Civil Engineering Visualization
Section Views

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Section Views

- **Section views** are an important aspect of design and documentation, and are used to improve clarity and reveal interior features of parts and structures.
- Section views are also used in the ideation and refinement stages of engineering design to improve the communications and problem-solving processes.

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Section Views

- **Sectional drawings** are multiview technical drawings that contain special views of a part or parts, views that reveal interior features.
- A primary reason for creating a section view is the elimination of hidden lines so that a drawing can be more easily understood or visualized.

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Section Views

- Traditional section views are based on the use of an imaginary cutting plane that cuts through the object to reveal interior features.

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Section Views

- This imaginary cutting plane is controlled by the designer and can
  - (1) go completely through the object (full section),
  - (2) go halfway through the object (half section),
  - (3) be bent to go through features that are not aligned (offset section), or
  - (4) go through part of the object (broken-out section).

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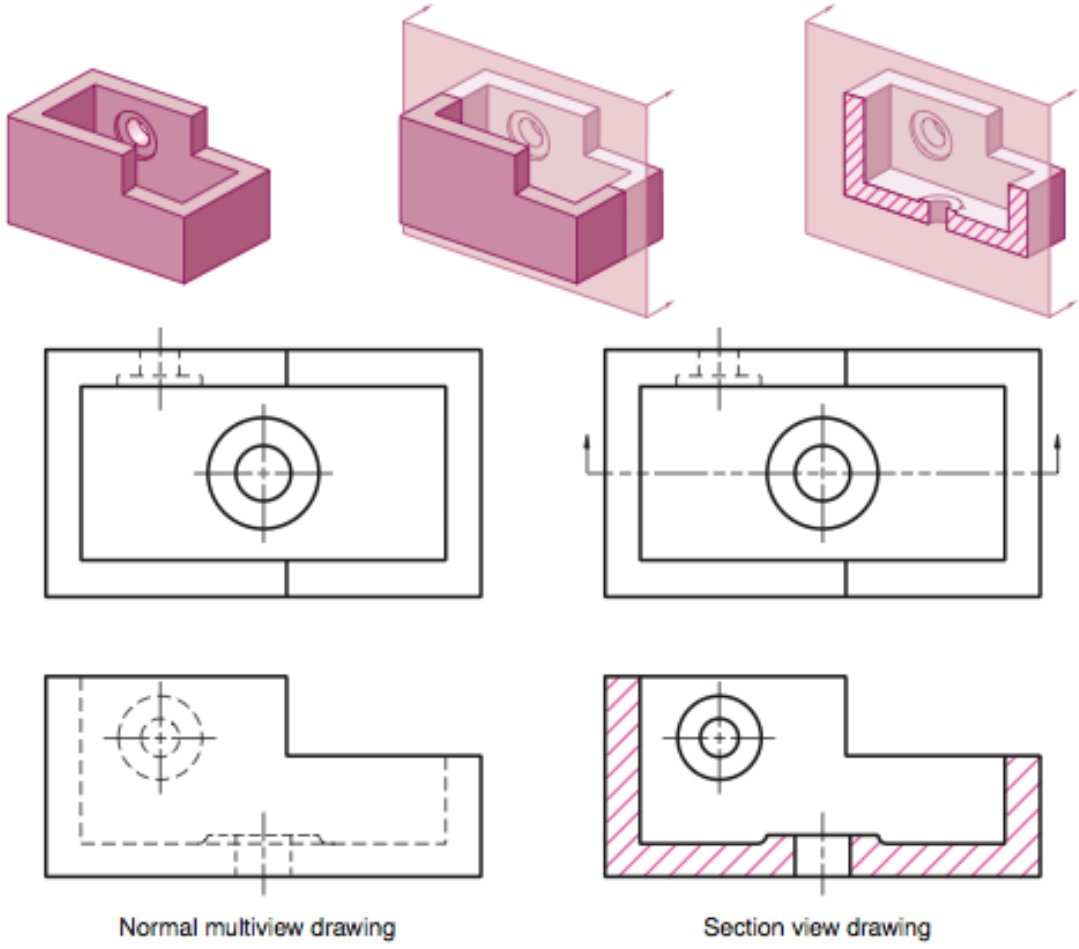
Section Views



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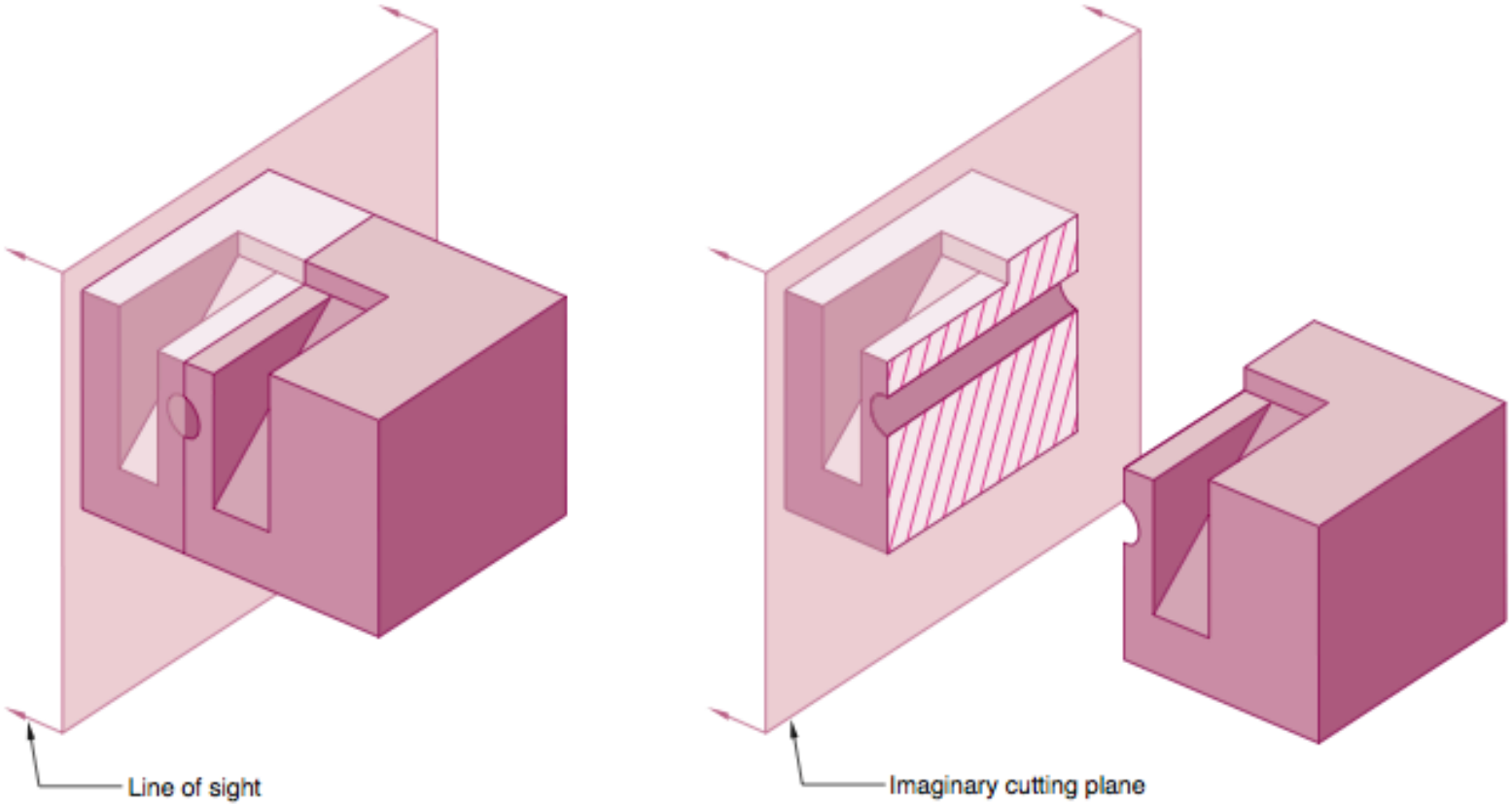
Section Views



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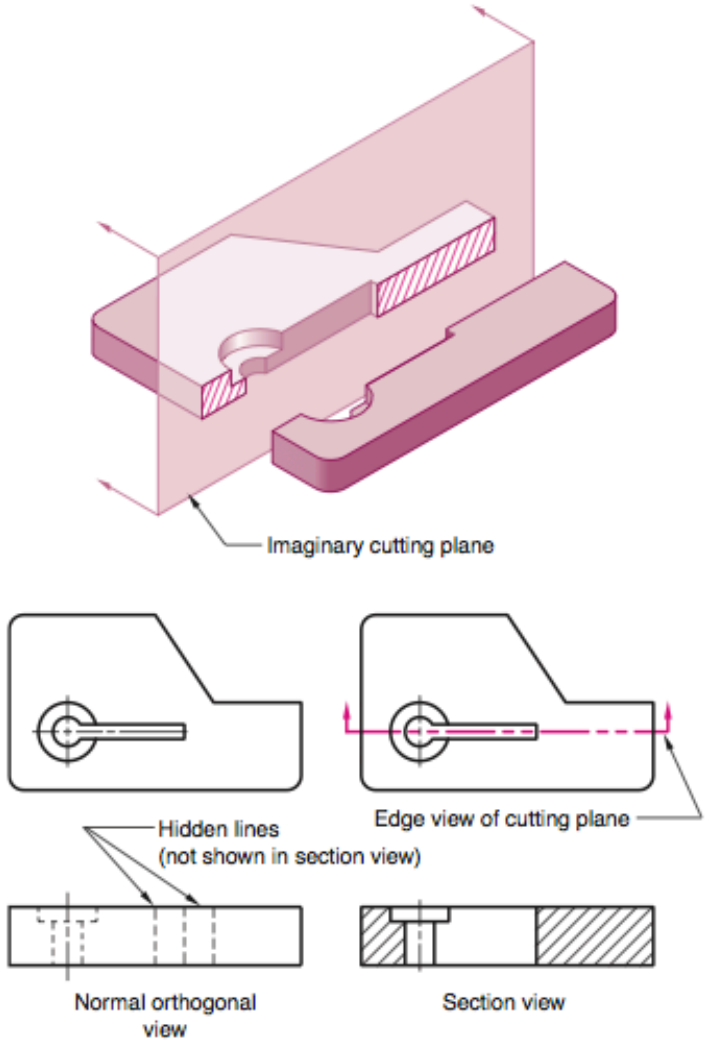
Section Views



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Section Views

- An important reason for using section views is to reduce the number of hidden lines in a drawing.
- A section view reveals hidden features without the use of hidden lines.

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Section Views

- Adding hidden lines to a section view complicates the drawing, defeating the purpose of using a section.

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Section Views – Cutting Plane Lines

- **Cutting plane lines,** which show where the cutting plane passes through the object, represent the *edge view* of the cutting plane and are drawn in the view(s) adjacent to the section view.

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Section Views – Cutting Plane Lines

- In the example, the cutting plane line is drawn in the top view, which is adjacent to the sectioned front view.

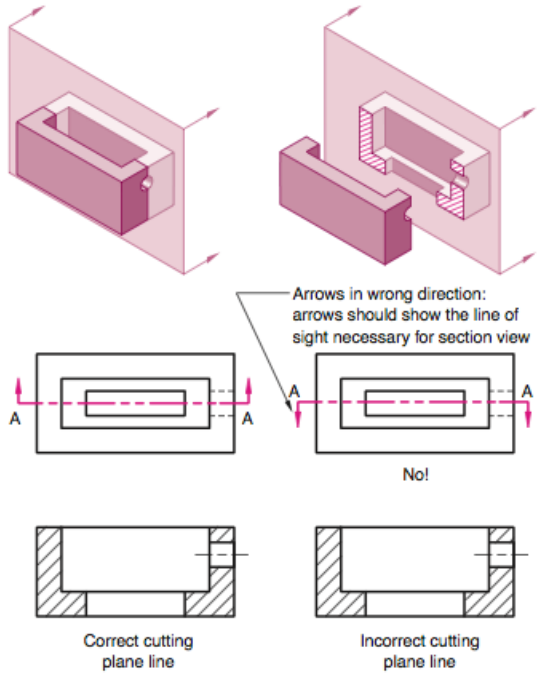

Figure 3.6 Placement of Cutting Plane Lines
The cutting plane line is placed in the view where the cutting plane appears on edge.

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Section Views – Cutting Plane Lines

- Cutting plane lines are *thick* dashed lines that extend past the edge of the object and have line segments at each end drawn at 90 degrees and terminated with arrows.
- The arrows represent the direction of the line of sight for the section view, and they point away from the sectioned view.
- The easiest way to draw the arrows is using the AutoCAD PolyLine.

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Section Views – Section Lines

- **Section lines** or **cross-hatch lines** are added to a sec- tion view to indicate the surfaces that are cut by the imaginary cutting plane.
- Different section line symbols can be used to represent various types of materials.

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Section Views – Section Lines

- However, there are so many different materials used in design that the general symbol (i.e., the one used for cast iron) may be used for most purposes on technical drawings.
- The actual type of material required is then noted in the title block or parts list or entered as a note on the drawing.

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Section Views – Section Lines

- The angle at which section lines are drawn is usually 45 degrees to the horizontal, but this can be changed for adjacent parts shown in the same section.
- Also, the spacing between section lines is uniform on a section view.

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Section Views – Section Lines

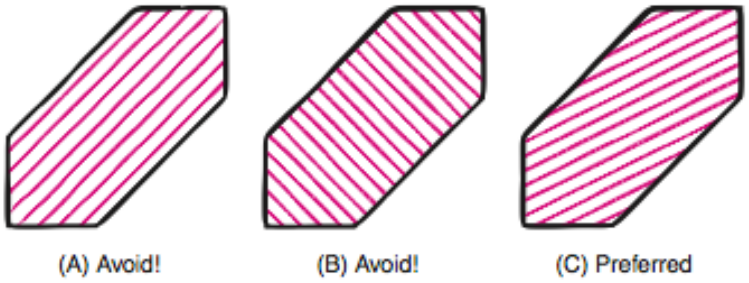

Figure 3.9 Section Line Placement
Avoid placing section lines parallel or perpendicular to visible lines.

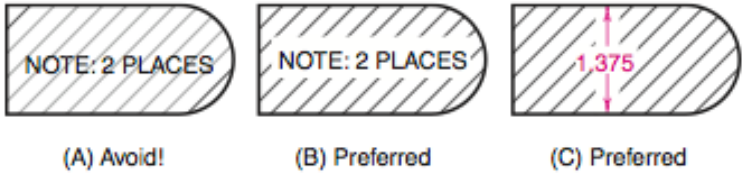

Figure 3.10 Notes in Section Lined Areas
Section lines are omitted around notes and dimensions.

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Section Views – Full Section

- A **full-section** view is made by passing the imaginary cut- ting plane completely through the object.
- All the hidden features intersected by the cutting plane are represented by visible lines in the section view.

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Section Views – Full Section

- Surfaces touched by the cutting plane have section lines drawn at a 45-degree angle to the horizontal.
- Hidden lines are omitted in all section views unless they must be used to provide a clear understanding of the object.

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Section Views – Full Section

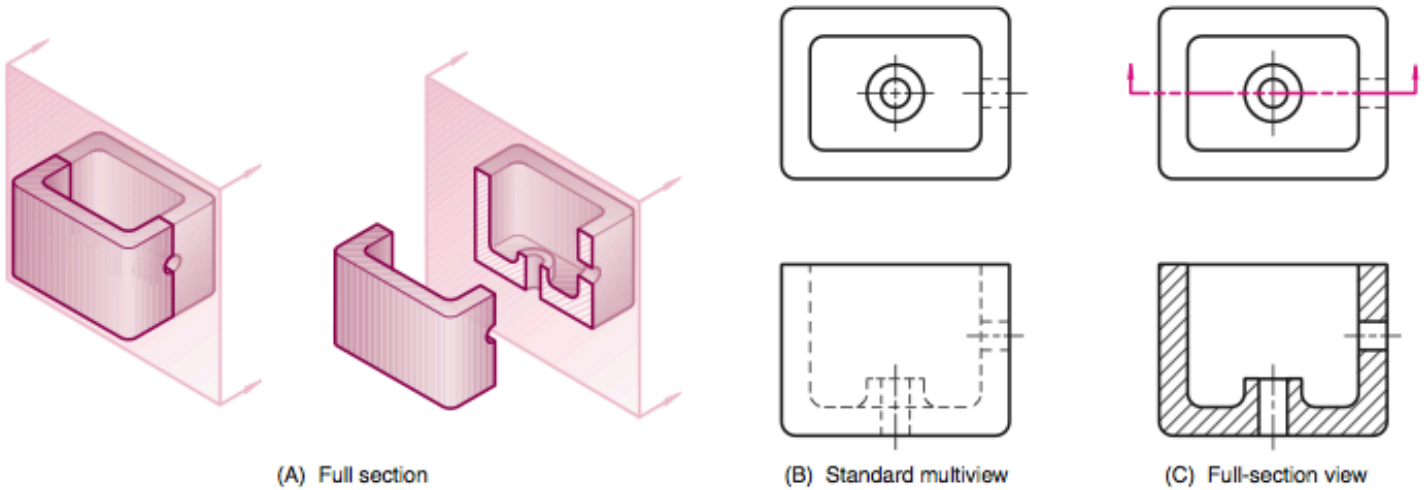

Figure 3.11 Full-Section View
A full-section view is created by passing a cutting plane fully through the object.

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Section Views – Half Section

- **Half sections** are created by passing an imaginary cutting plane only *halfway* through an object.
- The cutting plane passes halfway through an object and *one quarter* of the object being removed

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Section Views – Half Section

- Hidden lines are omitted on both halves of the section view.
- Hidden lines may be added to the unsectioned half for dimensioning or for clarity.

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Section Views – Half Section

- External features of the part are drawn on the unsectioned half of the view.
- A center line, not an object line, is used to separate the sectioned half from the unsectioned half of the view.

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Section Views – Half Section

- One arrow is drawn to represent the line of sight needed to create the front view in section.
- Half-section views are used most often on parts that are symmetrical, such as cylinders.
- Also, half sections are sometimes used in assembly drawings when external features must be shown.

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Section Views – Full Section

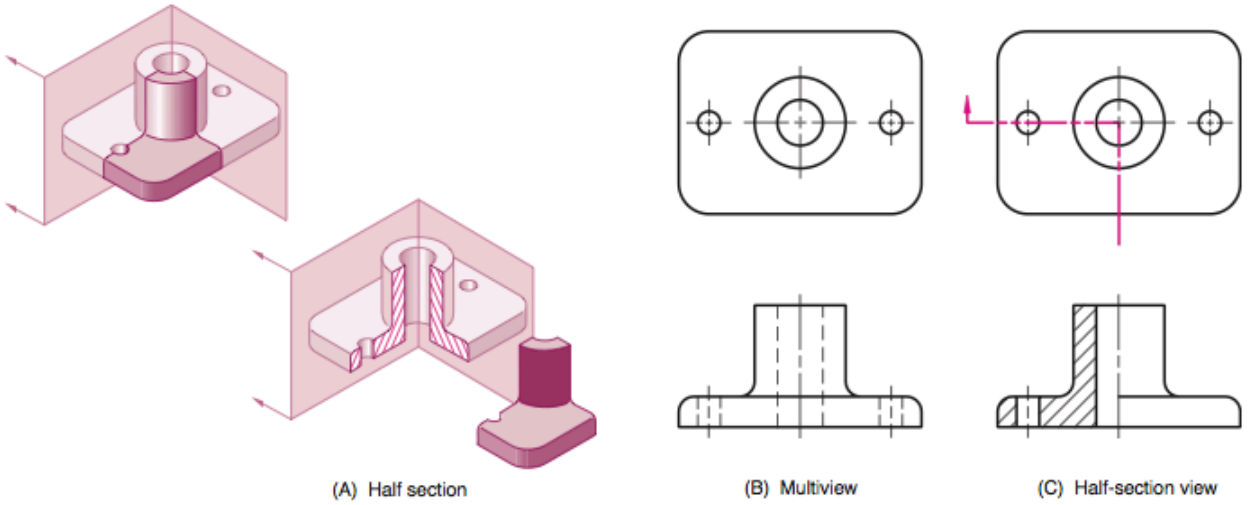

Figure 3.12 Half Section
A half-section view is created by passing a cutting plane halfway through the object.

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Section Views – Broken Out Section

- A **broken-out section** is used when only a portion of the object needs to be sectioned.
- The representation is a part with a portion removed or broken away.

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Section Views – Broken Out Section

- A broken-out section is used instead of a half or full section view to save time.
- A break line separates the sectioned portion from the unsectioned portion of the view.

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Section Views – Broken Out Section

- A break line is drawn freehand to represent the jagged edge of the break.
- No cutting plane line is drawn.
- Hidden lines may be omitted from the unsectioned part of the view unless they are needed for clarity.

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Section Views – Broken Out Section

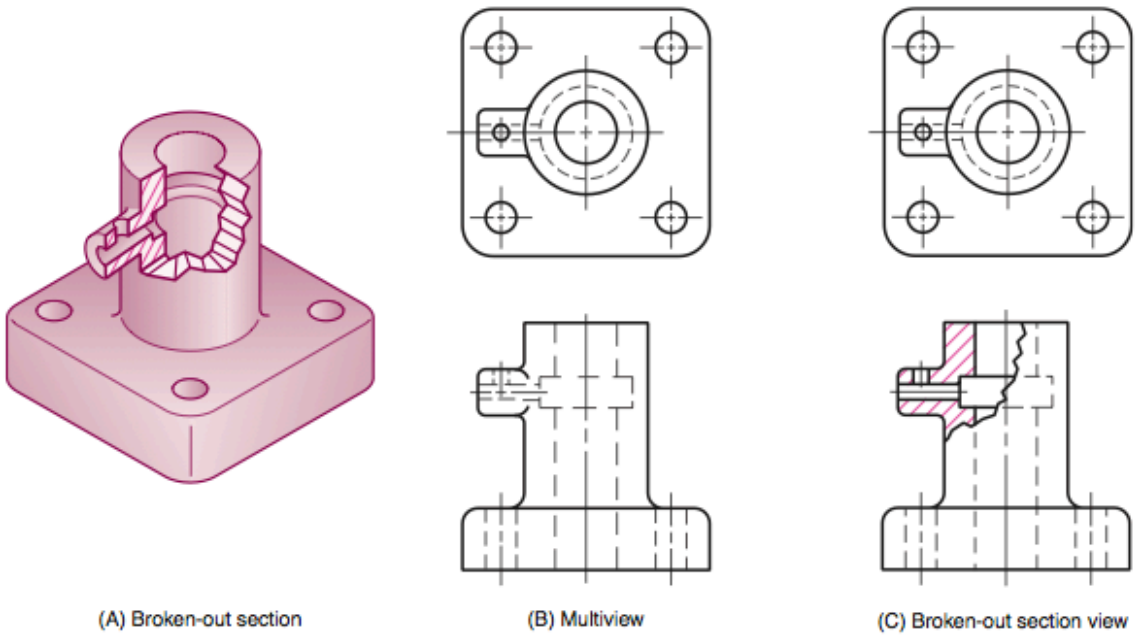

Figure 3.13 Broken-Out Section
A broken-out section view is created by breaking off part of the object to reveal interior features.

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Section Views – Revolved Section

- A **revolved section** is made by revolving the cross-section view 90 degrees about an axis of revolution and superimposing the section view on the orthographic view.
- When revolved section views are used, normally end views are not needed on a multiview drawing.

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Section Views – Revolved Section

- A revolved section is created by drawing a center line through the shape on the plane to represent in section.
- Visualize the cross section of the part being rotated 90 degrees about the center line and the cross section being superimposed on the view.

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Section Views – Revolved Section

- If the revolved section view does not interfere or create confusion on the view, then the revolved section is drawn directly on the view using visible lines.
- If the revolved section crosses lines on the view it is to be revolved, then the view is broken for clarity.

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Section Views – Revolved Section

- Section lines are added to the cross section to complete the revolved section.
- Visible lines adjacent to the revolved view can either be drawn or broken out using conventional breaks.

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Section Views – Revolved Section

- When the revolved view is super- imposed on the part, the original lines of the part behind the section are deleted.
- The cross section is drawn true shape and size, not distorted to fit the view.

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Section Views – Revolved Section

- The axis of revolution is shown on the revolved view as a center line.
- A revolved section is used to represent the cross section of a bar, handle, spoke, web, aircraft wing, or other elongated feature.

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Section Views – Revolved Section

- Revolved sections are useful for describing a cross section without having to draw another view.
- In addition, these sections are especially helpful when a cross section varies or the shape of the part is not apparent from the given orthographic views.

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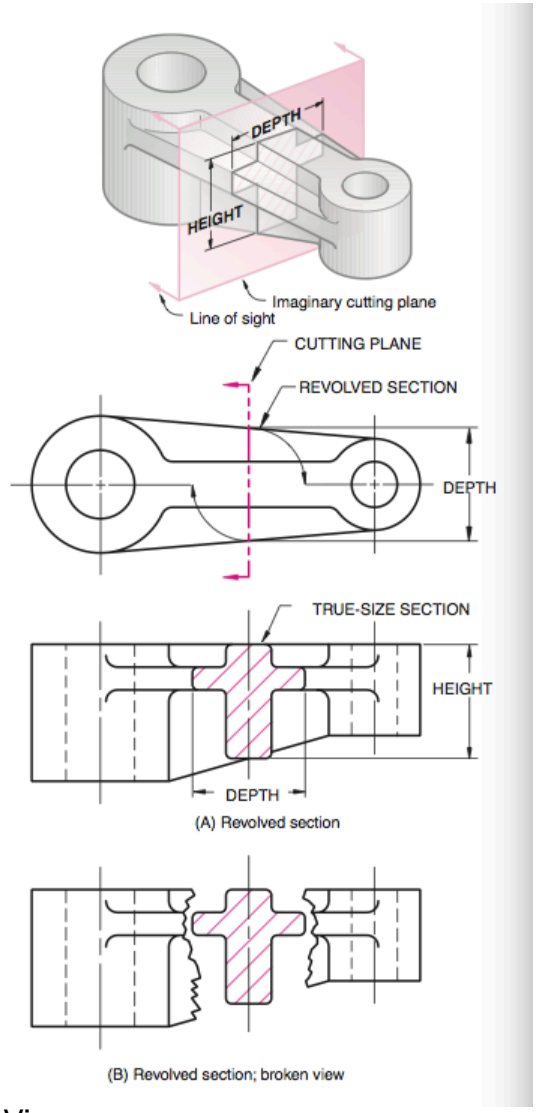
Section Views – Revolved Section



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Section Views – Offset Section

- An **offset section** has a cutting plane that is bent at one or more 90-degree angles to pass through important .
- Offset sections are used for complex parts that have a number of important features that cannot be sectioned using a straight cutting plane.

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Section Views – Offset Section

- The cutting plane line is drawn with 90-degree offsets.
- Thechange of plane that occurs when the cutting plane is bent at 90 degrees is not represented with lines in the section view.

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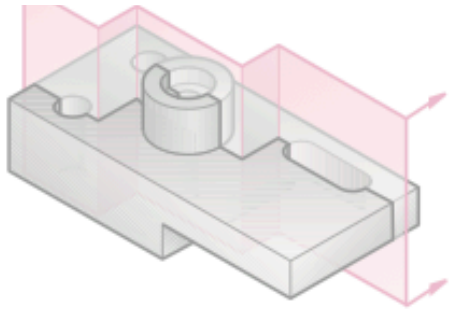
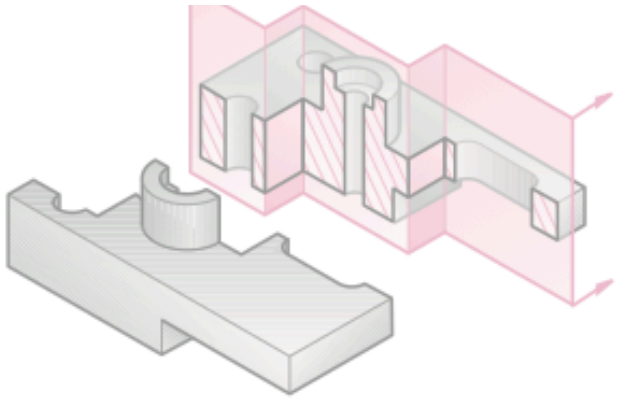
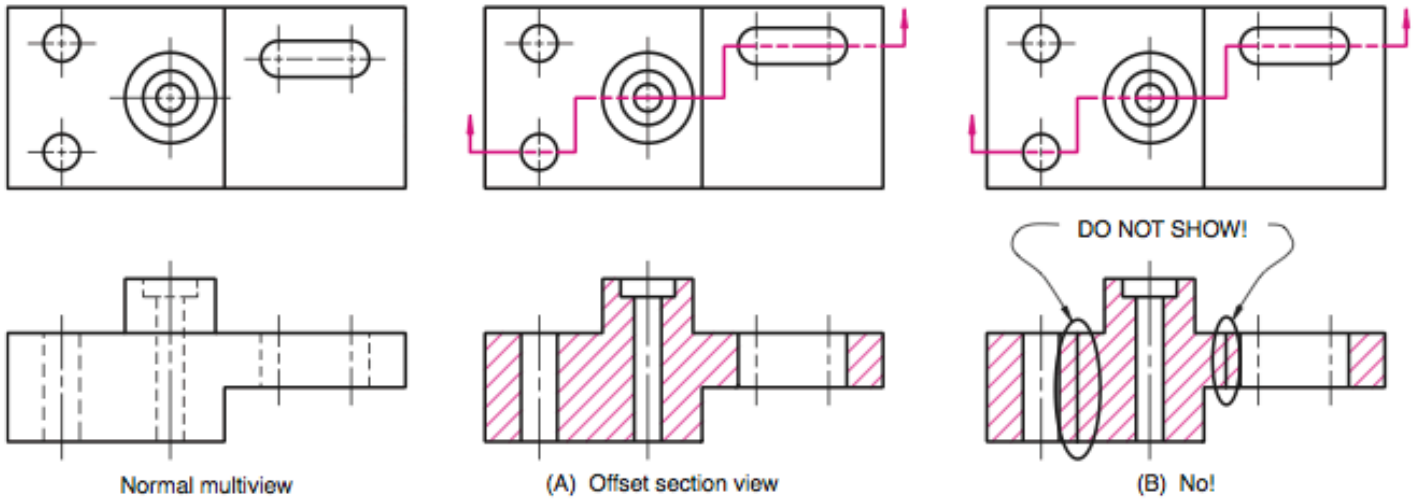
Section Views – Offset Section







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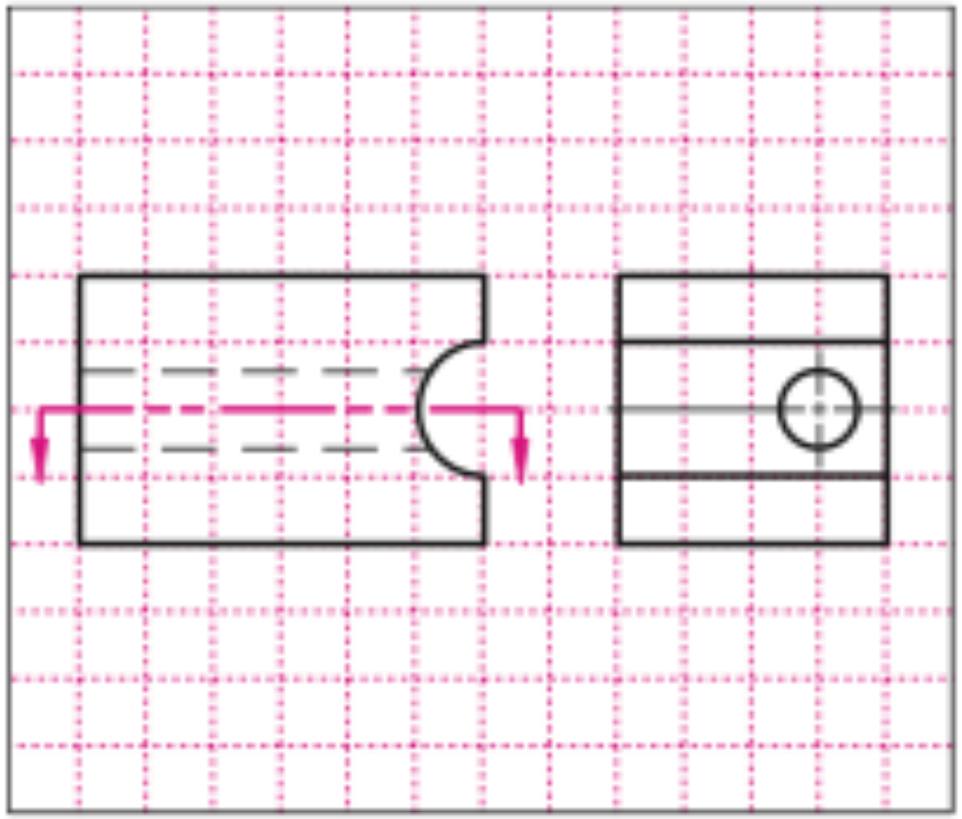
Example One – Full Section



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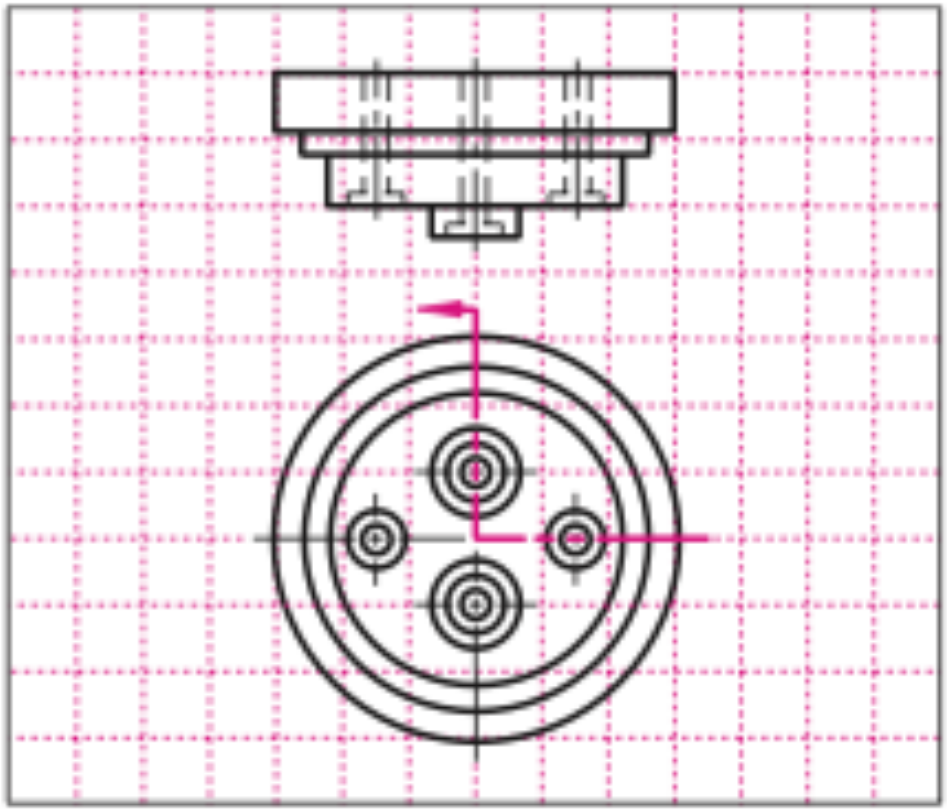
Example Two – Half Section



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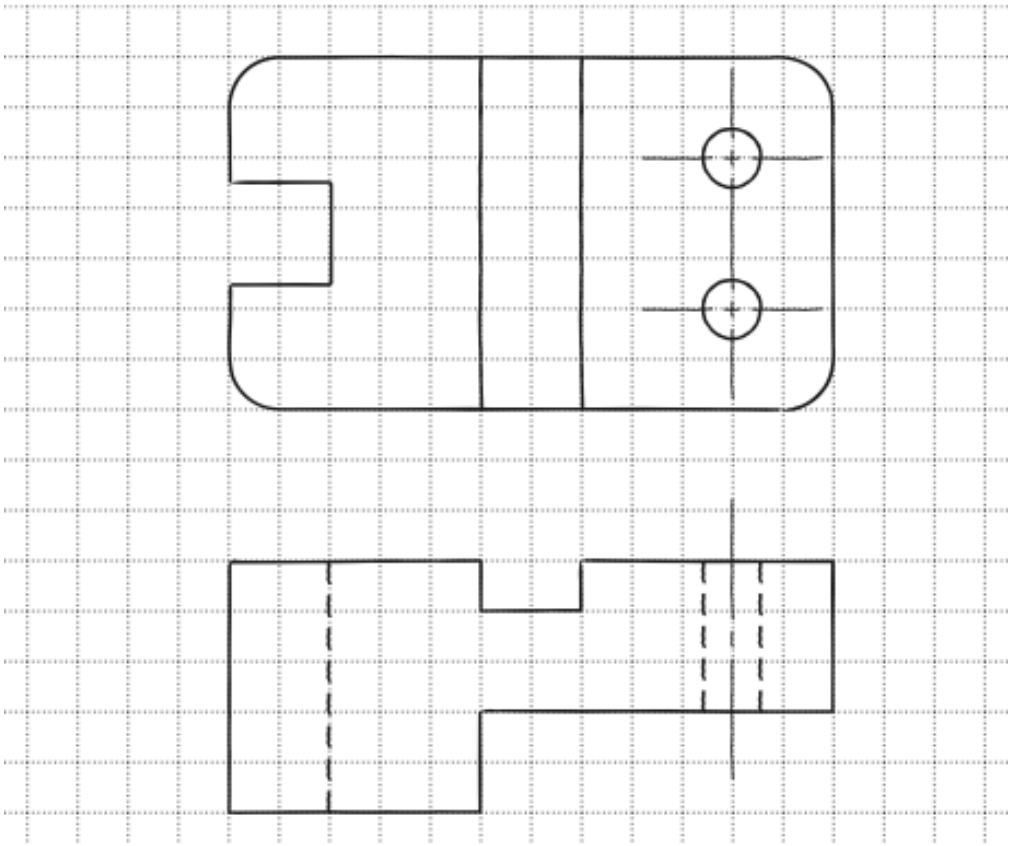
Example Three – Offset Section



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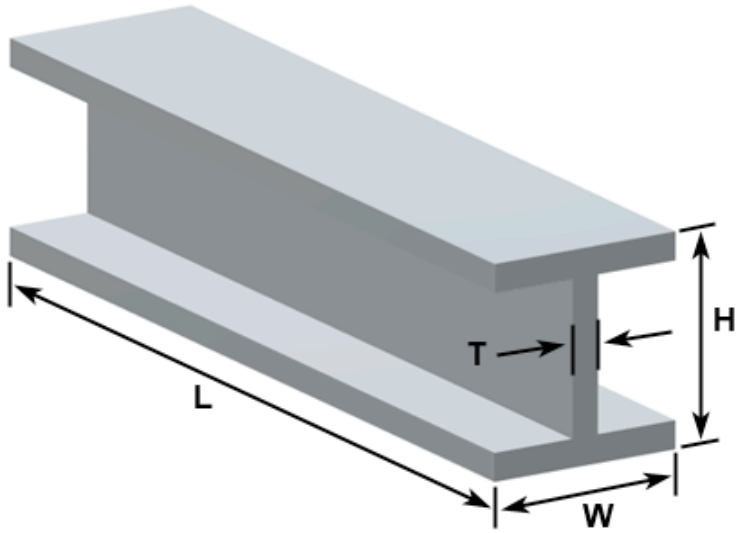
Example Four – Rotated Section



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LAB PROBLEMS TO BE COMPLETED AND SUBMITTED BY THE END OF LAB

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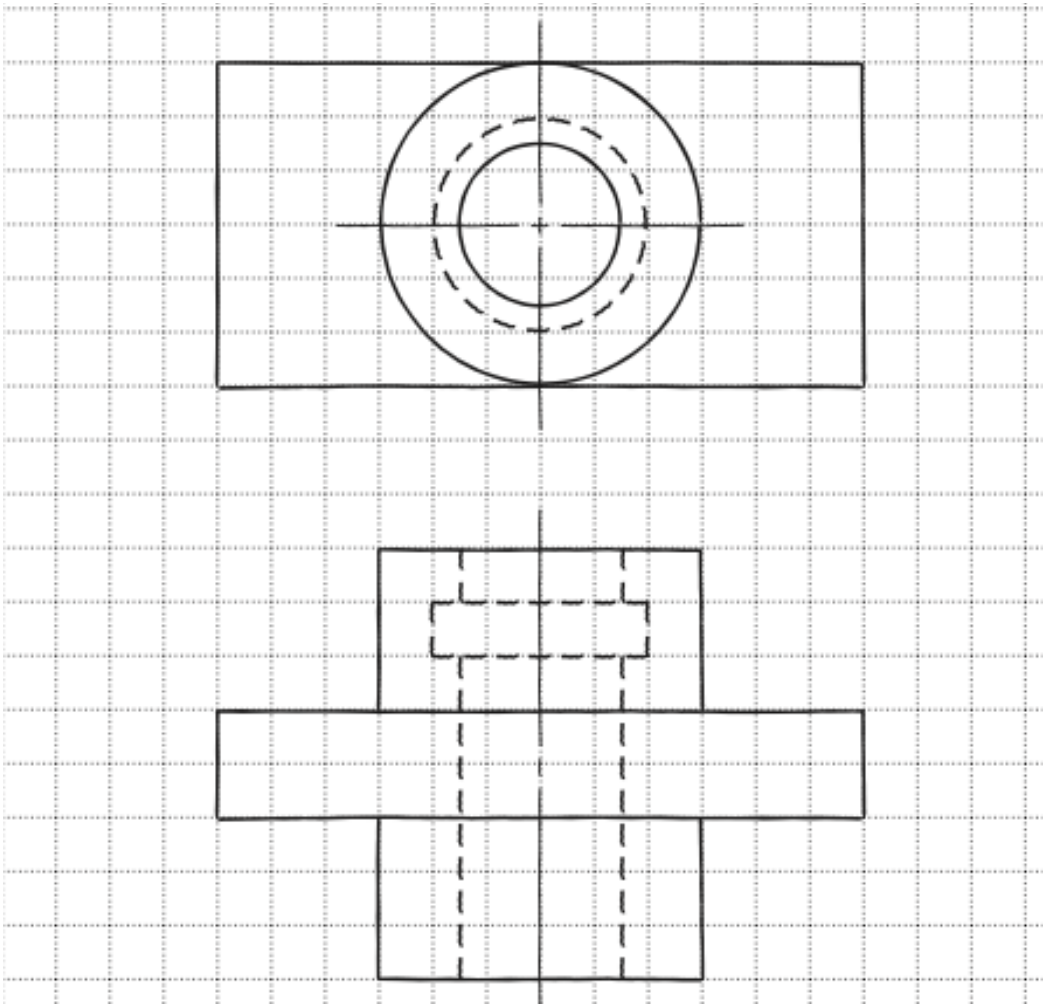
Problem 1 – Full Section



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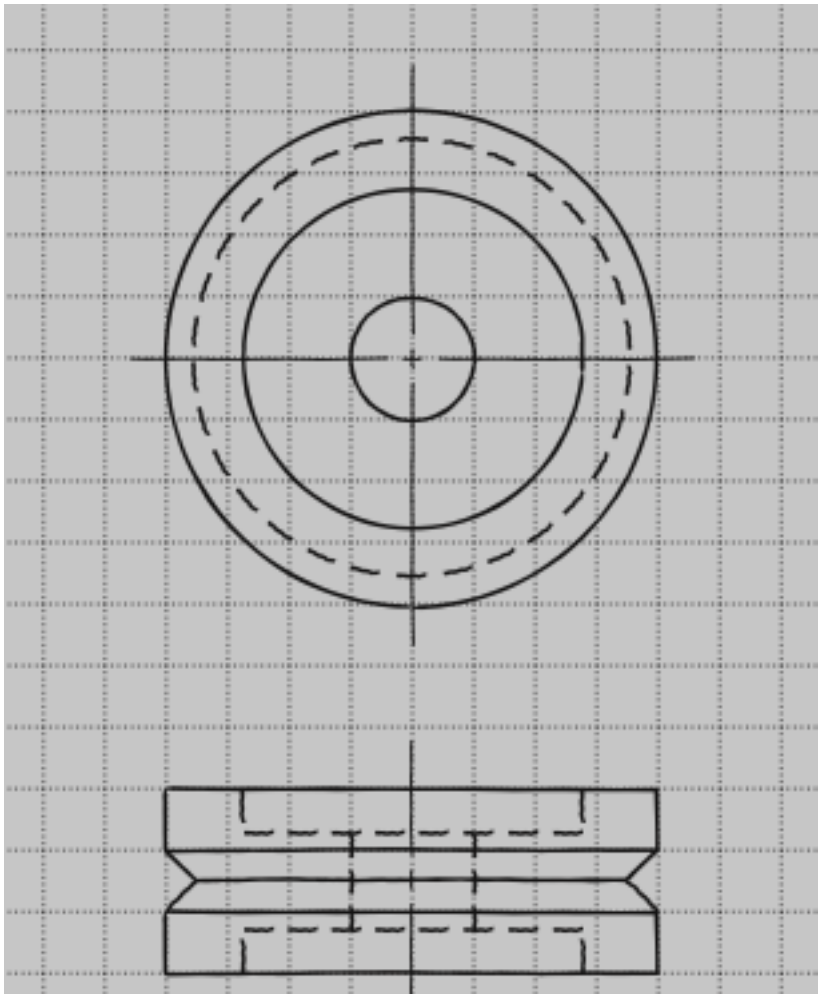
Problem 2 – Half Section



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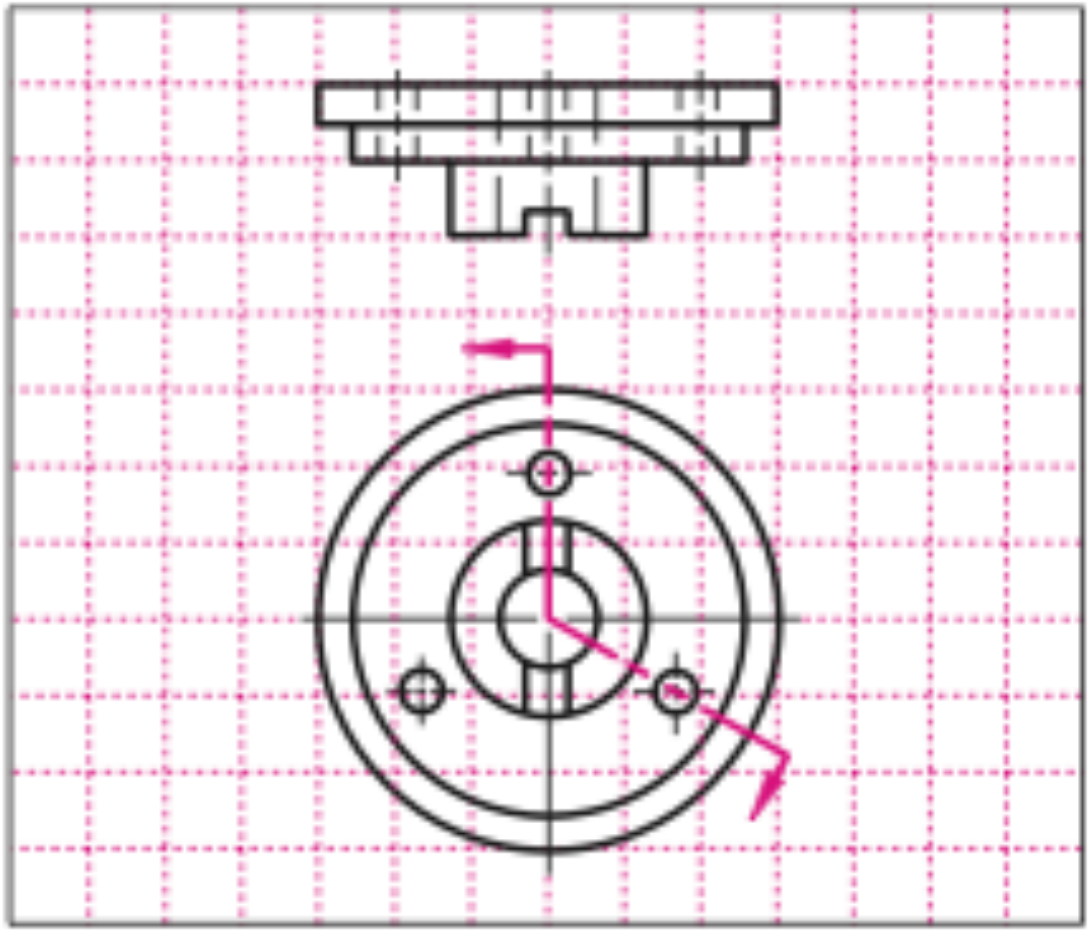
Problem 3 – Offset Section



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LAB PROBLEMS TO BE COMPLETED AND SUBMITTED BY THE BEGINNING OF THE NEXT CLASS (12:30 PM – 3 OCTOBER)

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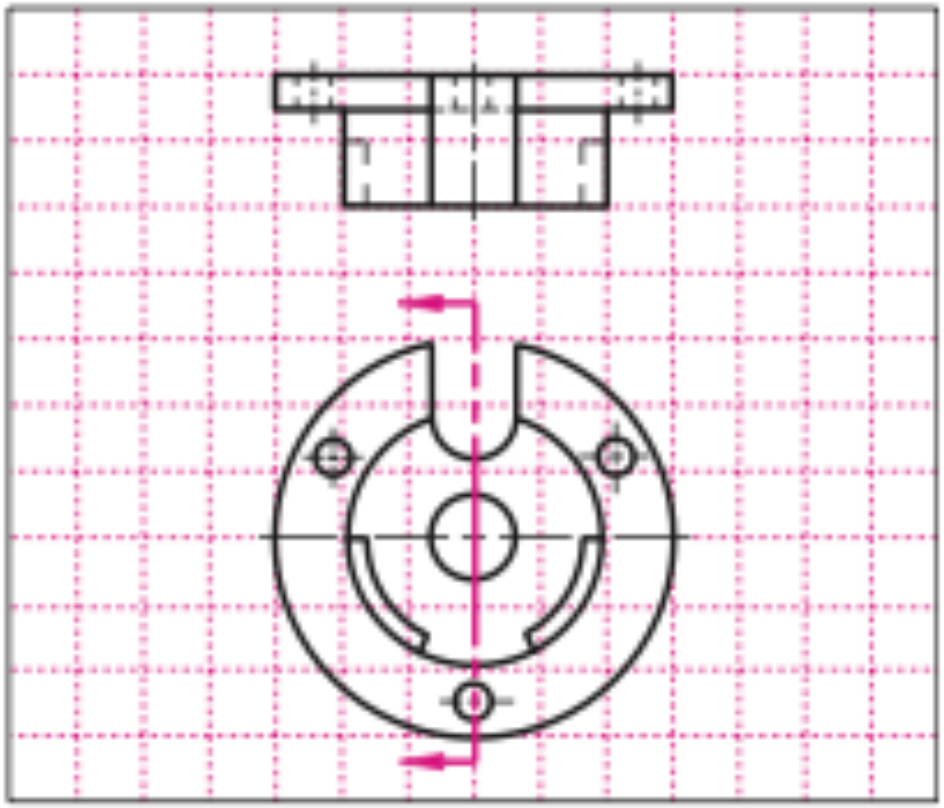
Problem Four – Full Section



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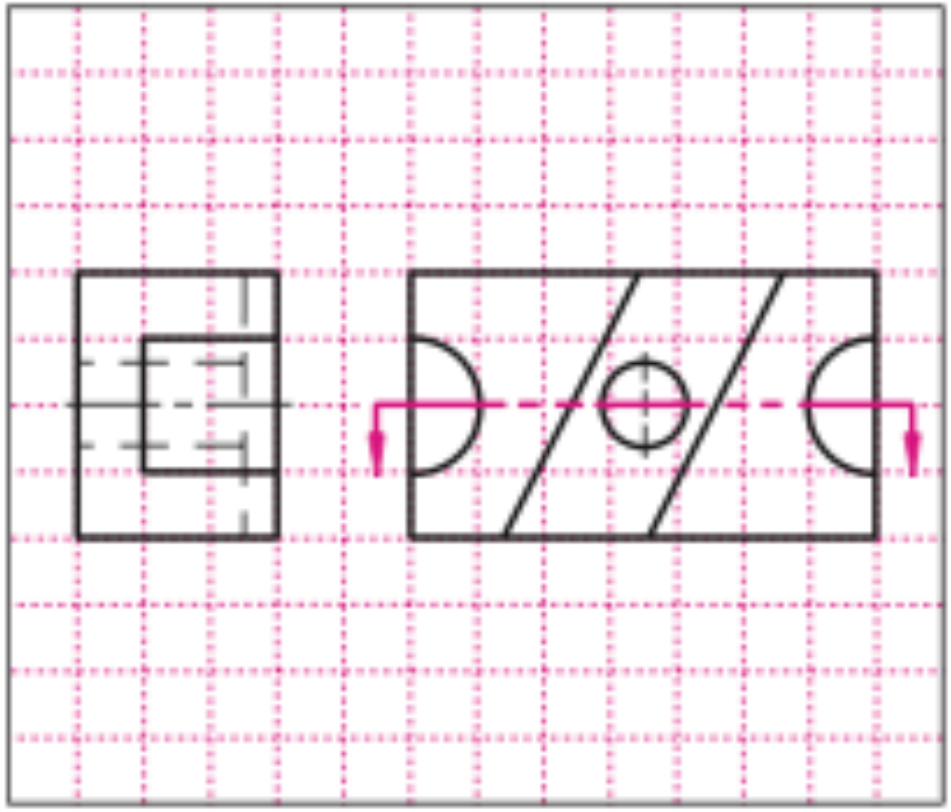
Problem Five – Full Section



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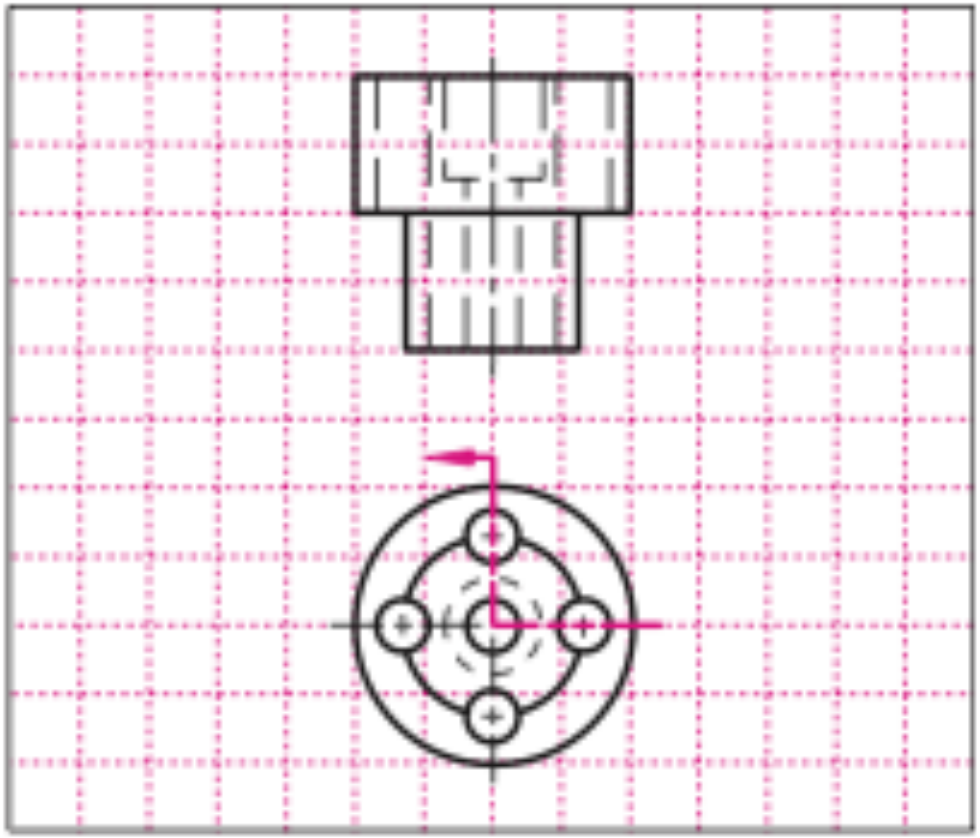
Problem Six – Half Section



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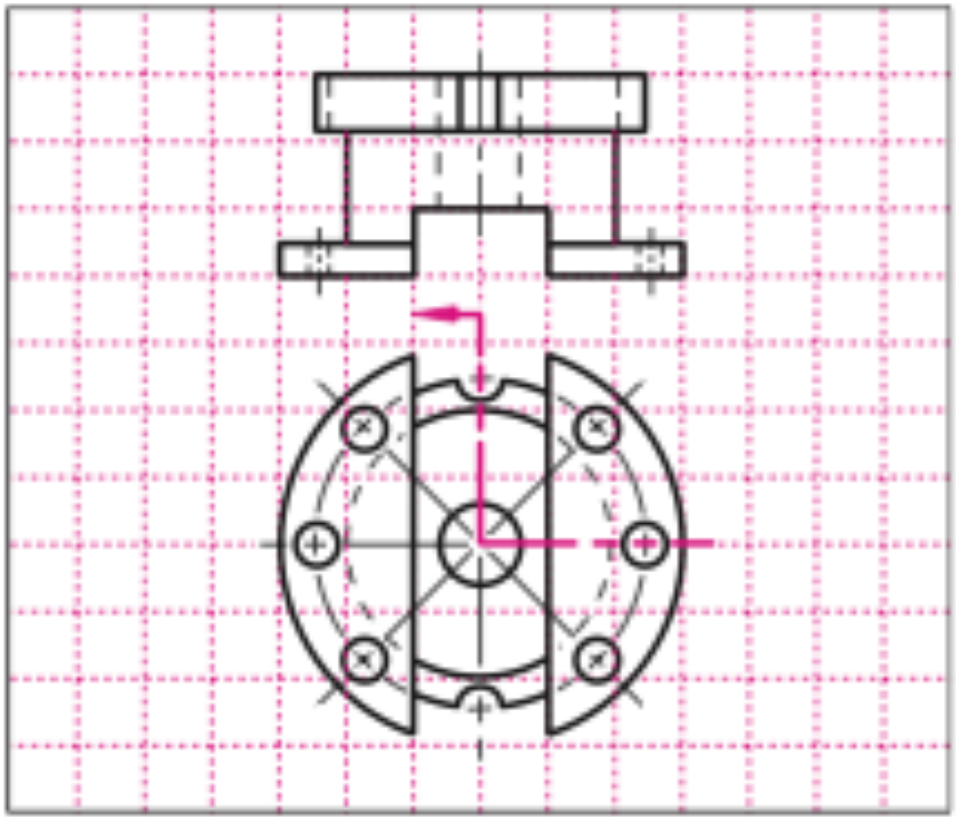
Problem Seven – Half Section



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Problem Eight – Offset Section