Vector Graphics

Objects

- Vector graphics are stored as objects that have a variety of characteristics:

  - Node or vertex points (X,Y or X,Y,Z) stored as cartesian coordinates

  - Stroke

  - Fill

  - Misc properties (material type, etc)

Display

- The display resolution of vector objects is purely a function of the resolution of the output device and any scaling factor.

- A screen is a low resolution device while an inkjet printer might be a very high resolution device.

Position

- Since vector graphics are stored as a series of cartesian coordinates, vector objects can be translated, scaled and deformed by simply performing operations on the node points.

- Computer displays are raster output devices, so any computer storing vector graphic objects has to render them at the resolution of the screen.

- Graphic display cards are GPUs that can rapidly render raster from vector graphics.

Vector Primitives

- Once a vector primitive is defined it can be modified in almost any way, including but not limited to:
  - Stroke
  - Fill
  - Shape

Points

(x,y)

- Theoretically no stroke & no fill, but are usually drawn with some stroke

- Theoretically occupies no space at all, since it is just a point
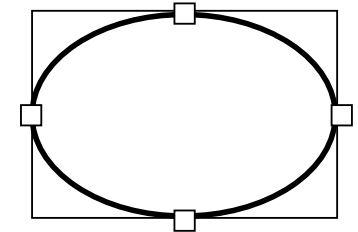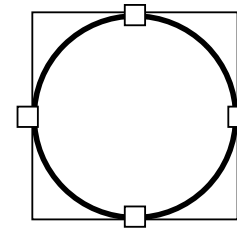
Lines

(x1,y1)   (x2,y2)

- Stroke only - no fill

- Set off by two 'end', 'vertex' or 'node' points

Circles/Elipses Arcs

- Have stroke and fill

- Based on tangent fit within rectangles

- Rarely based on a centroid and circumference (only good for perfect circles)

- Arcs are a special case of a circle with only part of the perimeter stroked.

Polygons/Polylines

- Have stroke and fill

- Defined by a series of node points

- Polygons are closed

- Polylines are open *

- Some display languages limit the number of nodes per polygon

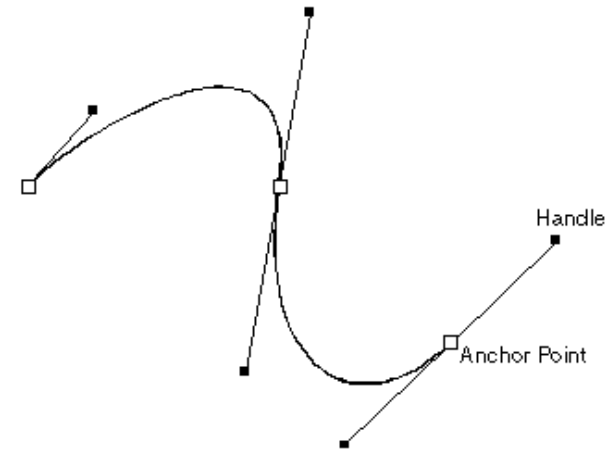(x1,y1)   (x2,y2)

(x3,y3)

(x1,y1)   (x2,y2)

(x3,y3)
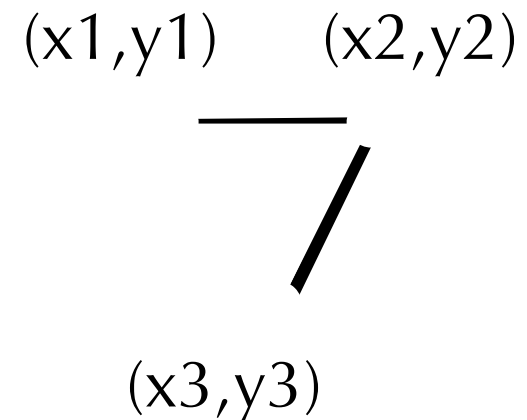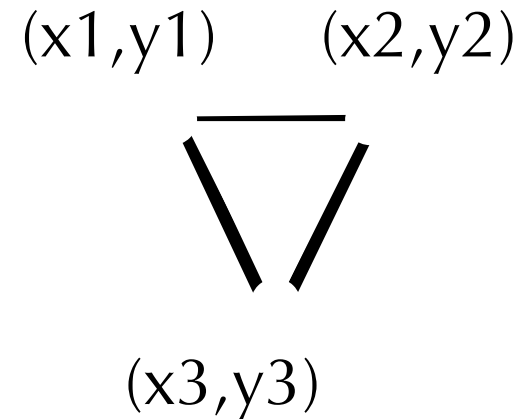
Curves and Polygons

- Polygons are made up by straight line segments. Very smooth curves can only be drawn with a vast number of node points to approximate the smoothness.

- The higher resolution the output device, the worse a polygon will fit a smooth curve.
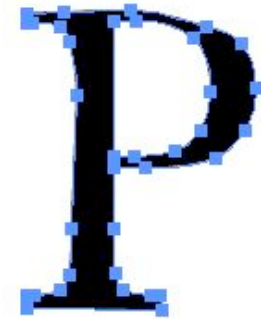
Bezier Curves

Handle

Anchor Point

- Bezier curves allow smooth curves to be drawn merely by storing anchor points and the ends of tangent lines to those curves.

Bezier Curves
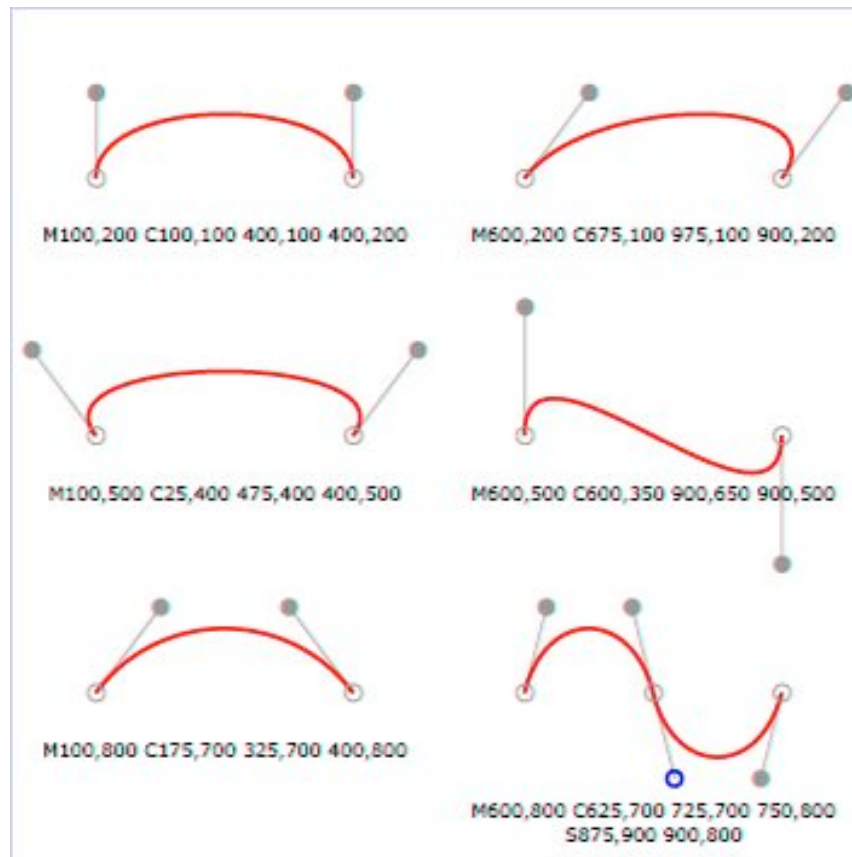
Fonts

- Fonts on modern computers are stored, more or less, as bezier curves with 'hints' about how to draw the character at different font sizes.

- This greatly facilities scaling, rotation and deformation of font characters.

Operations

Ordering

- Vector objects are rendered in the order they are in the display list.

- Since you might want to change the list position of vector objects programs will allow you to move the objects forward and back within the display list.
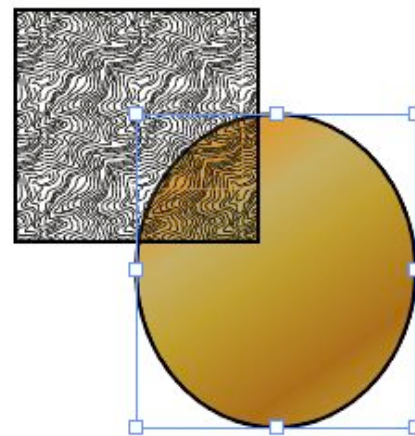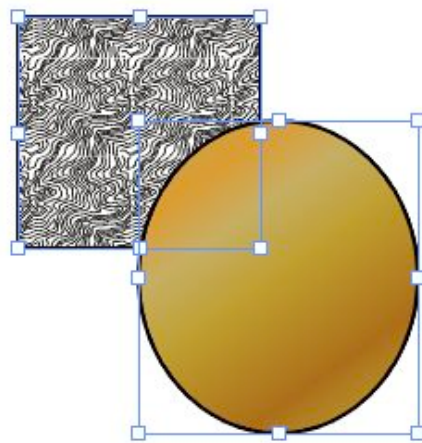
Grouping

- Complicated objects can be constructed by 'grouping' vector objects that have been made.

- Once grouped all the component vector objects act together as a single object.

- Selection tools are available that you select a single vector object within a group.

Grouping
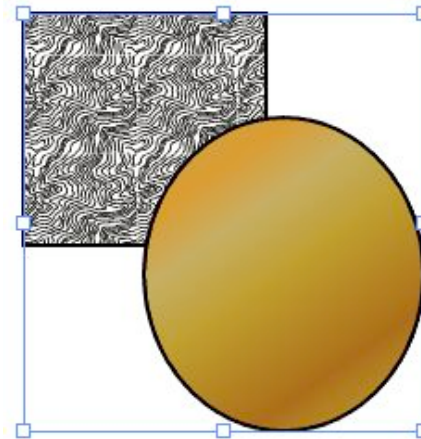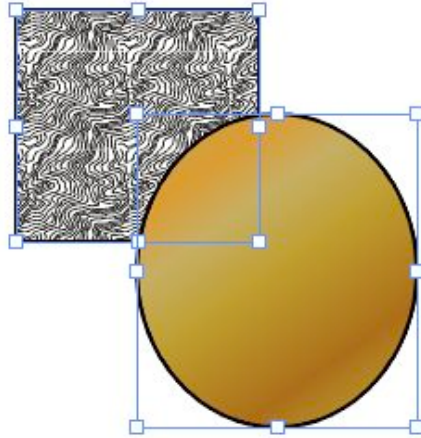
Assignment

- Make up a fictional map that fits a single page of paper.
- The map should have:
  - Map name and your name
  - Date
  - Bar scale
  - Legend
  - Appropriate labels
- At the least the map should contain:
  - At least 4 roads (no more than 2 of the same rank)
  - Mountains
  - At least 4 rivers/streams and a body of water
  - At least 2 cities/villages/urban areas
  - At least 1 pipeline
- Feel free to be imaginative, but this should look like a map and not a cartoon.