

**Exam Question 8 - ICT, CAD & CAM, Systems & Processes**  
(This question is worth 15 marks in the exam)

## Computer Systems

Apart from the specific graphic software such as Image Manipulation Software (e.g. Coreldraw) using computer systems with other appropriate software and hardware can support the designing and making graphical products.

Software typically include:

**Word Processing software to create text**

Edit text and check spelling and grammar

**Use Spreadsheet software to collate numerical data**

Create graphs and charts and model 'what if' scenarios

**Access the internet and world wide web (www)**

Use search engines to find useful information and download resources

**Use of other computer based multimedia resources**

Transfer data from subject based software (e.g. CD ROM's)

Hardware typically include:

**Digital Cameras**

Capture still images and video clip and upload to a computer for editing

**Flat Bed Scanner**

Scan a variety of media onto computer using the optimal resolution

**Printers**

Printing hard copies in mono, colour, and duplex printing format and to different size paper and optimal resolution

In a perfect world, data saved using the above computer systems would be transferable between software packages and computers. Unfortunately it is also necessary to understand different file types so that this can happen. The following is a list of the most common file types that you should learn:

.jpg	Save and compress bitmap files
.tif	Save, transfer and compress bitmap files
.gif	Preserve transparency in an image and for animation
.wmf / .eps	Save and transfer vector files
.dxf	Save and transfer vector CAD files
.pdf	Make transferable documents using vector, bitmap and text elements
.rtf	Save and transfer rich text files
.mpeg	Save and compress video files
.html	Web sites

## Flat Bed Scanner

A flat bed scanner is an input hardware that is commonly used to input images and text into computers. Most scanners have many functions and are able to scan in the following 5 modes:

**LINE ART - BITMAP MODE - ONE BIT MODE.**

Black and white line art only. Line drawings. Scanned image is black & white.

**GREY SCALE - 8 BIT MODE.**

Black and white photos. Shaded drawings. Scanned image uses 256 greys.

**RGB COLOUR MODE.**

Colour photos. Colour drawings. Scanned image uses millions of colours.

**CMYK COLOUR MODE.**

Colour photos. Colour drawings. Only use for images that are going to be commercially 4 colour printed. Scanned image uses millions of colours.

**INDEX COLOUR MODE.**

Use when scanning images for use on web sites. Scans use 256 colours.

The Process of using a scanner is as follows:

1. Know the size the scan will be printed.
2. Know the resolution the scan will be printed.
3. Clean the scanner glass.
4. Use the centre of the glass area not the edges.
5. Place the image for scanning straight on the glass.
6. Close the lid of the scanner
7. Select the scan mode, resolution and scaling factor needed.
8. Scan the image.
9. Save the image into a suitable folder on the computer system.

When scanning it is important that the scanner is set to the correct resolution. Resolution is measured in dpi which stands for dots per inch, the higher the dpi the better resolution and detail within the scan. However it is important not to use too much dpi as this will not result in a better image. Only top quality art books use 400 dpi - there is no need to exceed this when scanning.

In order to get the best scan for the output there are some basic rules:

INKJET PRINTERS	Scan at one third of output resolution.
MONO LAZER PRINTERS	Scan at the output resolution
ON SCREEN DISPLAY	Scan at 72 or 75 dpi.
COMMERCIAL PRINTING	Scan at twice linescreen resolution used by the printer.

### Examples:

An image to be printed on an inkjet printer at 2400dpi should be scanned at 800dpi

An image size 40mm x 80mm to be printed to a size of 60mm x 120mm on a mono laser printer at 2000dpi should be scanned at 2000dpi and scaled up to 150%

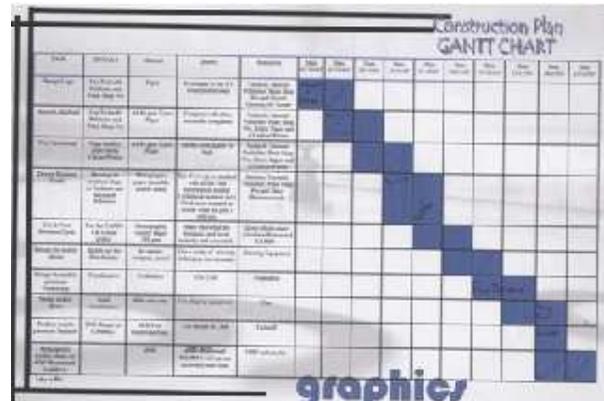
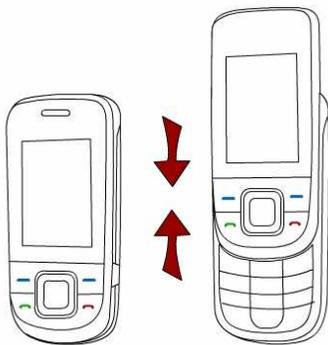
### Duplex printing

Duplex printing is a feature of computer printers that allows the automatic printing of a sheet of paper on both sides. Print devices without this capability can only print on a single side of paper, sometimes called simplex printing.

Systems and processes can be presented and explained in many ways:

- Flow charts  
A flow chart breaks down the steps in order to show in stages the process.
- Sequence diagrams  
Sequence diagrams work similarly to a flow chart it breaks down the steps in order to show in stages using images.
- Story boards  
Story boards use illustrations and images to show a sequence showing motion, story boards often resemble cartoons.
- Gantt charts

A Gantt Chart is normally used to plan a schedule, planning tasks against time.

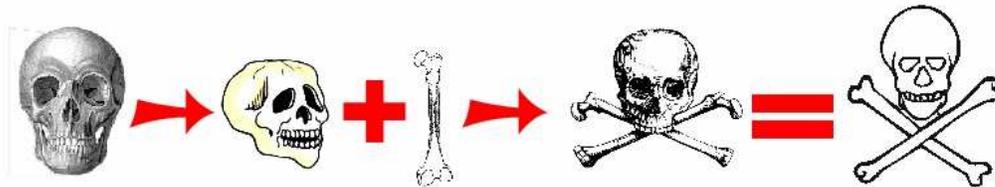


Tip:  
When presenting work expressive arrows can add interest and direction of movement.

Signs and symbols are all around us from warning symbols, direction signs, remote control, buttons...most have been developed and simplified to convey their message in a much simpler form.



The process of designing a symbol involves simplification.



Representing data graphically can make the data easier to read and analyse. There are four main charts.

- Line chart  
A line chart represents data by joining the data points together with a straight line. Line graphs are used to track changes over short and long periods of time
- Bar chart  
A bar chart represents data by long bars these can be either vertical or horizontal. The bars must be equally spaced.
- Pie chart  
A Pie chart represents data in a circle; proportions of the circle represent the data.
- Pictorial chart  
A pictorial chart represents the data by using symbols or picture, sometimes they are also called pictograms.



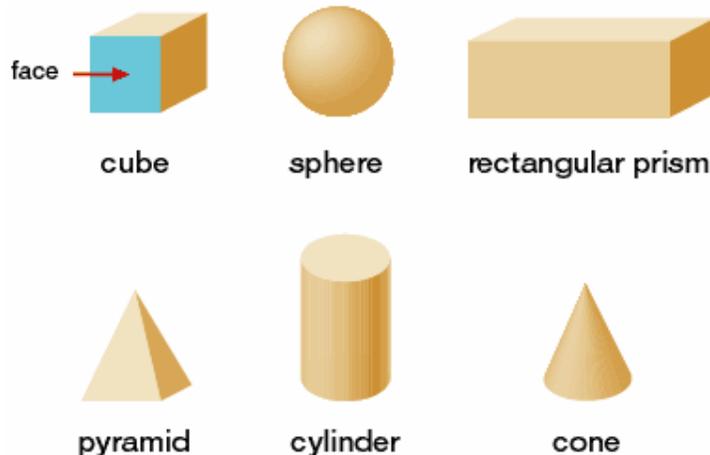
Graphical detail can bring out designs; small touches can improve the appearance of sketches, presentations and drawings such as

- **Weighted line**  
Is a dark line applied to the outside of a drawing enhances the shape lifting it from the paper.
- **Shadows**  
Shadows and shading are used to enhance the realism of a shape often to make shapes more 3D
- **Backgrounds**  
Backgrounds can give a sense of depth to a drawing Is a dark line applied to the outside of a drawing enhances the shape lifting it from the paper.
- **Rendering**  
Rendering is the application of shade, texture and colour to gives a drawing a sense of realism. Rendering can be done manually by using colouring pencils, magic markers, pastels, watercolours... but rendering can also be done digitally often used as a presentation drawing. Rendering must reflect the material and finish.

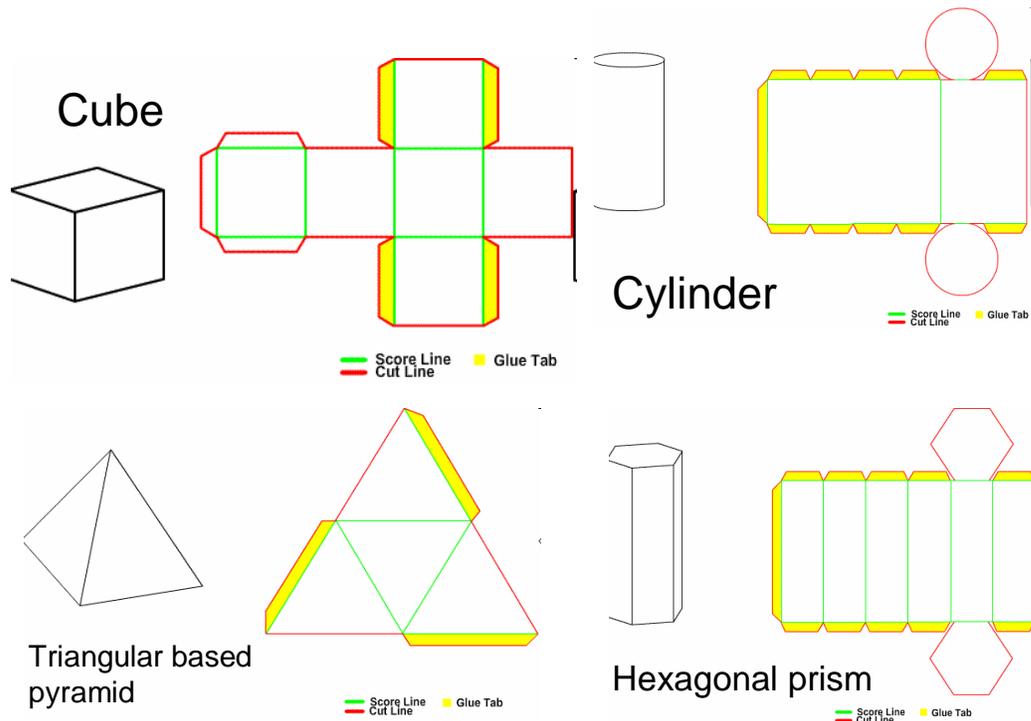
### Solid / Plane Geometry

#### Simple Boxes and NETS

Solid shapes can be described as cubes, spheres, prisms, pyramids, cylinders and cones. These shapes are useful when designing packaging within Graphic Products. The solid shape can be created into a net with glue tabs and closure points. When constructed the shape appears solid from the outside but is in fact hollow so that it can contain a product of some kind.

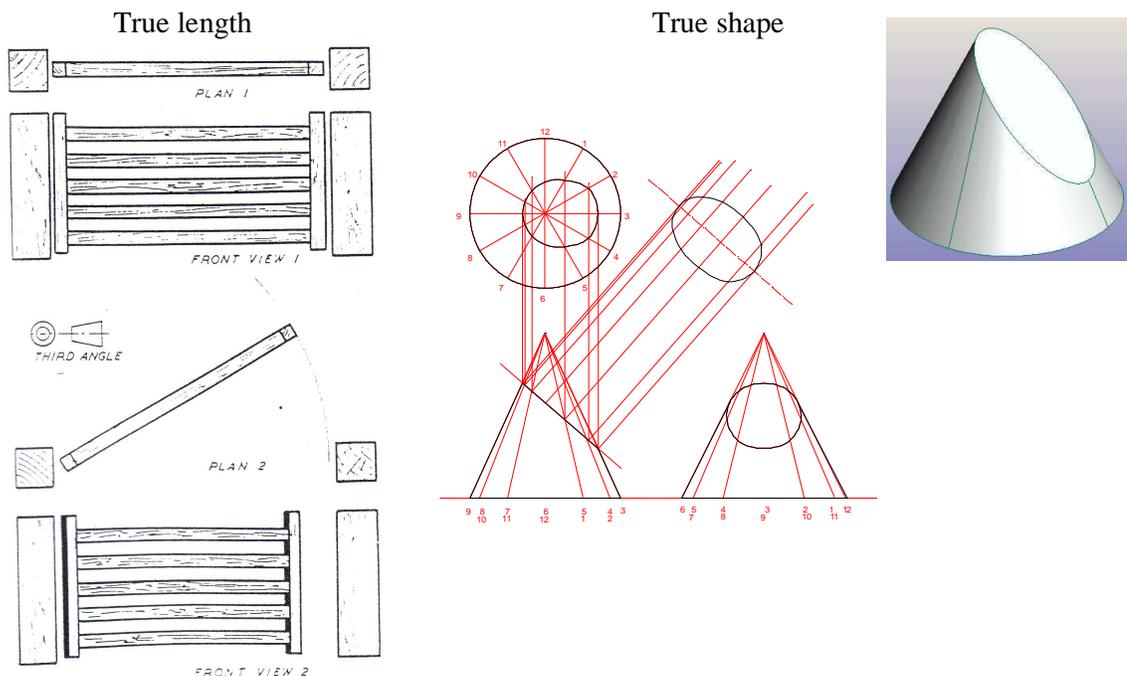


Packaging of this form can then be coloured and graphics added ready for printing. Once printed it can be cut out using a CAM machine such as a lazer cutter or by hand using a craft knife, cutting mat and safety rule.



### True Lengths & True Shapes

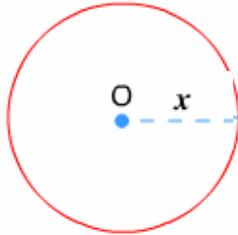
The true length of an object is often obstructed by a particular view point. The example of a gate below highlights this point, Looking straight ahead at a closed gate gives you an idea of the true length however if it is open your view changes and the gate looks shorter.



## Loci

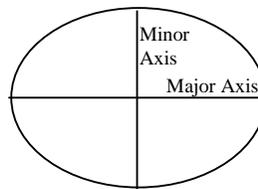
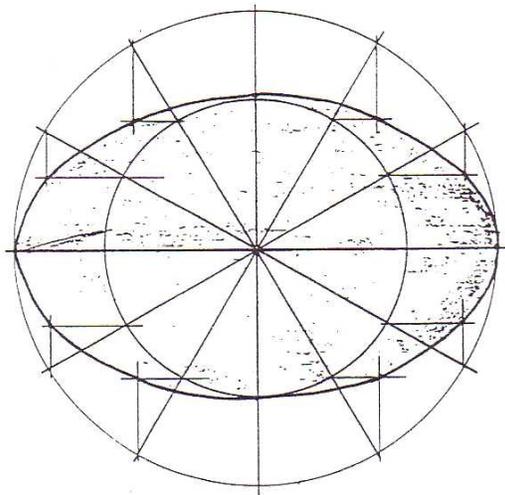
A locus is the path of movement and the plural for locus is loci. A locus is a path. The path is formed by a point which moves according to some rule.

The locus of a point moves so that it is always a set distance (x) from a fixed point (O). In the example below, the resulting shape will be a circle.



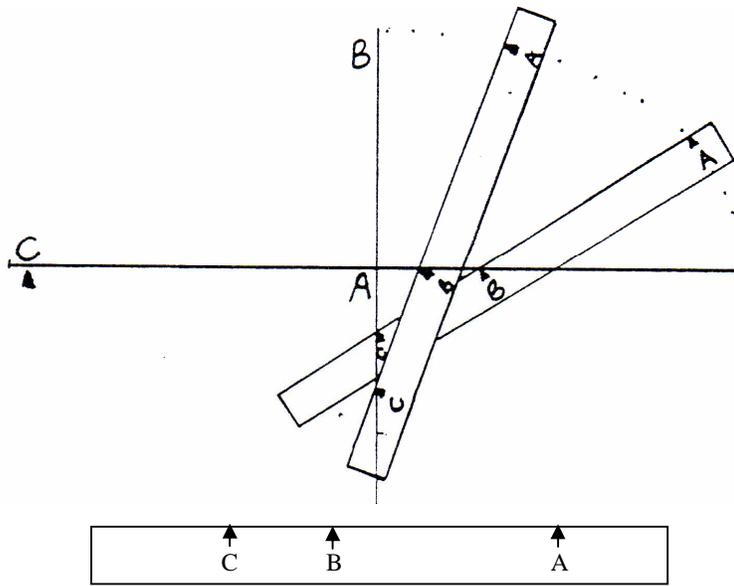
## Construction of ellipses

### Concentric Circles Method



1. To construct an ellipse you need to know the value of the major and minor axis
2. Set your compass to  $\frac{1}{2}$  the major axis and draw a circle. Do the same with the minor axis, using the same centre point
3. Divide your circle, using a set square ( $60^\circ - 30^\circ$ ) into 12 equal parts
4. Where these dividing lines touch the major axis circle, draw vertical lines
5. Where these dividing lines touch the minor axis circle, draw horizontal lines to meet the new vertical lines, where they meet mark with a dot
6. Join the dots carefully to provide an ellipse

## Trammel Lines Method



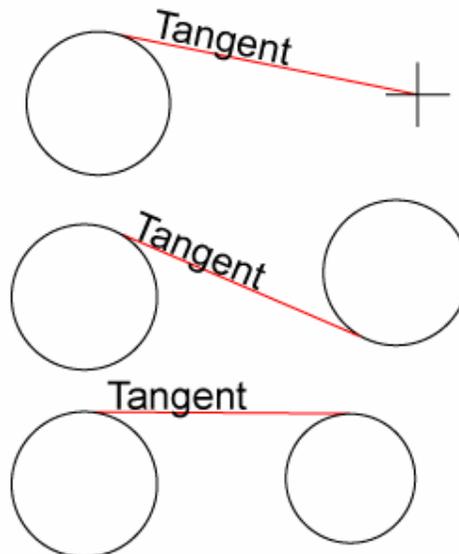
1. Firstly draw your major and minor axis at  $90^\circ$  to each other
2. Using a strip of paper for your trammel mark distance A-C (which is half the major axis) and A-B (which is half the minor axis)
3. Place the trammel so that C always remains on the minor axis and B always remains on the major axis, A is the outline of your

ellipse. Mark dots off along for outline

4. Take care when joining the dots to create the outline of your ellipse.

## Tangents

A tangent can be a line or curve that touches another surface such as a circle. A tangent is a straight line that touches the outside of a circle at a point.



## Orthographic Drawing

Orthographic drawing is a way of drawing a three dimensional object. Normally the object is drawn as three separate, related views - Front View, Side View and Plan View. Although more views can be drawn if required. This style of drawing is called

**ORTHOGRAPHIC DRAWING.** This system of orthographic drawing is used around the world and is the standard for designers.

The drawing below shows the front, side and plan views of an iPod Nano. Look carefully at the position of each of the views. The front view has been drawn first because it has most of the detail and the side view is drawn next. Last the plan view is drawn directly above the front view. Extra views can also be drawn to show information. All of the views line up with one another.

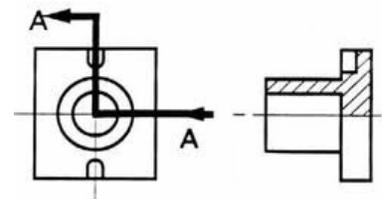


Symbol: Third Angle Projection

It does help to plan what you will be drawing before you start. This would involve working out the sizes if you are designing a new product or measuring something you are going to draw. In order to draw the iPod Nano orthographic drawing a sketch was made and dimensions were added to it to plan it out. The views to be drawn were also planned out.

Drawings in orthographic that are either too small or too large to fit on a piece of paper can be drawn to scale e.g. drawings larger than actual size would be written as 2:1, 5:1 etc. while drawings smaller than actual size would be written as 1:2, 1:5 etc.

These kinds of drawings are drawn when you want to show what the inside of something looks like. A section is a drawing that cuts through the product at a particular place. The cut point or section is usually marked with diagonal lines where the product is sectioned.

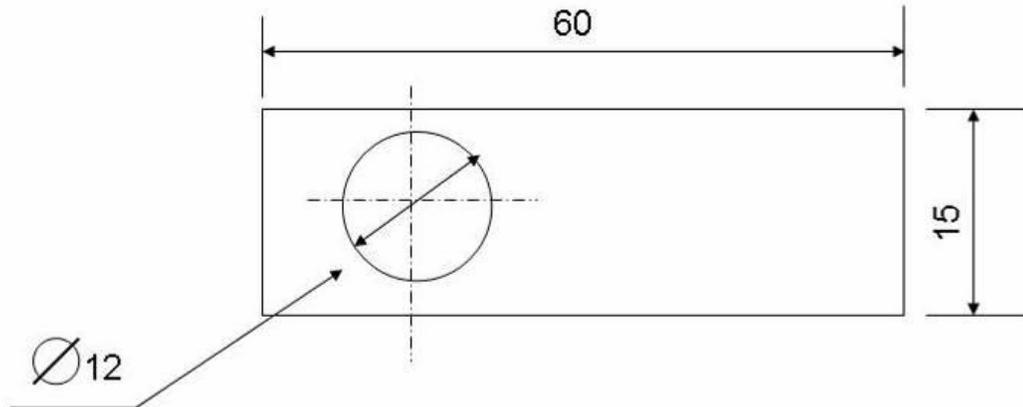


Dimensions or measurements are added to the completed views on the orthographic. They usually show enough dimensions for the product to be manufactured. The key dimensions are always added. This enables anyone looking at the orthographic drawing, to work out the overall size of the object. More dimensions can be added if necessary. Dimensions are drawn on each of the views. The unique thing about this style of drawing is that they can be understood across the world no matter what language you speak.

Dimensioning Standards.

These are a set of rules that are followed from British Standards.

- Always use millimetres.
- Use the number only.
- Millimetres are the standard measurement used in British Standards.
- Put your numbers above the dimension line and in the middle.
- The words ALL DIMENSIONS IN MMS should appear on your drawing.



- All vertical dimensions are written on the left of the dimension line.
- When dimensioning a circle's diameter use this symbol  $\varnothing$ .
- The Radius would read - R6.

Pictorial drawings

A Pictorial drawing (often referred to as an artists impression) is a drawings (sketched or computer generated) that shows what a product will actually look like when made. Usually the following drawing methods are used:

- Perspective Drawing
- Isometric Drawing

## Perspective Drawing

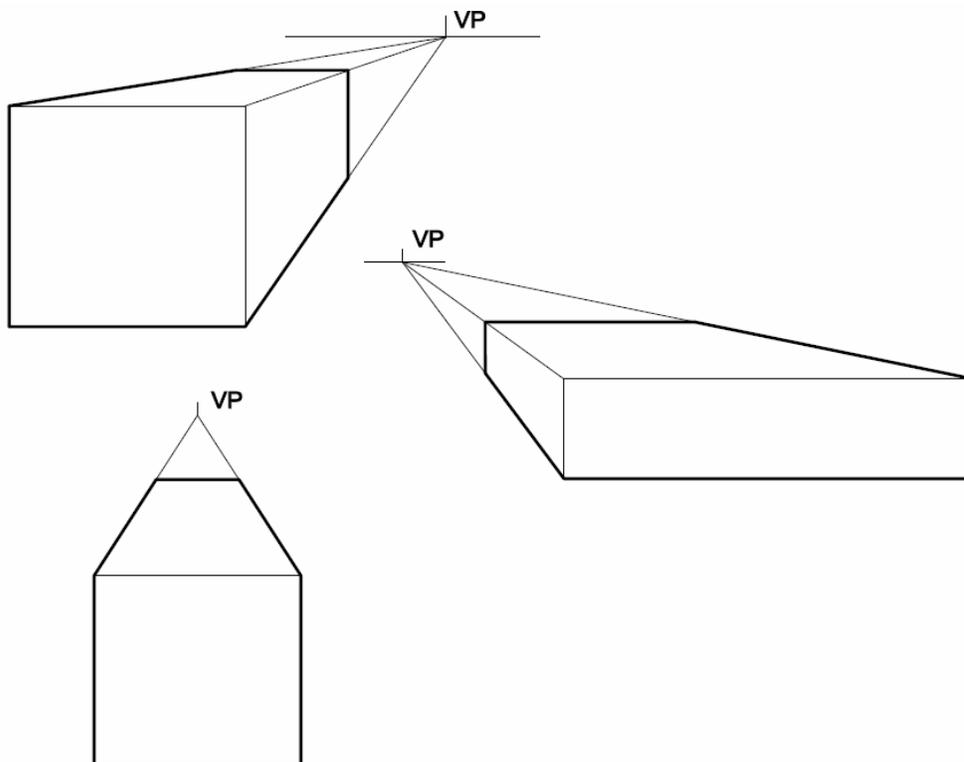
Drawing objects in perspective makes them look solid and gives a sense of depth to the picture. When we draw in perspective objects of a similar size appear to get smaller in size as they get further away from us. Also parallel lines appear to get closer together the further they are away from us. Also equal lengths appear to be smaller the further they are away from us.

In perspective there are three ways to draw objects.

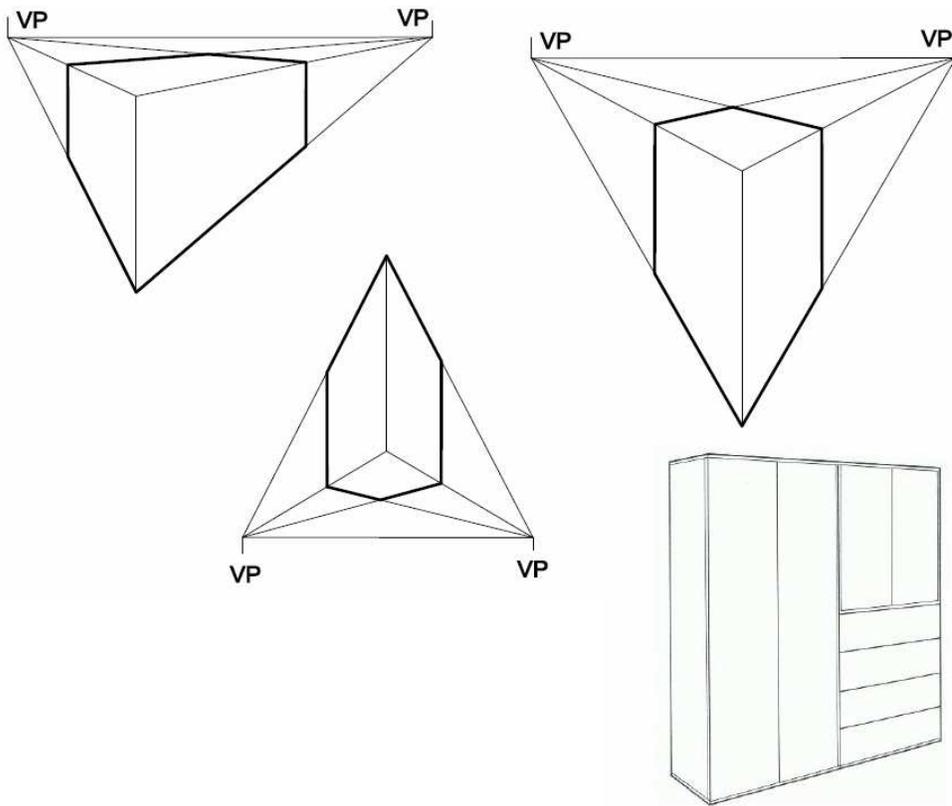
- One Point Perspective
- Two Point Perspective
- Three Point Perspective

The difference between the three are the number of vanishing points. (VP). Let us look at all three.

### One Point Perspective

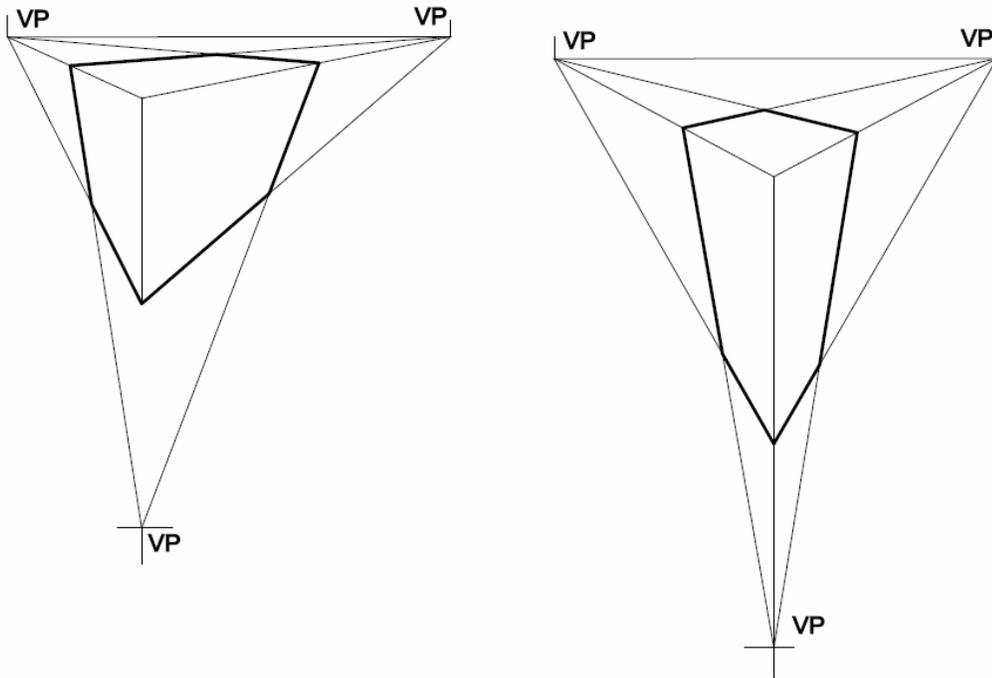


## Two Point Perspective



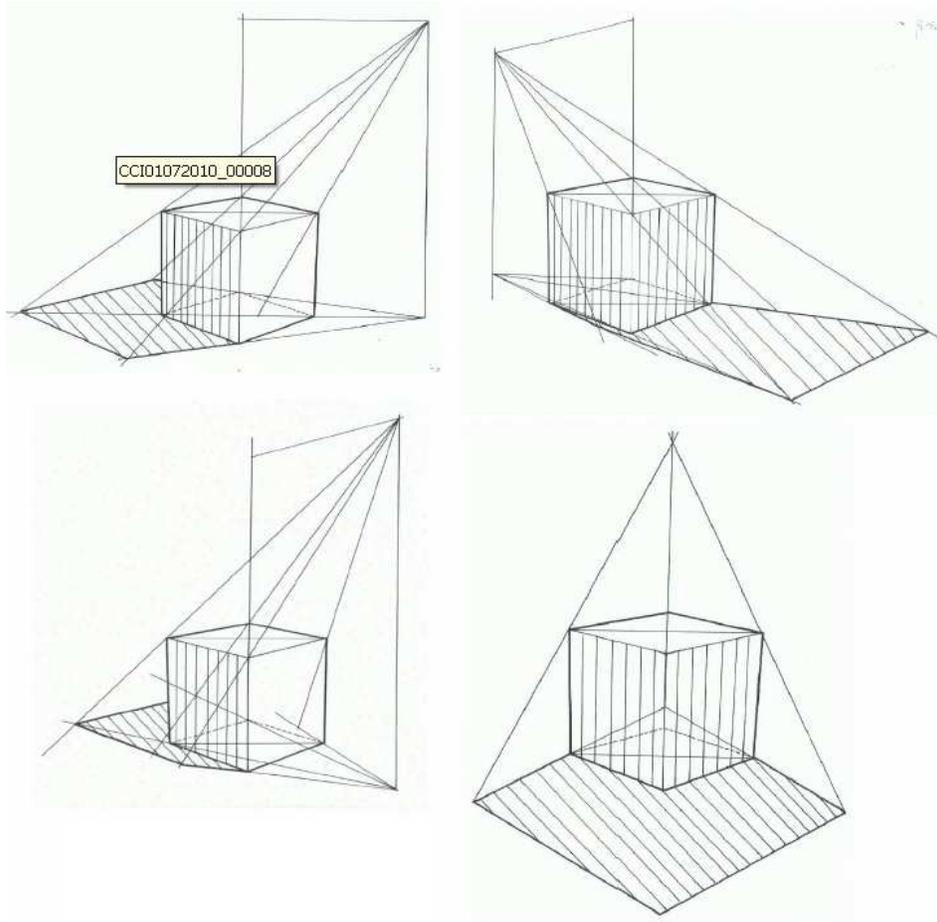
Right: A Wardrobe drawn in Two Point Perspective.

## Three Point Perspective



## Drawing Shadows in Perspective

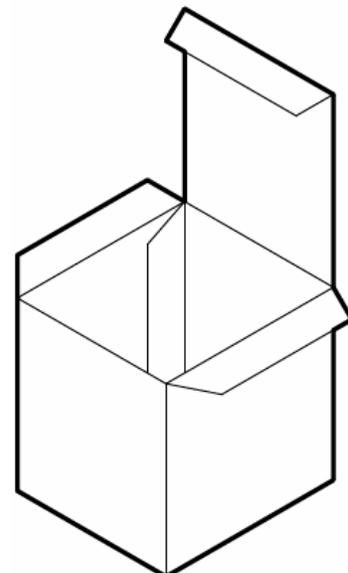
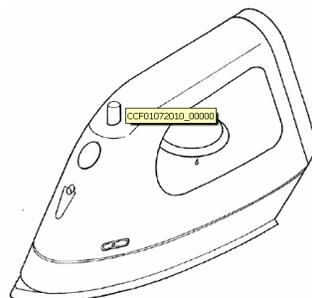
In order to make sketches and formal drawings look realistic it is good to add shadows to objects. Here are some examples of how shadows are constructed in perspective.



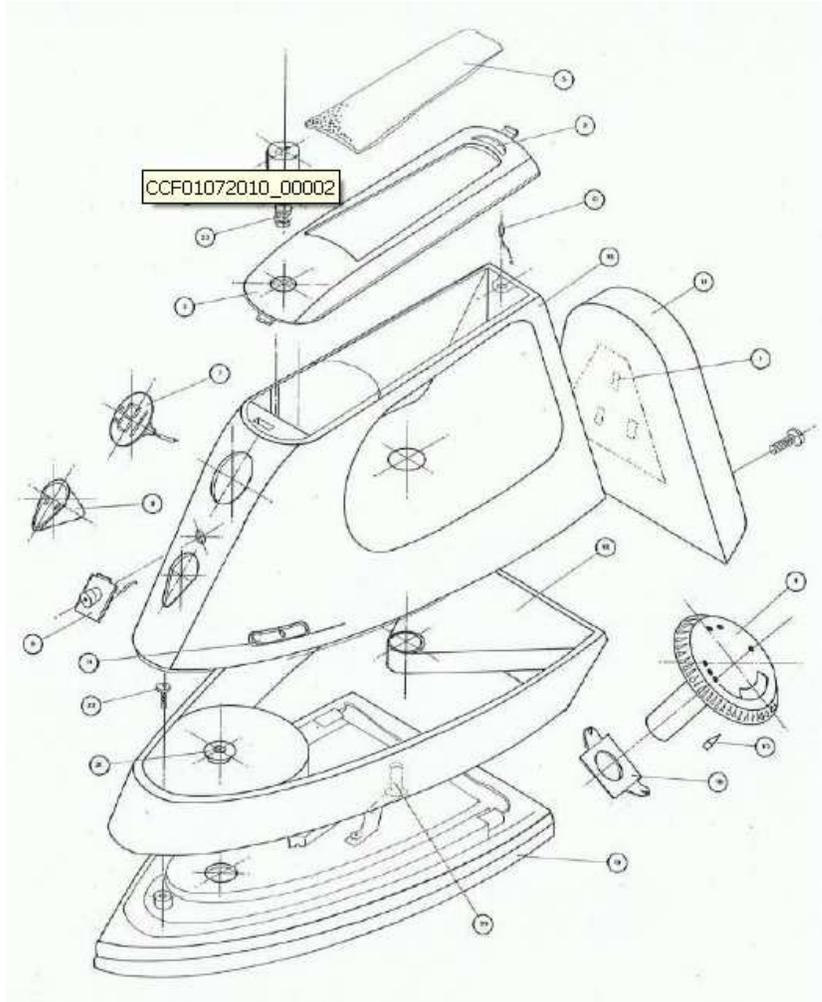
The hatched diagonal lines are the cast of the shadow

## Isometric Drawings

Isometric drawing is way of presenting designs/drawings in three dimensions. The example has been drawn with a 30 degree set square. In isometric projection the product is always drawn at 30 degrees. This requires skill and precision.



Exploded views are often a good way of showing detail and how parts fit together. The drawing below shows a domestic iron. It has been drawn as an exploded drawing. In an exploded drawing the products are drawn with all their parts disassembled (taken apart). It is important to notice that all the parts are in line with each other, drawn usually along a centre line which is drawn through the centre of the design.



## Modelling

Modelling can be described quite simply as '3D experiments that designers use to help them design.'

When we design, we sketch our ideas on paper and try to work things out before we start making. This may be done as 3D sketches or as 2D views, and notes are added to the sketches to explain our thoughts at the time. Some designers may use sketch books to record initial ideas or it could just be done on blank sheets of paper. You may find it very difficult drawing something just from thinking about it in your head, and also you may not think that your idea you are thinking of will work. This is why we often make models of our ideas as we design products. The advantage of doing this is that immediately you start making a model the product becomes 3D, and if the

product you are designing is made full size, you can also get a good idea of its scale and size.

Modelling also allows you to test out things if they are mechanical, or need to be a specific size. The whole idea of making a product model is that you are able to hold, feel and 'operate' a three dimensional model. This is the best way to find out how a design will actually perform when it is manufactured. Modelling also allows you to test features such as proportions, scale and functions. James Dyson suggests that designers should get into 3D modelling as quickly as possible when they are designing. Modelling your ideas could save time and money because this is the chance to spot any design faults, which can be easily rectified.

There are many different kinds of models that can be made, and you should select the particular type of model to suit what you are designing and the stage you are at in the Design Process. Some are very quick and inexpensive; others are more expensive and take time to manufacture. Which model you decide to make will depend upon what you are trying to work out, and what stage you are at in your project. The key is to understand what the different types of models are and which one helps you develop your design solution the best.

## Different Kinds of Models

These are the main types of physical models you could make in the studio or workshop. The cost and time taken to make each type of model will depend upon the materials used and the appearance or finish required.

### 1. Sketch/Mock up Models

Sketch models are often made alongside design sketches to help explore ideas and start the development process.

### 2. Scale Models

Used when designing products where size and scale is important

### 3. Block Models / Product Models

Block models are mainly solid models that look like the real product with controls that work but there are no internal workings.

### 4. Working Models

Working models are used to explain how the product or a part of it works

### 5. Prototypes

A Prototype is the final model or product which has been made to be tested or trialed before being put into production.

The advantage of these physical models is that you can handle them, test things and visualise the product from every angle. You can also photograph them to help you sketch the idea in use, and develop it. They all use different materials which are appropriate to the task and purpose of the model. The materials chosen will have to be joined together and finished using different techniques.