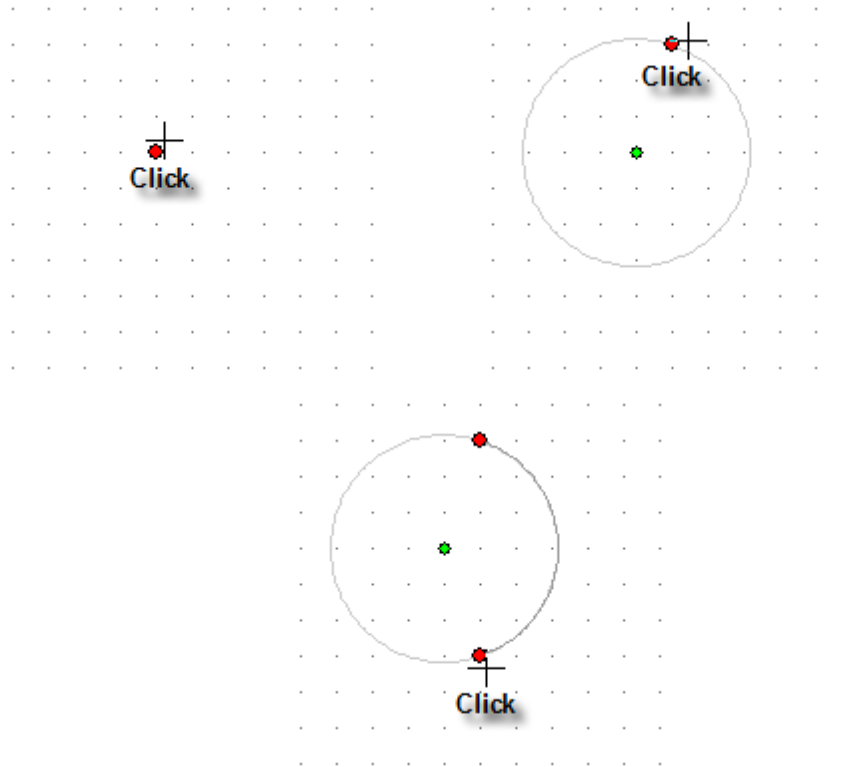
## 7 Arcs

FX Draw has four arc tools that allow you to draw circular and elliptical arcs. Most of the tools operate in a similar way to other tools but there are two unique things worth knowing.

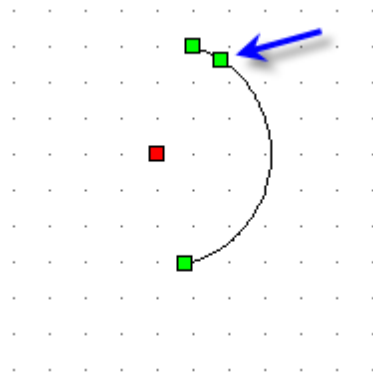
### Centre / End Points Arc



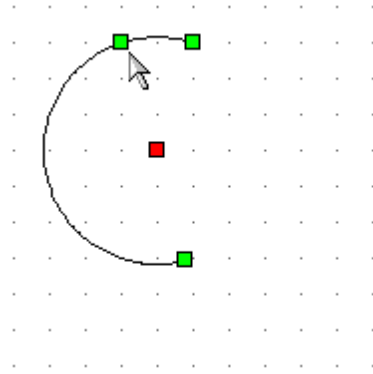
The Centre / End Point arc tool defines an arc by three clicks - on the centre and the two end points of the arc. FX Draw shows you the circle the arc will fall on in light grey and shows the arc you have defined in dark grey.



Draw an arc and select it. You should notice something interesting. There is an extra point, on the arc, that you never marked.



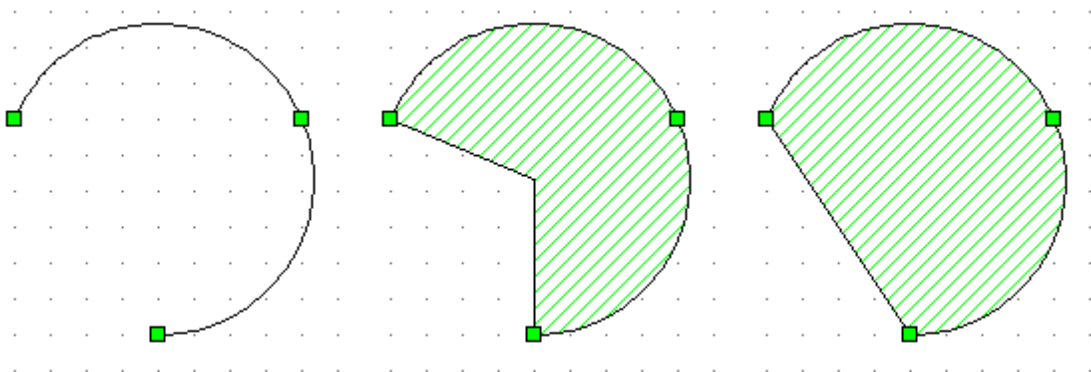
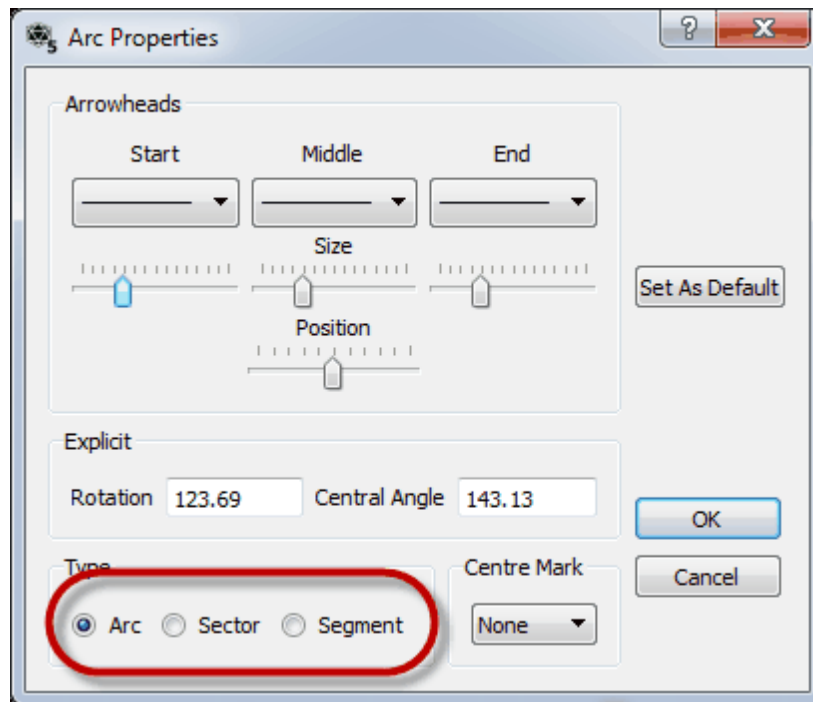
The problem with centre / end point arcs is that the centre and two end points actually define **two** arcs - the minor one shown and a major one. By moving this extra point, you can change the arc from minor to major.



This concept also applies to elliptical arcs.

### Secants and Sectors

Arcs can be turned into secants and sectors. Right click on the arc.





As shown above, sectors and segments can be shaded.

## 8 A GAD Trick

You may have wondered how FX Draw chooses which geometrically interesting point to jump to. The actual process is quite complex but in essence, each point is given a “mass” based on “importance” (for example, the middle of a line is considered more “important” than the point one third along the line). FX Draw then calculates an “attraction” in much the same way as gravity—attraction is based on mass divided by the square of the distance. The most “attractive” point wins.

Sometimes this system can cause a few problems when there are a lot of geometrically interesting points around. A very important point may not win the attractiveness competition because you are so near another, less important point.

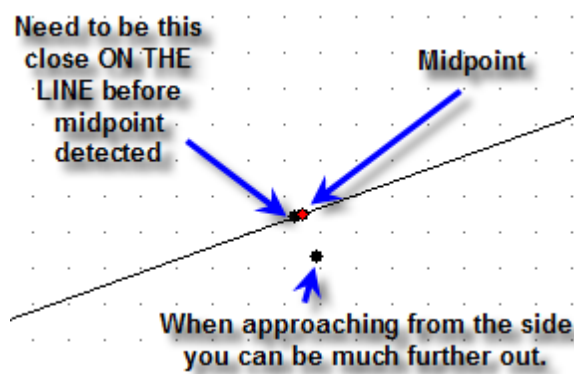
The practical impact of this is that sometimes you can find the important point you want BY MOVING SLIGHTLY AWAY FROM IT.

As a simple example, draw a line.

First, try to get the midpoint of the line by moving the mouse as accurately as you can ALONG the line. In other words keep the mouse cursor ON the line while you are trying to find the midpoint.

You should find that there is a relatively small range where FX Draw will find the midpoint. Most of the time it will report that it has found a Point on the Figure. Points on Figures are much less “important” than midpoints BUT because you are very close to the figure, they become very attractive.

Now approach the midpoint of the line from the side (perpendicularly). You should find that FX Draw finds the midpoint a LOT further out.



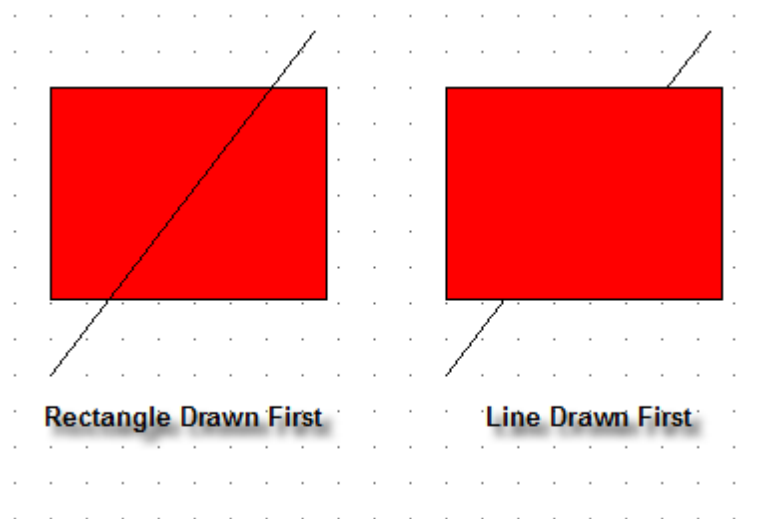
## 9 Drawing Order

As you create a diagram, FX Draw remembers the order that you drew the figures in. When it draws your diagram, it will draw each individual figure in the same order as you created it in.

Most of the time the order does not matter. It DOES matter when a figure has been filled.

Try drawing a line and then a filled rectangle that covers part of the line. The line should “disappear” under the rectangle.

Now draw a filled rectangle and then a line that crosses over the rectangle. The line will be visible on top of the rectangle.



Different drawing orders can dramatically change how your diagram looks. FX Draw allows you to change the drawing order of your figures.

The Drawing Order toolbar lets you change the drawing order of figures in your diagram.



The first button moves the currently selected figure to the front of your image. It makes the selected figure the LAST thing drawn.

The second button moves the currently selected figure to the back of your image. It makes the selected figure the FIRST thing drawn (and hence the most likely thing to be covered up later).

The third button moves the selected figure one level towards the front of the image.

The fourth button moves the selected figure one level towards the back of your image.

Using these four buttons you can exert a large amount of control over how your diagram is drawn.

## 10 Maintaining The Aspect Ratio of a Gallery Image

Whenever you select a gallery image to draw, FX Draw will place the image into the rectangle you sketch out. Sometimes this is not appropriate.

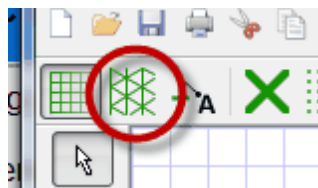
Some diagrams rely on a particular aspect ratio (height compared to width) so that they appear correctly – an example is the pulley diagrams in Dr Mark Dabb's gallery available on our website.

Holding down the SHIFT key while drawing your gallery image forces FX Draw to use the same aspect ratio as the original creator of the image. You can force FX Draw to draw it as the diagram's creator intended.

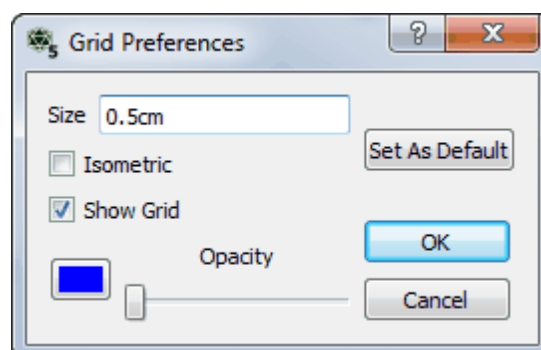
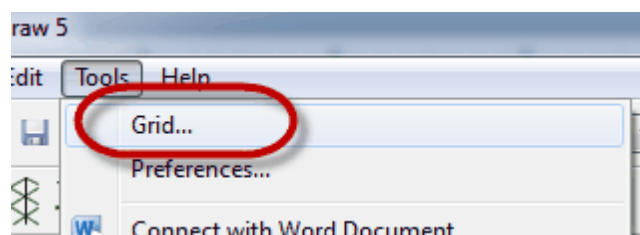
## 11 Drawing Isometric Diagrams

By default, the underlying grid is a Cartesian grid with 5mm spacing. You can change it to be an isometric grid that makes drawing isometric diagrams MUCH easier.

Push the isometric grid button.



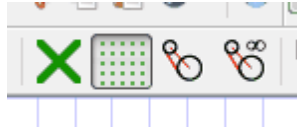
Alternatively, go to the Tools menu and choose Grid...



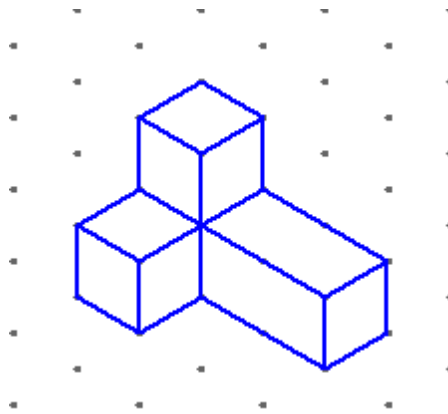
Second, set the grid size to something bigger – we suggest 10mm or larger – as 5mm is too small for isometric diagrams.

Finally put a tick in the Isometric checkbox.

It is best to turn GAD OFF when drawing isometric diagrams. Go to the GAD toolbar and push the grid button.



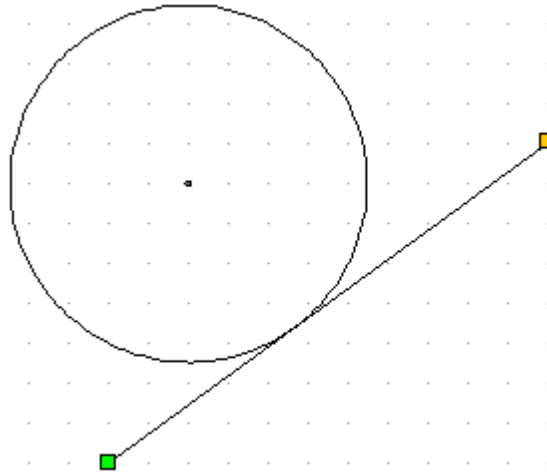
Your cursor will now jump to the underlying isometric dots and isometric drawing is easy.



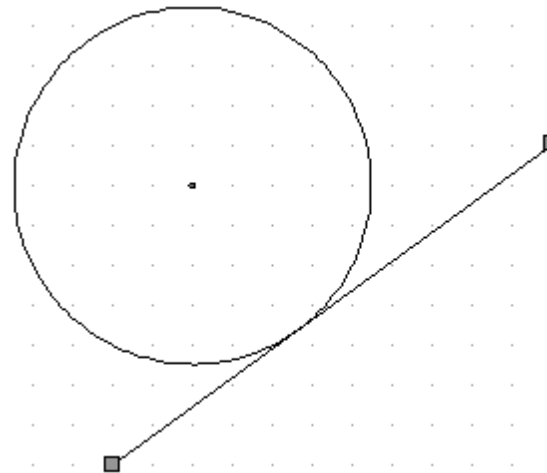
## 12 Locking Figures

If you have carefully placed a figure in exactly the right spot and want to make absolutely sure that you don't move it accidentally, you now have the option of locking it.

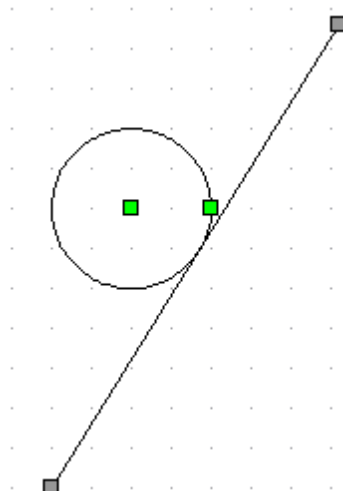
Draw your diagram and select any figures you want to lock.



Now press the lock button and the figure will be locked in place. FX Draw will change the squares to grey to show you that they are locked.



This line is now locked in place and you will not be able to move it at all apart from one important exception - it will still remember and use any GAD Links that were used. Even though you will not be able to directly move the line, if you change the circle, the line will remain tangential.



You can unlock any locked figures by selecting them and clicking on the lock button.