

ICHS Technical Department

Higher Graphics Notes

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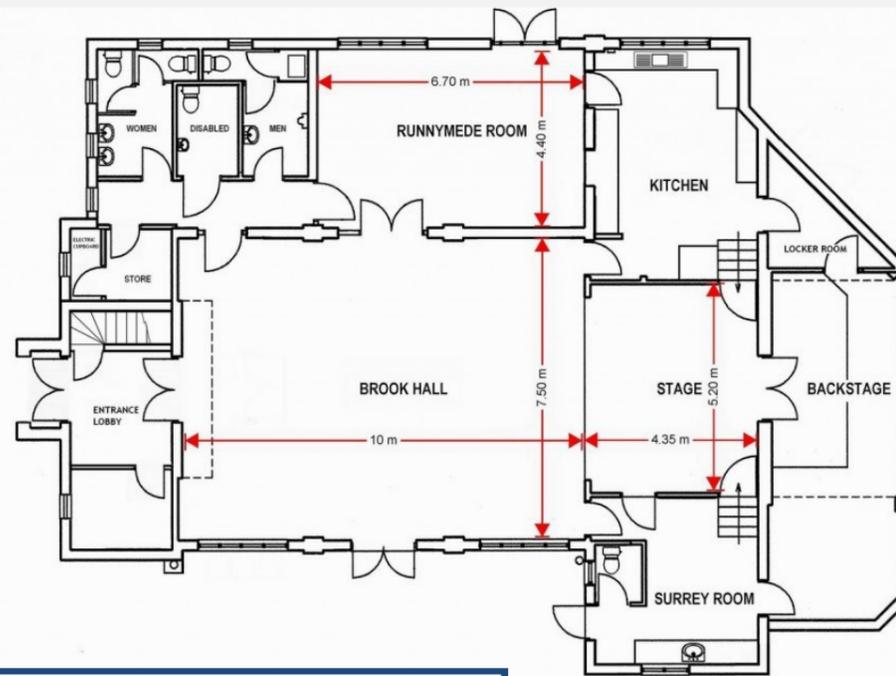
The 3Ps

Production Graphics

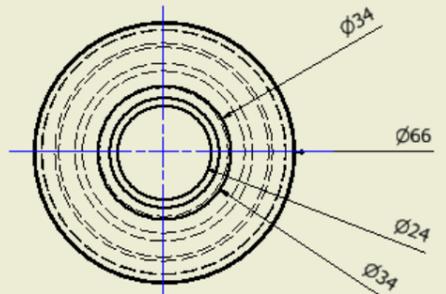
These graphics—as the name suggests—are used to produce the article in question. They must therefore be accurately **dimensioned** and in proportion.

Benefits of using **production drawings**; dimensioned orthographic views, exploded drawings, surface developments and sectional views

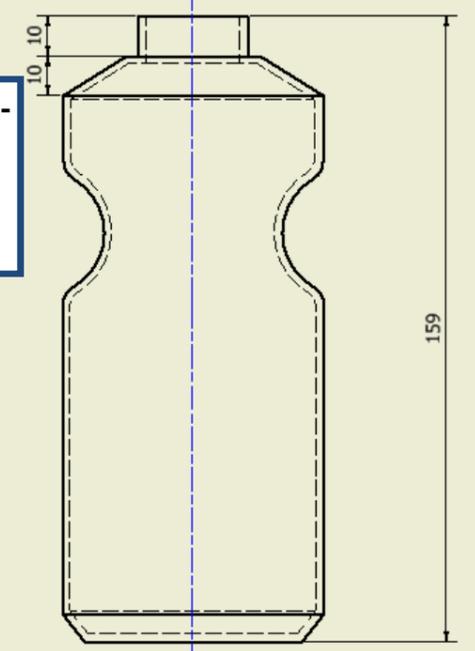
- They are accurate and drawn to scale
- They can be easily dimensioned
- Technical details can be shown using a variety of drawing types
- Commonly required parts can be added to a library to be easily accessed and re-used.
- Because of the international standards applied, they can be understood and used by anyone in the world.
- They can be used in promotional material to illustrate how products are assembled.



This **floor plan** is a production drawing; it has specific dimensions and various items of detail and information are included.



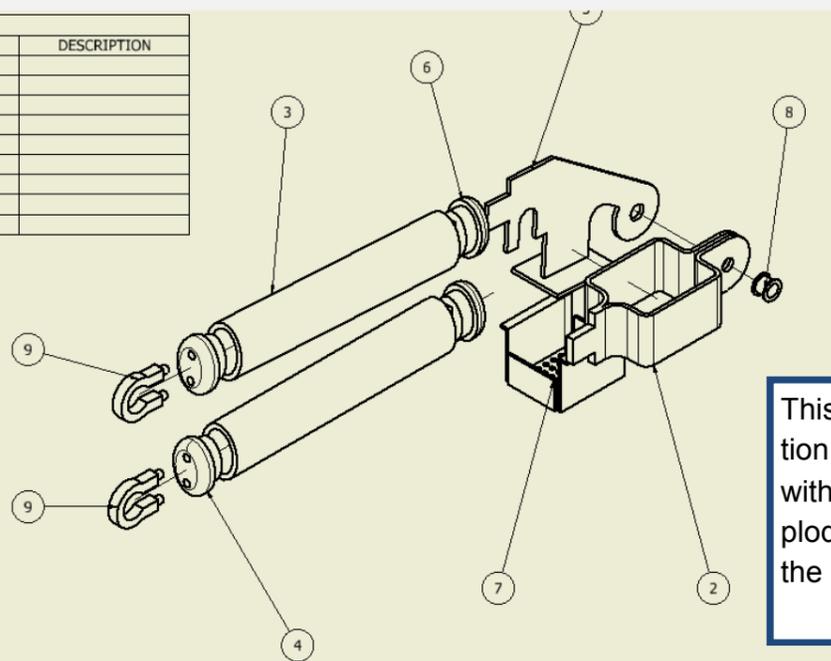
PLAN (1 : 1)



ELEVATION (1 : 1)

This **dimensioned orthographic drawing** is a production drawing; it has specific dimensions of the bottle which would allow it to be produced.

PARTS LIST			
ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	PUSHERHANDLETOP	
2	1	INTOP	
3	2	HANDLE	
4	2	INVBASEENDS	
5	1	INVPUSHER	
6	1	TOPEND	
7	1	INVMESH	
8	1	RIVET	
9	2	INVHOOK	



This **exploded isometric** is a production drawing; the parts list corresponds with the **balloon numbers** on the exploded views. This provides details of the model's assembly.

The 3Ps

Promotional graphics

The purpose of these graphics is to make the product attractive to the consumer—in short, **to sell** the product. Various graphic techniques—both manual and computer based—are applied to achieve this.

Construction and property businesses



NEW LAND
WORKSHOPARCHITECTS

THE BAY

Selling or renting the property is an important part of any building project. This often begins before the building work starts. In fact, it is now common to buy a new house before a brick has been laid – think of all the new build houses in Livingston which are sold before they are finished.

The process of selling a new building is known as **marketing the property**. This requires a special type of graphic known as an illustration.

Illustrations are usually pictorial graphics and they are vital to the marketing plan because:

- They can be drawn in perspective and rendered in colour to make them realistic and attractive to customers
- They promote the property on the market
- They are easily understood by the public because they are not technical graphics
- They can be included in sales brochures for customers
- They can represent the property in pleasant, mature surroundings – like trees, plants etc. which are unlikely to be there at the building site when the property is being built.

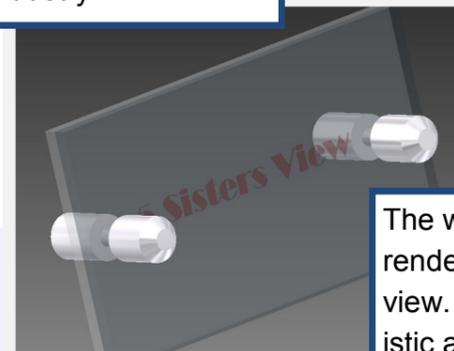
Benefits of using **promotional graphics**—posters, leaflets, web pages, graphs, animations, billboards, etc.

- They can be easily understood by people with no technical training
- They can show a customer what the finished product would look like
- Images can be enhanced to make them more attractive to the customer
- They can be made to look more realistic than production drawings
- The same product can be styled to appear to a particular market.

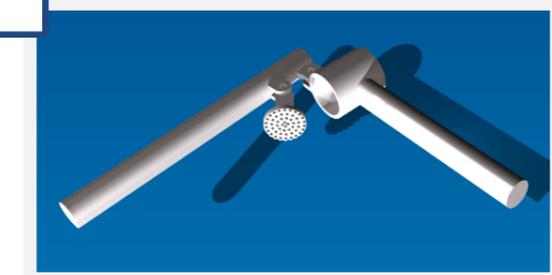
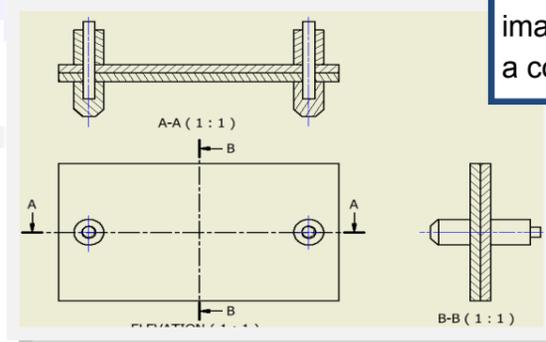
Consumer industry



Manufacturing/ engineering industry



The wall display has been rendered from a pictorial view. This allows a more realistic and easy to understand image of it to be produced for a consumer.



BSI Dimensions and protocols

The British Standards Institution (BSI) is a body which is responsible for a range of standards controlling quality over many different areas of industry and elsewhere. Within graphics, there are several you must be aware of and understand. They are mostly concerned with **Production Drawings**, such as building plans and engineering layouts. Their purpose is to ensure **uniformity and consistency** across all material, and allow everyone concerned to understand the drawings and their intentions.

BSI symbols for construction

These are symbols used within the construction industry to represent a range of features which are relevant within this field. They are adopted so all architects, planners, engineers and tradesmen involved understand how the plans are laid out and what is required from them.

hatching 	prohibition sign 	safe condition sign 	warning sign 	mandatory sign 	BSI kitemark
sink 	sinktob 	wash basin 	bath 	shower tray 	WC (toilet)
window 	door 	radiator 	lamp 	switch 	socket
north symbol 	sawn timber 	concrete 	insulation 	brickwork 	3rd angle projection symbol

Inveralmond Community High School
Technical Department

Mandatory Signs

Blue circular background with white symbol e.g eye protection must be

Safe Condition Signs

Green rectangular / square background with white text or symbol. E.g first aid, indication of direction.

Warning Signs

Yellow triangular background with black band e.g risk of electric

Prohibition Signs

white circular background with red band and cross bar e.g

Firefighting Signs

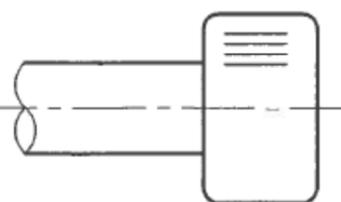
Red square background with white symbol or text e.g fire alarm

Danger Identification

Used to identify the perimeter of a hazard. The stripes are black and luminous orange or yellow.

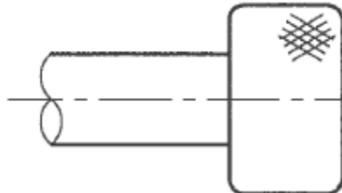
Some conventions

Knurling is a series of small grooves or indents which help provide a grip. The two types are **straight** and **diamond**. The symbols are shown.



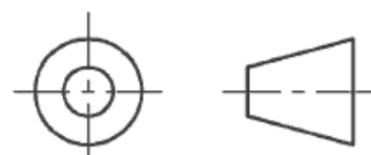
Straight grooves across.

Straight Knurling

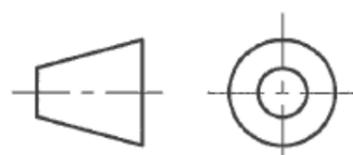


two sets of curved grooves across forming a diamond style pattern.

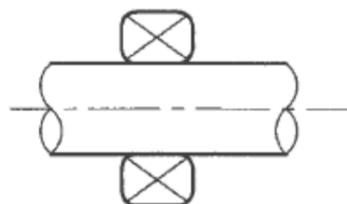
Diamond Knurling



3rd Angle Projection Symbol

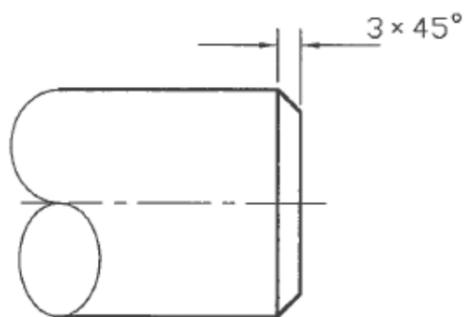


1st Angle Projection Symbol



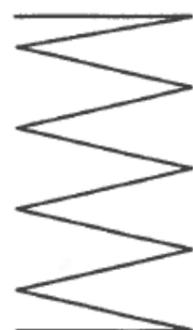
Roller Bearing

Make sure you can identify each of the projection symbols shown. You may be asked to sketch these symbols as well as identify them.

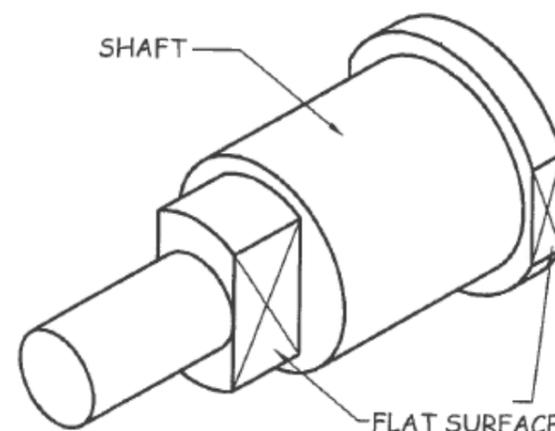


Dimensioning a chamfer

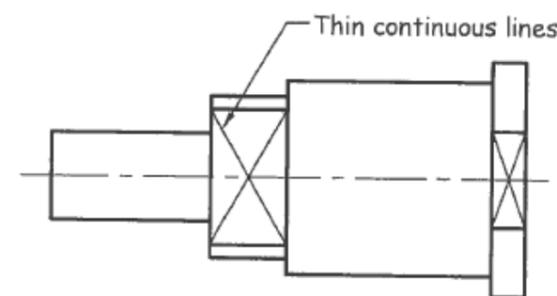
Make sure you remember how the chamfer is dimensioned. This has appeared in a few examination papers over the last few years.



Spring



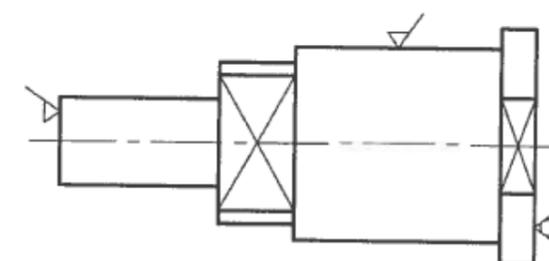
Flat surface on a shaft.



This view shows the convention which shows a flat surface on a shaft. Diagonal lines across the flat surface. Note: the diagonal lines are thin continuous lines.

Machining Symbol

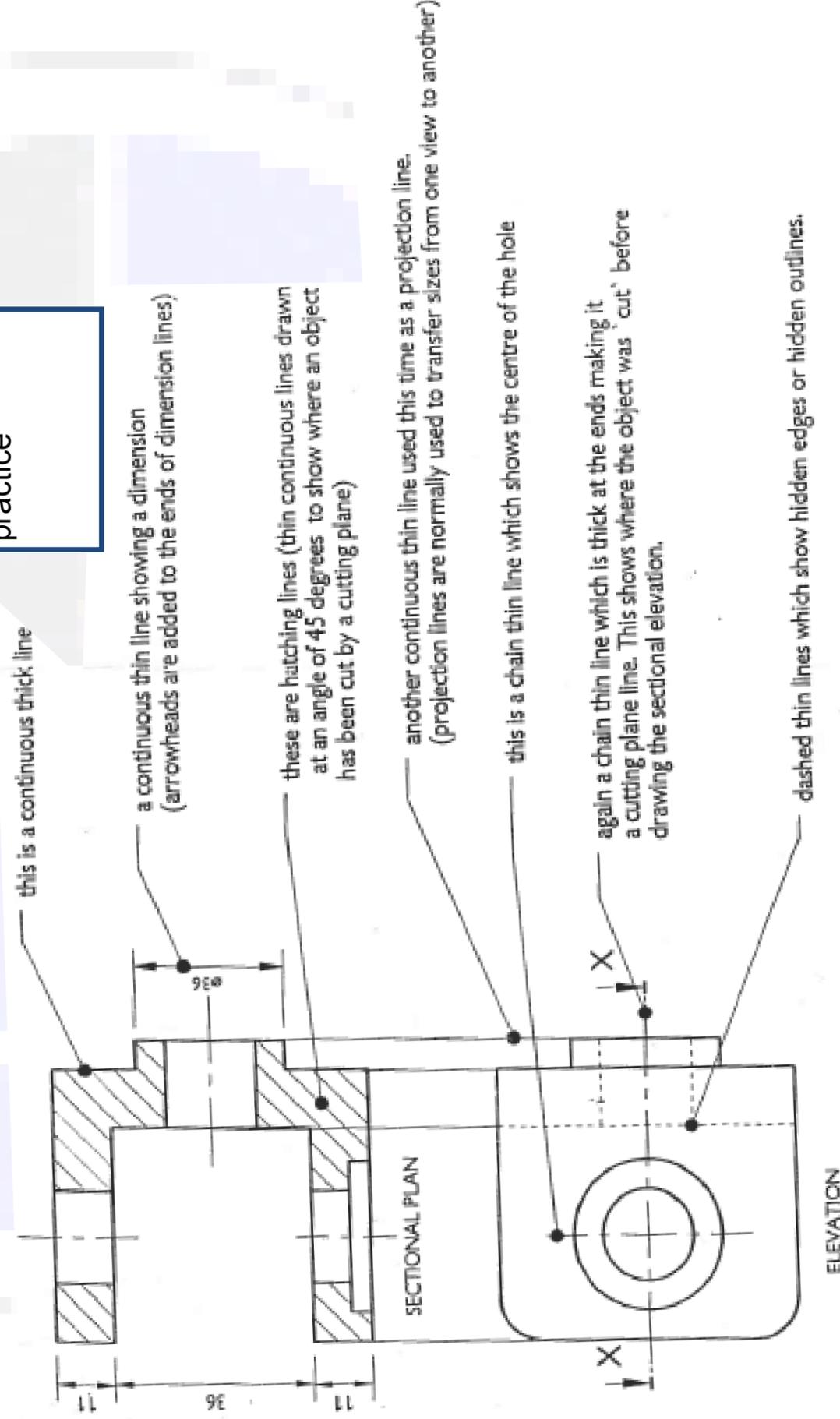
- ✓ This symbol represents the surface texture (how rough or smooth the surface is)
- ✓ If a surface requires to be machined, a horizontal line is added to the symbol.
- ✓ If machining is not permitted (not allowed) a circle is added to the symbol.



BSI Line Types

DESCRIPTION	LINE	APPLICATION
continuous thick line		visible edges and outlines
continuous thin line		dimension, projection, hatching, leader lines
dashed thin line		hidden edges and outlines
thin chain line		centre lines
thin chain, thick at ends		cutting plane/section lines
thin chain double dashed		fold/bend lines on a development, extreme positions of moving parts
continuous thin straight with zigzags		limits of partial or interrupted views
continuous thin irregular		

Line types and dimensions in practice



BSI Dimensions

It is important you are aware of the various BSI line types used within graphics; both to accurately produce your own drawings and to interpret others.

You will need to understand these line types for your final exam.

These symbols are used for dimensioning:

- ∅ diameter
- R radius
- square
- CL centre line
- AF across flats (Hexagons)
- AC across corners (Hexagons)

Dimension Lines

where possible, place the dimension lines outside the outline.

Arrowheads should be small and slim, with the point of the arrowhead touching the projection lines.

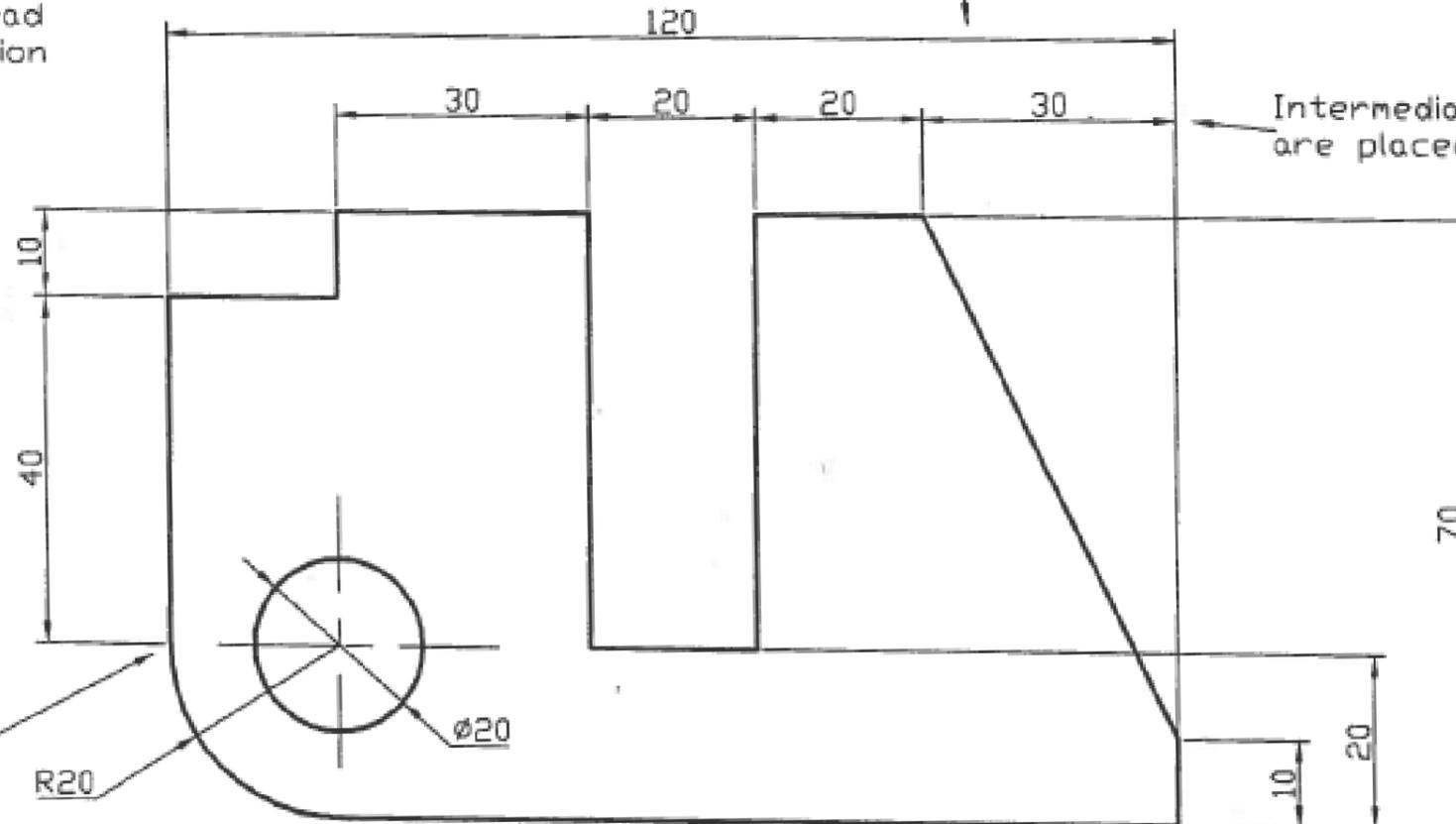
Overall dimensions are placed further away from the drawing.

Intermediate dimensions are placed in line

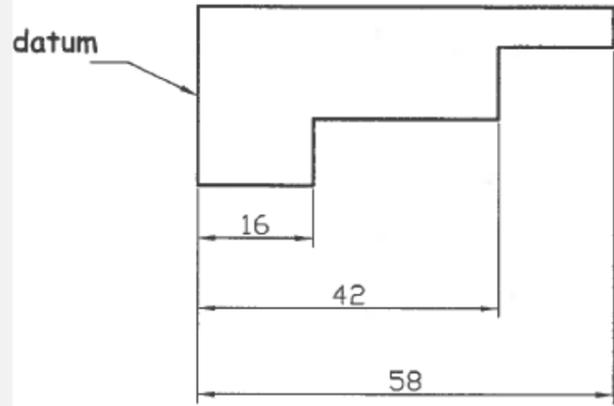
Figures on vertical dimension lines are read from the right hand side.

Projection/leader lines
these lines enable the dimension to be placed outside the outline of the drawing. leave a small gap to avoid confusing the leader line with the outline.

Always show the diameter of a circle, never its radius.

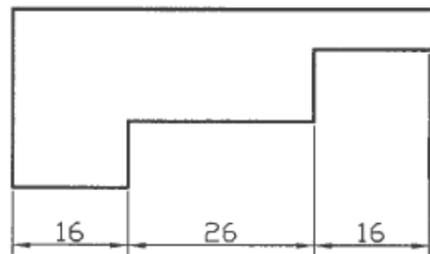


Parallel Dimensioning

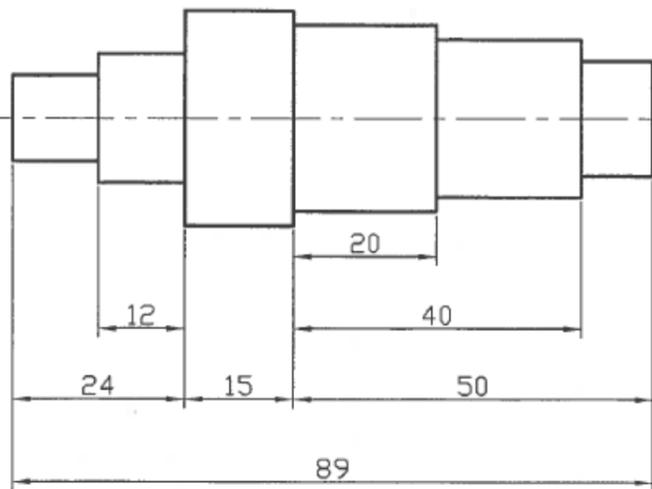


Parallel dimensioning
Parallel dimensioning consists of a number of dimensions originating (starting from) a datum feature (a common point), in this case the line on the left hand side.

Chain Dimensioning



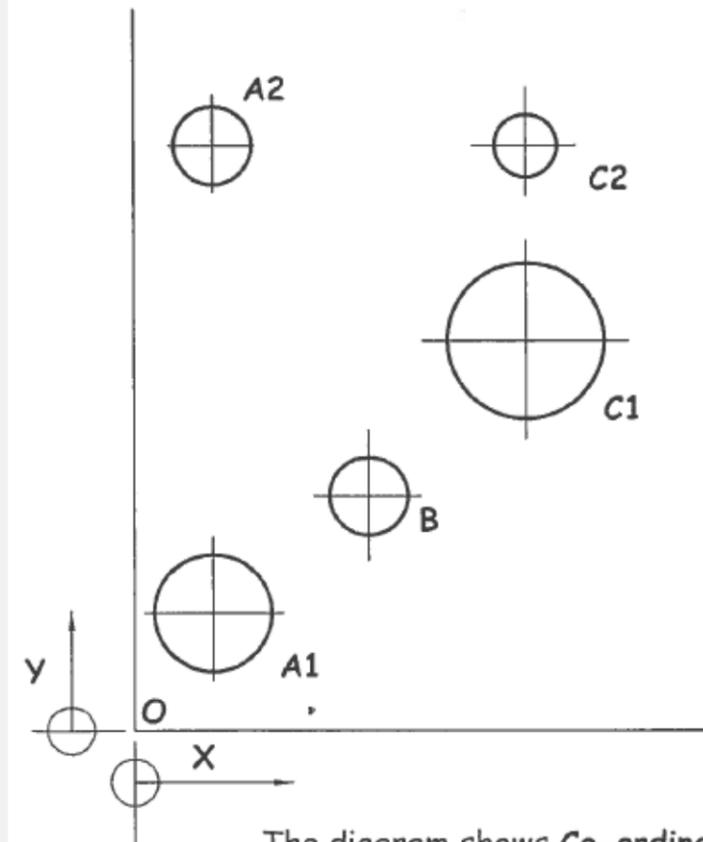
Chain dimensioning should only be used where the possible accumulation of tolerances does not endanger the function of the part. This basically means that there is more chance of the final size being too big or too small because each size is measured from the previous one which may be inaccurate.



Combined dimensioning.
This method uses chain dimensioning and parallel dimensioning on the same drawing.

Co-Ordinate Dimensioning

Make sure you understand the diagrams and why they might be used rather than more traditional dimensioning methods.



HOLE	X	Y	Ø
A1	10	15	15
A2	10	75	10
B	30	30	10
C1	50	50	20
C2	50	75	8

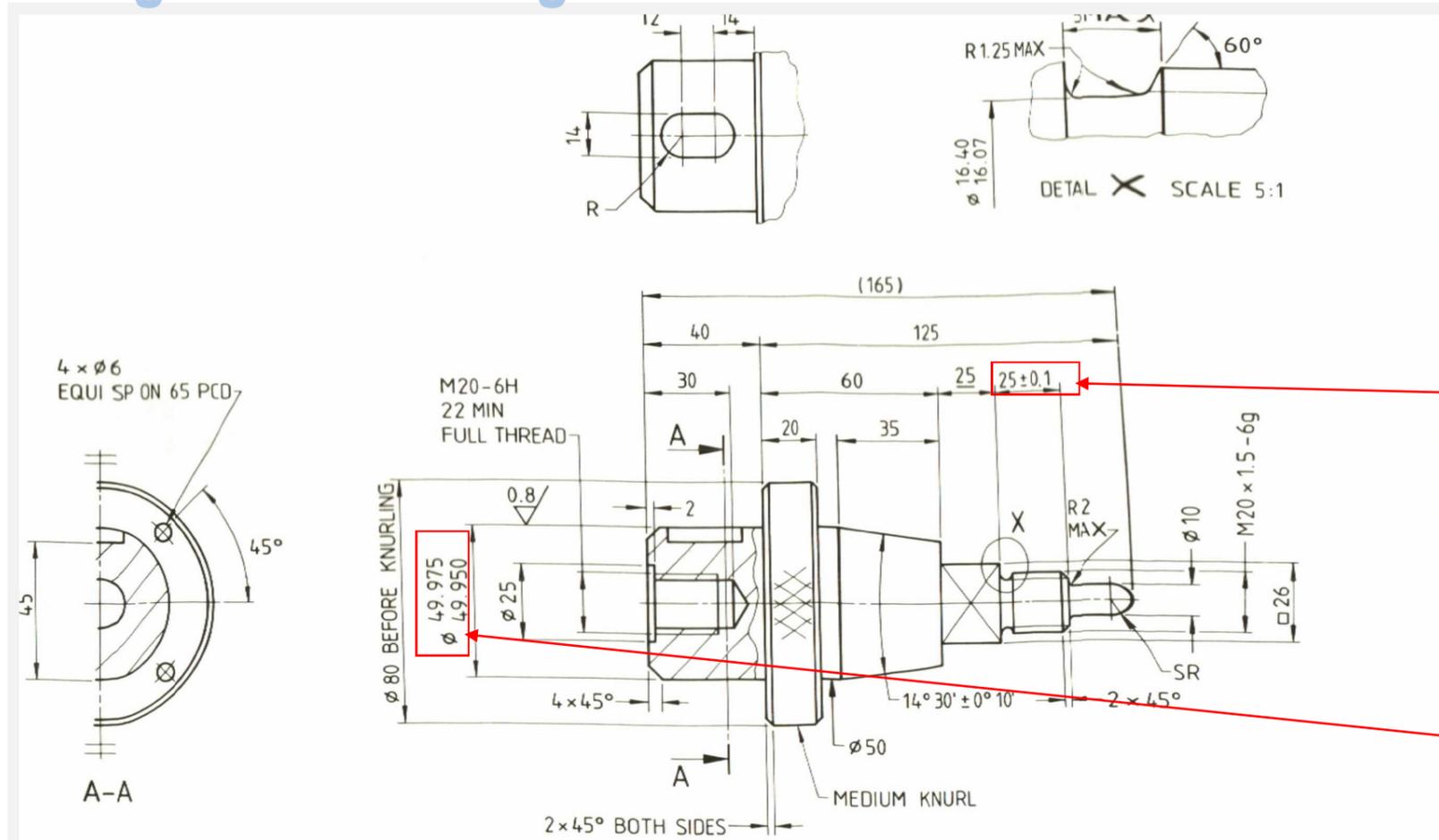
The diagram shows **Co-ordinate Dimensioning**.

One advantage of using co-ordinates is that they simplify the drawing and produce an easier method of locating specific points within a drawing i.e. the drawing is less "cluttered".

Less space is required to produce the drawing.

Another advantage is that all dimensions are measured from a single point (O), which means the finished object will be more accurate. This basically means that a single measurement is more accurate than having to produce two or more measurements.

Scaling and tolerancing

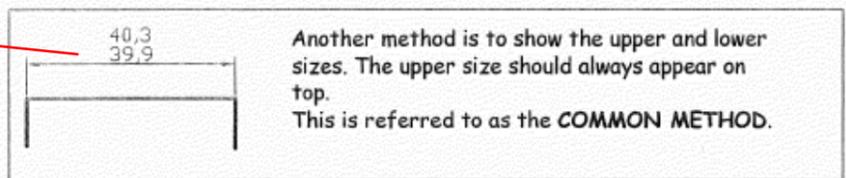
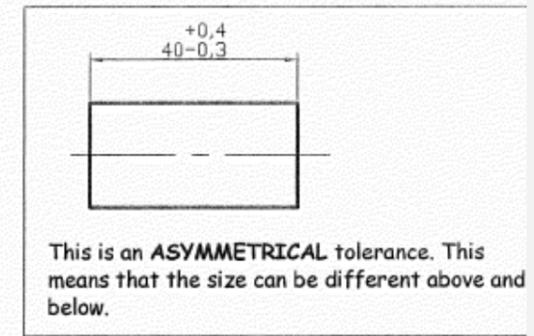
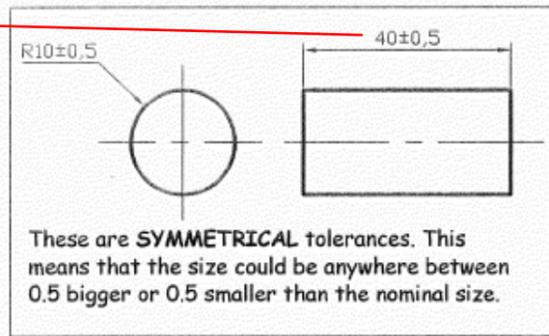


Tolerances

Tolerances are required during the manufacturing process. Anything which is required to fit or interact with another part must be manufactured to set tolerances. E.g. a tyre for a bicycle must be able to fit onto the bicycle wheel, an electrical plug must fit into the socket, batteries must be able to fit into the holders etc etc. Tolerances are also required in other situations. The position of a brick wall in a house, steel girders in roof structures etc.

The tolerance required will vary from situation to situation. A ROLEX watch will be made to much "finer" tolerances than a childs TIMEX watch. The machinery and equipment required to produce a ROLEX will be much more expensive than the machinery required for the TIMEX.

How to show a TOLERANCE



DO NOT SCALE						
1 TO BS 1134 2 OVER EXCEPT 3 E STATED 4 ADS TO BS 3643	TOLERANCE	MATERIAL	PROJECTION	DRAWN	MAP	ORIGINAL
	DIMENSIONAL ± 0.2	STEEL TO BS 970		DATE	86 06 17	SCALE
	ANGULAR ± 2° UNLESS	070M26		CHECKED	LD	1:1
	OTHERWISE STATED			DATE	86 06 30	
				ALL DIMENSIONS IN mm		
				CONNECTOR		DRG NO.
						2

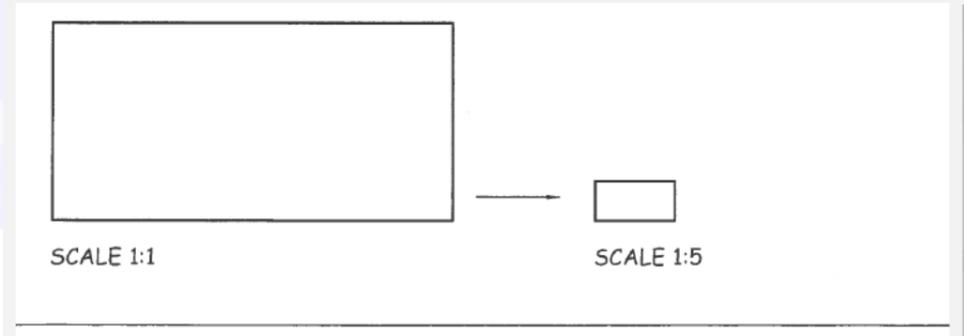
Scaling

A drawing can be scaled to make it bigger or it can be scaled to make it smaller.

The scale of a drawing depends upon:

1. The size of the paper being used
2. The size of the object being drawn
3. The amount of detail required

In general, scales should allow easy and clear understanding of the object being drawn.



EXPLANATION OF THE SCALE TERMS.

Scale 1:1 means the actual size of the object.

Scale 5:1 means five times bigger than the actual size

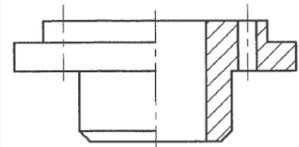
Scale 1:5 means one fifth of the actual size.

Title block

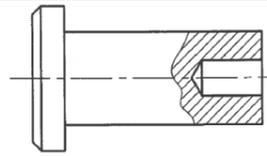
This contains such information as drawing name, number, date, tolerances, scale and third angle symbol. This is important as it sets out the standards the drawing uses and ensures there is no ambiguity regarding the information it represents.

Additional views

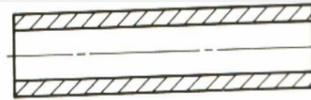
Sections



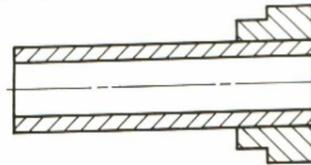
Half-Sectional View.
Symmetrical parts may be drawn as a half sectional view on one half and the other half as an ordinary outside view as shown above.



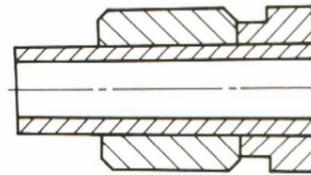
Local or Part Section
A local or part section may avoid the need for a complete sectional view.
Note: a thin continuous irregular line is used for a part or local section.



(a) Hatching separated areas.



(b) Hatching adjacent parts



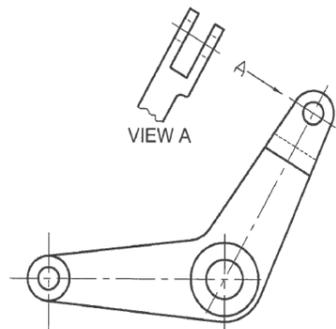
(c) Hatching adjacent parts at the same angle

Parts and features of parts not normally sectioned

When a sectional view is given where the cutting plane passes longitudinally through fasteners, such as bolts and nuts, and shafts, ribs, webs, spokes of wheels, etc., it is the practice to show them in external view (see figure 32).

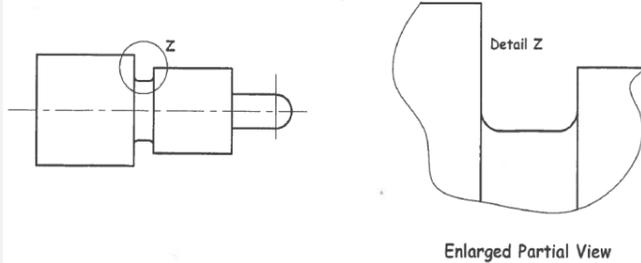
Partial views

IT IS NOT always necessary to draw a full view of an object. Sometimes a partial view is all that is required to show any details required.



Enlarged Partial View

The diagrams show how details can be made clearer by taking a partial section and making it bigger.



Interrupted views

Interrupted views are used to save space. Rather than drawing a long component e.g. a shaft, the interrupted view can represent the complete component by drawing part of it. All the components below could be long items which could not fit onto an ordinary piece of paper if drawn to full size. The interrupted view allows enough detail to show the component without drawing it full size.



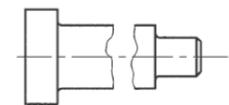
Conventional break lines for a solid shaft.



Conventional break lines for a hollow shaft.

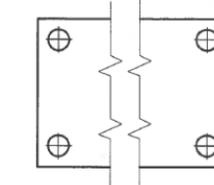


General break lines.



Break lines for a solid shaft.

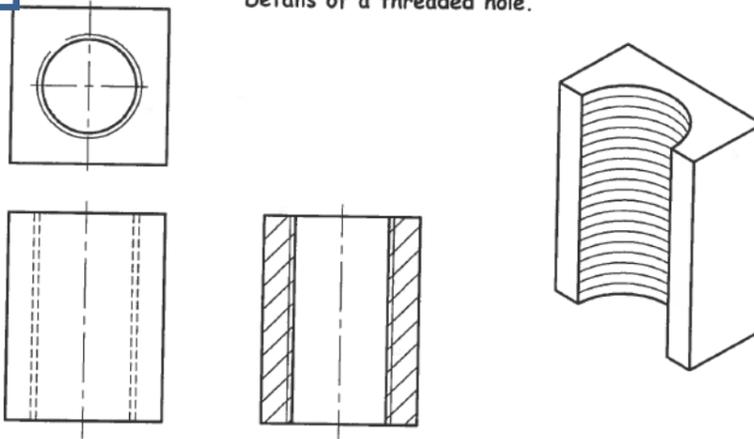
extends a short distance.



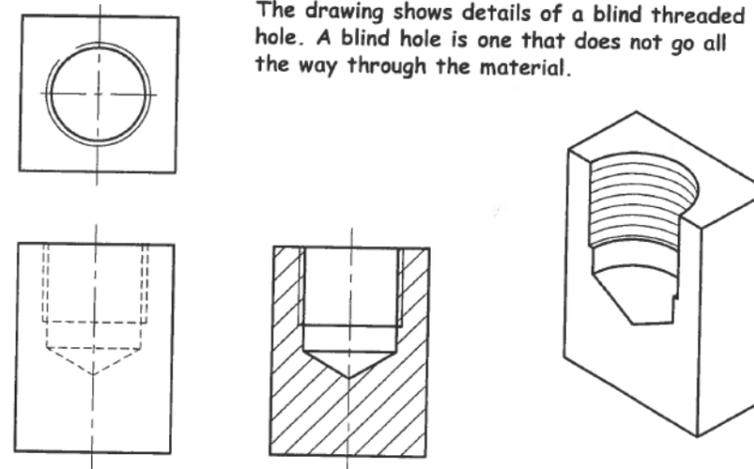
Another way to show an interrupted view is to use thin continuous line with zig zags. The zig zag line must continue for a short distance outside the outline as shown above.

Holes

Details of a threaded hole.



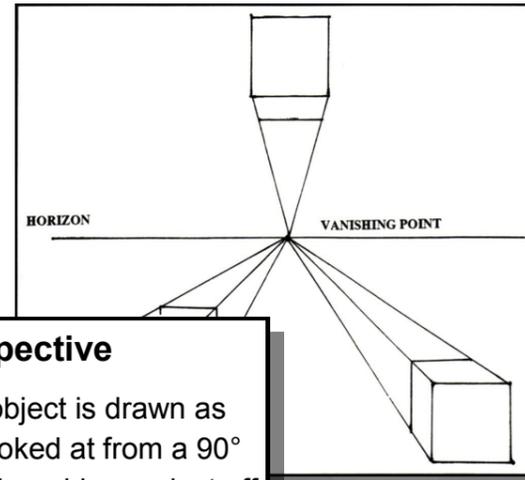
The drawing shows details of a blind threaded hole. A blind hole is one that does not go all the way through the material.



Drawing views

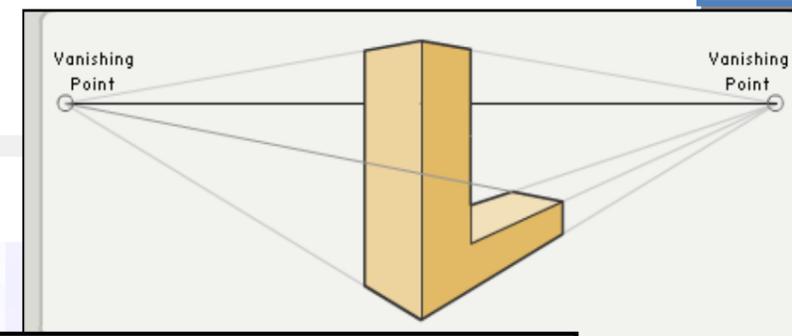
Pictorial views

These views allow all three dimensions of an object, etc. to be seen. They are not known as **3D views**, however as they cannot be turned around or manipulated as they are still 'flat' views. Instead, they can be described as **2½ D**. They are used in many different situations to give a more realistic and easy to understand view of the item, in a way which orthographic views may not. This is also beneficial to communicate information to individuals who are not technically-minded or experienced in reading orthographic views.



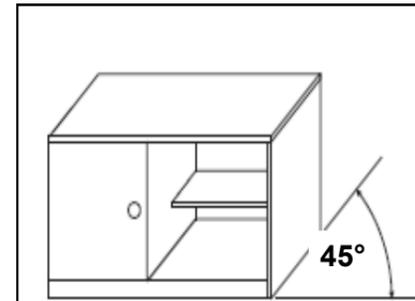
1 Point Perspective

The front of the object is drawn as its true shape (looked at from a 90° angle), and its other sides project off to a 'vanishing point' on a horizon line. These sides are subject to **foreshortening**—the effect that things become smaller as they are further away. This gives the description of **perspective**.



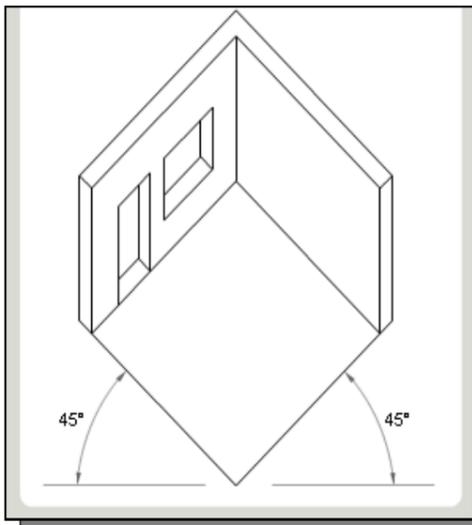
2 Point Perspective

A more realistic perspective view, this time with two vanishing points. The drawing is usually started with a vertical **leading edge** at the centre, and the 'horizontal' lines of the object going to either of the vanishing points. This form of pictorial view is often used in promotional graphics for houses, etc.



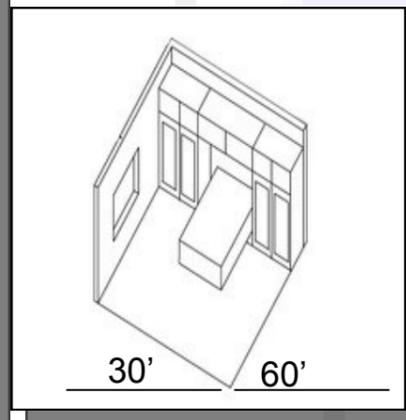
Oblique views

These views show the true shape of the elevation, with the breadths being projected back at 45° and divided by 2. They are often used to show circular based objects as the circle remains true, unlike isometrics where it becomes an ellipse.



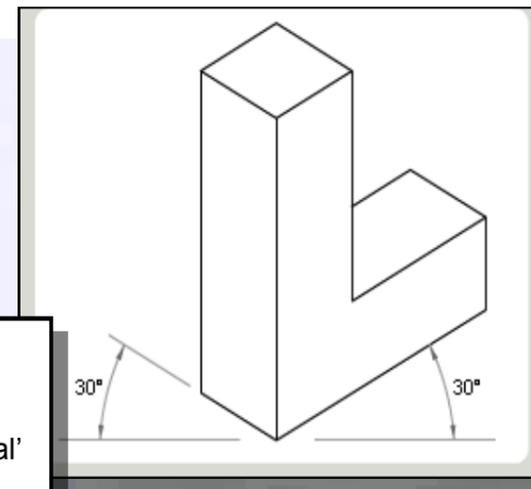
Planometric views

These views always have a 90° corner at their centre, and the other two angles add up to 90° also. They can either be $45^\circ/45^\circ$ or $30^\circ/60^\circ$. They are frequently used to show the inside of rooms, but often outside features too such as gardens, etc.



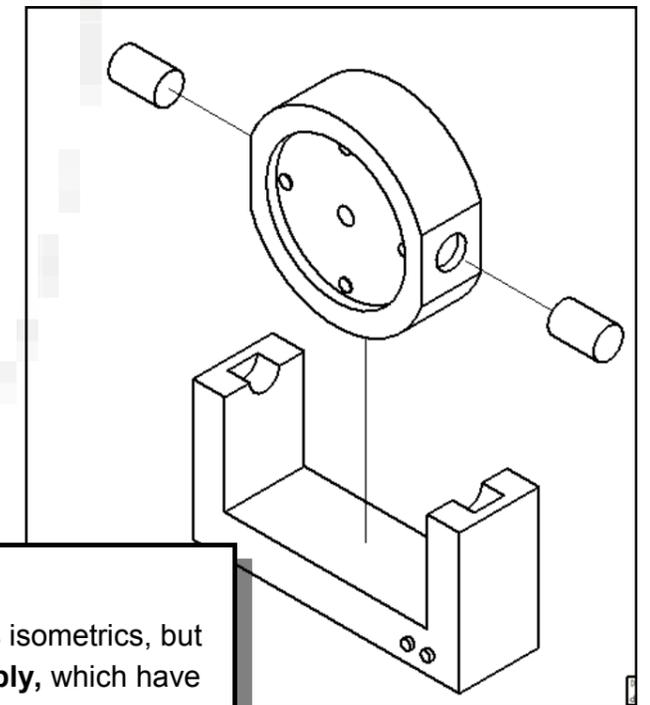
Isometric views

These views have vertical heights and the two 'horizontal' dimensions are angled at 30° . All the sizes of the object being drawn remain the same from the orthographic view it is based on—ie the height is still the same as are the length and breadth. Isometric views are frequently used to represent everyday objects and engineering/technical parts to make them easier to visualise.



Exploded Isometric

These views follow the same rules as isometrics, but involve 2 or more parts of an **Assembly**, which have been separated in a **linear** way. This is known as an **exploded view** and can be considered to be the opposite of an assembly. They are used to illustrate the relationship between separate parts within an assembly, and are often used in instruction manuals for furniture, toys, etc.

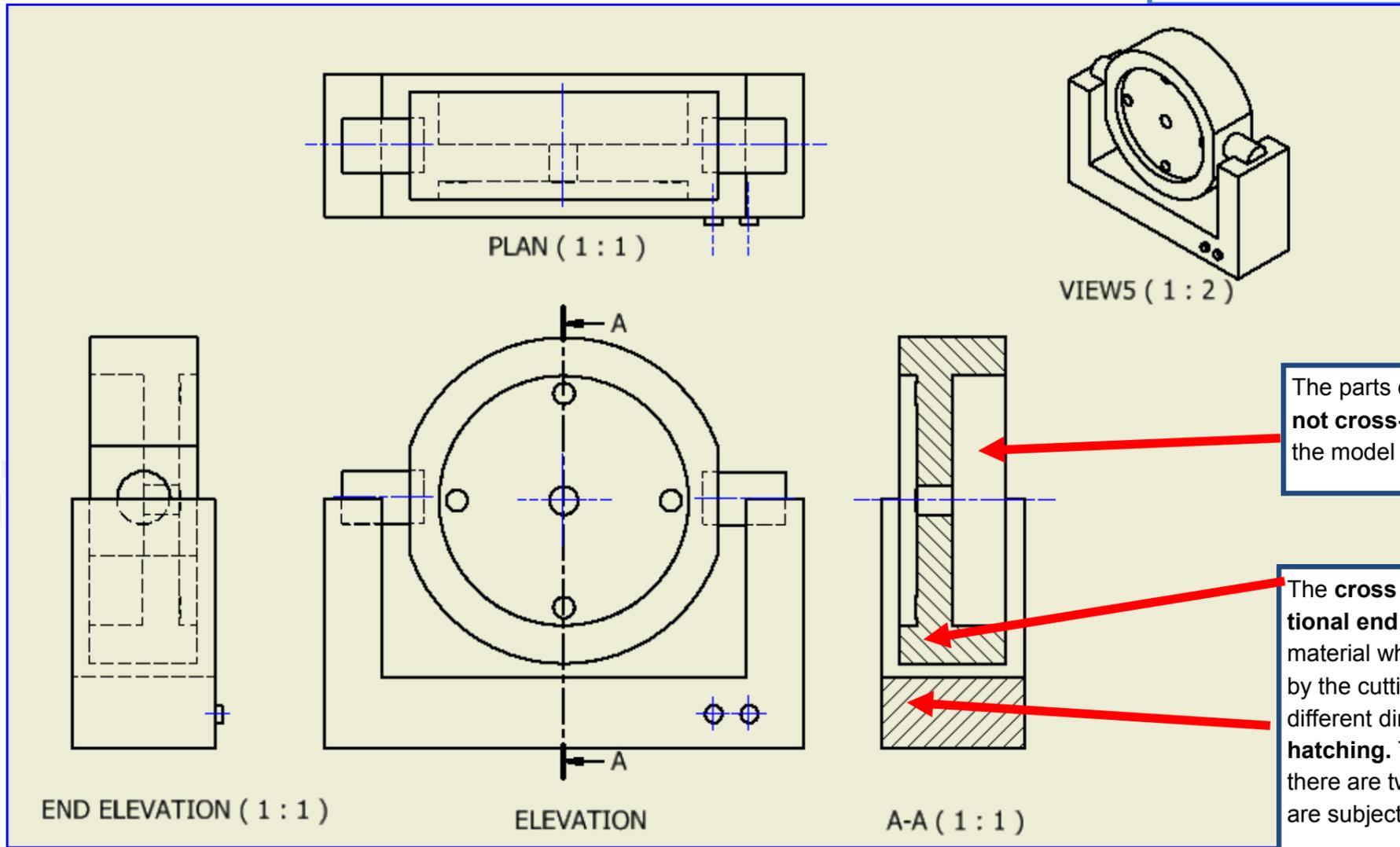


Drawing views

Assemblies and sections

Sectional views

These are used to show **hidden features** within the view—often an assembly. They allow various parts and edges to be seen as if the object has been ‘cut open’. They can either be **sectional elevations** or **sectional plans** depending on the view required and are labelled with the letters used by the **cutting plane**.



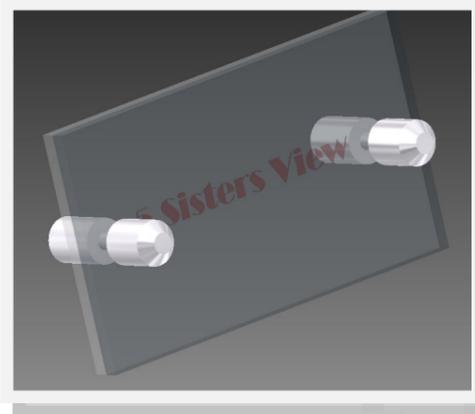
The parts of the view which are **not cross-hatched** are parts of the model which are ‘fresh air’.

The **cross hatching** in this **sectional end elevation** shows the material which has been affected by the cutting plane **A-A**. Note the different directions of the **cross-hatching**. This illustrates that there are two different parts which are subject to the section.

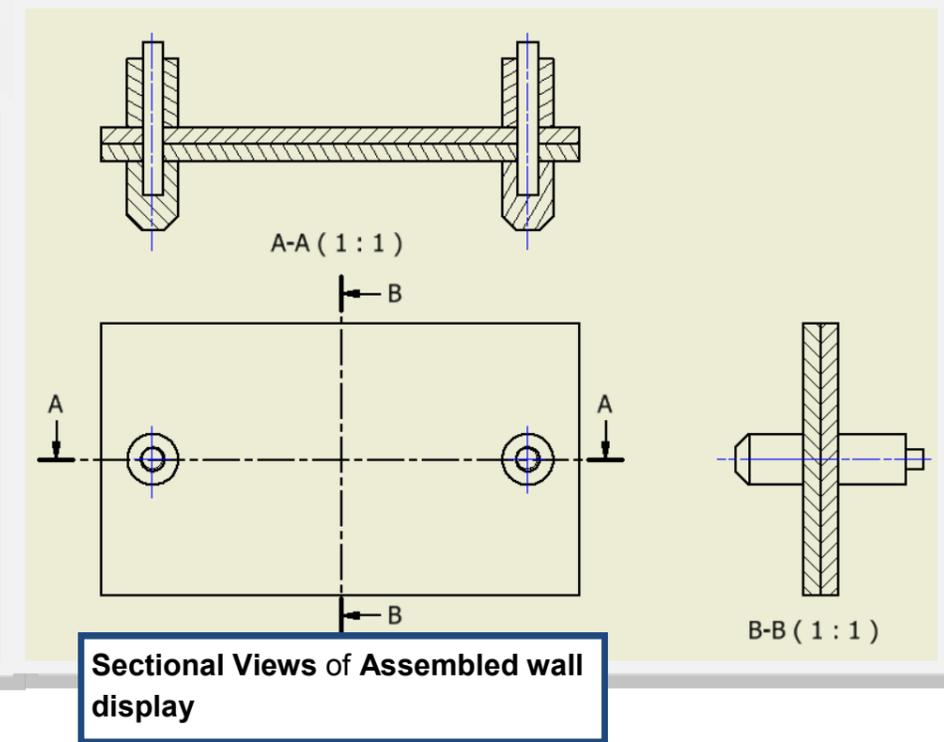
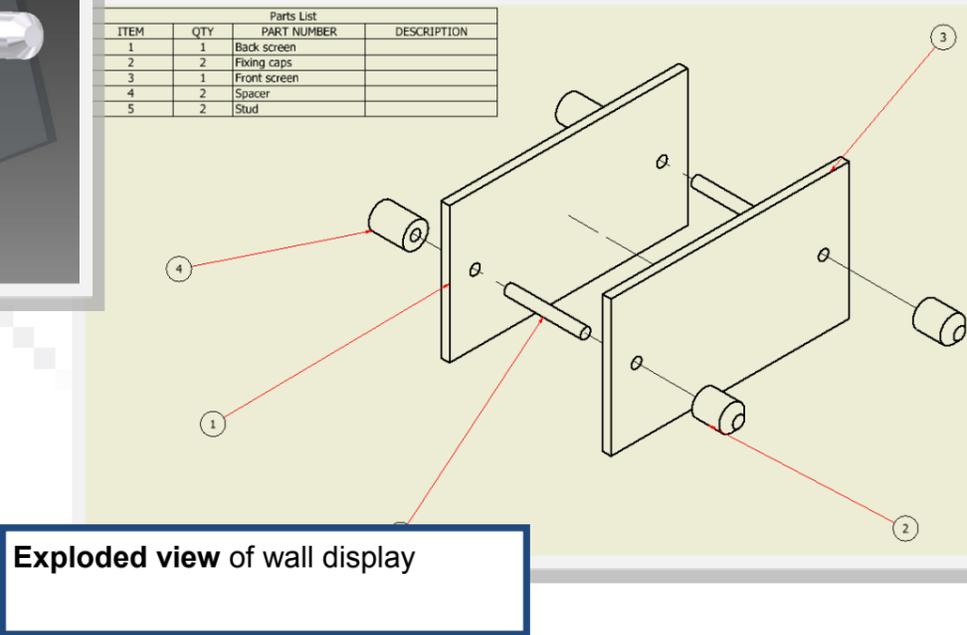
Assembly drawings

These drawings represent more than one part which have been joined or connected to each other. They are widely used for many purposes—basically whenever different parts are assembled!

Often, an **exploded view** is provided to make the assembled view easier to understand. An **assembled view** can be thought of as being the opposite to an **exploded view** and vice versa!

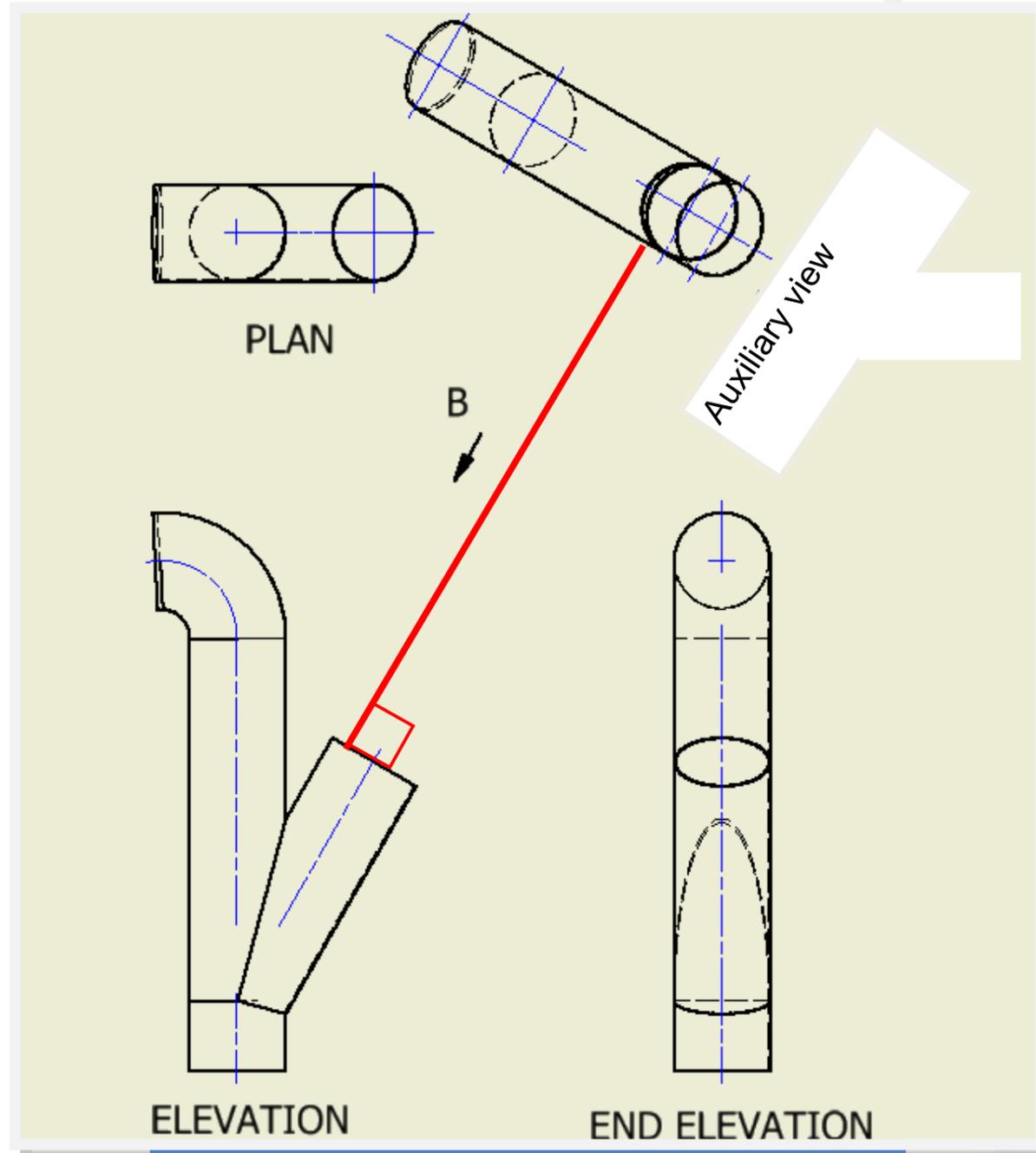


Parts List			
ITEM	QTY	PART NUMBER	DESCRIPTION
1	1		Back screen
2	2		Fixing caps
3	1		Front screen
4	2		Spacer
5	2		Stud



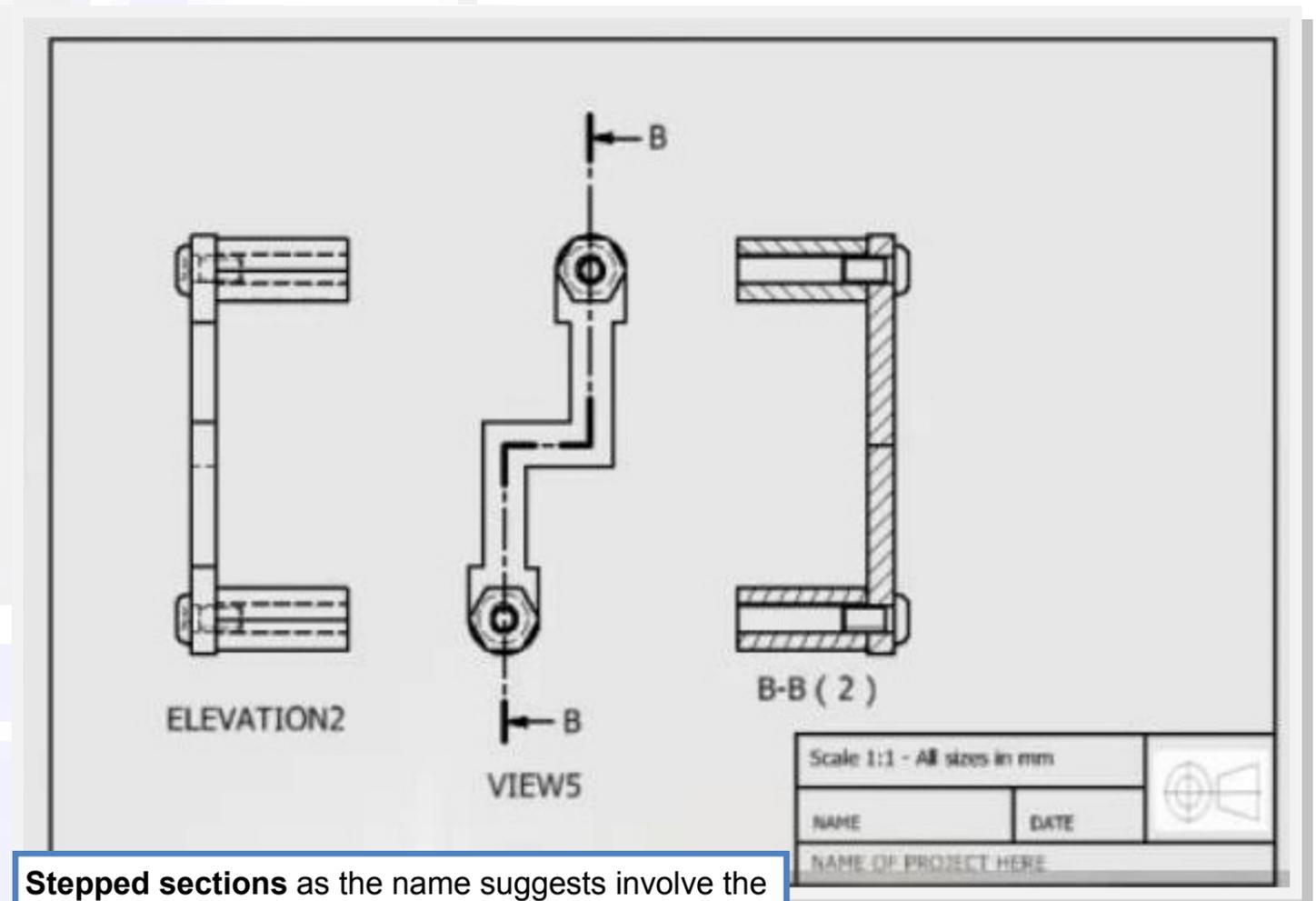
Drawing views

Auxiliary views

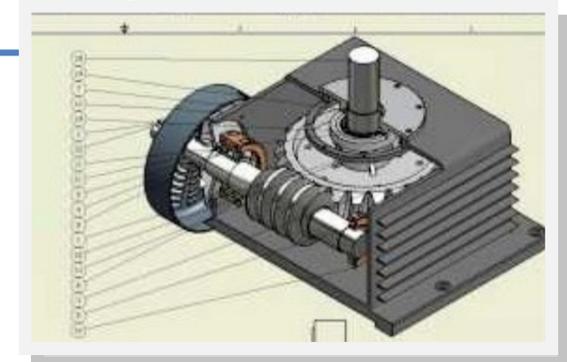


Auxiliary views enable another direction of view to the component, etc. in question. They are often adopted as a means of inspecting sloping edges as the slope in question is viewed as a **True Shape**.

Stepped section



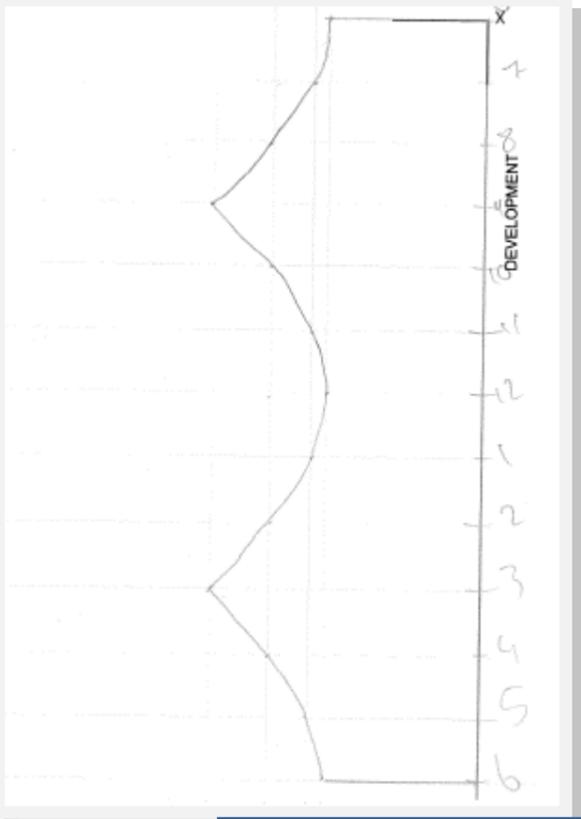
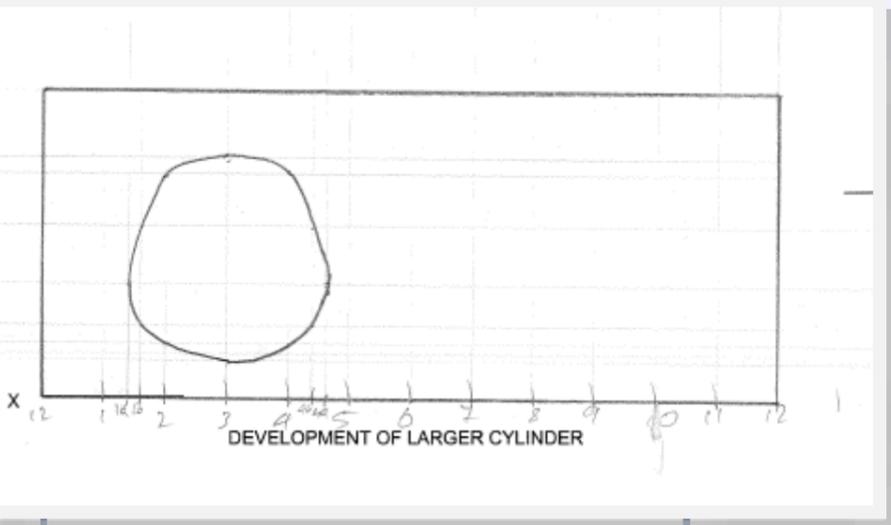
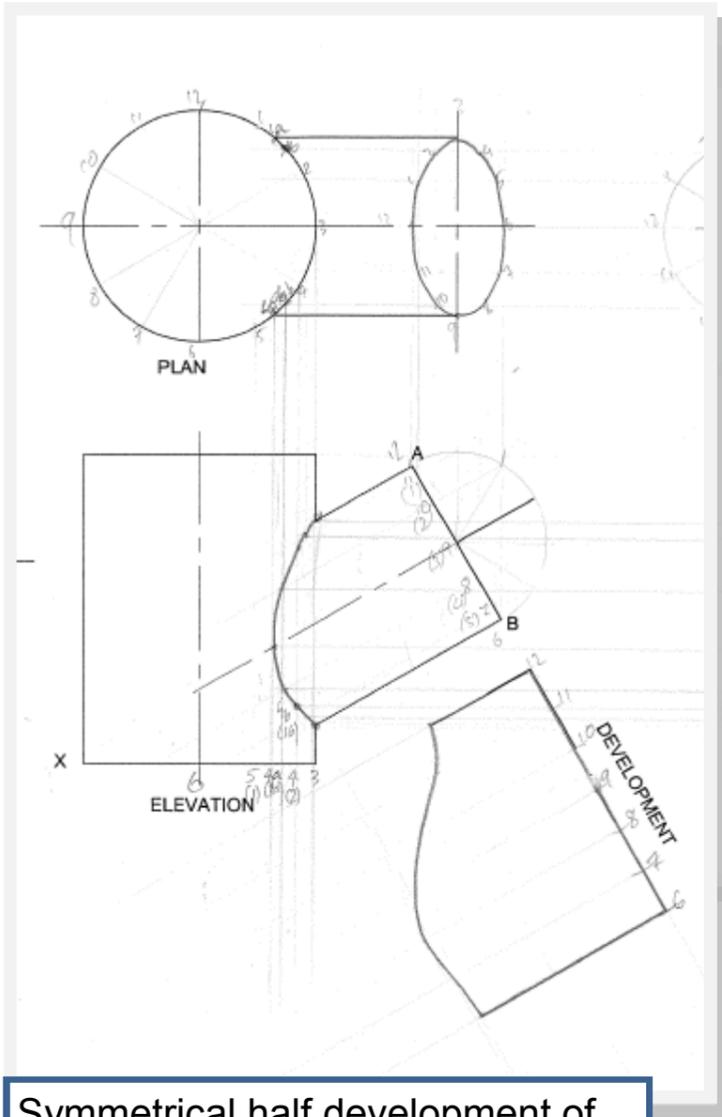
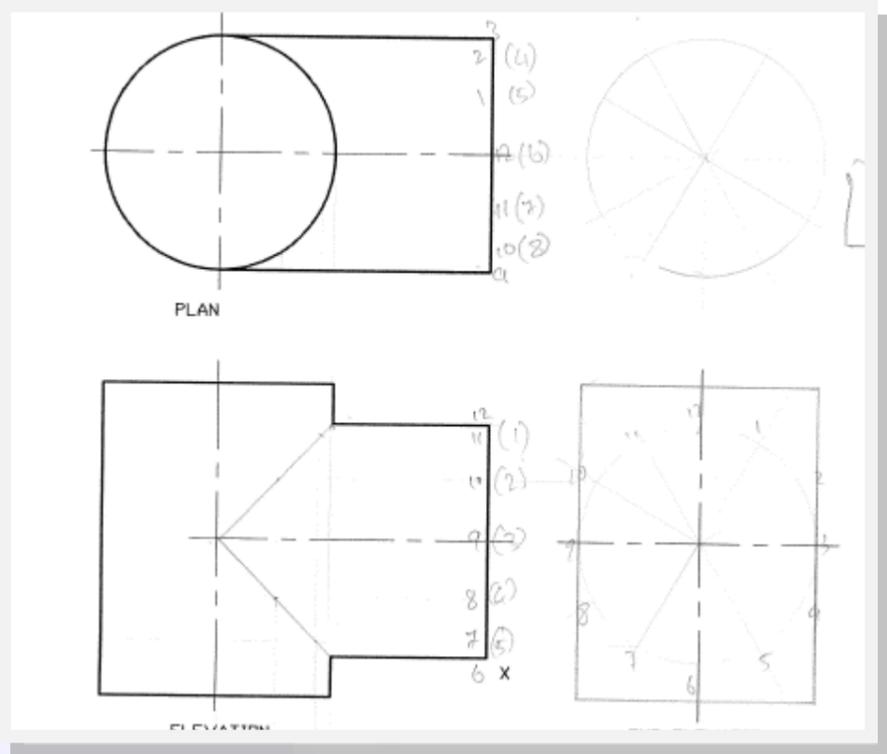
Stepped sections as the name suggests involve the cutting plane changing direction, instead of being in a continuous vertical or horizontal direction. This enables more complex parts to be sectioned fully, or a portion to be inspected.



Interpenetration and intersection of prisms and cylinders

Interpenetration of two cylinders.

Cylinders of different diameters, one at an angle.



This development show the hole in the large cylinder to allow angled

Symmetrical half development of small cylinder.

Interpenetration of two cylinders, both same diameter at 90° angle.

Geometric shapes and forms

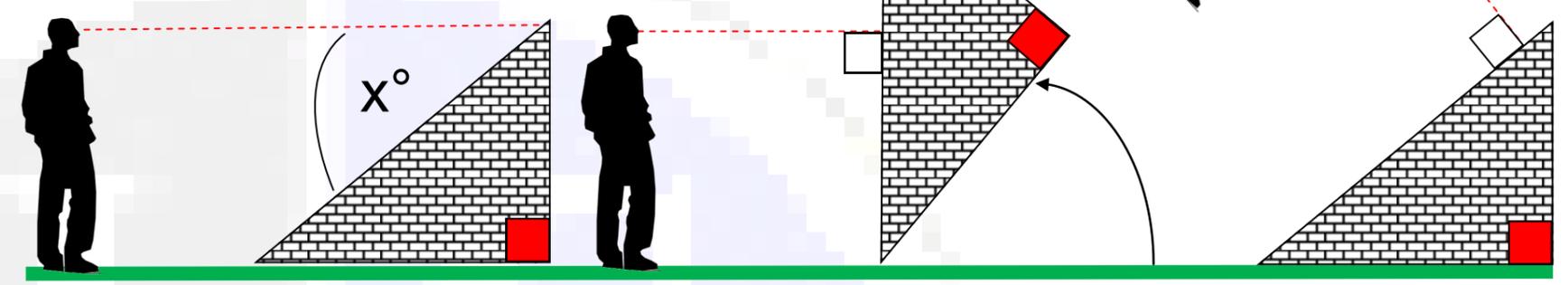
True lengths and shapes

The **true shape** and/ or **length** of an object can only be seen if one looks at the surface at an angle of 90°. In your exam you can be asked to identify different true shapes of sectioned objects



These well-known structures have sloping sides. Their **true length** can only be observed as shown by the graphic to the right.

True Lengths



The line of the man's sight is at an acute angle to the slope of the wall. That means that he is not seeing the **True Length** of the slope. If you think of Pythagoras' Theorem you did in maths, you will remember that this side is the largest of the three in a right an-

If the wall has been rotated so the man is seeing the 'slope' at an angle of 90°. This means that he is seeing the **true length** of the sloping wall. Note that it is now a lot higher in relation to his vertical height.

This view shows what the man would see if it was **his** position which had changed in relation to the sloping wall. He is still looking at the slope at an angle of 90° so he is looking at its **True Length**. It is this concept—of looking at the object at 90° to the sloping surface—that you need to understand when identifying true

True Shapes

Drawing and identifying these views requires you to use the same principles adopted to achieve the **true length**. In this case, it is the entire **surface** of the sloping face which is created, rather than a single line.

So think of the third graphic above, with the man 'hovering' above the wall at an angle of 90° to the slope. Several

<p>True shape of sloping surface</p> <p>PLAN ELEVATION END ELEVATION A A (1 : 2)</p>	<p>True shape of sloping surface</p> <p>PLAN ELEVATION END ELEVATION E</p>	<p>True shape of sloping surface</p> <p>PLAN ELEVATION END ELEVATION B</p>	<p>True shape of sloping surface</p> <p>PLAN ELEVATION END ELEVATION F F (1 : 2)</p>
<p>Cones</p>	<p>Prisms</p>	<p>Cylinders</p>	<p>Pyramids</p>

Colour theory

Colour is used extensively within all areas of graphics. Different effects within the same layout can be achieved easily with the appropriate application of colour.

It is important you are familiar with the **colour wheel**, the different effects colours have and how they work together.

Warm Colours such as reds, yellows and oranges are also known as **ADVANCING COLOURS** because they appear to be closer to the viewer than other colours. **A room painted in these colours would seem warm, but also feel smaller because warm colours make the walls look closer.**

Tone—this term describes lighter or darker versions of the same colour:



Tint: a lighter tone is a **tint** - (a colour mixed with white)

Shade: a darker tone is called a **shade** - (a colour mixed with black)

The Colour Wheel

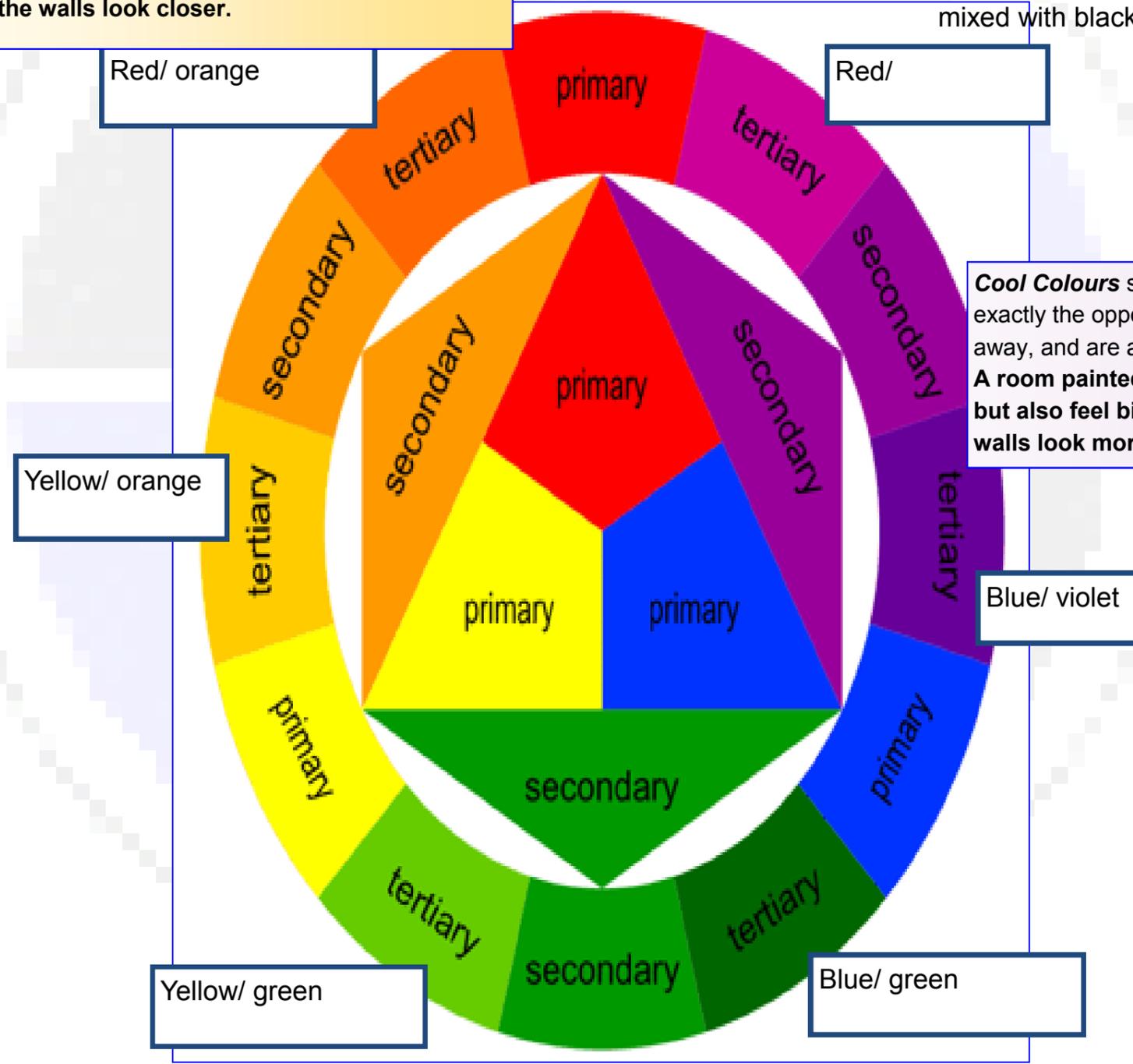
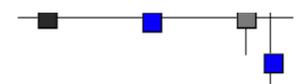
All colours are derived from the **primary colours**—yellow, red and blue—and are a result of mixing two of these together. This in turn produces **secondary colours**—green, orange and violet. When a secondary colour is mixed with a primary colour, a **tertiary colour** is produced.

Harmony

Colours which are close to or next to each other on the colour wheel are said to be in **harmony**. They **harmonise** with each other. They are **harmonious**.

Contrast

Colours which are opposite to each other on the colour wheel are said to be **complimentary**. They are **contrasting colours**.



Cool Colours such as blues, greens and violets have exactly the opposite effect. They appear to be further away, and are also known as **RECEDING COLOURS**. **A room painted in these colours would appear cold, but also feel bigger as these colours make the walls look more distant.**

- ### Colours and Moods
- Red:** warm, exciting, dangerous, passionate
 - Orange:** warm, happy, sunny
 - Yellow:** warm, happy, cheerful, bright, sparkling
 - Green:** cool, restful, fresh, calm, natural, quiet
 - Blue:** cool, elegant, sophisticated
 - Purple:** rich, pompous, regal
 - Neutrals: **Greys**—natural, restful, elegant; **Browns** - natural, earthy, safe
 - Black and white:** dramatic, elegant, stylish, sophisticated

Design Elements

Line

The use of **line** can be an important and effective technique to enhance a page. They can be used to **connect** parts of the layout, create **emphasis** on certain items and **separate** parts of the design from others.



This layout is quite **disconnected**—the text and the product are unrelated to each other and the different colours of the background appear separate from the hairdryer.



The use of the two sets of lines brings repetition to the display, and links the product on the right hand side with the text on the left. The lines also link both coloured parts of the layout together.



By simply applying two thin lines, the viewer's eye is led along the page from the product name to the slogan at the bottom right. The vertical line passes behind the product, so linking it to the slogan and the light blue element of the layout. This also brings depth to the display.

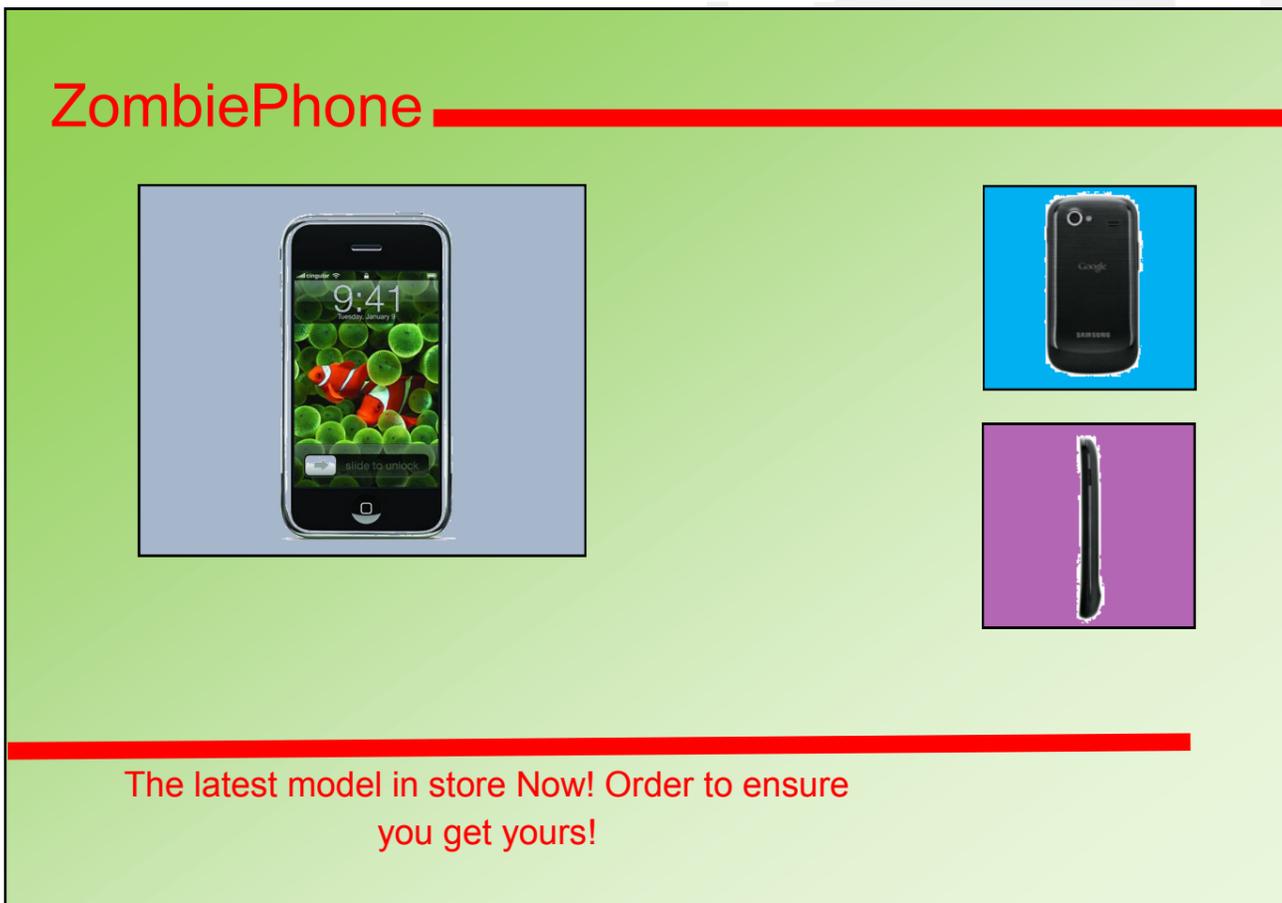


The wavy lines in this layout make it feel less formal and more vibrant than the other two layouts. An impression of movement is created here and again the reader's eye is taken to the slogan at the bottom.

Design Elements

Shape

As most layouts take the form of squares and rectangles, it is effective to use different shapes within the design. The use of circles for example, are useful for bringing contrast to a layout and creating visual interest. This is especially true if the product being advertised has straight edges, in this case a mobile phone.



This layout has is more vibrant and eye-catching as circles have been applied to it. The circles contrast well with the rectangular outlines of the phones and make them stand out more.

The straight red lines have been replaced with wavy lines and this gives a feeling of movement and contrast to it.

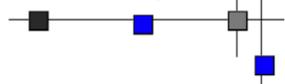
A change of font for the slogan further adds to the contrast in shape—it is less 'straight' than before and harmonises well with the circular shapes now adopted.

This layout is very straight and rectangular in structure. All the graphic items are in boxes, and the shapes of the product are also rectangular.

The red lines further add to this feel, and the display is not very eye-catching or exciting.

It lacks visual impact.

Inveralmond Community High School
Technical Department



Design Elements

Colour

The use of colour can have a dramatic effect on the impact of graphic layouts. Colour **combinations** should be considered, and not just colours in isolation. Colours working together are what makes a difference. If colour combinations are effectively applied, they can:

- Give visual impact to the layout
- Suggest a mood
- Unify a layout
- Make a product stand out
- Connect the product with a target market

You should be familiar with colour theory, which is covered elsewhere in your notes.

This colour scheme predominately uses **tones** of the same colour—blue.

This unifies the display and contrasts well with the red of the product—so creating visual impact.

The red of the product is used in the two items of text—this now becomes the **accent colour**. This unifies the display and also creates brand awareness as it is the same as that of the hairdryer.

Inveralmond Community High School
Technical Department



The application of colour combinations does not work effectively here—too many colours are used. The colours are in conflict with each other, and make the layout confusing to read. It is also difficult to read the slogan at the bottom.



White space

White space does not need to be white; it refers to a blank area or empty space on a page.

There are three main reasons for including white space in a layout:

- It calms a layout and makes a busy layout less busy.
- It can make an item in or near the white space stand out more—it gives that item **emphasis**.

It can allow the reader's eyes to rest. This is advantageous if the layout is busy.



This colour scheme only uses the colours of the hairdryer product. This means no 'extra' colours are used and they work well together to create a harmonious feel.

The light grey of the flashbars is effective in giving depth to the layout and makes the product stand out.

It is easier to see the slogan at the bottom now a single colour gradient has been applied to it.

Design Elements

Mass, value and texture

Value

This deals with the use of colour tones in a layout. Darker tones have a higher **value** and setting them against light tones makes a graphic display more dramatic.

Mass

All items in a layout have a **mass**. A bold heading has a greater **mass** than a small sub-heading. Lines and colour fills add mass but thin lines bring a formal elegance, while heavy blocks of colour can show

Texture

Texture can be considered in two ways: **Physical texture** is provided by the smoothness or coarseness of the paper. **Visual texture** is the pattern in images such as the pattern of tree bark in a photograph.

Design principles

Balance

It is quite straightforward to understand and apply the principle of balance in a layout.

Most layouts are based on a rectangular shape. If the advertised product is placed in the centre, there are two areas to fill—each either side of the graphic.

Layout [1] has been balanced **symmetrically**—if you divided it in half vertically, each side would be essentially the same.



This **symmetrical** layout is quite difficult to follow, and text items are spread over the page. This can make it difficult to read the text and there is little 'flow' to reading the layout.

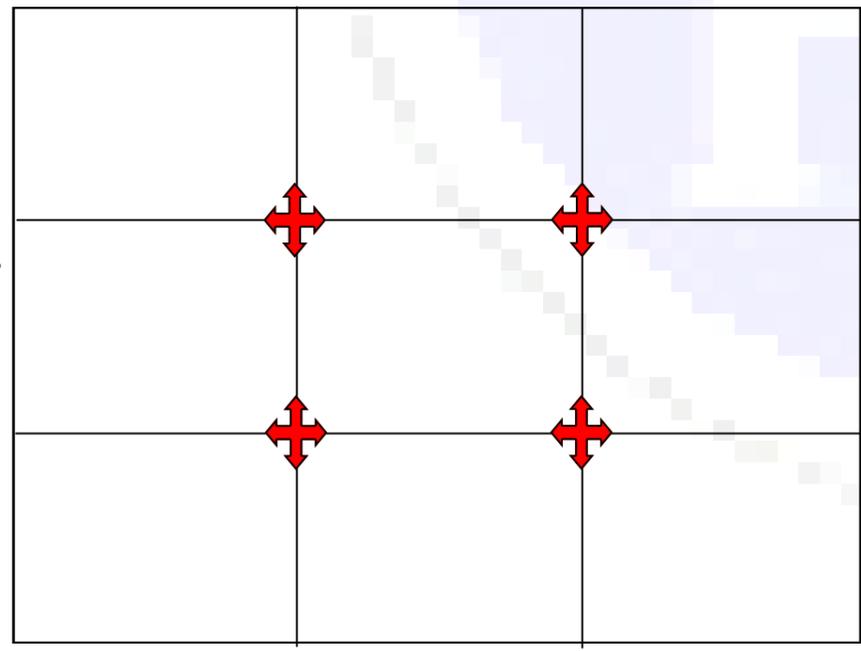


This **asymmetrical** layout is more eye-catching. As the text is positioned to the left and the graphic to the right, the layout 'flows' better.

The Rule of Thirds

If a space is divided into 9 equal rectangles, the four lines dividing the space provide **focal points**. If objects are and text are placed here or close to these lines, a more visually effective layout can be produced.

The points where the lines cross are called **impact points**, and these are key areas to place important features.



Some small alterations have been made here to further improve the layout. The text is grouped more together than before, the product has been enlarged and a shadow effect has been applied. The 'HeatWave' text has been reduced slightly in size and also moved to the left.

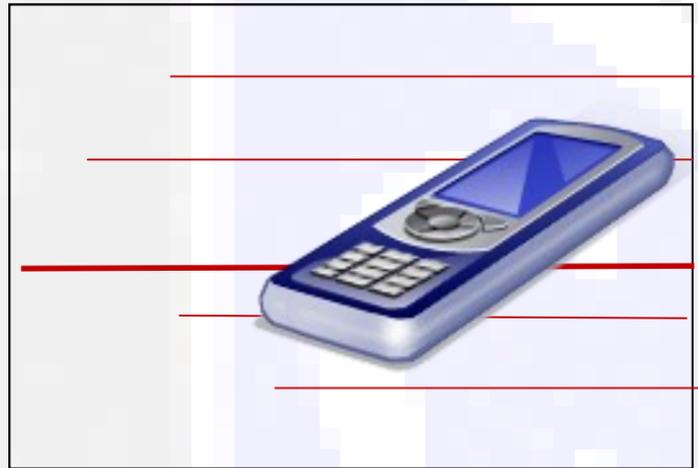
Design principles

Unity, repetition and harmony

As layouts usually consist of different graphic items and text, it is important to connect these different elements together within the layout so that they appear linked and together.



Unity is achieved here by overlapping the image onto the text. This makes a physical connection between the image and the text.



The same effect is achieved here by positioning the image over the lines



The repetition of the thicker blue lines with black outlines creates unity here. The use of a similar colour to the graphic is also a unifying feature.



By overlapping the image onto all three areas of the layout, unity is achieved. Again, a harmonious colour is effective in contributing to this effect and the flashbar connects the text to the image.



The three circles are filled with a similar colour to the graphic. The repetition of these circles creates a unifying effect to the layout.



By wrapping the text around the image, the layout is unified and connected.



Colour, repetition and positioning of graphic are used here to effect to create a unified layout.

Design principles

Alignment

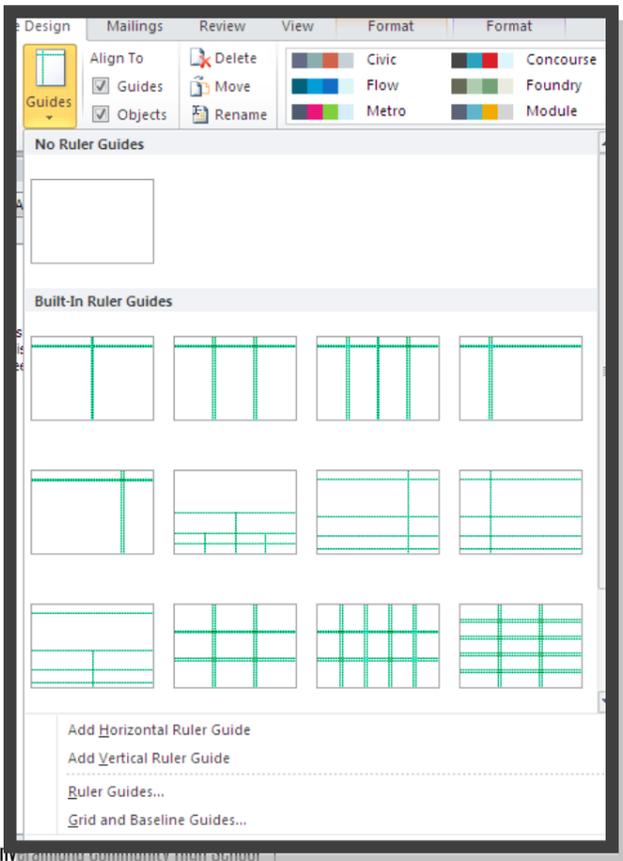
Alignment is an effective method to improve the structure of a layout. Good alignment makes a page easy to follow and organised and helps make it neat and sharp.



This layout [1] is poorly aligned. The impression given is one of disorganisation, and it appears messy and ill-structured. The image and various items of text are almost scattered around the layout, and it becomes difficult to take in the information.



Once guidelines are added to the display [2], one can see how poorly aligned the graphic items and text are. The guidelines illustrate where alignment can be achieved with edges of items.



This screenshot from Publisher shows how using a layout guide and the 'Snap' tool can effectively and easily enable alignment to be achieved in the display. Such a guide has been applied to the layout in [3]. One can see how the edge of each item and text is aligned with another.

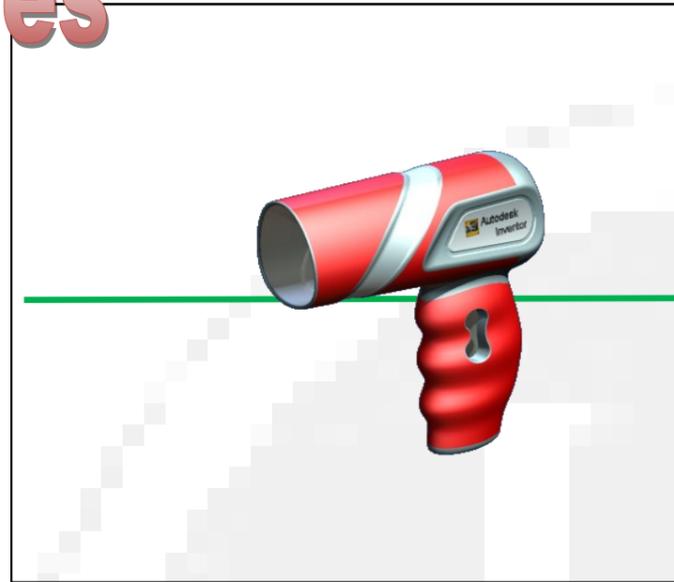


This layout [4] has the guidelines removed and demonstrates how effective good alignment is to a display. Compare it with the original layout [1] and note how it is more structured and organised.

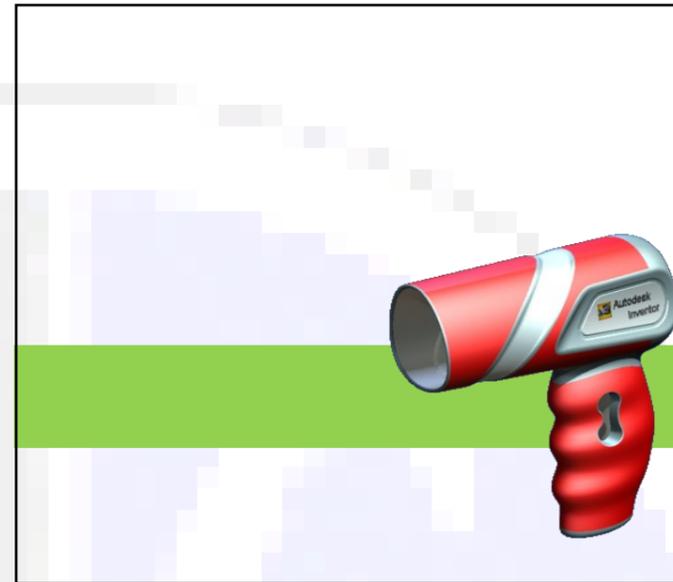
Design principles

Depth

As layouts are produced in a 2D format—usually a page—it is important to create an illusion of **Depth**. This illusion stimulates the layout and makes it more eye-catching. There are several methods to achieve an impression of depth.



If a **pictorial** view of the product is chosen, it appears to have more depth than a simple 2D view. Another simple method of creating depth in this layout is the application of a single thin line behind the hairdryer, making it look as if it is closer than the line.



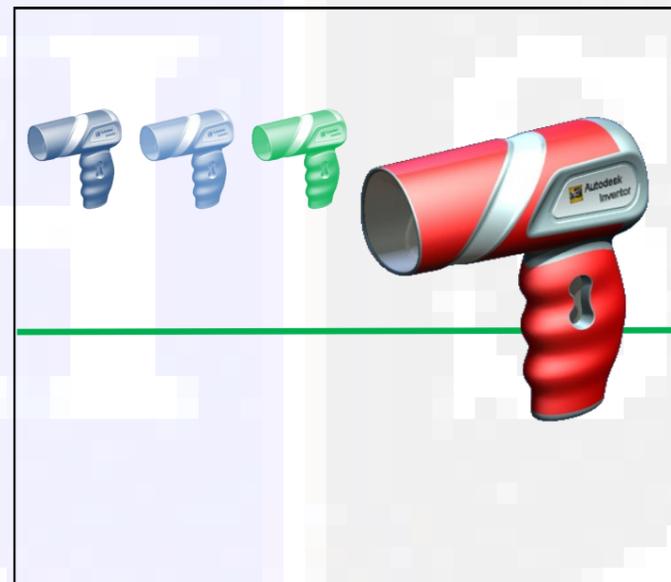
The same effect is achieved here by placing the product onto a coloured shape. As green is a **receding** colour, the effect is to push the hairdryer into the forefront of the layout—which makes it eye-catching.



Using the **Drop Shadow** tool in this instance creates depth in the layout by making it appear that the product is standing out from a background.



By applying an image as a background, depth is brought to this display. It is important to consider the style of the background to successfully achieve this, and in this one a blue washed out colour doesn't take away the emphasis on the hairdryer.



By placing the hairdryer in the forefront of the layout with smaller images of the same product next to it, an impression of depth is created.



By placing the product in front of the text, an impression of depth is created and the hairdryer is brought to the forefront of the layout.

Design principles

Emphasis and dominance

As graphic layouts are often looked at hurriedly by a reader, it is important to attract their attention quickly. If a page has no focal point or is generally bland, the reader shall ignore it and move on.

As a layout may contain several items of text and graphics, a strong **focal point** must be provided to centre the display around. This is normally the graphic or photograph on the page.

Dominance is when one item of the layout stands out more than the others.

Emphasis occurs when one item is made more eye-catching.

These are the three rules of order to dominance in a layout:

1. The main graphic or image should dominate the layout.
2. The title, heading or product should be next.
3. Less important items should be grouped and positioned effectively to support this order.

This layout has no item achieving overall dominance; as it is advertising the 'Boost' drink then the bottle should be the main item the viewer notices.

In this case, the bottle is 'swamped' by the other features in the display—the slogan and the athlete are perhaps the most noticeable features. The font size of the 'Boost' is almost the same as that of the slogan.



Some simple changes have been applied here to make the product become the dominant feature and emphasise the product name:

- The bottle has been enlarged and put off-centre. This immediately attracts the reader's attention.
- The athlete has been reduced in size, and relocated to the top left corner. She still contributes to the layout, but does not take over.
- The crowd silhouette has been faded slightly and put more behind the bottle—this is acting as a flashbar so giving the layout more depth and pushing the product forward.
- 'Boost' has been underlined to emphasise the product name more effectively
- The line at the bottom gives further dominance to the bottle and leads the eye to the slogan—which has been reduced in size.
- A gradient fill has been applied to the background. This has the effect of making the items in the layout stand out more and not be overcome by the starkness of the original solid background.



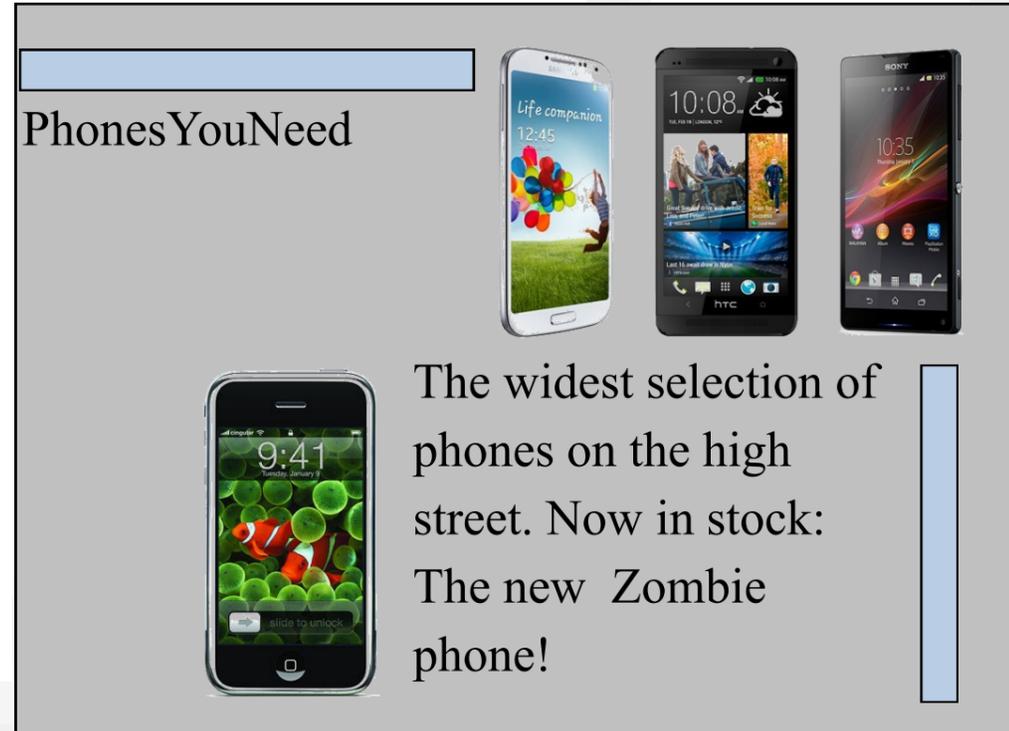
Design principles

Contrast

The purpose of a designed page is to grab the reader's attention—this is especially true in promotional graphics where the layout is competing against other adverts and products.

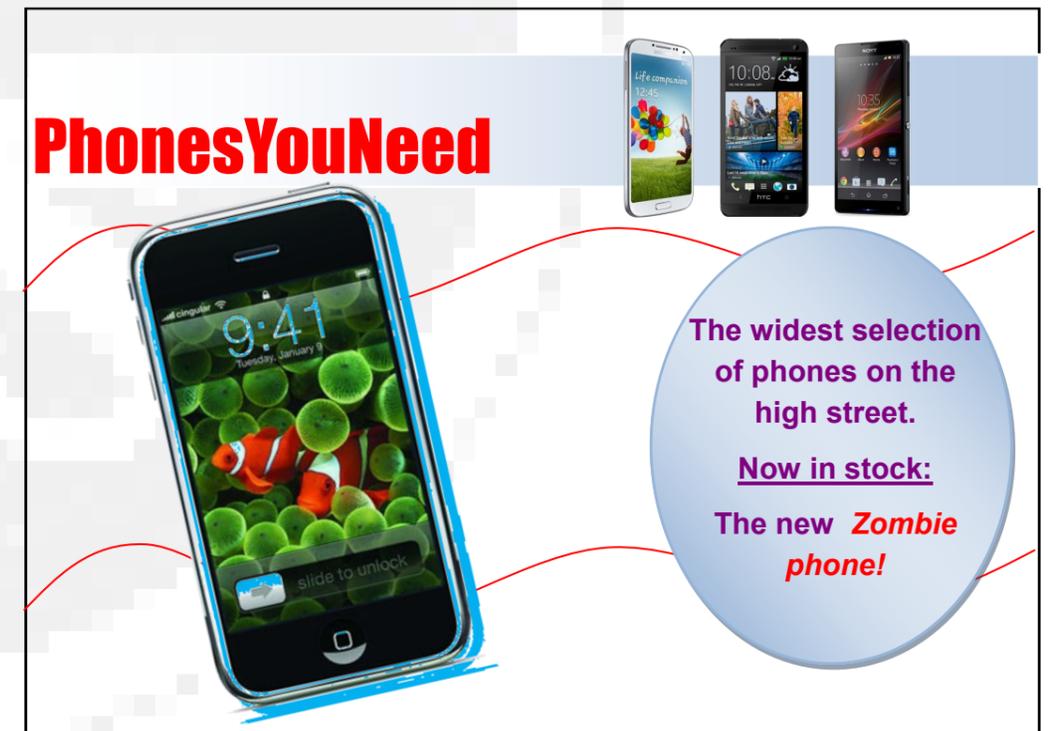
An effective way to achieve this is through the use of **contrast**—especially by comparing opposites.

Opposites can be between colours, horizontal and vertical lines and between shapes—such as circles and squares.



This promotional layout provides no occasions of contrast. The black text is almost lost against the grey background. The page is aligned well, but the straight shapes of the phones and the coloured shapes give the page a very grid-like feel and nothing in particular stands out.

This layout is different however. The display has a much more vibrant feel to it; the red wavy lines contrast strongly with the rectangular shapes of the phones, and by increasing the size of the main image and tilting it the phone grabs the reader's attention. By applying a gradient fill to the flashbar the red text of the company's name stands out more. The use of a circular background for the product information contrasts with the straight lines of the product and flashbar and grabs the reader's attention.



3D illustration

With the rapid development of 3D modelling, great advantages have been provided to engineers, architects and designer. Basic models can be effectively 'brought to life' by a range of features within the software. Most 3D modelling programs have an in-built package to enable illustration—i.e. Inventor Studio—but there are many 'dedicated' packages which can provide even greater depth to illustration. Several core features are applied to a basic model or scene to make it attractive and realistic:

- **Materials:** metals, plastic and wood effects can be added to the model to give it different appearances.
- **Lights:** there are two basic types of light used to illuminate a model or scene. **Global illumination** lights up the whole scene, **Focused illumination** involves individual lights pointing at specific parts of the display—like spotlights.
- **Reflections:** these are used to add further realism to the illustration, and bounce light and surface details to other parts of the model or scene.
- **Shadows:** usually a 'follow on' effect from applying light to the display, it adds further realism to the illustration. The more focused illumination involved, the more shadows.
- **Texture:** added to material to give it further life-like qualities. It could involve characteristics such as a 'rough' look for example knurled metal.



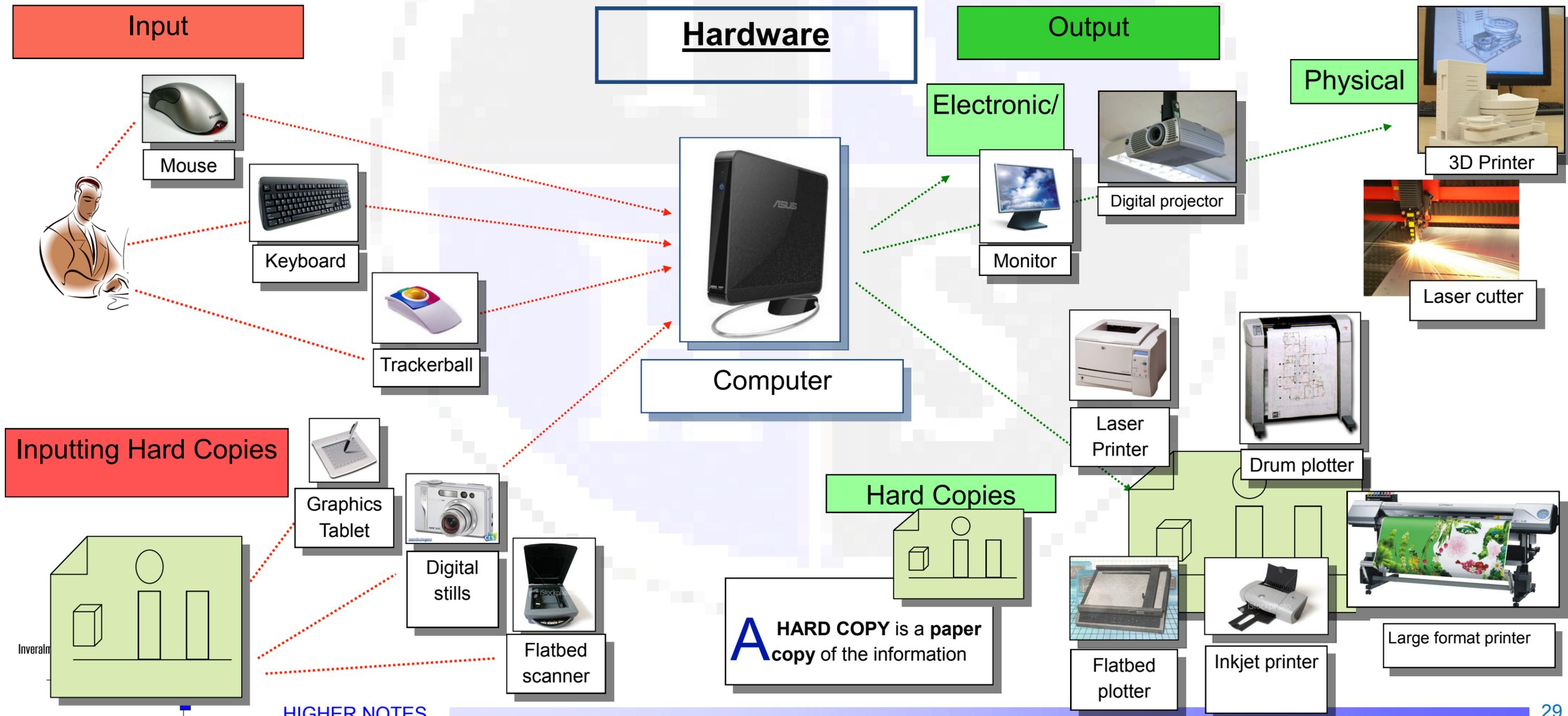
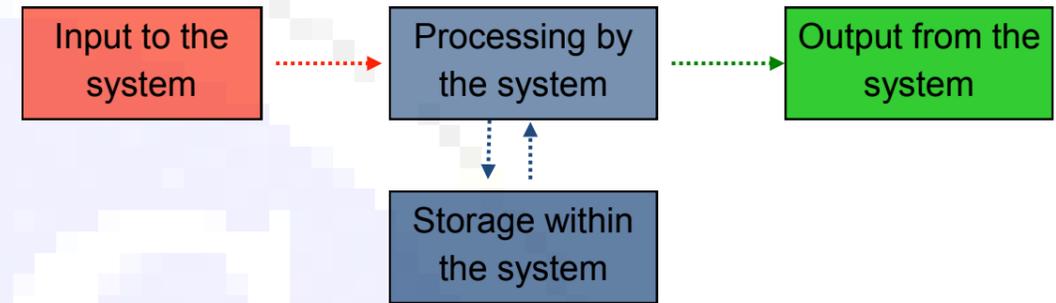
The role of the computer in graphics

Hardware and software

Computers use a combination of **hardware** and **software** to perform tasks. Hardware is the name given to the physical parts of the system such as keyboard, monitor and printer. Software is the name given to programs which interact with the hardware, enabling the computer to perform its tasks.

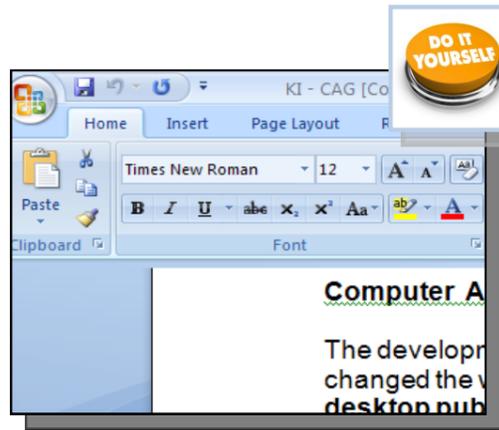


Information is **INPUT** into the computer via various forms of **HARDWARE**, the computer **PROCESSES** this information using **SOFTWARE** and the results are **OUTPUT** using **HARDWARE**.

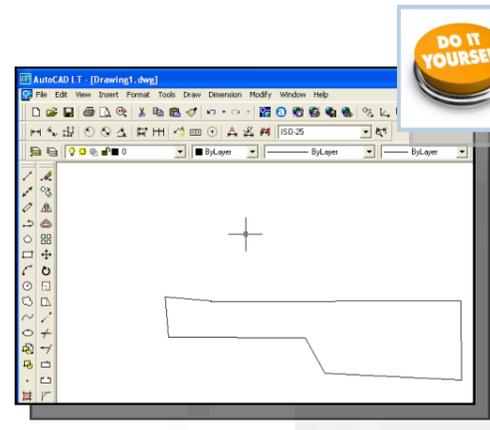


Software

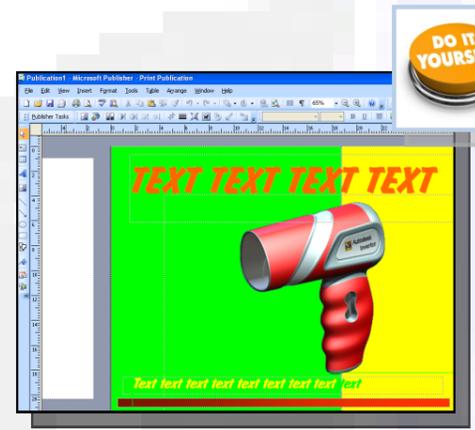
Software—the programs which allow the computer to do what you want it to—cover a huge range of functions. Most are dedicated to a particular role, but some programs have more than one feature—for example Inventor has a computer illustration feature: **Inventor Studio**. A comprehensive list is given on this page:



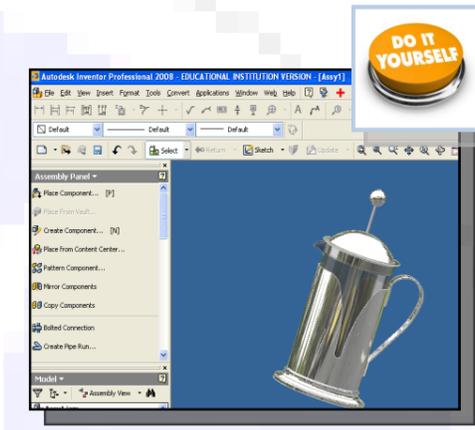
Word processing package e.g. Microsoft Word. This would be used to produce letters which only contain text.



Computer Aided Drawing (CAD) package e.g. Auto-Cad. This would be used to produce detailed technical drawings of some component.



Desk Top Publishing (DTP) package e.g. Microsoft Publisher. This is used to produce a mixture of text and graphics, for example a magazine.



3D Modelling package e.g. Inventor. This is used to produce realistic 3D models of components, allowing changes to be made easily.



Illustration and Presentation package e.g. Inventor Studio. This would be used to colour and render an object or environment.



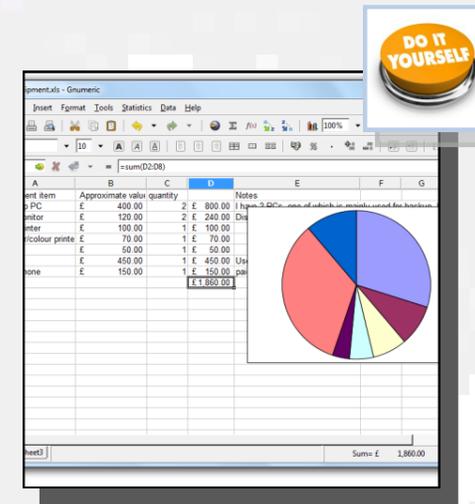
Website building software
These allow the rapid creation of websites, and packages range in sophistication.



Video editing software
This software enables the user to professionally edit pre-recorded videos.



Vector drawing
High quality vector drawings can be quickly produced. There are many free programs available.



Spread sheets
Spread sheet programs usually have a feature which lets the user represent the data graphically.



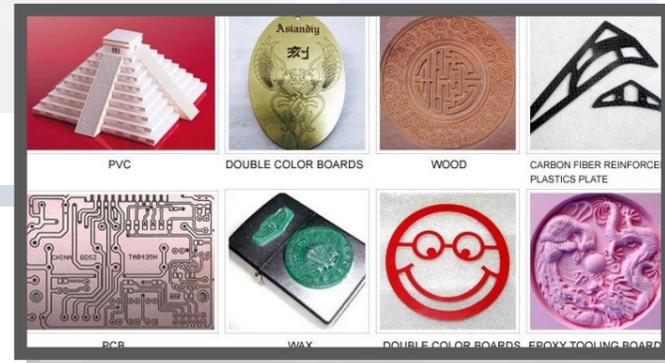
Photo editing software
These packages allows the manipulation of previously taken images.

3D CAD

3D CAD—also known as 3D modelling - allows the user to produce virtual models based on sketches produced within the package or imported 2D CAD drawings. 3D modelling has several uses within industry:

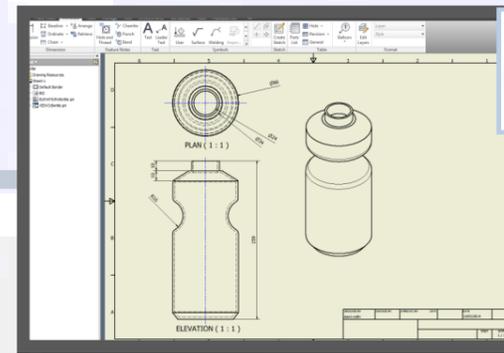
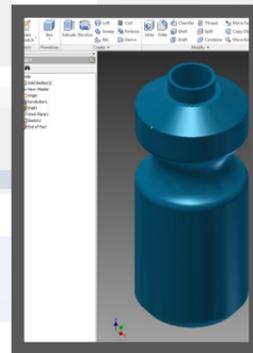
Manufacturing

Prototype 'models' of a design can be produced on the software and 'tested' via features in the program. This can be to simulate different areas of stress on the design or how it would react in various real-life situations. Computer Aided Manufacture (CAM) allows Computer Numerically Controlled (CNC) machines to produce physical parts. A result of this development over the years has been the replacement of many human workers with this automated system.



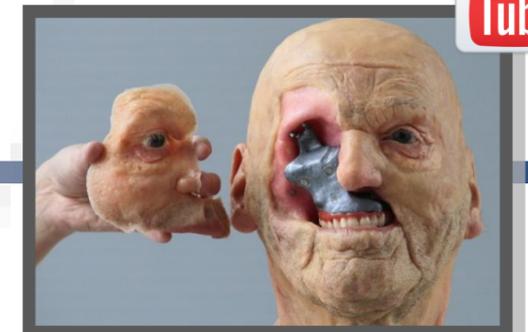
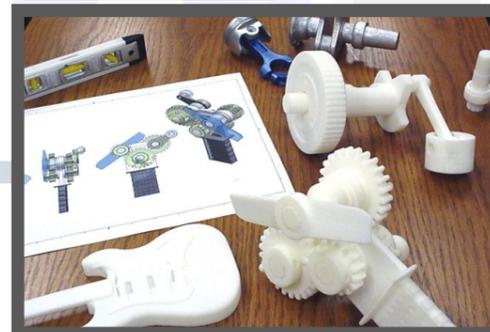
Production Drawings

2D CAD production drawings can be very quickly and accurately obtained from the 3D model. This can make it easier to produce these drawings than using manual methods or 2D CAD. Alterations to the model automatically update the 2D production drawing.



3D Printing

The 3D models can be exported as standard tessellation language (STL) files to 3D printers and produced as physical prototypes. This allows basic models to be produced to provide a hand-held, tangible version of the design from the computer. The advantages of this are that the designer or customer can get a 'feel' of how the design shall exist in real-life, in a way that the computer version cannot do, no matter how sophisticated the software is.



Simulation

This allows the creation of required situations for training, testing design/ materials and predicting future events. This is generally cheaper than 'real-life' and safer too.



3D Illustration

This improves the visual appearance of a 3D model, and some packages allow the user to interact and animate with the design. Most CAD packages have illustration features imbedded within them—ie Inventor Studio—but there are 'stand alone' products available which are solely devoted to the task.

Desktop Publishing (DTP)



Desktop Publishing (DTP) enables the production of magazines, newspapers, books, promotional literature etc. to be created on a desktop computer or laptop. The **publishing industry** creates these documents and the physical paper documents are produced by the **printing industry**. The design is the result of the work of the **graphic designer**.

Benefits of DTP to the Graphic Designer

Graphic designers nowadays operate on a very flexible basis— work can be produced anywhere and any time using modern technology and sent to the office via the internet.

Modern DTP packages allow exciting and imaginative displays to be very quickly and easily created. The main benefits DTP software brings to the graphic designer are:

- It is simple to make modifications to images such as colour, shape and formatting.
- Further modifications to the design can easily be implemented on behalf of the editor or client.
- The grid structure templates within DTP software enables designs to be created accurately and quickly.
- Design proposals can be sent to the editor or client electronically to save time. Their responses can be returned this way.
- The graphic designer can work from home. This saves travel costs and environmental impact of their journey.

Benefits of DTP to the graphics industries

As there is great competition among newspapers and magazines in the market and the circulation of most printed newspapers is declining, DTP provides many advantages to the industry:

- Proposals and final editions with full designs and images can be sent quickly electronically. These can then be forwarded onto the printer in this way.
- News reports can be sent from anywhere in the world email.
- The time it takes to design and publish a document is greatly reduced. Modifications can easily be made by the editor and sent to printer.
- Common features within a publication can be quickly produced via templates such as footers, running headers etc.

Benefits of modern printing methods to society

The advent of modern methods has had a major impact on the printing industry. Traditional methods were very labour intensive and large numbers of people were employed in various roles such as print-setters, labourers and engineers. The amount of semi-skilled workers has been reduced, although there is now great demand for highly skilled operators as more reliance is placed on computer controlled design and production. The new technology has also had an effect on the industry's environmental impact:

- Modern printing methods are more energy efficient than previous means.
- Many publications provide an electronic or online edition. This reduces the amount of paper and ink required
- Most publications use paper which can be 100% recycled as a result of modern printing technology.
- Modern inks are more environmentally friendly and less quantity is required. Inks are now based on vegetable oil rather than on petro-chemicals.
- The quantity of paper and inks required is digitally controlled. This reduces waste.



DTP techniques



Bleed

This main image bleeds off the printing area and through the margin. This creates an informal feel to the page.

Colour fill

Contrast and harmony can be achieved by formatting the text box appropriately. These two text boxes use a blue/ grey fill which harmonises with the main picture, but contrasts with reds used in the headers.

Column rule

This column rule gives this page a more formal look, and separates these two sections.

Reverse

The body text colour is black. The text of the subheading has been reversed, and the box filled with a darker colour. This creates contrast and gives the page interest.

Header

This is called a **running header**, and appears on every section of the magazine.

SPECIAL FEATURE



Declaring war on the 'dull' music scene....

KASABIAN

Headline

The headline introduces the article. In this case, the bold fonts create emphasis, and the reverse text on the blue/ grey fill gives it visual impact.

Drop capital

This larger first letter signifies the start of the article. The use of reverse also attracts interest.

Margin

Margin—the space at the side and bottom of the page where there is no text or graphic.

Kasabian burst on to the British music scene in 2004 with the release of their eponymous debut album. Disgusted with the clean living 'non' antics of the current groups of the time—Coldplay, Keane, etc.—they vowed to bring back some of the excitement and glamour that had been sorely missing. They have since gone from

strength to strength, becoming the major attraction at festivals over the years. As guitarist Serge says: "Oasis have gone. We are the biggest band in Britain now. Kasabian are to headline the Isle of Wight and Rockness festivals."

Page 6

Festivalseason.com

Gutter

This separates columns, and helps to de-clutter the page.

Text wrap

As it suggests, the text wraps around the image.

Cropped image

This is an image with the background removed. It creates a more interesting shape.

Excitement...what it is all about

The song "Vlad the Impaler" was released as a free download for a period of 4 days, as a preview for the album. The promo video for "Vlad the Impaler" stars Noel Fielding of *The Mighty Boosh*. The album's first official single was the track "Fire", which was released on 1 June 2009, and the song "Where Did All the Love Go?" was released as the second official single. The third single "Underdog" was used in the movie *Takers* (2010).

On 14 June 2009, *West Ryder Pauper Lunatic Asylum* reached number one in the UK top 40 charts, spending two weeks there. *West Ryder Pauper Lunatic Asylum* was shortlisted for the 2009 Mercury Prize, and was named 'Best Album' at the 2009 Q Awards. The band won "Best Group" at the 2010 Brit Awards. At the 2010 Q Awards the band won the "Best Act In The World Today".

The song "Fire" was used as the Barclays Premier League theme song for

Lead singer Tom explains the Kasabian philosophy

Where do you prefer to perform?

Scotland—the crowds are always up for it and go mental.



Lead singer Tom

Why do you hate some other bands' boring attitudes?

All rock bands have a responsibility to live the life of a rock star—who wants to hear about Chris Martin's vegan diet or the Fratellis going to bed early? People want an escape from the grinding routine of life, and we'll give them that.

Heading

This introduces a separate section of the article.

Tilt

This image is tilted, which catches the reader's attention. It creates a modern feel, which will appeal to the youthful target market.

Caption

Gives information about the image.

Sub-headings

These break up the large section of body text. The use of the accent colour produces a visual rhythm.



Favourite festival?

T in



Page 7

Page number (folio)

Desktop Publishing

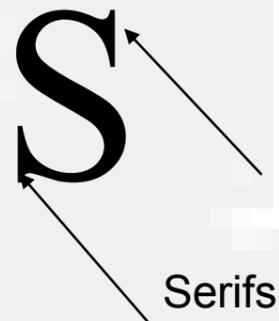


Text

Text is obviously used throughout a publication, and it is put to different uses to satisfy particular requirements of the piece. **Headers** and **footers** appear at the top and bottom of the page respectively, and give information, such as date, page, the feature concerned, etc. **Headings** and **titles** give an introduction to the article, and **subheadings** divide the article into smaller sections. **Pull-quotes** draw the reader's attention to the article and **captions** explain an image or photo. The main body of text is called **body type, or body copy**.

Typeface

Fonts are in two styles— **serif** and **sans serif**.



Serifs

M H S

Serif text—they have a line crossing or tail between the two free ends of the stroke.

This creates a serious/ formal look and is often used for the body text in quality

M H S

Sans serif—a typeface without serifs.

This creates a less serious,

Examples of fonts

Times New Roman
Baskerville Old Face
Century Schoolbook

Serif fonts

Arial
Europa

Sans serif fonts

Arnold Bocklin
Gospel

Fun fonts

Contrast can be created in a publication by using a sans serif font for the title, and a serif font for the main body text. A good 'rule of thumb' when deciding on font styles is **keep it simple** - use 1 sans serif font for headings, subheadings and captions, and 1

HIGHER NOTES

Desktop Publishing

Text formatting

Text size is measured in **points**.

22 point bold text

14 point regular text

Bullet points can make the piece more 'snappy', especially

ROOMS

- En suite WC
- Sky TV

An **indent** is a good way of signifying the beginning of a

This year's T in the Park may have one of the lowest key line ups in recent years, with few major stars of note.

Last year, the presence of the mighty Kasabian, global superstar JayZee and even Madness kept up

A **drop capital** indicates the start of the article and indents the main body copy next to the drop capital:

Last year, the presence of the mighty Kasabian, global superstar JayZee and even Madness kept up the festival's reputation as

A **hanging indent** uses a drop capital, but indents the rest of the column underneath:

Last year, the presence of the mighty Kasabian, global superstar JayZee and even Madness kept up the festival's reputation as one of

Left-aligned text can make the publication appear more sophisticated. It is the most

Last year, the presence of the mighty Kasabian, global superstar JayZee and even Madness kept up the festival's reputation as one of

Justified text produces vertical lines on each side. It gives the text a strong visual shape, but can create unwanted hyphenation and exaggerated word spacing.

Last year, the presence of the mighty Kasabian, global superstar JayZee and even Madness kept up the festival's reputation as one of the best.

Right-aligned text can look sophisticated and is often used for subheadings and

Last year, the presence of the mighty Kasabian, global superstar JayZee and even Madness kept up the festival's reputation as one of the best.

Centred text creates a symmetrical column of text, but is difficult to read and

Last year, the presence of the mighty Kasabian, global superstar JayZee and even Madness kept up the festival's reputation

Text wrapping allows text to be placed around an im-



Last year, the presence of the mighty Kasabian, global superstar JayZee and even Madness kept up the festival's reputation as one of the best.



Text/Typeface/Font

There are different ways of organizing text which are used globally. This is referred to **justification** or **alignment**.

Aligned Left

Lorem ipsum dolor sit amet, consectetur adipisicing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat.

Aligned Right

Lorem ipsum dolor sit amet, consectetur adipisicing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat.

Justified

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Centered

Lorem ipsum dolor sit amet, consectetur adipisicing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat.

Copy/cut/paste

When you take an image/piece of text etc. and copy it from one place to another. Cut is when you delete something from its original location and paste it somewhere else.

Shortcuts: Ctrl C / Ctrl X / Ctrl C

Handles

Handles are the parts which appear when you select an image. By moving these you can manipulate the image in many ways i.e. changing the size or rotating an image.



Colour Fill

This is when you take a shape with an outline and fill it in with a colour this is shown in the images below.



Before col-

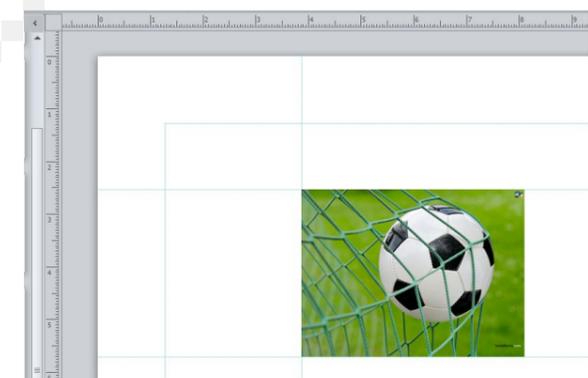


After colour

Guidelines

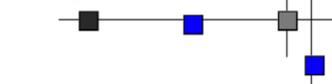
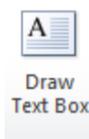
Guidelines are guides which you access via your rulers on your page. They act as a guideline for aligning images/text etc.

You can select **Snap to Guidelines** which will allow your image to automatically jump to meet with guidelines you have positioned on the page



Text Box

A text box is what you would insert into a page in order to insert text into your document. It should look something like the image shown.





Cropping

Cropping is a tool which allows you to delete unwanted parts of an image. You can crop an image by pulling in the sides or by cropping around the outline of the shape as shown in the second cropped image



Original image



Cropped Image



Cropped Image

Rotate

Rotate is when an image is rotated like the beach ball shown in the second image. You can rotate an image/text to any specific angle you wish



Original image



Rotated image

Transparency

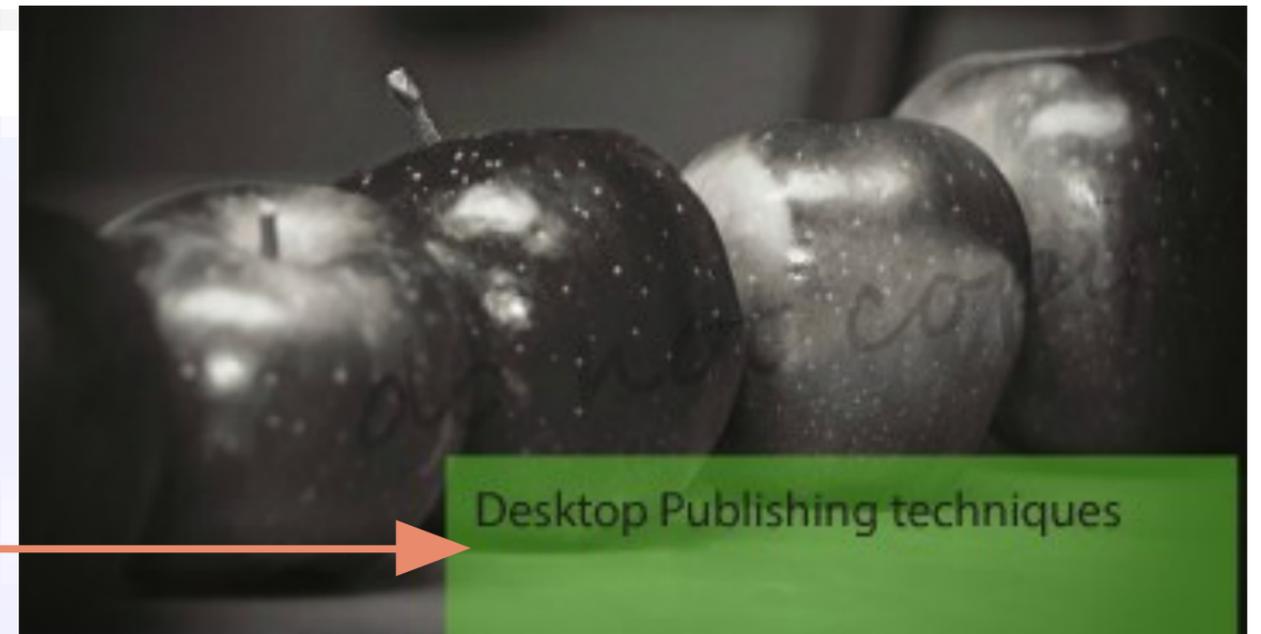
When you make an image/text/ block of colour etc. 'see-through' so that you can see anything positioned behind

Text Wrap

When you alter text to wrap around an image or shape

Drop Shadow

When you make an image/text/ block of colour etc. 'see-through' so that you can see anything positioned behind

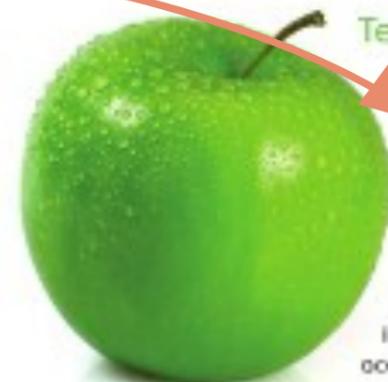


Desktop Publishing

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat. Duis aute irure dolor in reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla pariatur. Excepteur sint occaecat

cupidatat non proident, sunt in culpa qui officia deserunt mollit anim id est laborum Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat. Duis aute irure dolor

in reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla pariatur. Excepteur sint occaecat cupidatat non proident, sunt in culpa qui officia deserunt mollit anim id est laborum Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim



Text Wrap

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Drop Shadow

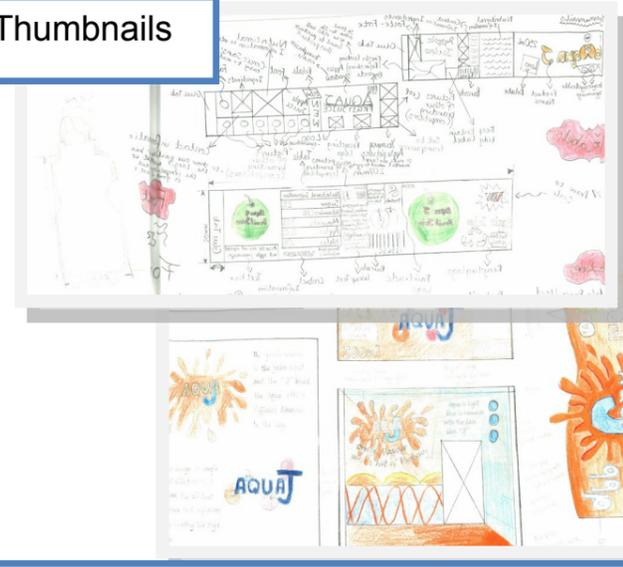
Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquip ex ea

DTP Planning strategies



Register marks and crop marks

Thumbnails



These are the PRELIMINARY graphics one uses to plan out and consider different layouts for the DTP brief. A development of ideas should occur and the quick sketches should be well annotated—comments reflecting the designer's thoughts.



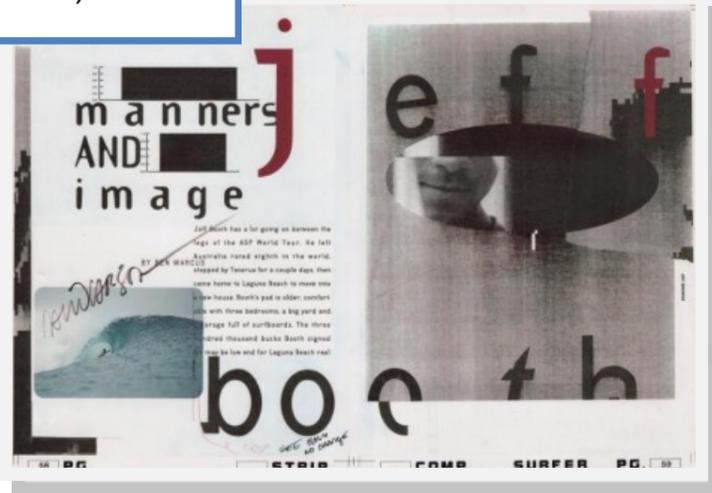
The desired layout page is usually printed within a sheet of larger paper than what is required. For example, an A4 page shall be on an A3 sheet.

Register marks: When printing an image that has more than one colour, it is necessary to print each colour separately and ensure each colour overlaps the others precisely. If this is not done, the finished image will look fuzzy, blurred or "out of register" (see image to right). To help line the colours up correctly, a system of registration is necessary.



Exaggerated example of a mismatch of CMYK registration

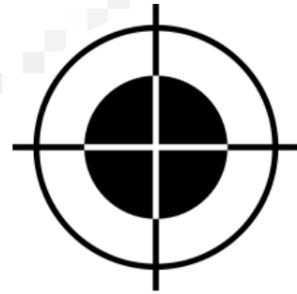
Proof (pre-press)



This is the proposal submitted to the client by the printer before a full run commences. This gives the client the opportunity to assess its suitability before it is printed. A **hard proof** involves a paper copy and a **soft proof** is via electronic means.



An example of registration misalignment, note the cyan and magenta plates are not in the exact place. Also halftones are visible on the top area.



A commonly used registration mark. Although it seems black in colour the actual value should be C=100,M=100,Y=100,K=100



Vector graphics v. Bitmap/ Raster graphics

Vector

Made up of individual scalable objects, which are defined by mathematical equations, which allows them to render at the highest quality. Objects may consist of lines, curves and shapes with editable attributes such as colour, fill and outline. An object can be modified by shaping and transforming using nodes and handles.

Bitmap

Also known as raster images. Made up of pixels in a grid. Each pixel contains specific colour information. A pixel is minutely small, a single image may be composed of thousands of individual pixels. These pixels are only clearly and individually visible when the image is magnified



Two advantages a Vector image has in comparison to a Bitmap image.

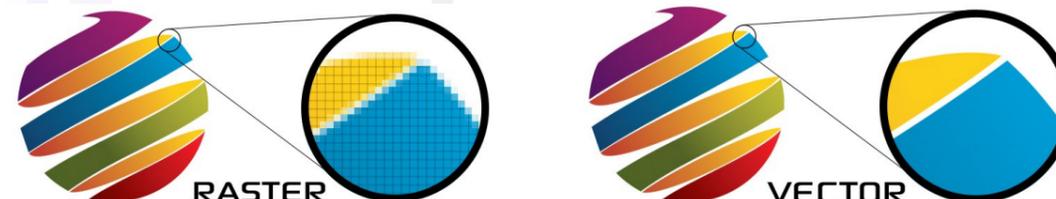
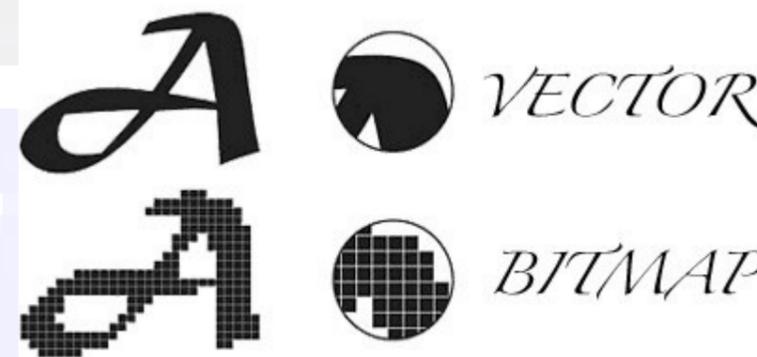
Vector images can be scaled, skewed, stretched without losing their quality. A Vector image can also be manipulated without losing its quality. The same can not be said of Bitmap, which, when scaled will lose its original map of bits.

Vector image:

- Scalable.
- Has no background.
- Resolution independent.
- Unsuitable for photo realistic images.

Bitmap image:

- Restricted to rectangle.
- Quality is reduced when resized.
- Made up of pixels in a grid.



2D CAD



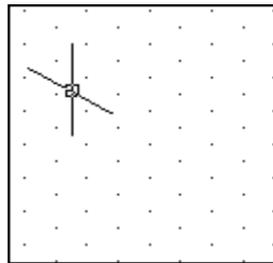
2D CAD can basically be considered as being a computer version of a manual drawing board and is used extensively in the architectural, engineering and construction industries. It also forms the basis for producing 3D models. By applying on-screen commands the user can quickly, easily and accurately produce high-quality 2D drawings of the required format.

2D CAD packages bring several advantages to the process. In addition to increased **SPEED** and **ACCURACY** of production, the drawings can be easily **EDITED, STORED** and **TRANSFERRED** immediately around the world via the internet. 2D CAD also provides the user with several features which are unique to this medium:

Grid

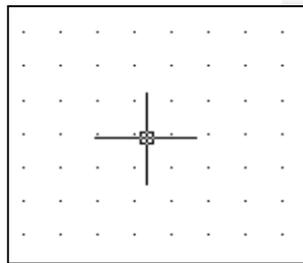
By applying a grid template to the drawing, the user can 'Snap to grid' - this means that each point and line on the drawing is joined to a pre-determined format. The size and style of the grid can be set before drawing and this allows greater accuracy and speed of production. It can be compared with the drawing instruments used with the manual drawing board such as the rule, set squares and T-squares.

Isometric



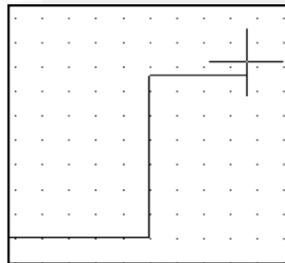
Displays a 30° grid on screen which makes isometric drawing easier and more accurate.

Ortho grid



Displays a grid on the screen to any desired spacing. This makes orthographic drawing easier and more accurate.

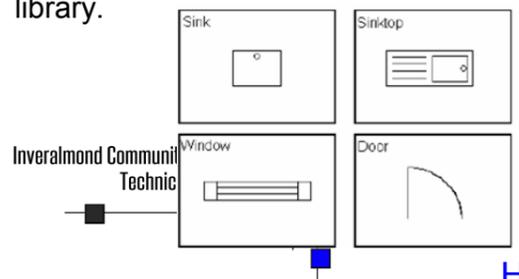
Ortho



Restricts the movement of the cursor to horizontal and vertical movement only. This makes orthographic projection

Library of parts

This allows the user to insert previously drawn and saved parts into a new drawing. The advantage of this feature is that each part is **UNIFORM** (BSI symbols, etc.) and does not have to be redrawn each time it is required. The library feature allows newly drawn parts to be saved for future use and multiple users can add to and access the library.



Some disadvantages with CAD...

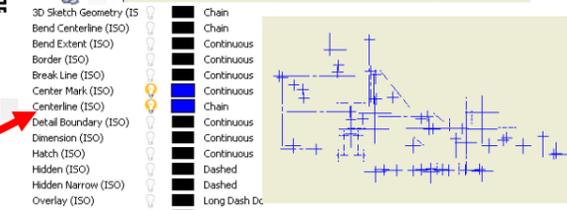
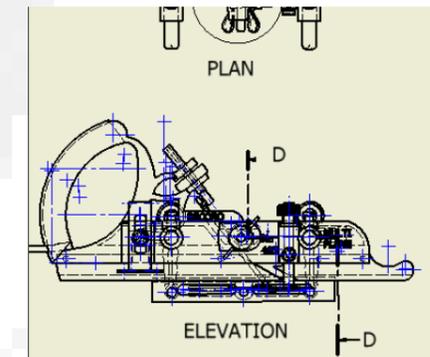
Using CAD as a software package involves some of the risks associated with any computer systems, such as:

- The initial cost of a computer system is high, as is the cost of retraining staff that are used to producing drawings by traditional methods.
- It takes time to convert existing paper drawings over to an electronic format, although **scanners** can help with this.
- Loss of material can occur due to computer viruses and power failures.
- Possible theft of materials is more common with a CAD system.

Layers

A CAD drawing is made up of individual 'layers', with each layer providing a different line type or 'element' of the drawing. This allows that layer to be isolated and edited/applied to the drawing. For example, within a large floor plan the electrical, plumbing or heating systems can be displayed individually so allowing that information to be easily available to the individual required without the drawing becoming 'cluttered' with excess detail.

Layer Name	On	Color	Line Type	Line Weight	Scale by Line ...	Plot
3D Sketch Geometry (IS)	On	Black	Chain	0.25 mm		
Bend Centerline (ISO)	On	Black	Chain	0.25 mm		
Bend Extent (ISO)	On	Black	Continuous	0.50 mm		
Border (ISO)	On	Black	Continuous	0.70 mm		
Break Line (ISO)	On	Black	Continuous	0.50 mm		
Center Mark (ISO)	On	Blue	Continuous	0.25 mm		
Centerline (ISO)	On	Blue	Chain	0.25 mm		
Detail Boundary (ISO)	On	Black	Continuous	0.25 mm		
Dimension (ISO)	On	Black	Continuous	0.25 mm		
Hatch (ISO)	On	Black	Continuous	0.18 mm		



All the layers in the CAD drawing have now been turned off, apart the centre lines. This can be done with any layer in the drawing.



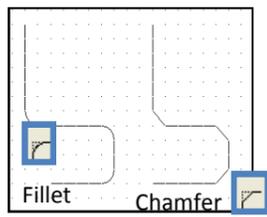
The main CAD comands

These CAD commands are taken from 2D Auto-CAD, but all can be used within the **sketching** mode of 3D Modelling packages, including Inventor. They are all designed to make the drawing of material as easy and efficient as possible for the user.

Trim, extend and break

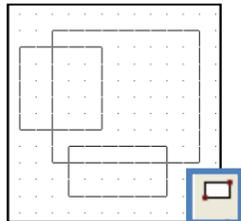
trim			Trims the end off a line
extend			Makes a line longer
break			Removes a section from the middle of a line

Fillet and chamfer



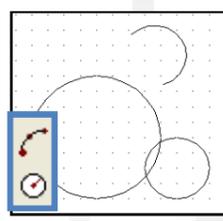
Rounds (fillets) corners;
Angles (chamfers) corners

Rectangle/box



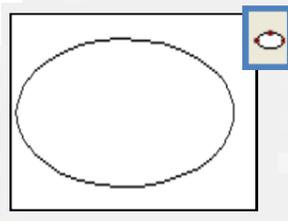
Draws squares and rectangles accurately and quickly

Circle and arc



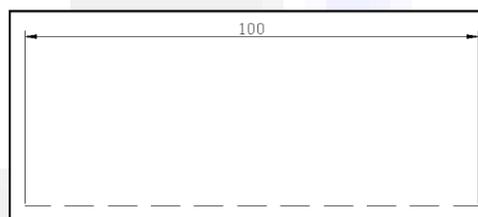
Draws circles and arcs accurately and quickly

Ellipse



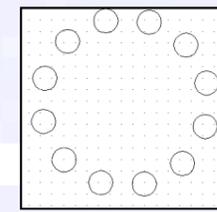
Draws circles and arcs accurately and quickly

Dimension



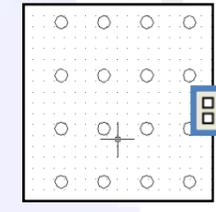
Automatically measures then dimensions chosen parts of a drawing.

Ring Array



Creates a circular arrangement from copied objects.

Box Array



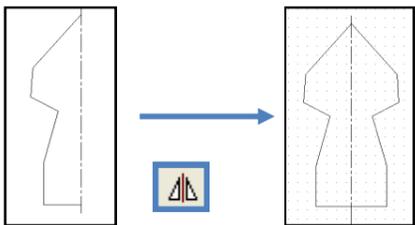
Creates a rectangular arrangement from copied objects.

Text



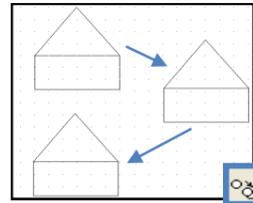
Allows text to be entered in a variety of fonts and sizes

Mirror



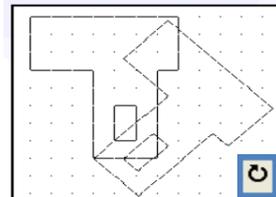
Creates a mirror image copy of an object

Copy



Copies and positions without having

Rotate



Turns an object to any angle required.

Scale

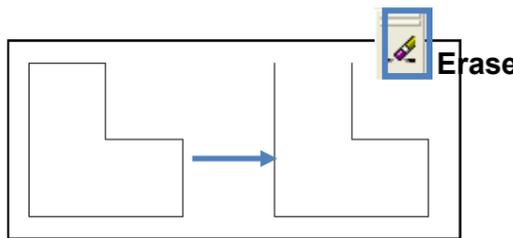


This changes the sizes of objects.

Line types

Linetype	Appearance	Description
ByLayer		
ByBlock		
CENTER2		Center (.5x)
Continuous		Continuous
HIDDEN2		Hidden (.5x)

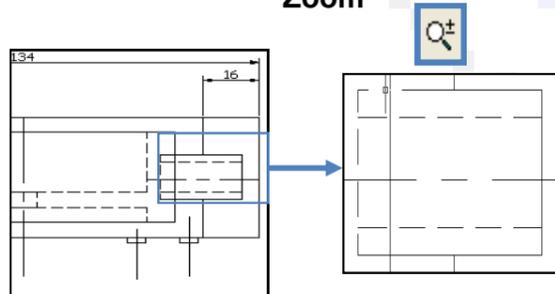
Allows any BSI line types to be used in the drawing.



Erase

Erases selected lines or areas from a drawing

Zoom



Enlarges view so that small details appear bigger and are easier to work on.

Layers

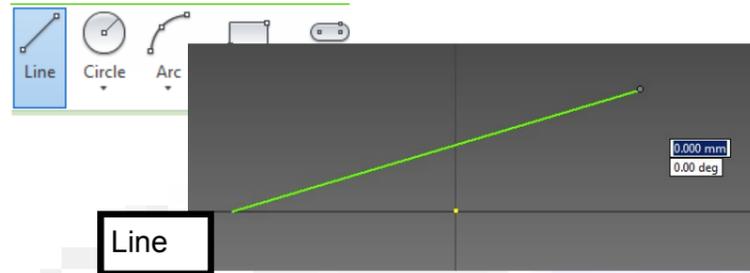
Name	On	Freeze...	L...	Color	Linetype	Lineweight
0				250	Continuous	Default
Centre Line				250	CENTER2	0.15 mm
Defpoints				250	Continuous	Default
Dimension				250	Continuous	0.15 mm
Hidden Line				250	HIDDEN2	0.15 mm
SMART-Redline				250	Continuous	0.15 mm

Allows a complex drawing to be built up in several layers to make it easier to work on.

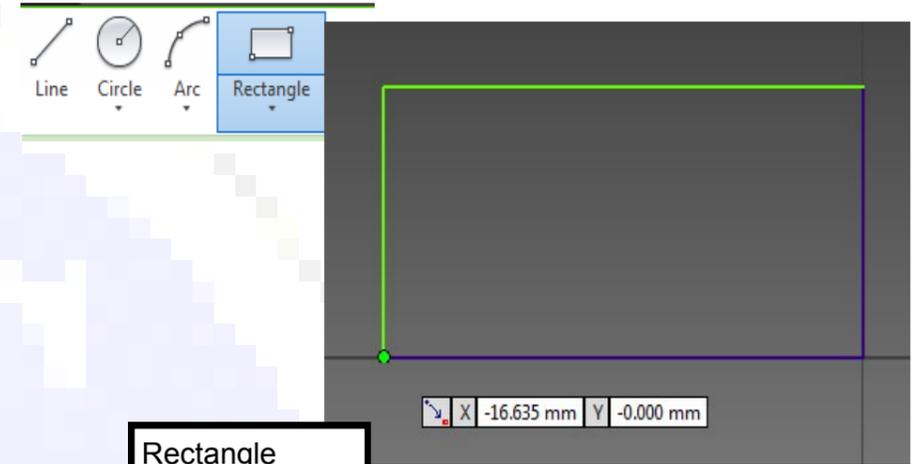
Drawing tools



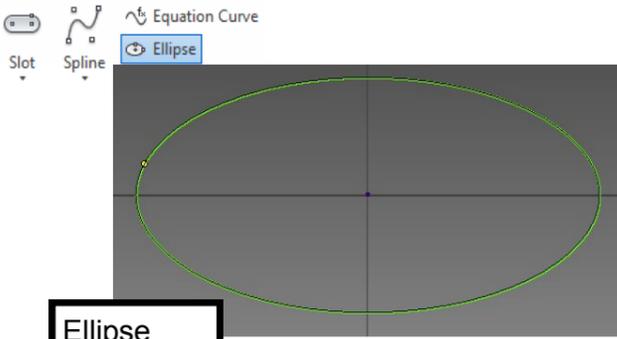
These are the tool you use within **SKETCH MODE** to produce the initial component before it becomes a **MODEL**.



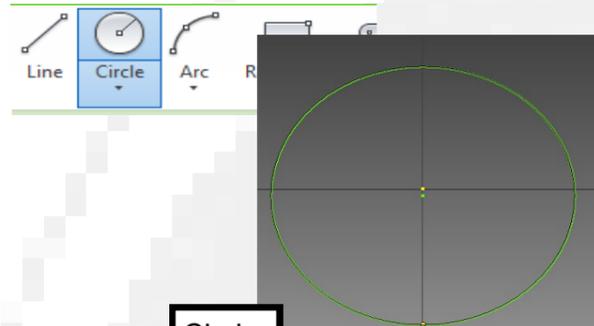
Line



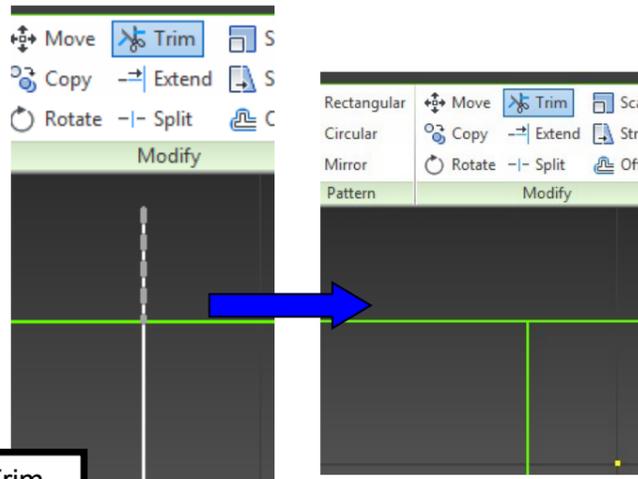
Rectangle



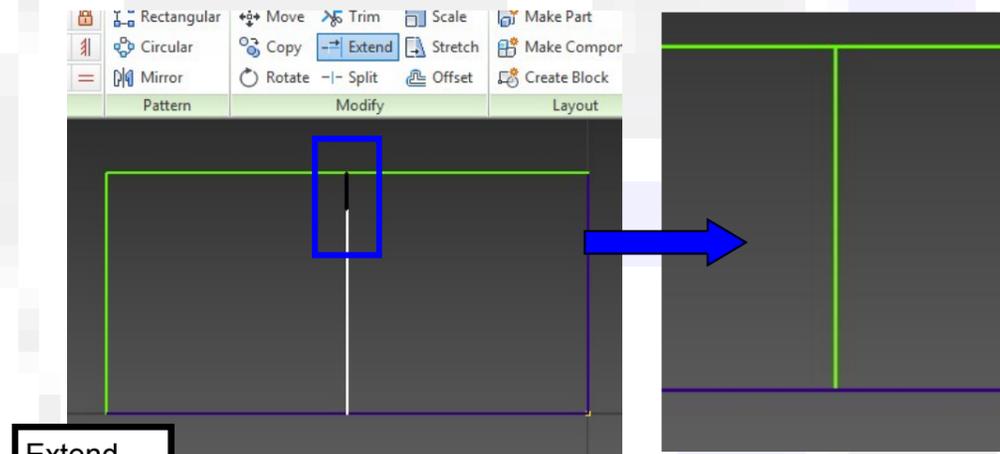
Ellipse



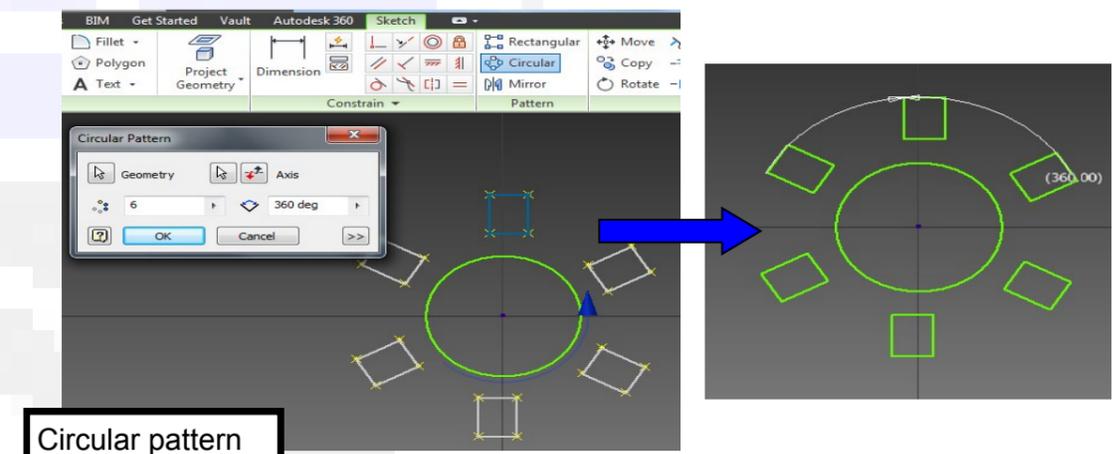
Circle



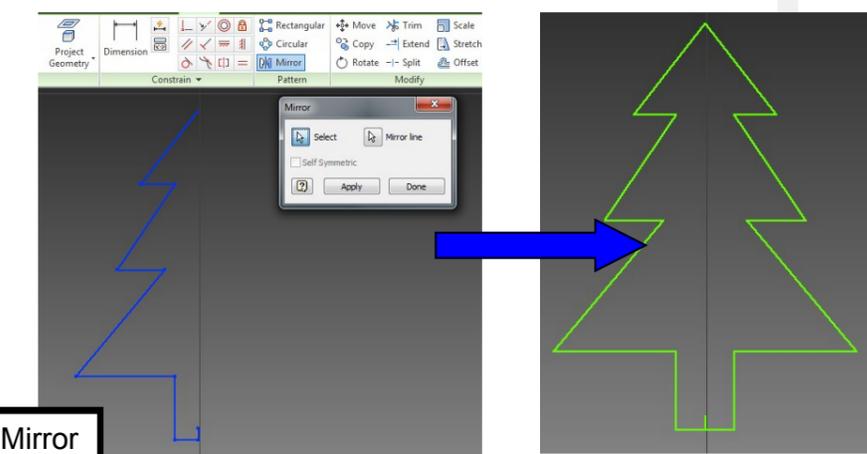
Trim



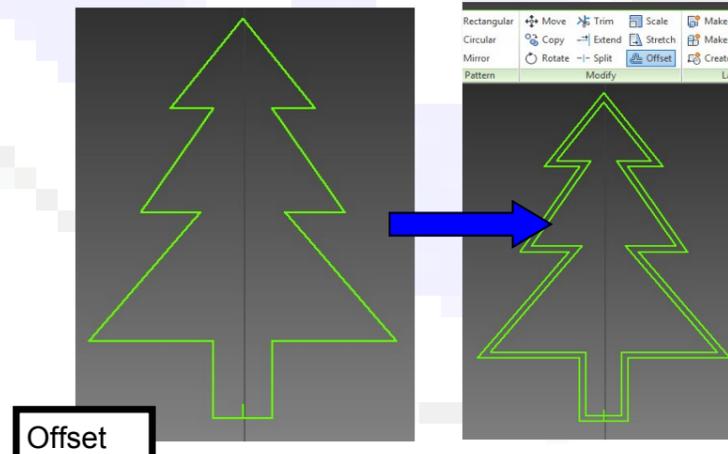
Extend



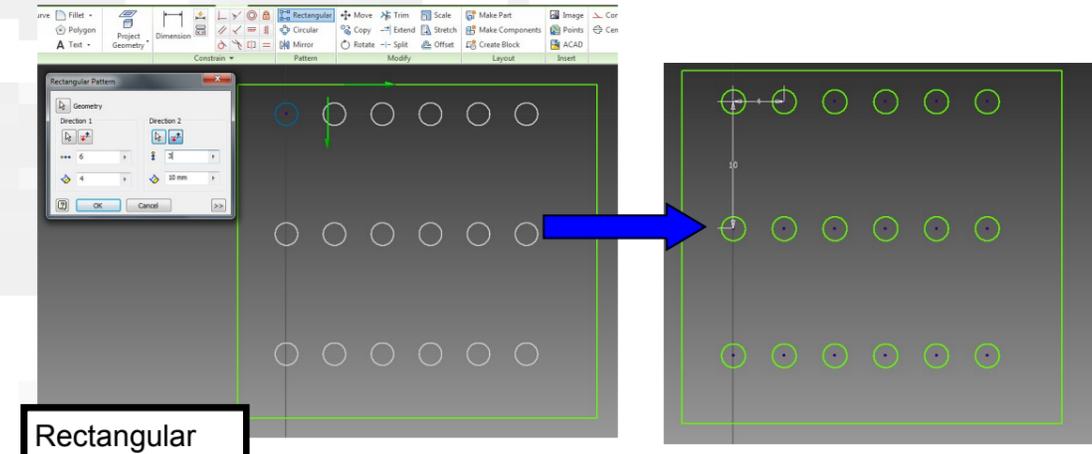
Circular pattern



Mirror



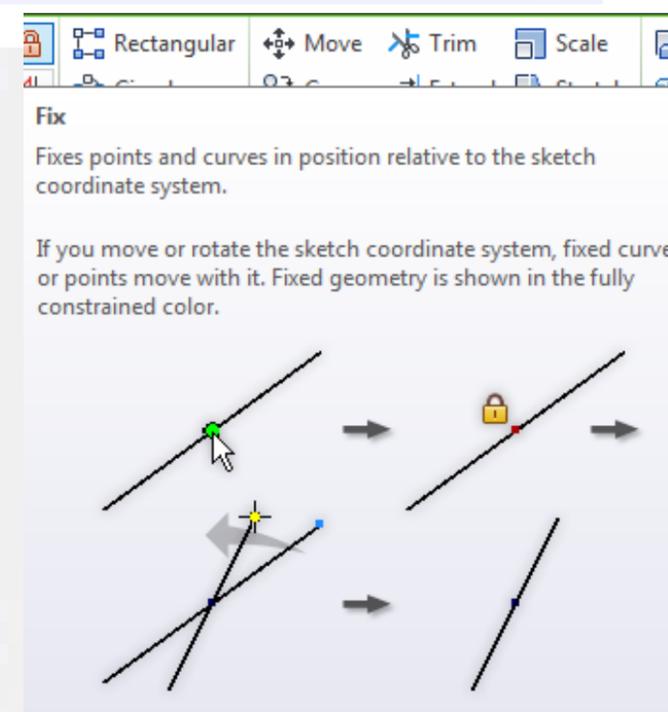
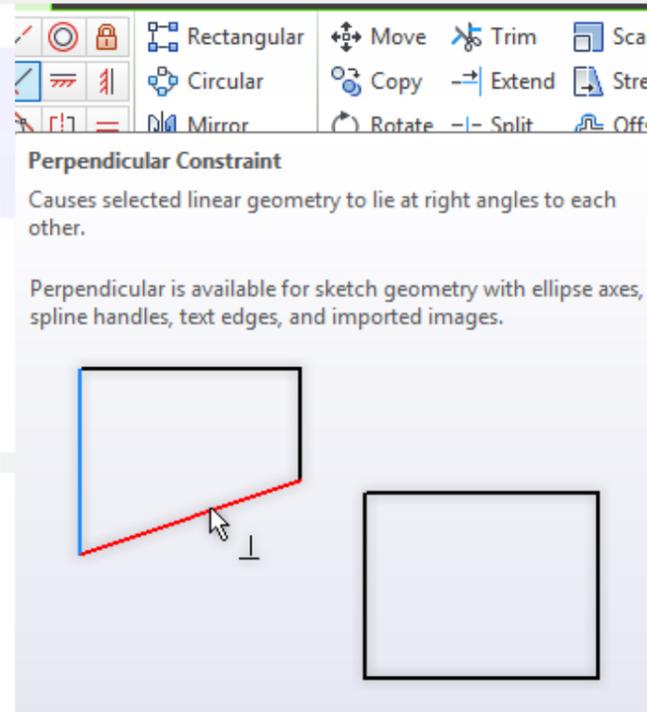
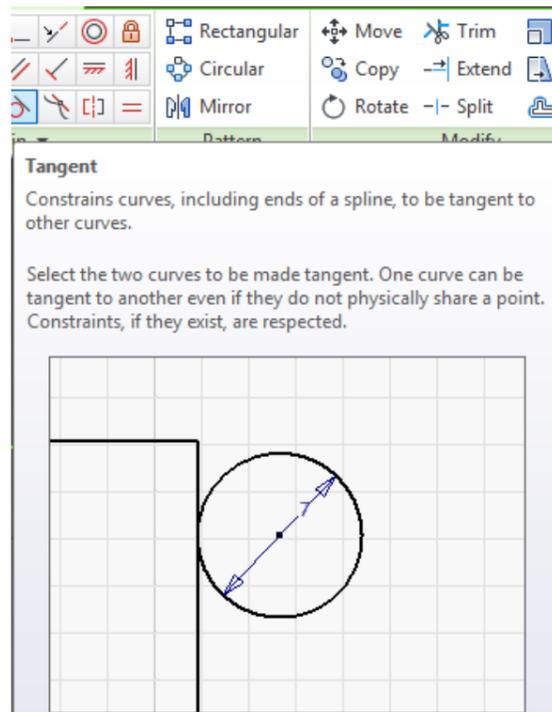
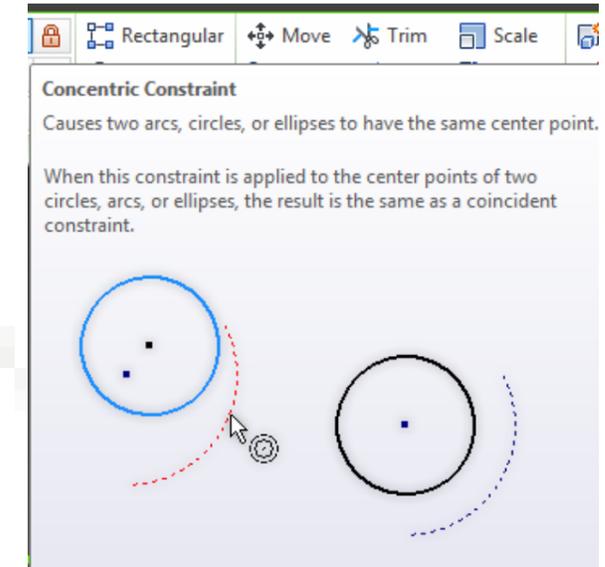
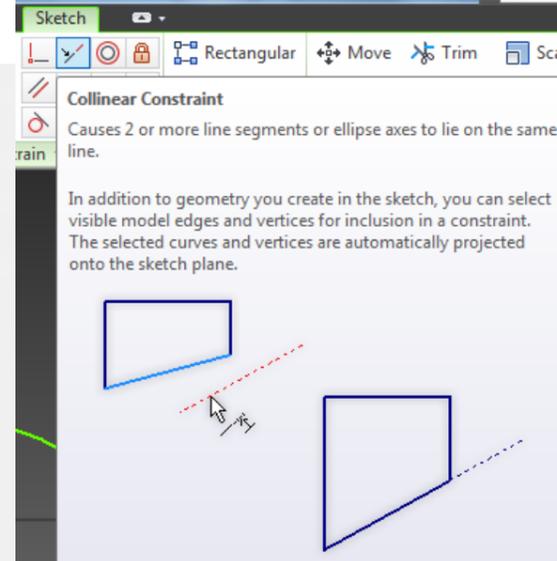
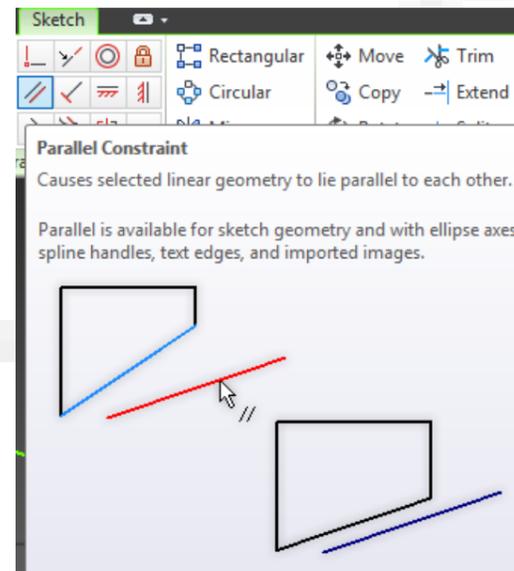
Offset



Rectangular pattern



Constraints are intended to make the initial sketch quicker and easier to produce.

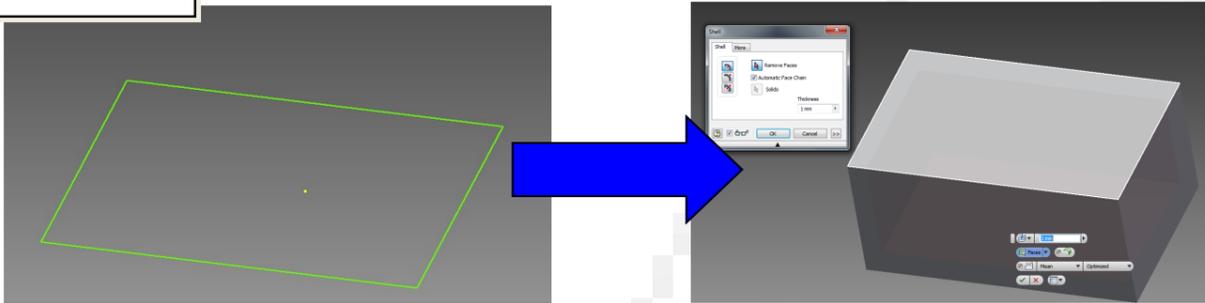


Modelling features:

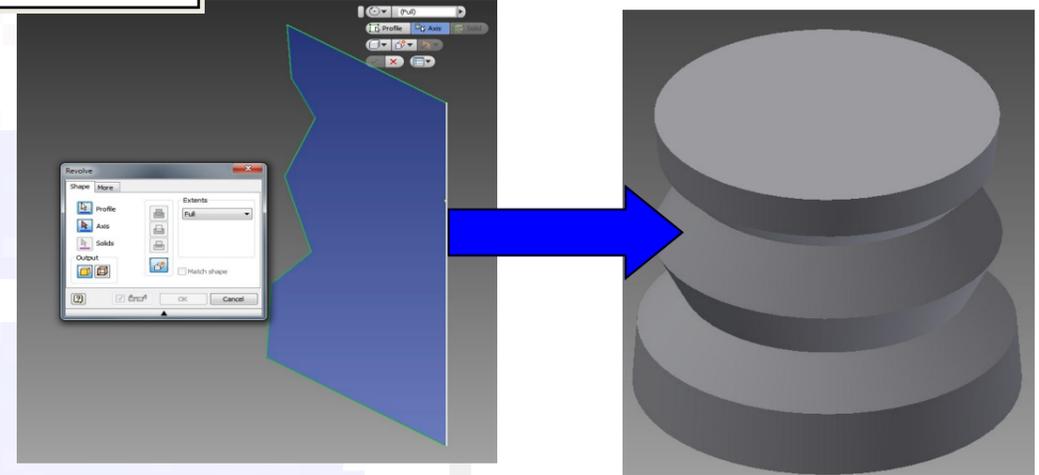


These are the functions which transform the sketch into the 3D model.

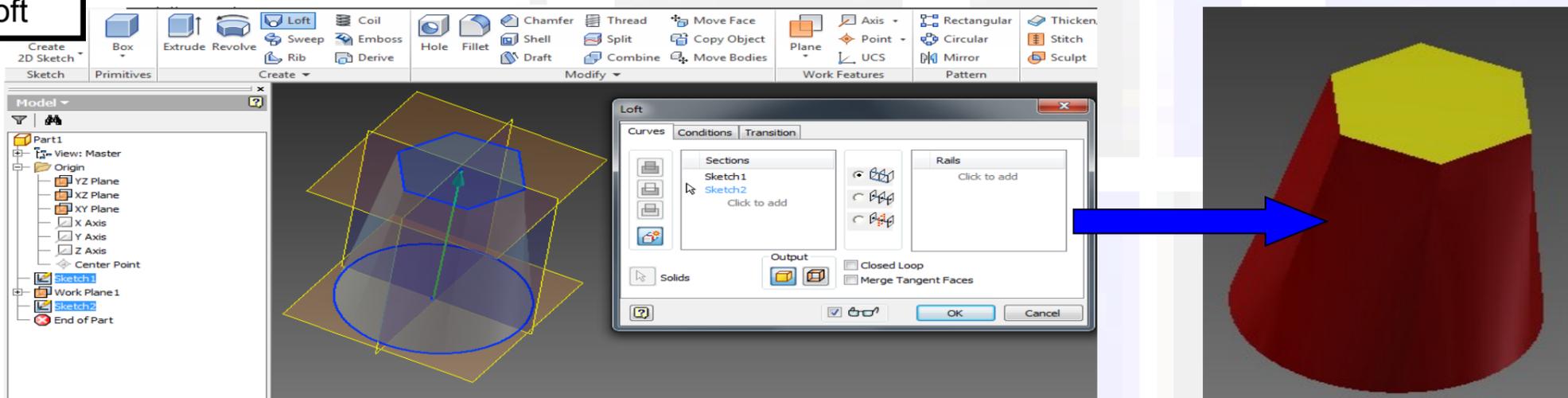
Extrusion



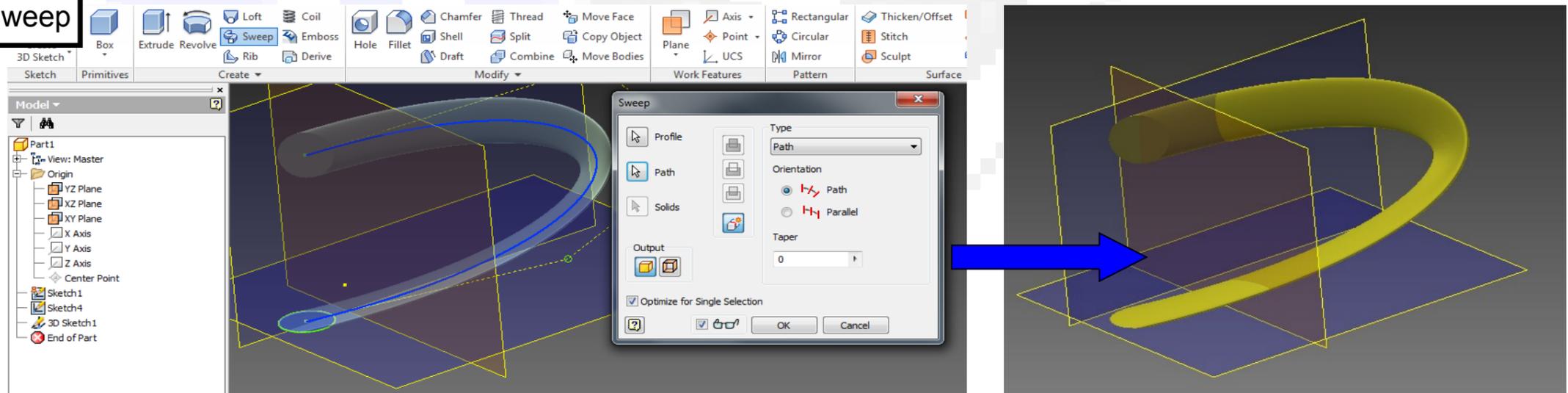
Revolve



Loft



Sweep



Modelling edits:



These three edits are known as BOOLEAN functions, and are a basic way to change a model and build others.

Add

Subtraction

Intersection

Shell

Fillet

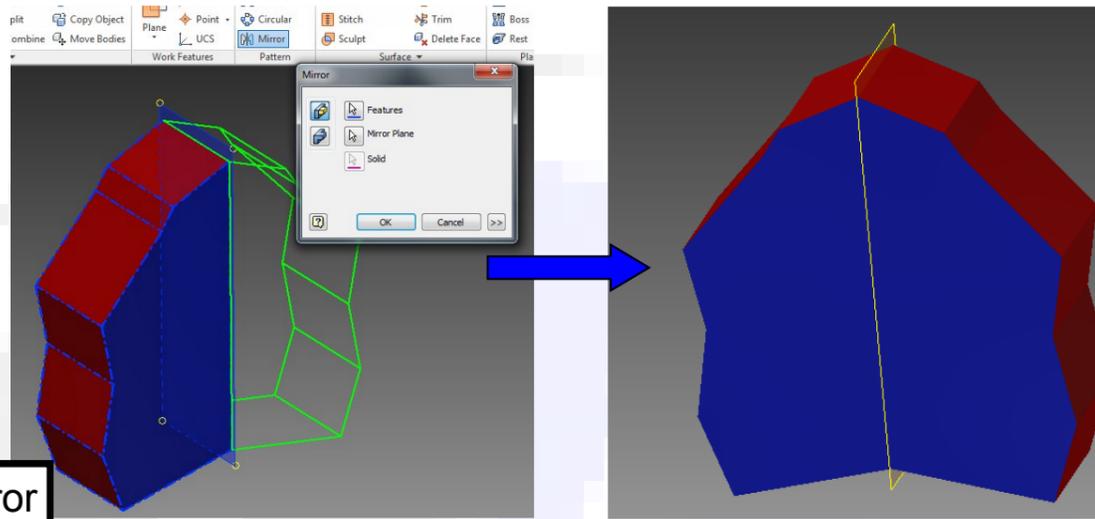
Chamfer

Modelling edits:

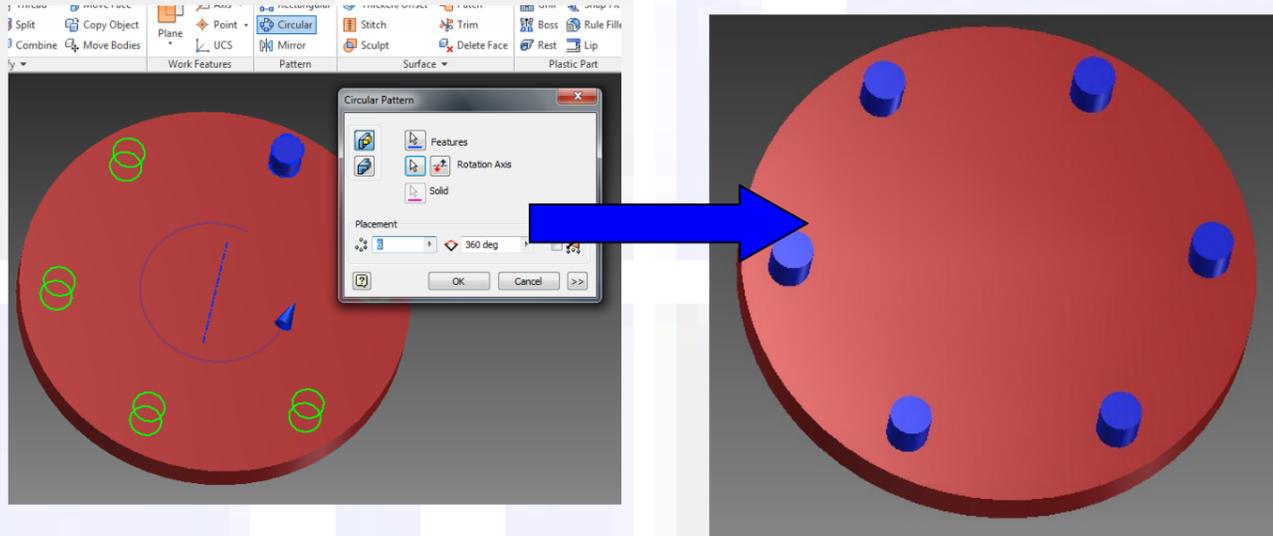
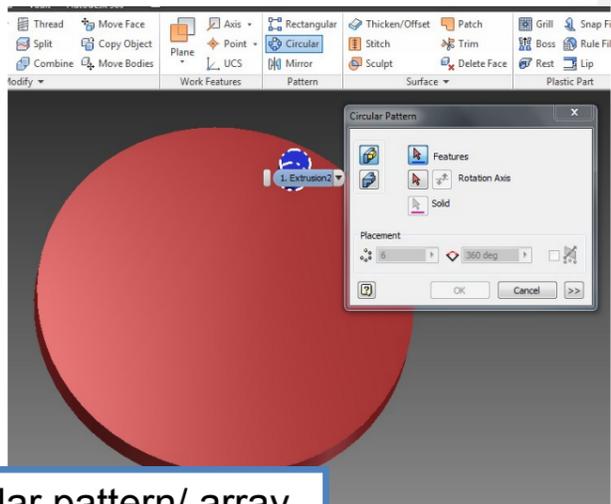


These edits are used to quickly change an existing model's features into more complex forms.

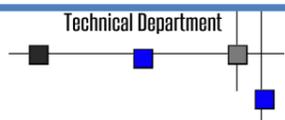
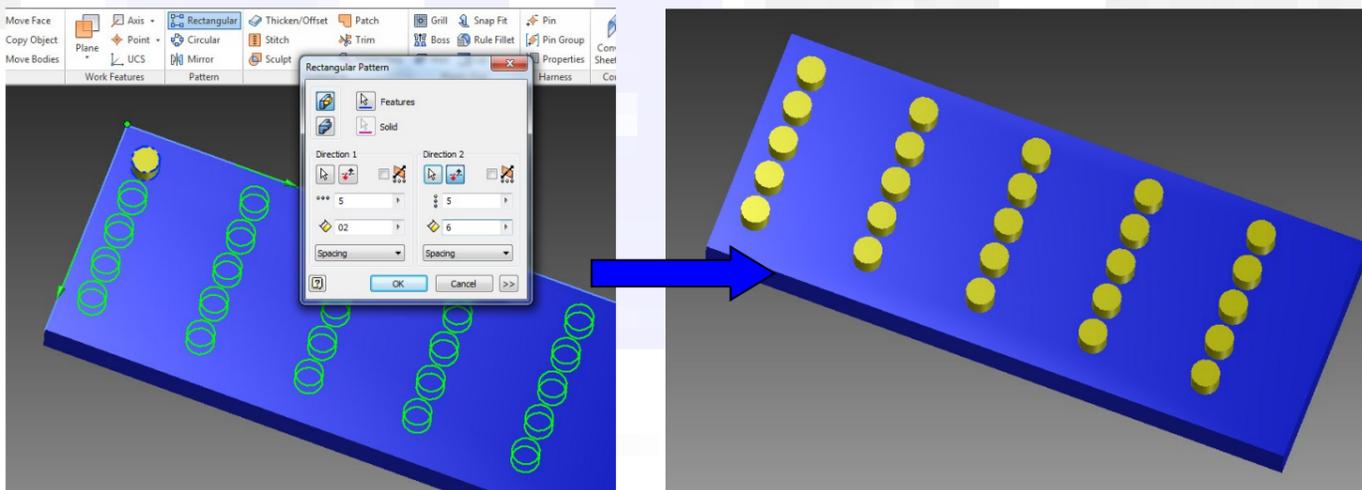
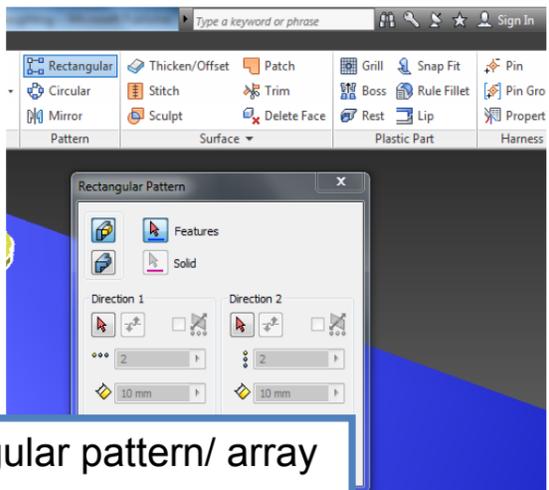
Mirror



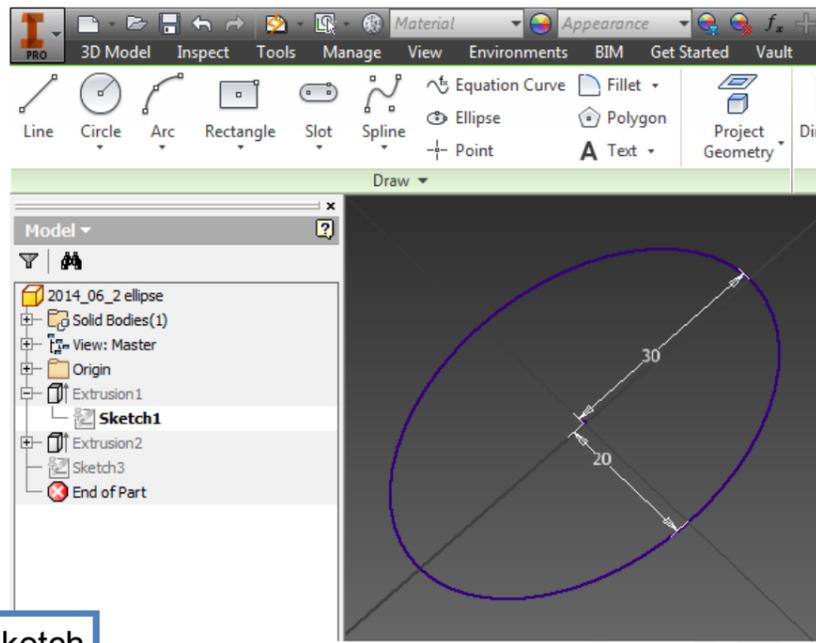
Circular pattern/ array



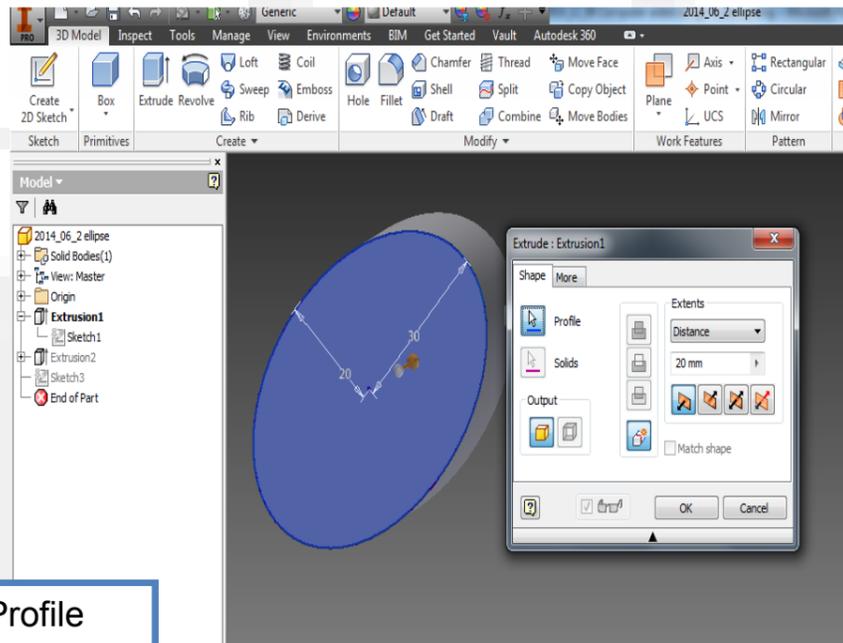
Rectangular pattern/ array



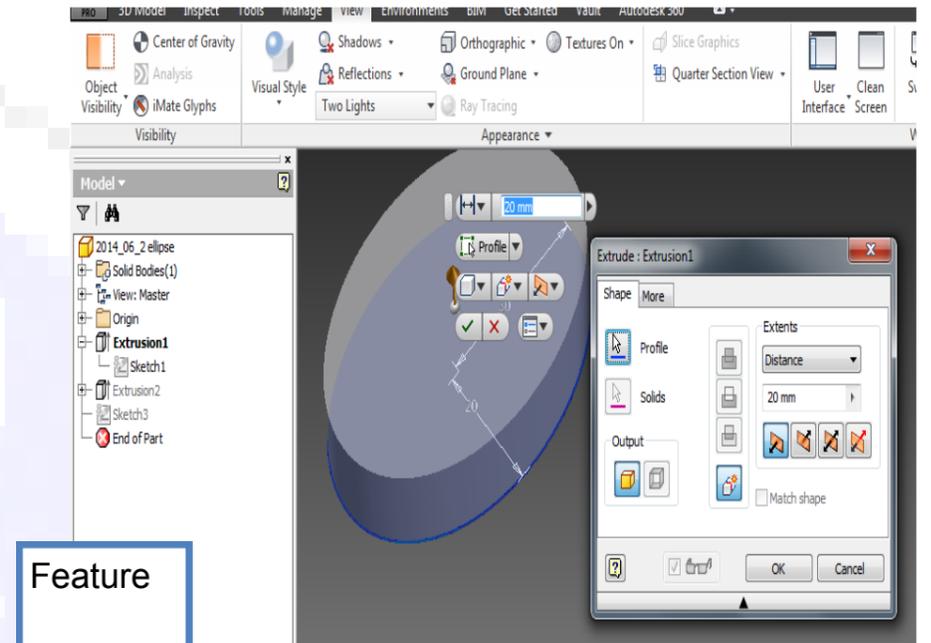
Modelling terminology



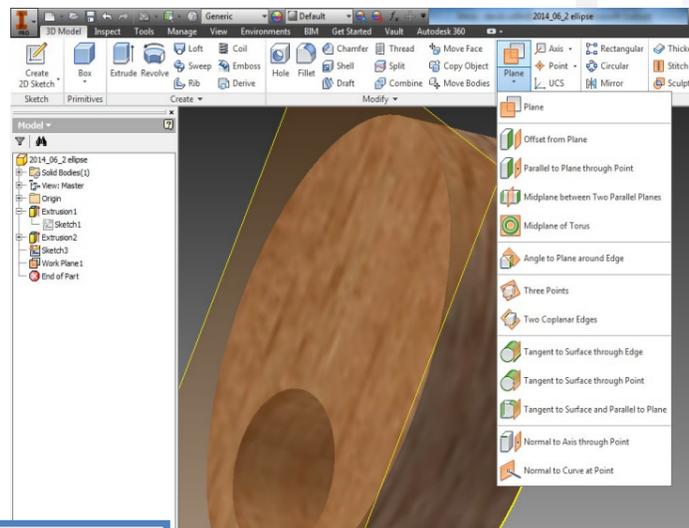
Sketch



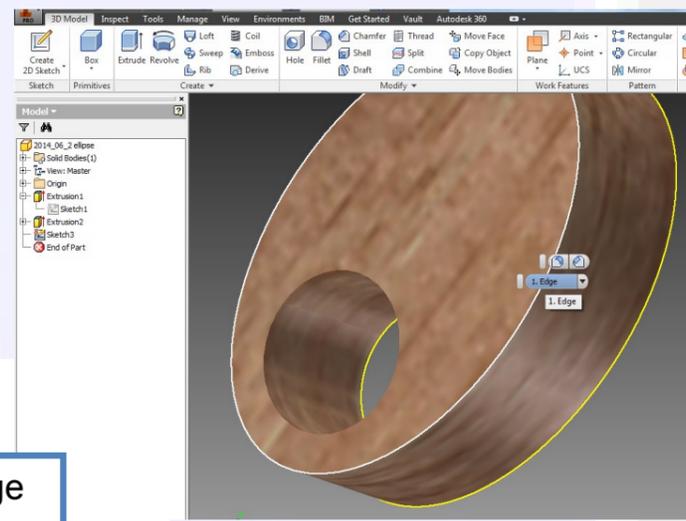
Profile



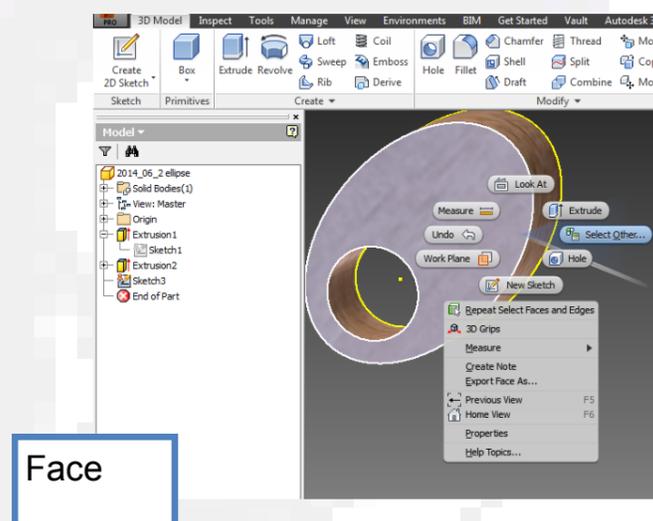
Feature



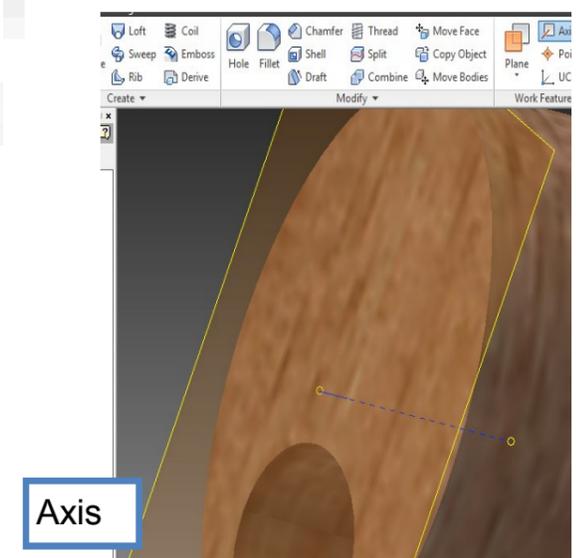
Work Plane



Edge



Face

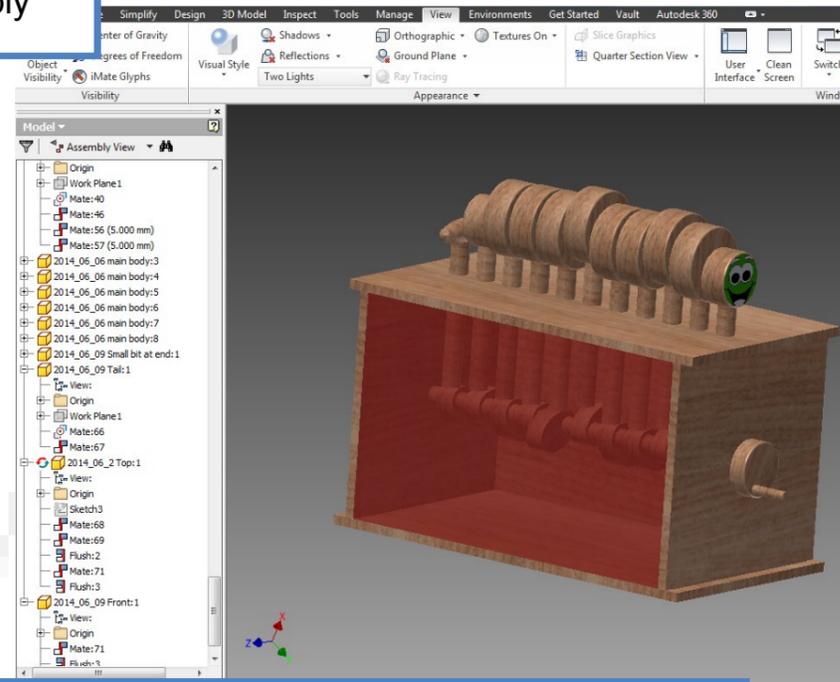


Axis

Modelling terminology

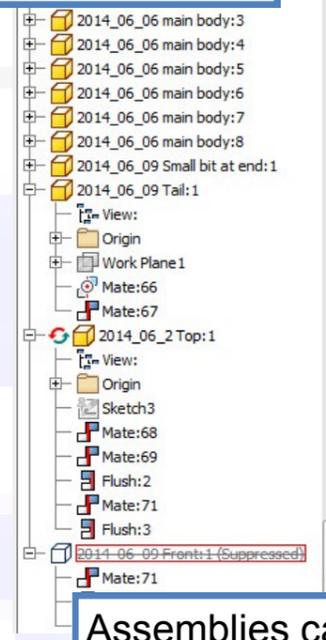


Assembly



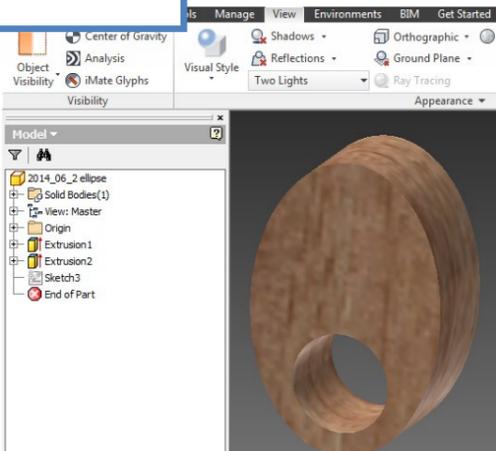
This is when 2 or more components are joined together to form a larger overall body.

Suppress



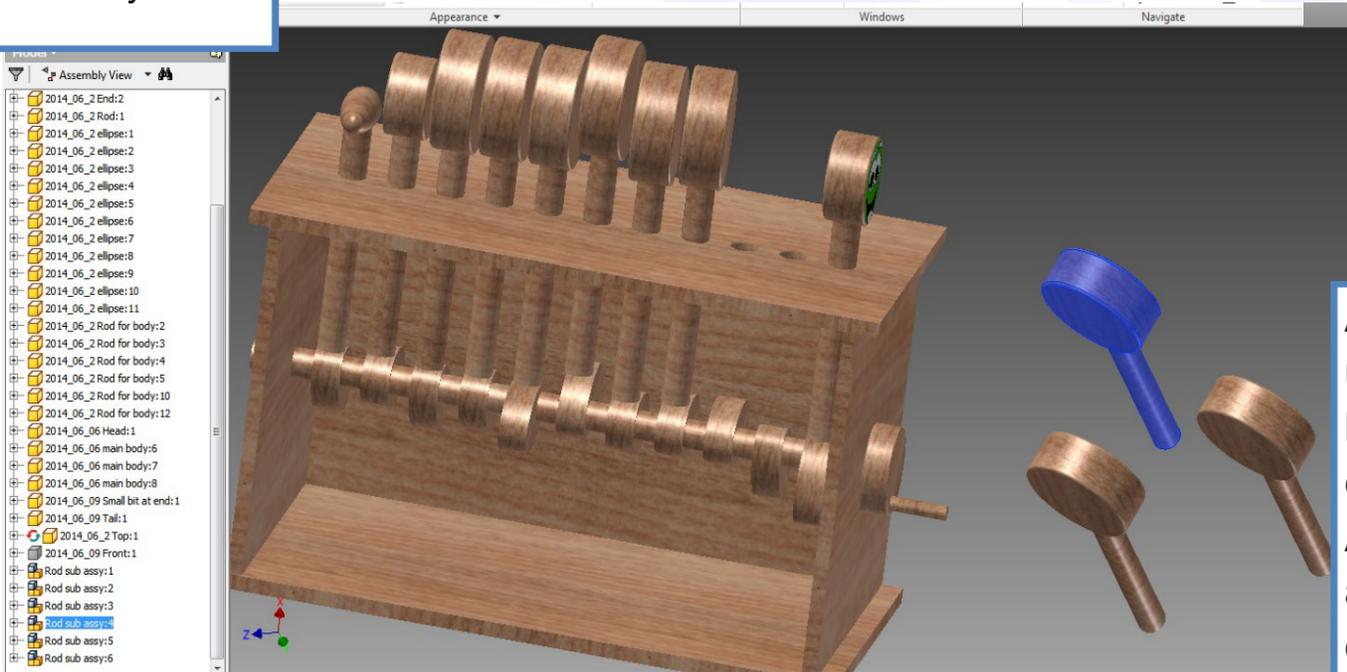
Assemblies can become complicated as more components are added. The **SUPPRESS** function can toggle a component's visibility on/ off to enable other components to be seen more effectively. In the image above, the red plastic front of the caterpillar toy has been suppressed to enable the interior to be inspected.

Component



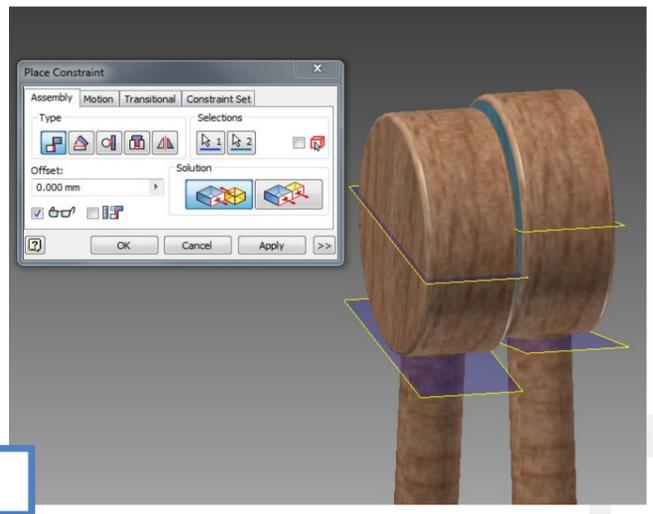
This is a single part, either within an assembly or on its own.

Sub-assembly

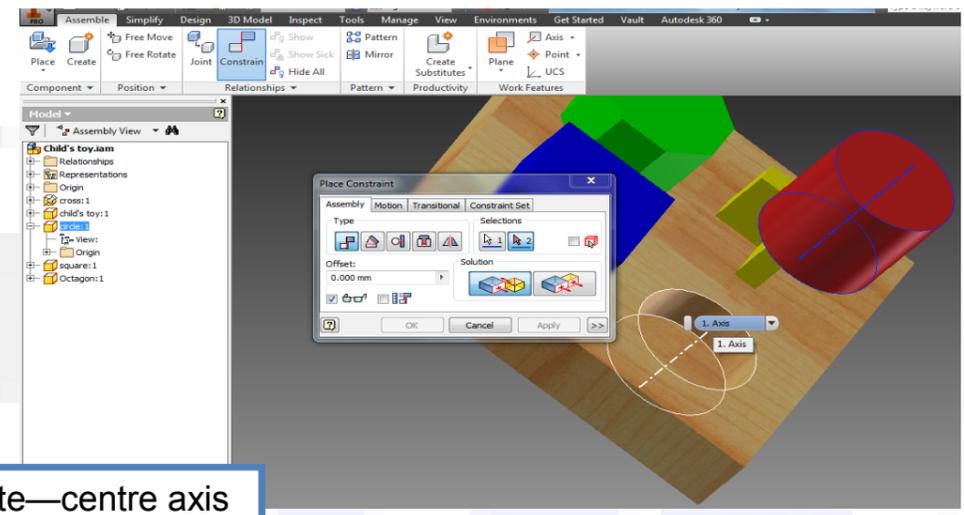


Assemblies may consist of a lot of frequently used components which are themselves assembled together. To make the overall assembly easier and quicker to work with, **SUB-ASSEMBLIES** may be adopted. In this example, a sub-assembly of the vertical rods and the caterpillar body parts has been put into the overall toy assembly.

Assembly



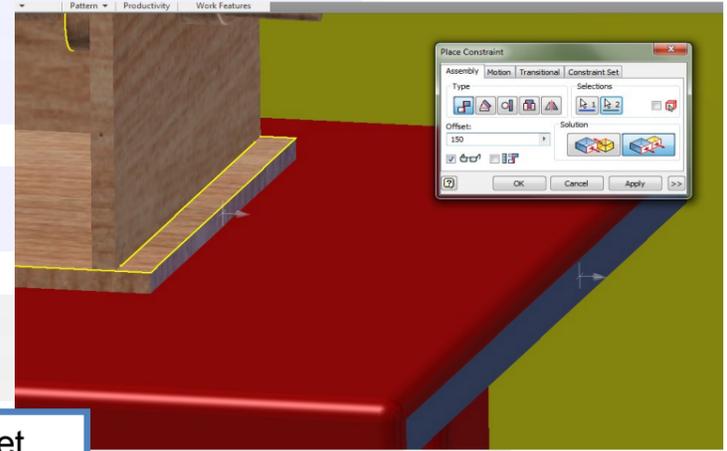
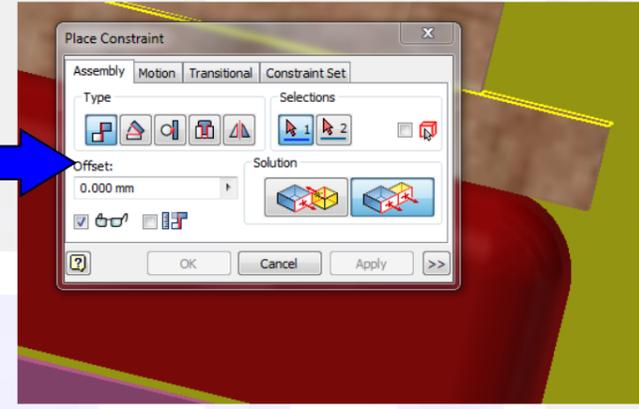
Mate



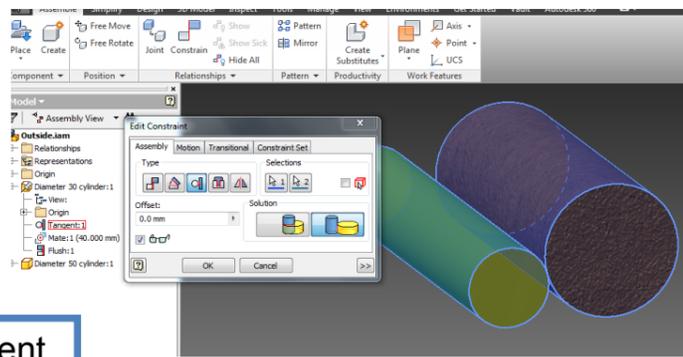
Mate—centre axis



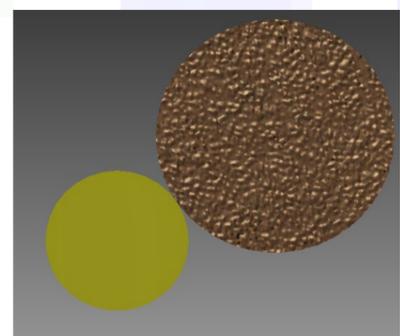
Align



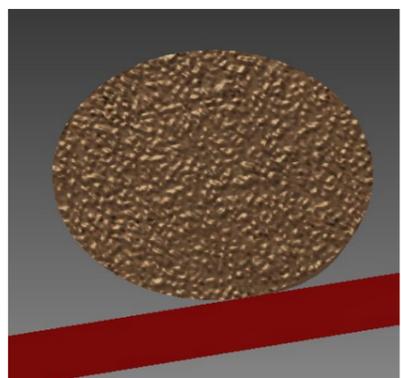
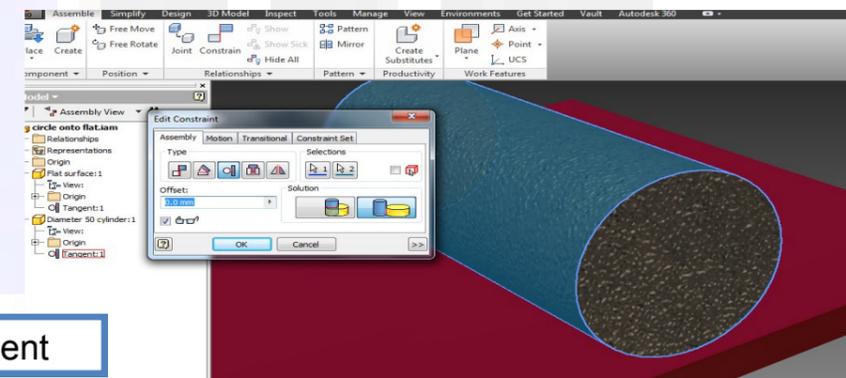
Offset



Tangent



Tangent



Modelling terminology

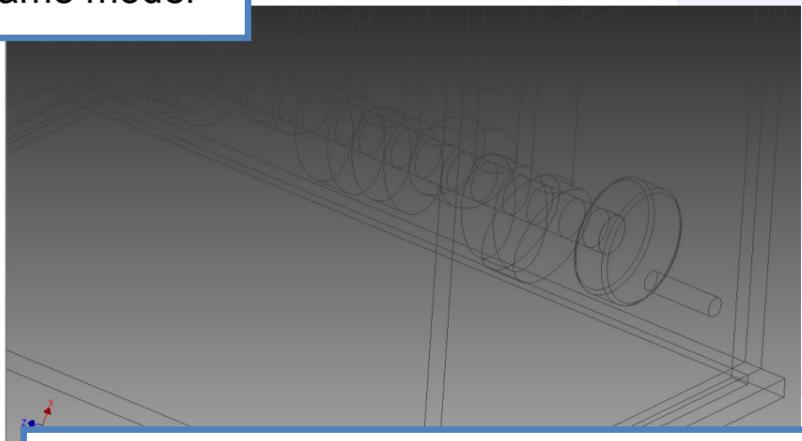


Solid model

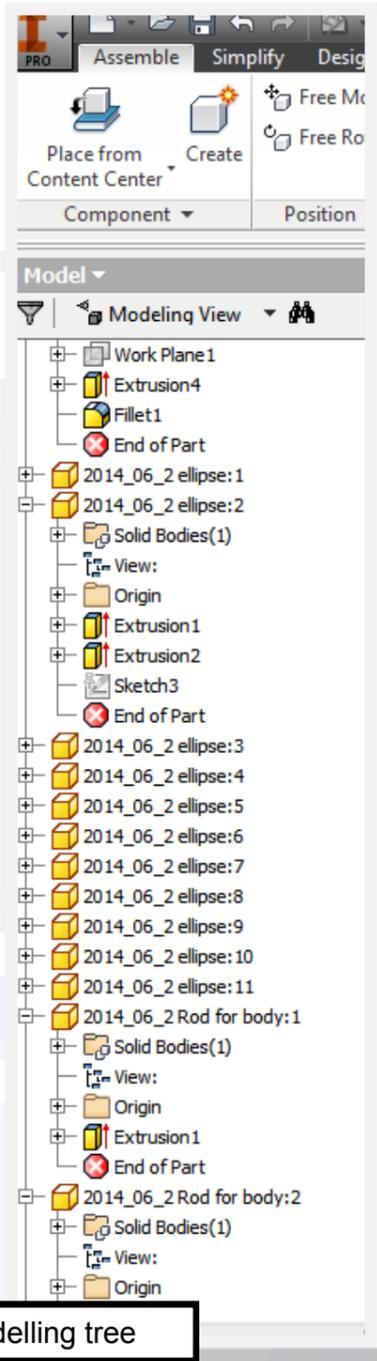


This is the most commonly used view for modelling and enables surface textures and material to be applied.

Wire frame model

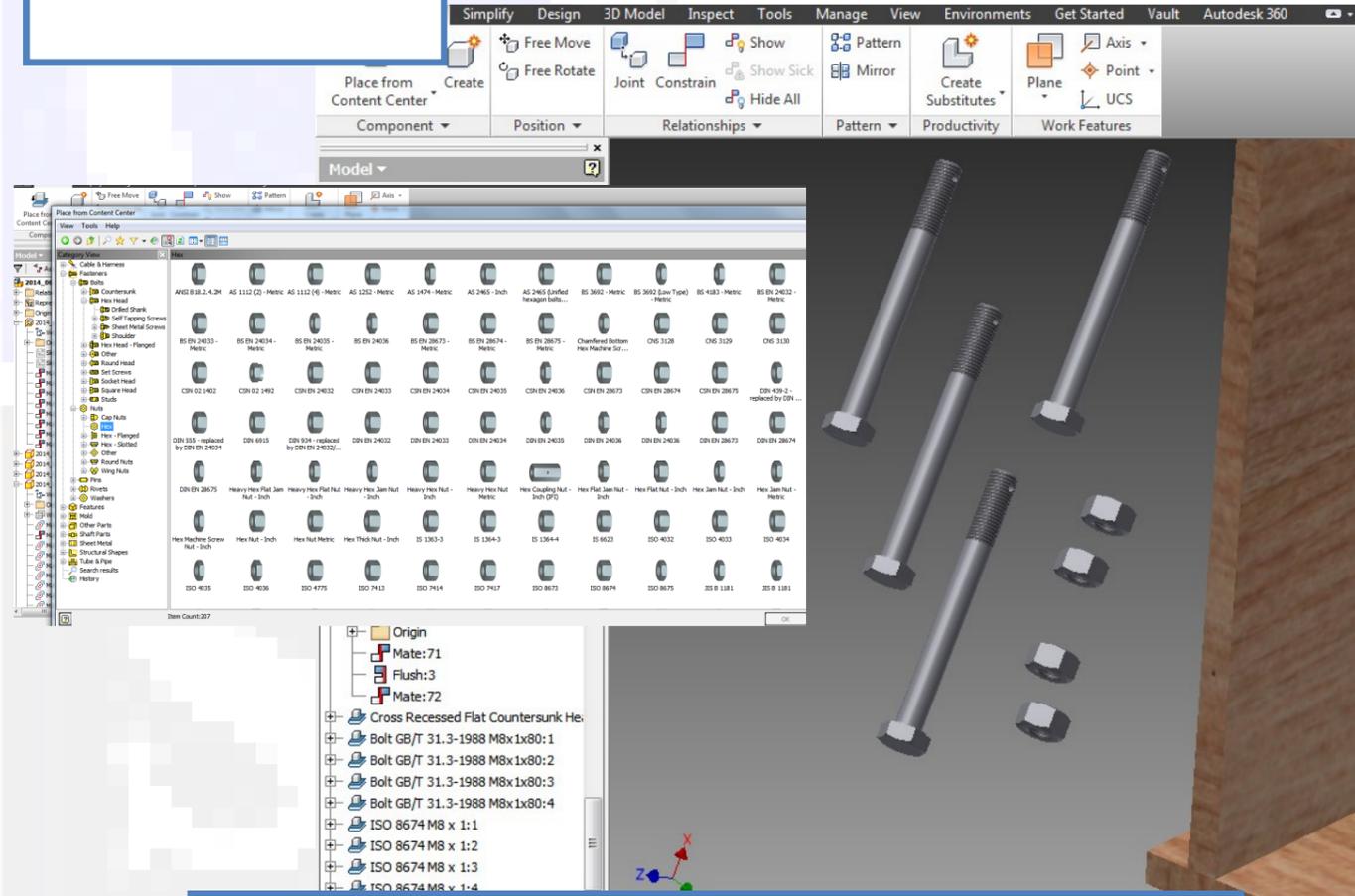


This modelling view only shows the edges of the model and can be useful to show the internal features of an assembly.



Modelling tree

Library of components



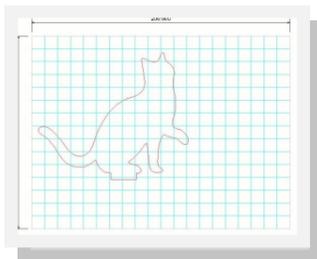
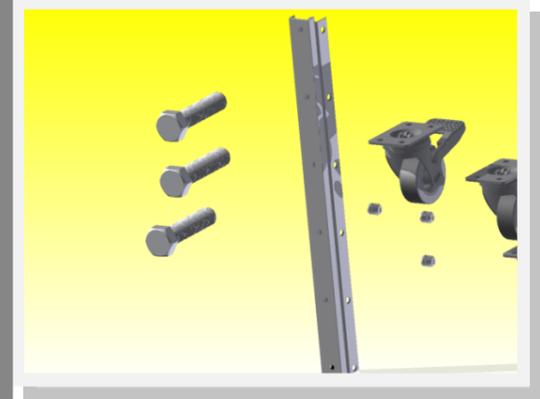
Frequently used components can be accessed in a library; this saves time and ensures that all components are of the same standard. This may be within the user's local system or from the internet

File types:

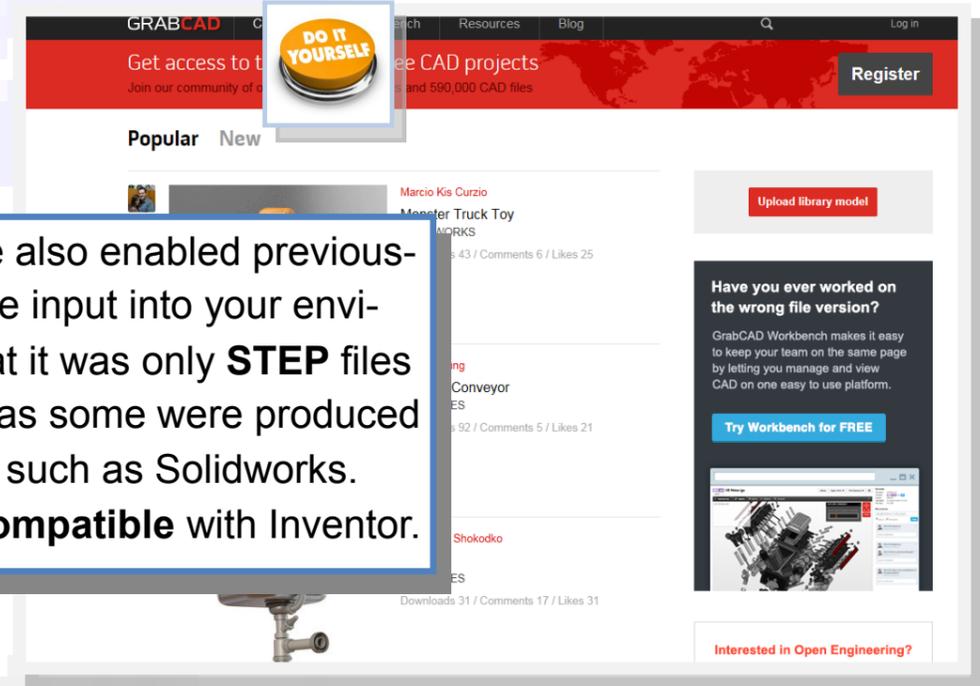
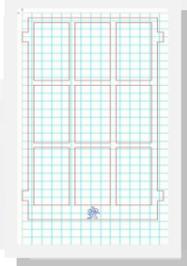
AutoCAD DXF (Drawing Interchange Format, or Drawing Exchange Format) is a CAD data file format developed by Autodesk¹ for enabling data interoperability between AutoCAD and other programs. The image here shows an AutoCAD drawing which has been converted to DXF to be input into a laser cutter to produce the physical model.



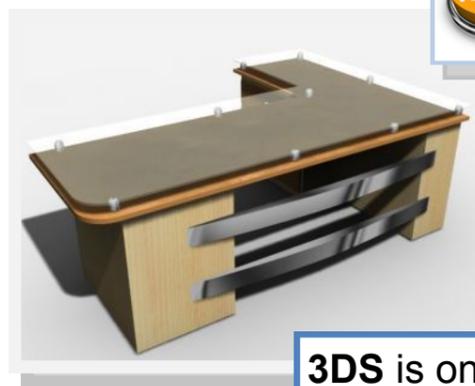
A **STEP** file enables 3D Models produced in one program—such as SOLIDWORKS—to be used in another (i.e. Inventor). Usually a model produced in one would be INCOMPATIBLE with another program, but saving it as a STEP file ensures COMPATIBILITY.
The image here shows STEP files which you were required to use for your Higher Assignments.



©R. McCluskey



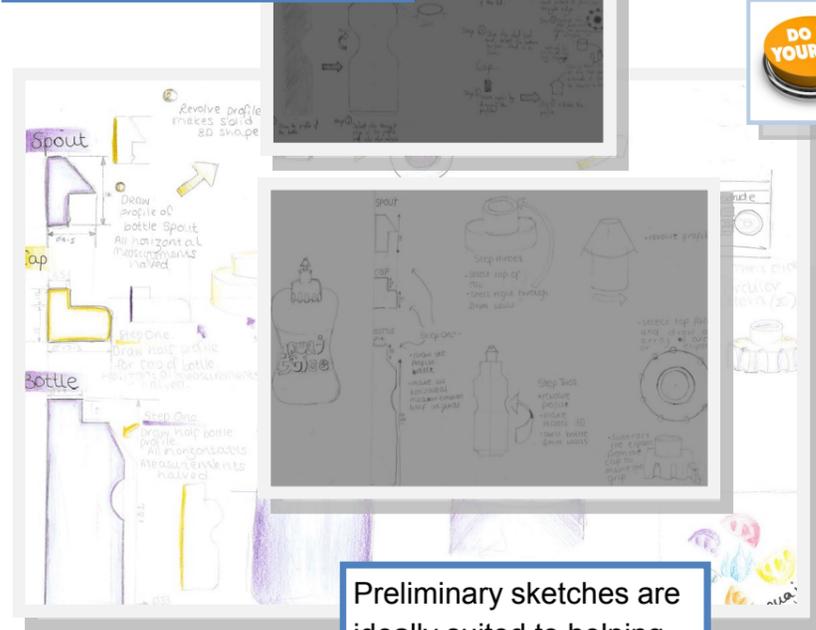
The **GRABCAD** website also enabled previously produced models to be input into your environment. Remember that it was only **STEP** files which could be utilised, as some were produced on other CAD programs such as Solidworks. Solidworks files are **incompatible** with Inventor.



3DS is one of the file formats used by the Autodesk 3ds Max 3D modelling, animation and rendering software.
This enables files to be transferred be-

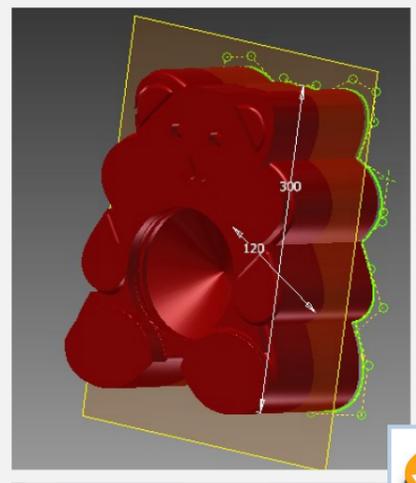
Modelling concepts

Modelling plan

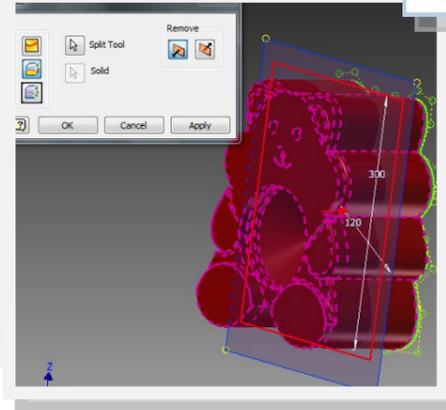


Preliminary sketches are ideally suited to helping plan out complex 3D modelling operations.

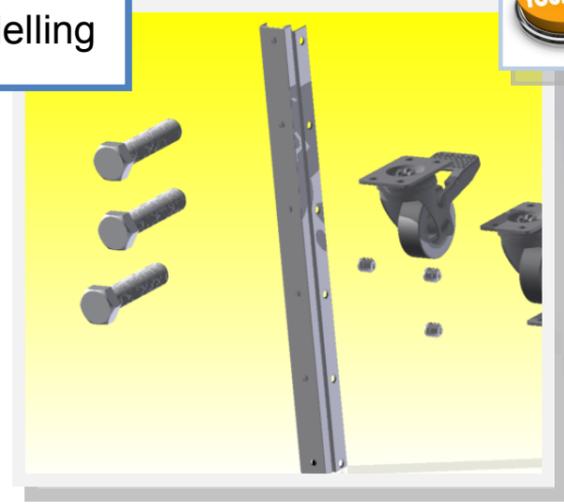
Top down modelling



This is when two separate entities are produced from an existing, initial model. The advantages to this are that the two parts fit together exactly, and time is saved as just one model is required to be produced initially rather than two separate halves. This image illustrates two separate parts of a speaker case which have been produced from the initial whole



Bottom up modelling



Your Higher assignments were produced using **bottom up** modelling, whether it was the drawer runner, castor wheel or knock down fittings. This allows more complex models to be produced from an initial, relatively simple parts. Sub assemblies are often used within bottom-up modelling.

