Orthographic & Isometric Drawing Lesson
TOPICS

- Working Drawings, Isometric Drawings & Orthographic Drawings
- Glass box concept
- Multiview projection
- Orthographic projection of point, line, plane, surface and object.
- Line convention (The meaning of lines in Orthographic Drawings)
TOPICS (continued)

- Working Drawings
- Scaled Drawings
- Dimensioning
- Drawing with a Miter Line
- Practice Worksheets
The final stage of illustrating your solution is to prepare a set of technical illustrations called **Working Drawings**.

This set of drawings contains all the information needed to build the product.
Orthographic Drawings

- Used to show details of the front, top and right side views
- Uses 3 views
- Used to provide dimensions and special shapes by using different line types. For example object, hidden, and center lines.
- Draw the front first, top second, and right side last
- Space the views out equally at 40 mm
- A miter line is used to project details of the object from the top view to the right side view without measuring. Drawn at 45 degrees.
ISOMETRIC Drawings

- Three dimensional (3d)
- You can see how all three views fit together
- All horizontal lines are angled at 30 degrees and vertical lines remain vertical
- Hidden lines and dimensioning are not shown on Isometric drawings
Orthographic and Isometric

Orthographic:
- Top View
- Front View
- Right Side View

40 mm space

Isometric:
- Top View
- Front View
- Right Side View

Miter line 45°

30°
MULTIVIEW PROJECTION

Three principle dimensions of an object … … can be presented only two in each view.

Adjacent view(s) is needed to fulfill the size description.
TO OBTAIN MULTIVIEW REPRESENTATION OF AN OBJECT

1. Revolve the object with respect to observer.

2. The observer moves around the object.
REVOLVE THE OBJECT
OBSERVER MOVE AROUND

Top view

Front view

Right side view
THE GLASS BOX CONCEPT

- Rear view
- Left side view
- Bottom view
Orthographic Projection of Object Features
OBJECT FEATURES

Edges
are lines that represent the boundary between two faces.

Corners
Represent the intersection of two or more edges.
Surfaces are areas that are bounded by edges or limiting element.

Limiting element is a line that represents the last visible part of the curve surface.

OBJECT FEATURES
PROJECTION OF LINE

True length

Point

Equal length

NORMAL LINE
PROJECTION OF LINE

True length

Foreshortened

Equal length

INCLINED LINE
PROJECTION OF LINE

Foreshortened

Equal length

OBLIQUE LINE
PROJECTION OF PLANE

INCLINED PLANE

Foreshortened

Equal length

Edge

Foreshortened
The views are obtained by projecting all object features to the picture plane.

You have to project the remaining surfaces which are invisible too!
PROJECTION OF OBJECT
PROJECTION OF TOP VIEW

TOP VIEW PROBLEM NO. 4

Diagram of a top view projection with dimensions and annotations.
PROJECTION OF TOP VIEW

TOP VIEW PROBLEM NO. 6

[Diagram of a top view problem with dimensions labeled: 1/2", 2", 3", 4", 7".]
PROJECTION OF TOP VIEW
PROJECTION OF TOP VIEW
PROJECTION OF TOP VIEW

TOP VIEW PROBLEM NO. 9
PROJECTION OF FRONT VIEW
PROJECTION OF FRONT VIEW
PROJECTION OF FRONT VIEW
PROJECTION OF FRONT VIEW
PROJECTION OF FRONT VIEW
PROJECTION OF RIGHT VIEW
PROJECTION OF RIGHT VIEW
PROJECTION OF RIGHT VIEW
PROJECTION OF RIGHT VIEW
PROJECTION OF RIGHT VIEW
Line Convention
The meaning of lines
LINE CONVENTION

- The meaning of lines
- Precedence of coincide lines
- Hidden line drawing
- Center line drawing
THE MEANING OF LINES

Object Lines

- Heavy unbroken lines indicate visible edges of an object.
THE MEANING OF LINES

Hidden Lines

- Medium lines with short evenly spaced dashes
- Indicate concealed edges

Extraneous lines
Center Lines

Thin lines made up of alternating long and short dashes
Indicate centres and axes of symmetry
THE MEANING OF LINES

- Dimension Lines

- Thin lines with arrowheads at each end

- Indicate dimensions
THE MEANING OF LINES

Extension Lines

Thin unbroken lines
Indicate ends of dimensions
ORDER OF IMPORTANCE

Visible line

Hidden line

Center line

PRECEDECENCE OF LINE
Fig. 4-15 ■ Architectural line conventions as used on an architectural floor plan.
# Architectural Lines

<table>
<thead>
<tr>
<th>No.</th>
<th>Line Type</th>
<th>Line Style</th>
<th>Line Weight</th>
<th>Lead</th>
<th>Width</th>
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<tr>
<td>1</td>
<td>Object lines</td>
<td>Thick</td>
<td>H,F</td>
<td>2</td>
<td>0.50 mm</td>
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<td>2</td>
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<td>Medium</td>
<td>2H,H</td>
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<td>3</td>
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<tr>
<td>4</td>
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<tr>
<td>5</td>
<td>Short break lines</td>
<td>Thick</td>
<td>H,F</td>
<td>2</td>
<td>0.50 mm</td>
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<tr>
<td>6</td>
<td>Phantom lines</td>
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<tr>
<td>8</td>
<td>Border lines</td>
<td>Very thick</td>
<td>F,HB</td>
<td>3</td>
<td>0.80 mm</td>
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<tr>
<td>9</td>
<td>Extension lines</td>
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<td>2H,3H,4H</td>
<td>00</td>
<td>0.25 mm</td>
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<tr>
<td>10</td>
<td>Dimension lines</td>
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<td>2H,3H,4H</td>
<td>00</td>
<td>0.25 mm</td>
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<tr>
<td>11</td>
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<tr>
<td>12</td>
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<td>00</td>
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<tr>
<td>14</td>
<td>Layout lines</td>
<td>Very thin light</td>
<td>4H</td>
<td></td>
<td></td>
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<tr>
<td>15</td>
<td>Guidelines</td>
<td>Very thin light</td>
<td>4H</td>
<td></td>
<td></td>
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<td>16</td>
<td>Lettering</td>
<td>Thick</td>
<td>H,F</td>
<td>1</td>
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OBJECT and HIDDEN LINE EXAMPLE

FINISHED FRONT VIEW DRAWING WITH "DOTTED" LINES

PAPER HELD IN IMAGINARY POSITION IN FRONT OF OBJECT

FIGURE 1
Draw front view first
OBJECT, HIDDEN and CENTER LINE

EXAMPLE

Draw top view second
OBJECT, HIDDEN and CENTER LINE EXAMPLE

Draw right side view last
Hidden line should join a visible line, except if it extended from the visible line.
Hidden line should join a visible line, except it extended from the visible line.
Hidden line should intersect to form **L** and **T** corners.

Correct

No!
Hidden arcs should start on a center line.
DOTTED LINE PROBLEM NO. 1
DOTTED LINE PROBLEM NO. 2

HIDDEN LINE PRACTICE
HIDDEN LINE PRACTICE
HIDDEN LINE PRACTICE
HIDDEN LINE PRACTICE
HIDDEN LINE PRACTICE
HIDDEN LINE PRACTICE
CENTER LINE PRACTICE

- In circular view, short dash should cross at the intersections of center line.
- For small hole, center line is presented as thin continuous line.
- Center line should not extend between views.
CENTER LINE PRACTICE

- Leave the gap when centerline forms a continuation with a visible or hidden line.
- Center line should always start and end with long dash.
DRAWING USING A MITER LINE
DRAWING USING A MITER LINE
SCALED DRAWINGS

Objects must be scaled to fit onto a piece of drawing paper

They are exact in every detail but reduced or enlarged in size in direct proportion to the actual object

Scale 1:1
1 mm on drawing paper = represents 1mm of the actual object
Many objects are too large to be drawn to their full size. For example an airplane and house.

**Reduced Scales**

If an object is too big to fit on your page it must be reduced.

1:2  1 mm on page $= $ 2 mm on Actual Object

1:5  1 mm on page $= $ 5 mm of Actual Object

1:10 1 mm on page $= $ 10 mm of Actual Object
SCALED DRAWINGS

Often it is necessary to produce drawings larger than full size.

Details of small objects are clearer and easier to dimension when they are drawn larger than their actual size.

Enlarged Scales

Sometimes an object is so small that to see its features properly, it must be enlarged on the paper.

\[
\begin{align*}
2:1 & \quad 2 \text{ mm on paper} = 1 \text{ mm of Actual Object} \\
5:1 & \quad 5 \text{ mm on paper} = 1 \text{ mm of Actual Object}
\end{align*}
\]
A title block is a portion of a drawing that is set aside to give important information about the drawing. The drafter, the scale, the units, and your name.

You must “frame” your drawing to make it look professional. Draw a 1 cm border and a 1 cm high area for your title block.

A title block template can be found on the shared drive. Ask your teacher.
<table>
<thead>
<tr>
<th>Title</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heart Lake Secondary School</td>
<td>Size</td>
</tr>
</tbody>
</table>

**TITLE BLOCK TEMPLATE**
DIMENSIONING DRAWINGS

DIMENSIONING RULES:

These rules apply to the placement of the various lines, the weight of the lines and the placement of the values. They are listed below in Figure 1.

ARROWHEADS APPROXIMATELY
3 mm x 1.0 mm

10 mm BETWEEN DIMENSION LINES

END 1.0 mm PAST DIMENSION

THIN AND DARK

ARROWHEADS MUST TOUCH EXTENSION LINE

DIMENSION IN LINE WHERE POSSIBLE

EXTENSION LINES BEGIN 1.0 mm FROM PART BEING DIMENSIONED
DIMENSIONING DRAWINGS

Figure 1 Dimensioning rules (preferred method)

1. Dimension lines are thin and dark. They are broken in the middle with a space large enough to hold the dimension.
2. Dimension lines are drawn parallel to the object.
3. Dimension lines are spaced approximately 10 mm apart beginning from the object.
4. Dimension lines have arrowheads on each end to show the limit of the dimension.
DIMENSIONING DRAWINGS

- Ask your teacher for a list of dimensioning Rules
- Dimensioning lines must follow these rules
THE STAGE IS SET FOR YOU TO BECOME AN EXPERT TECHNICAL DRAWER

Practice drawing worksheets can be found on the shared drive