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

Stroke only - no fill

Set off by two ‘end’, ‘vertex’ or ‘node’ points

(x1,y1) —— (x2,y2)
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

\[(x_1,y_1) \quad (x_2,y_2) \quad (x_3,y_3)\]
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 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.