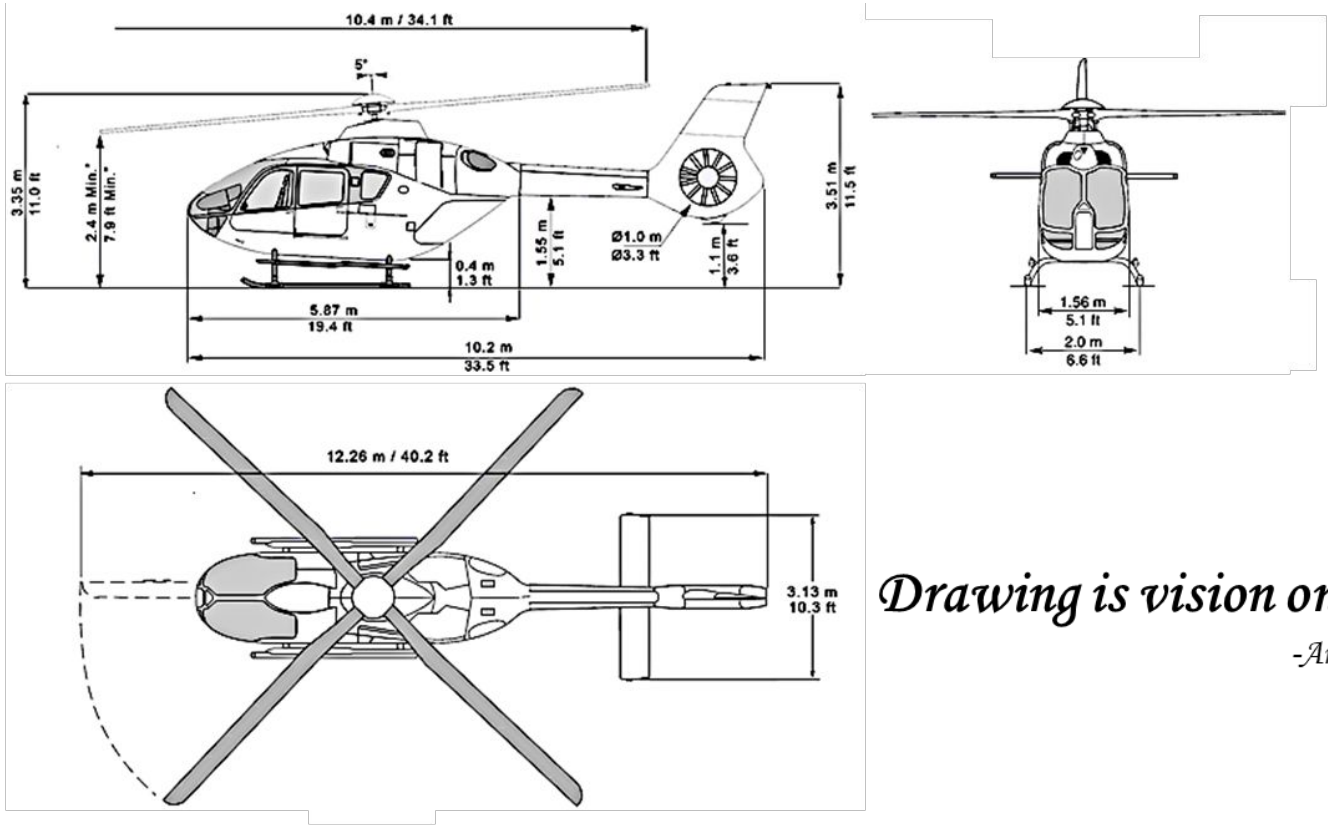
ES 101: Engineering Graphics



Drawing is vision on paper

-Andrew Loomis

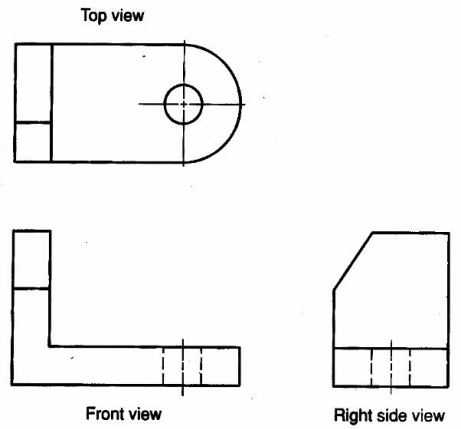
https://www.aiut-alpin-dolomites.com/english/technical_details.html

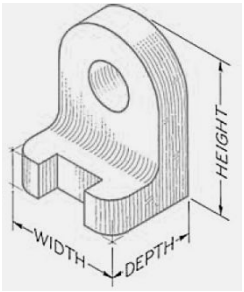
Class#6 – 30th October 2024

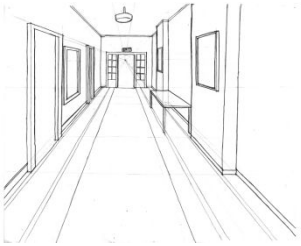
Sameer Patel
Assistant Professor
Civil Engineering & Chemical Engineering
IIT Gandhinagar

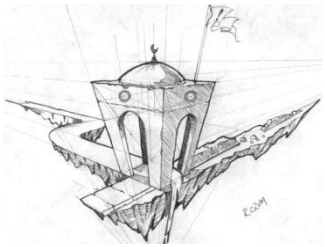
Types of projections

- Projections
  - Parallel
    - Oblique
    - Orthographic
      - Multi-view
      - Axonometric
        - Isometric
  - Perspective
    - One point
    - Two point
    - Three point

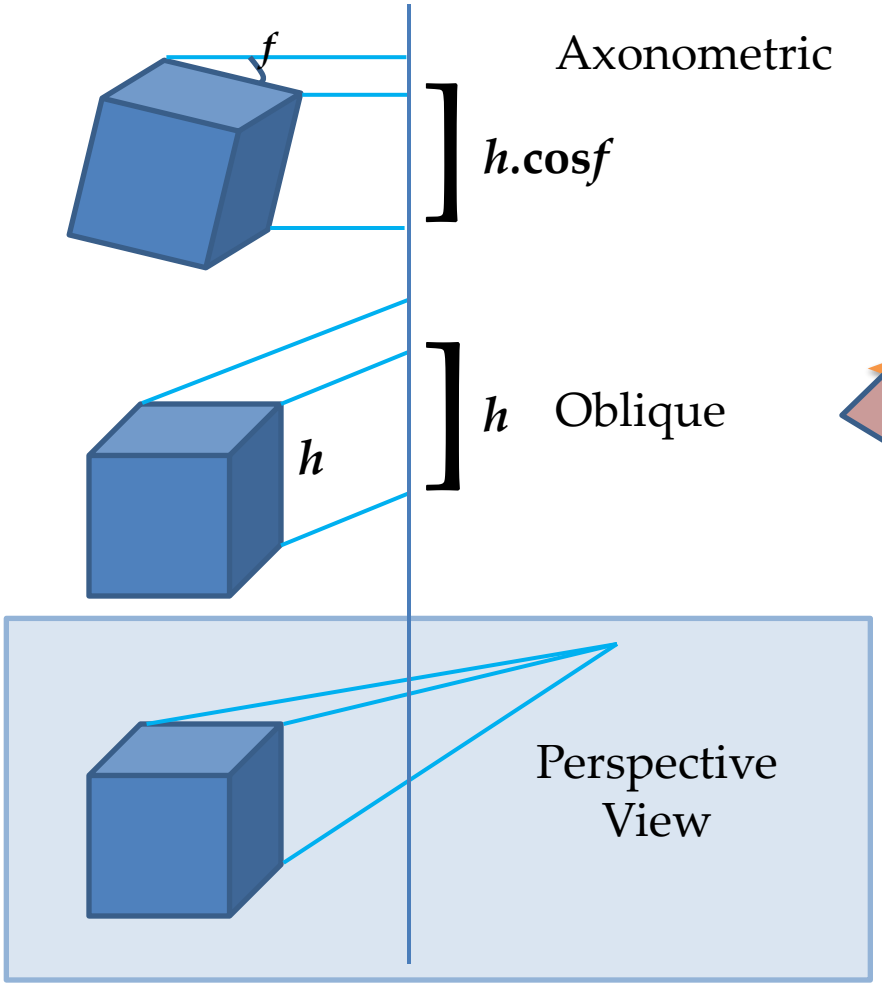


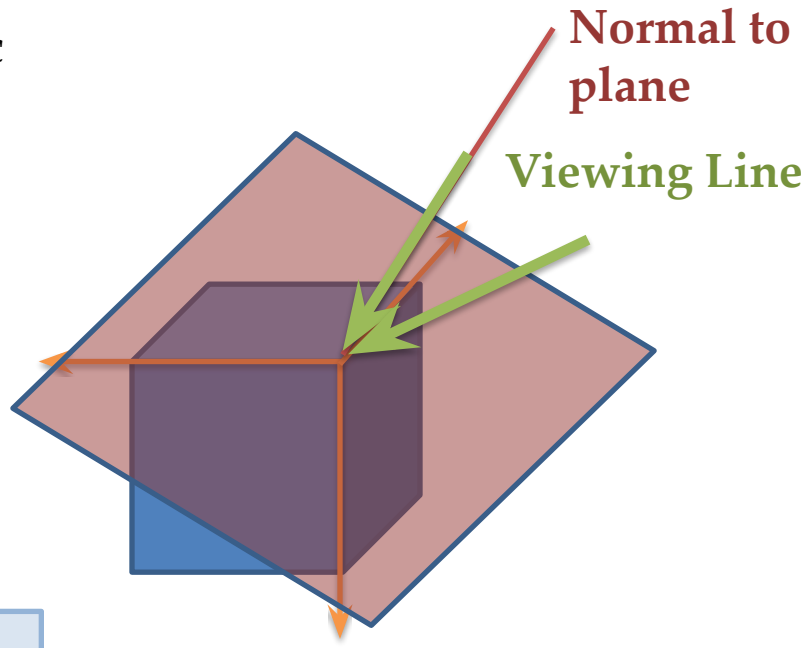




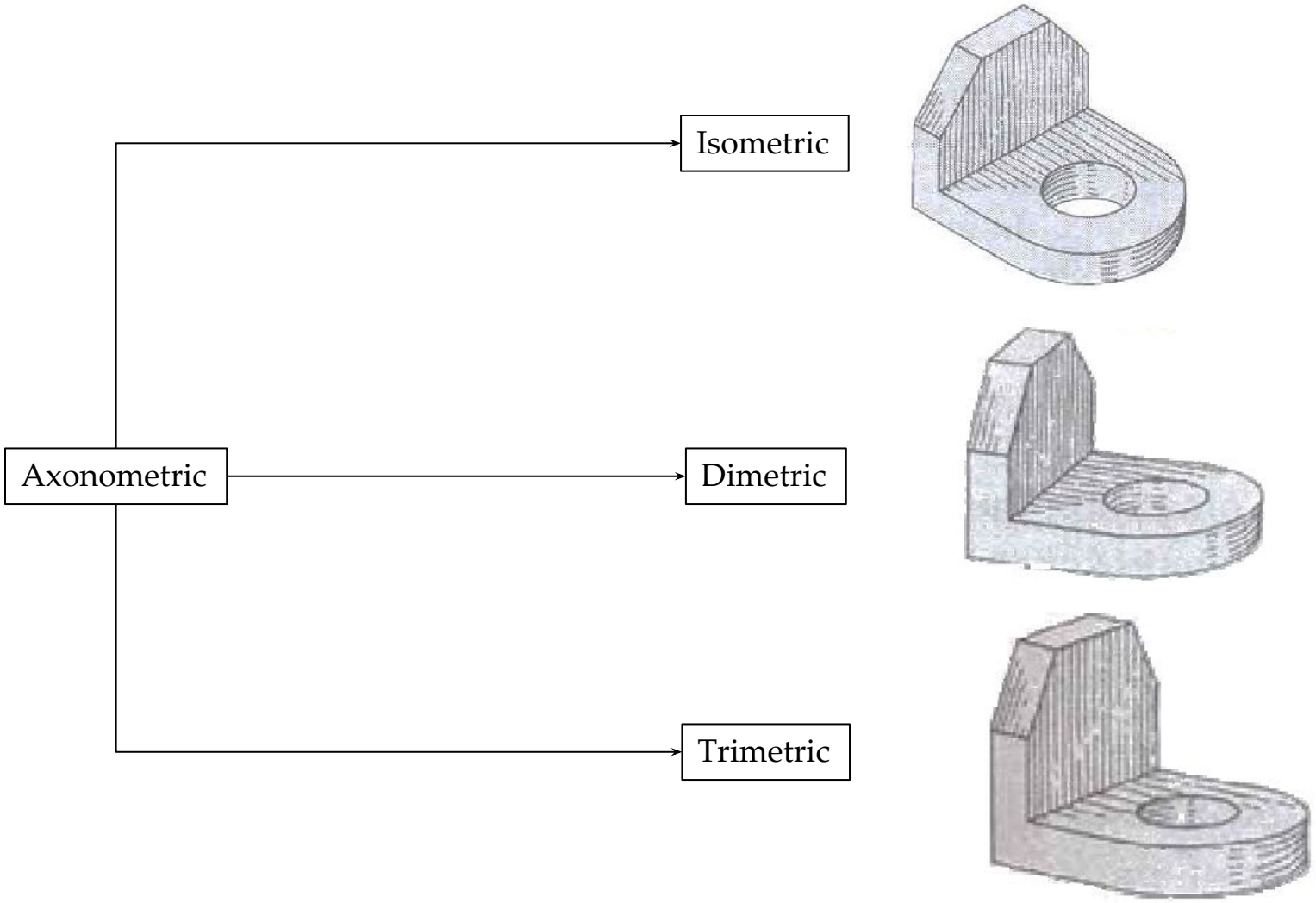


Types of projections

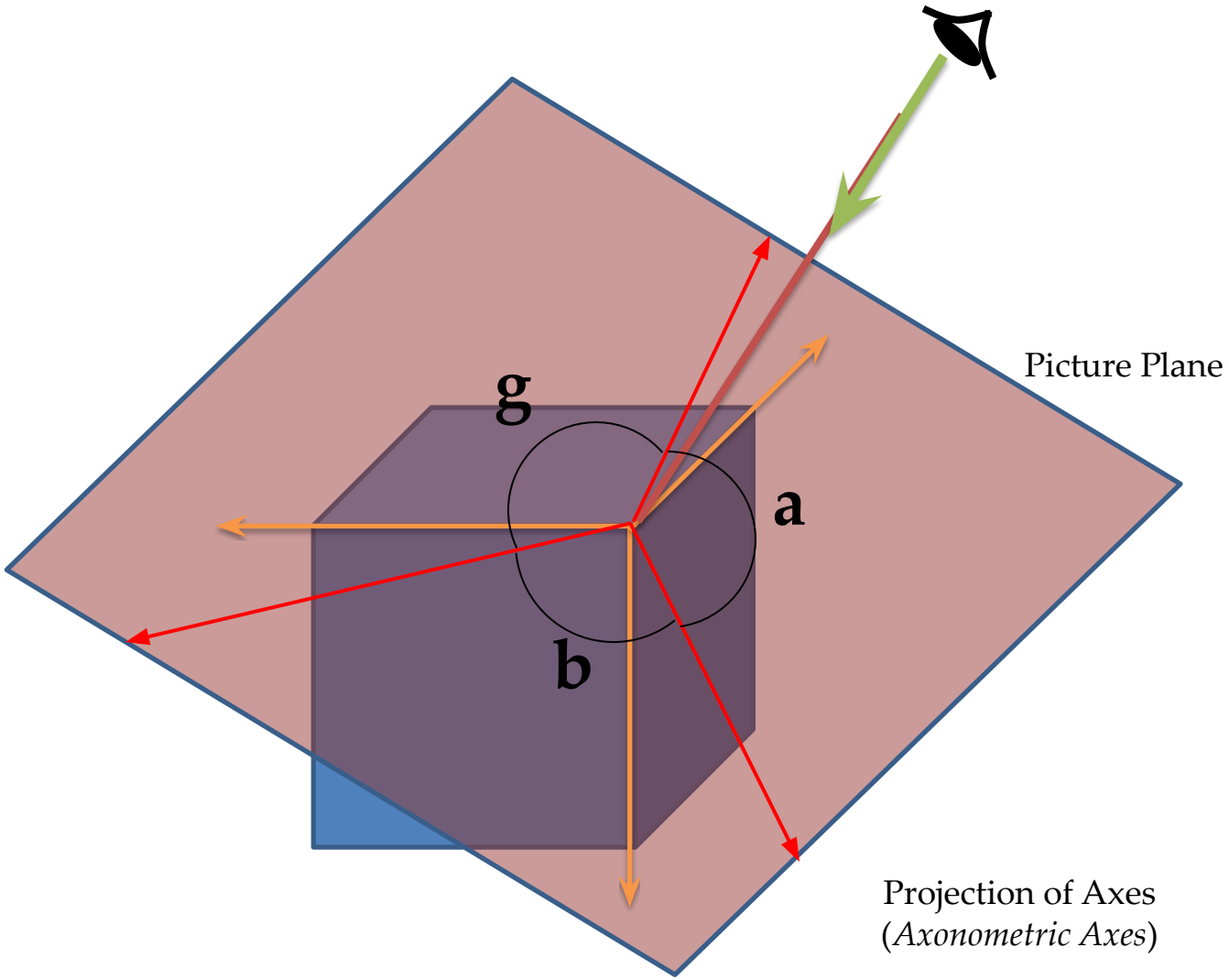




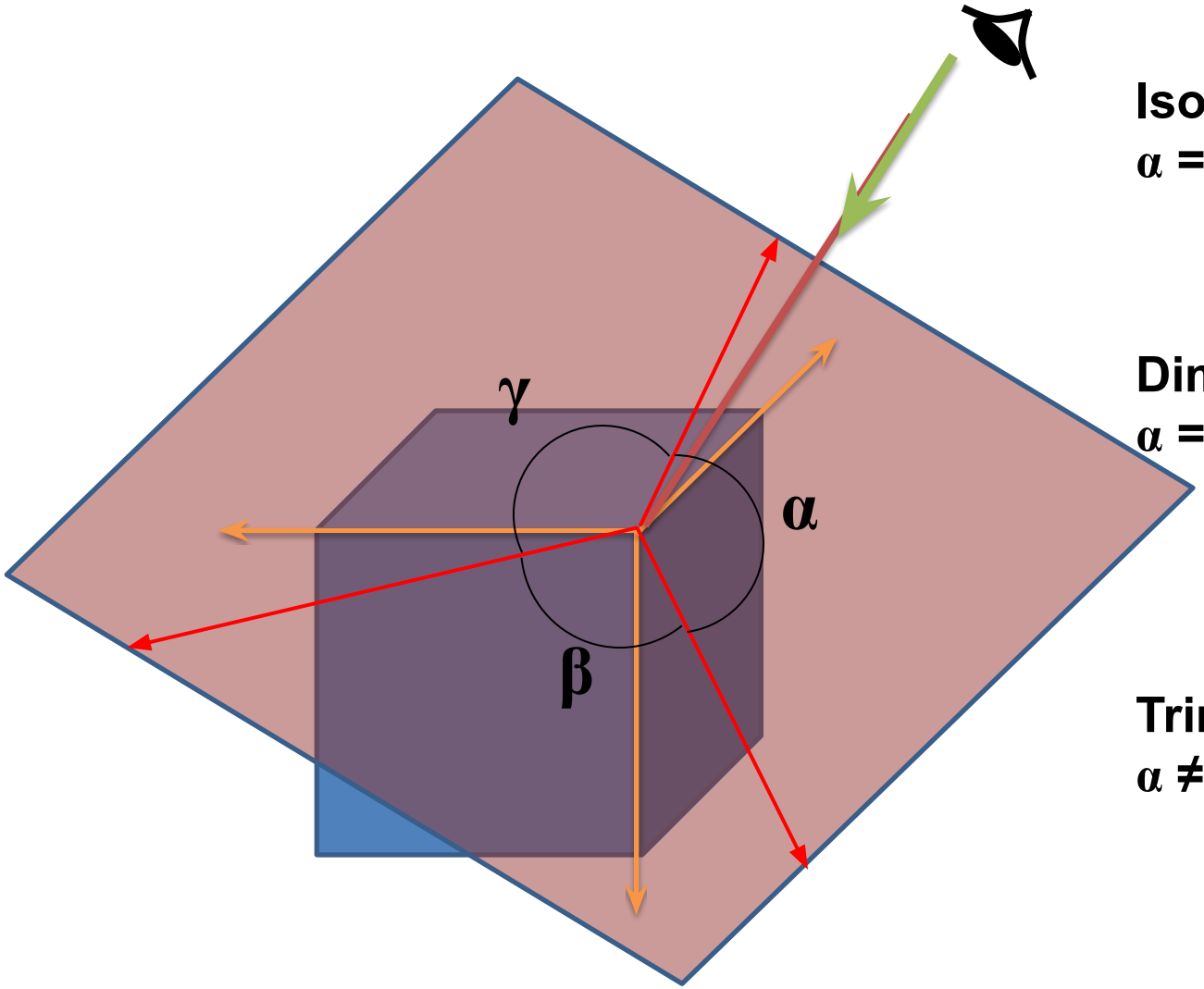
Types of Axonometric projections



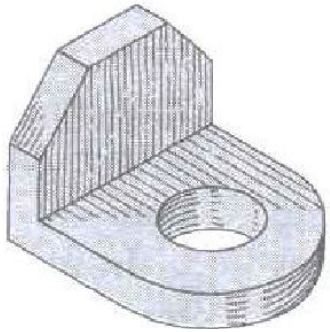
Axonometric projections



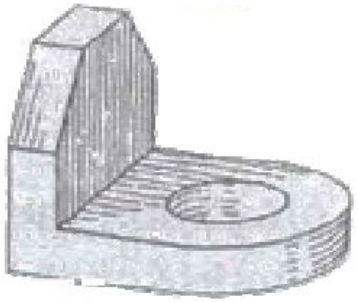
Classification of Axonometric projections



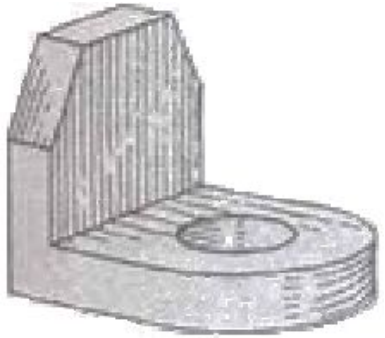
Isometric:
$\alpha = \beta = \gamma$



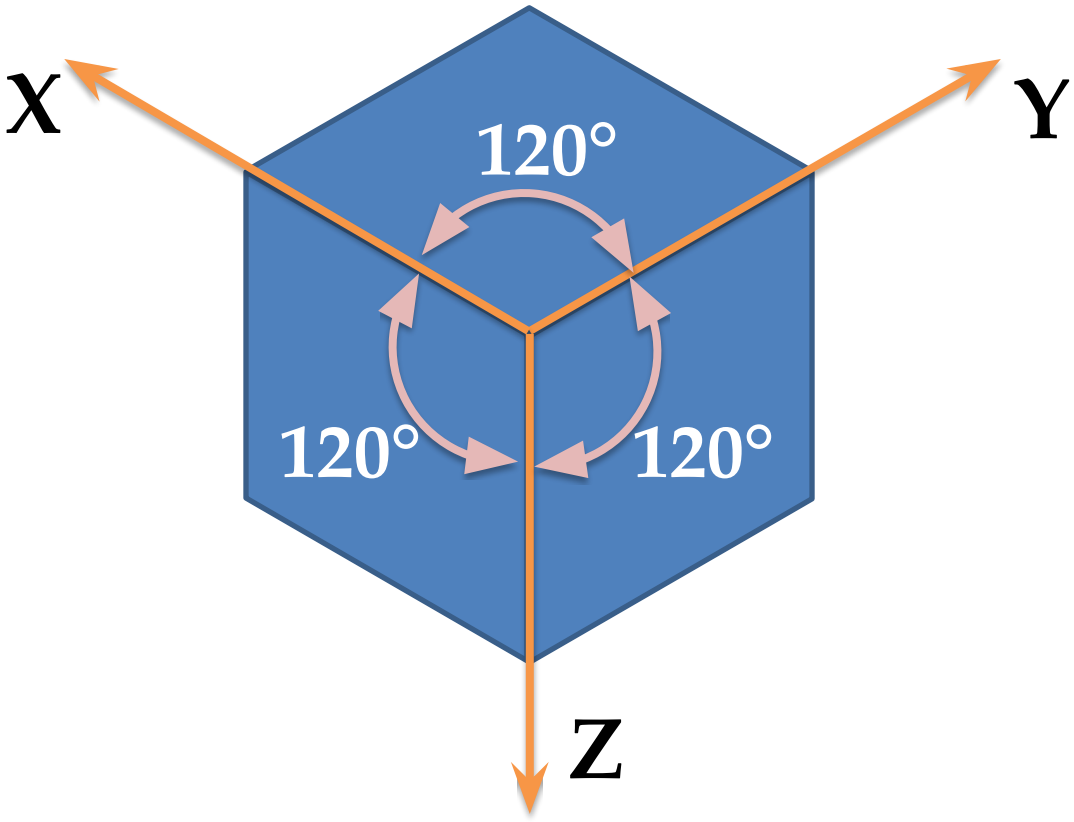
Dimetric:
$\alpha = \beta \neq \gamma$

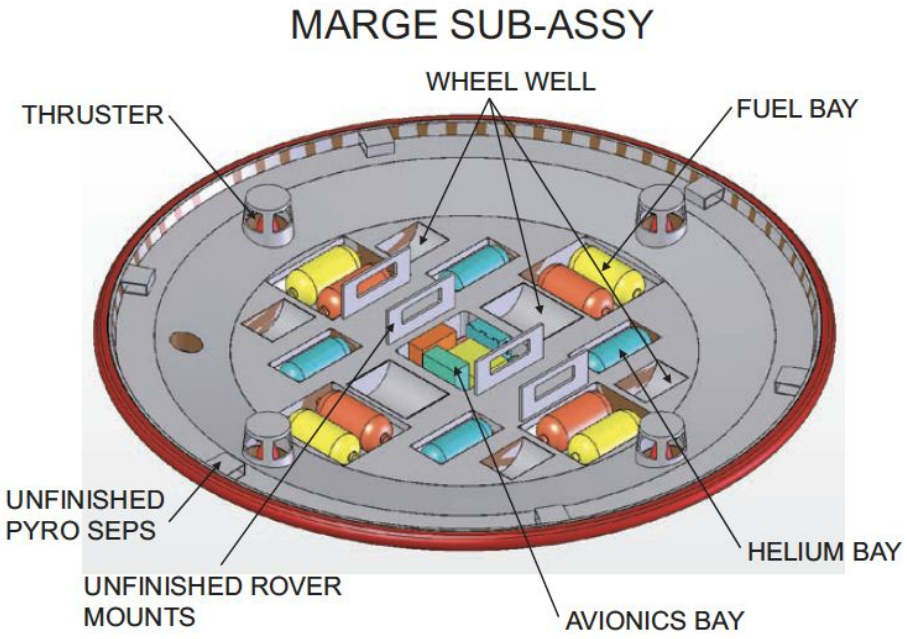


Trimetric:
$\alpha \neq \beta \neq \gamma$

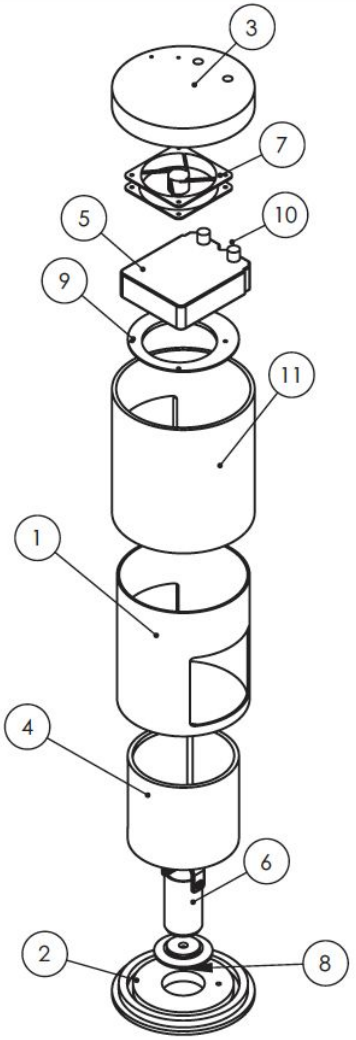


Isometric projection





ITEM NO.	PART NAME	QTY.
1	Outer Tube	1
2	End	1
3	Top	1
4	Inner Tube	1
5	Heat exchanger	1
6	Assem Sampler	1
7	Fan	1
8	Sample Bottom	1
9	HX Mounting Plate	1
10	Cooling Hose	1
11	Door	1



DIMENSIONS ARE IN MM
TOLERANCES:
FRACTIONAL ±
ANGULAR: MACH ± BEND ±
TWO PLACE DECIMAL ±
THREE PLACE DECIMAL ±

MATERIAL: N/A

FINISH: N/A

DO NOT SCALE DRAWING

	NAME	DATE
DRAWN		
CHECKED		
ENG APPR.		
MFG APPR.		
Q.A.		

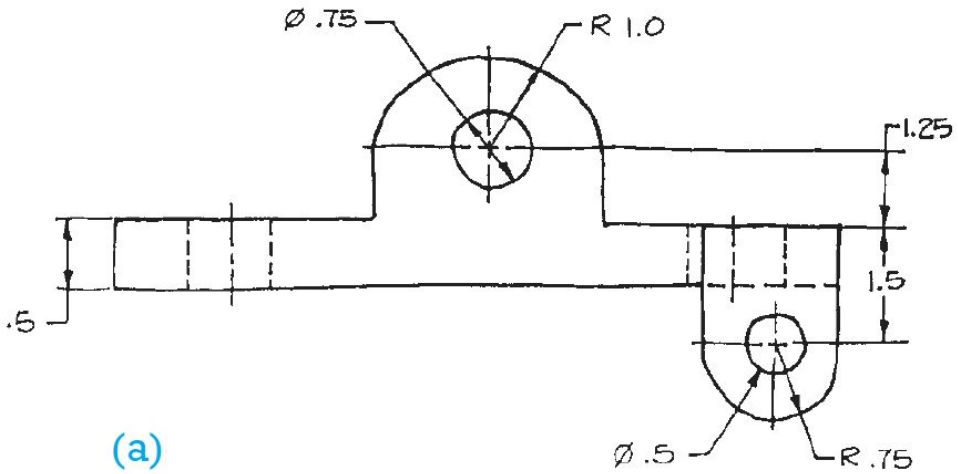
COMMENTS:

MONTANA STATE UNIVERSITY

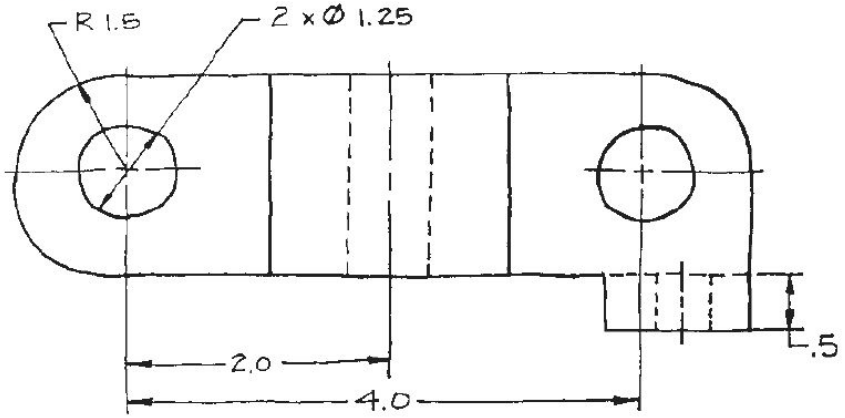
SIZE A | DWG. NAME: Assem Round Encloser | REV.

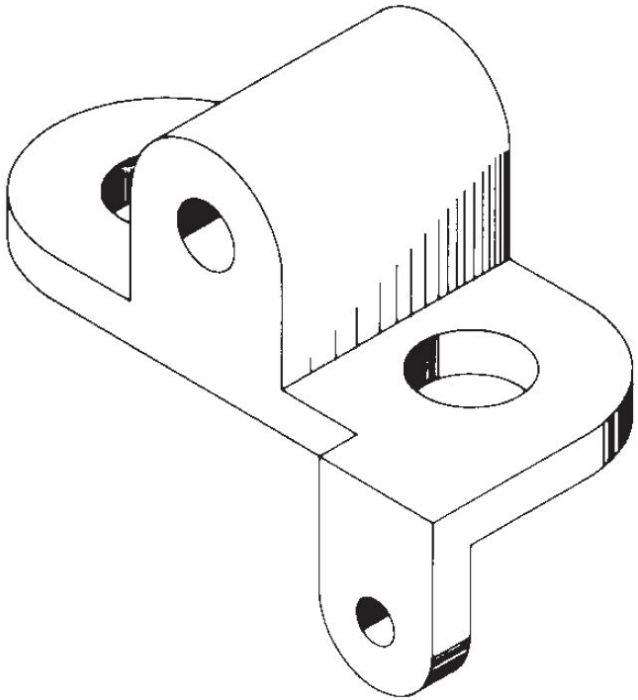
SCALE: 1:1 | WEIGHT: | SHEET 1 OF 1

D. A. Madsen, D. P. Madsen, *Engineering Drawing and Design*, Cengage Learning, 6th Ed., Boston



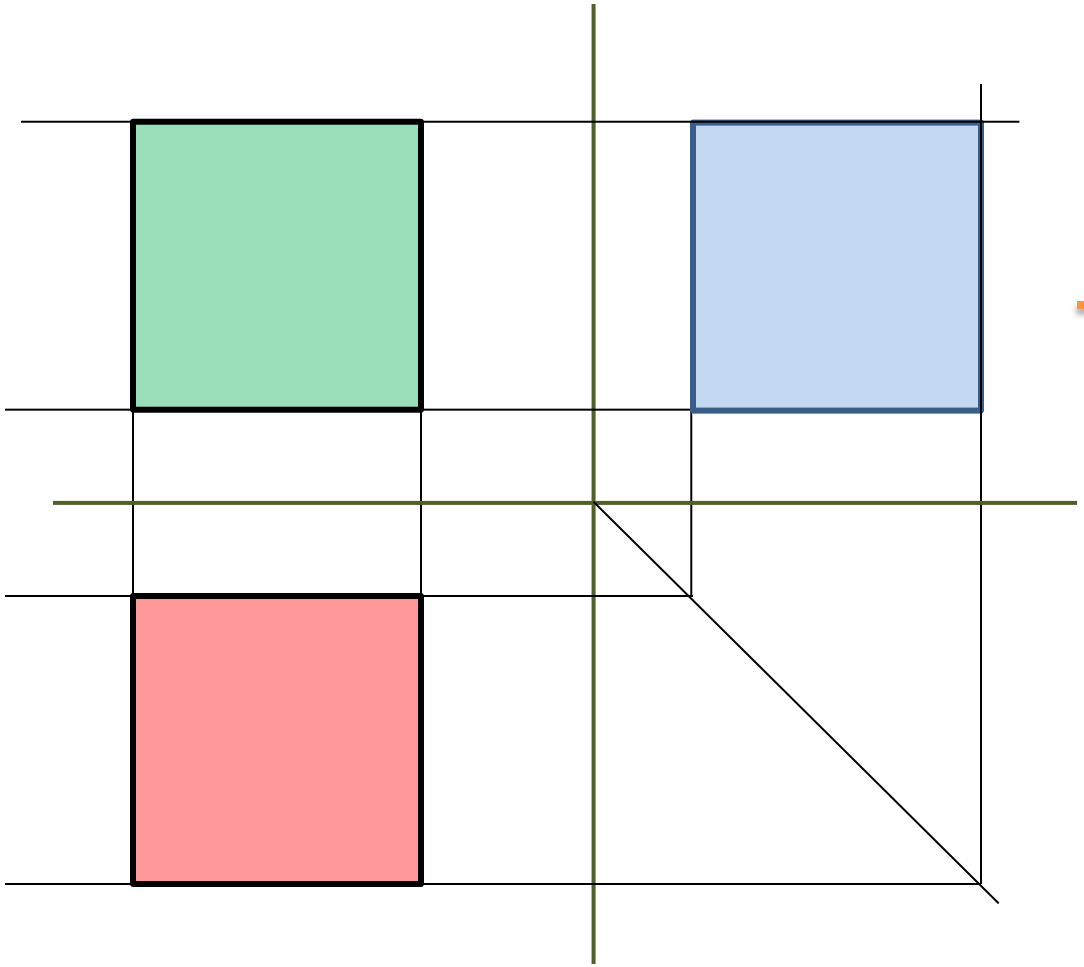
(a)

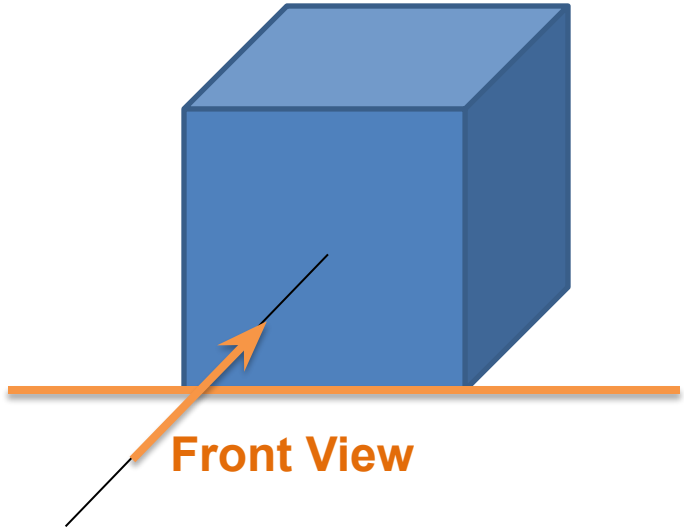




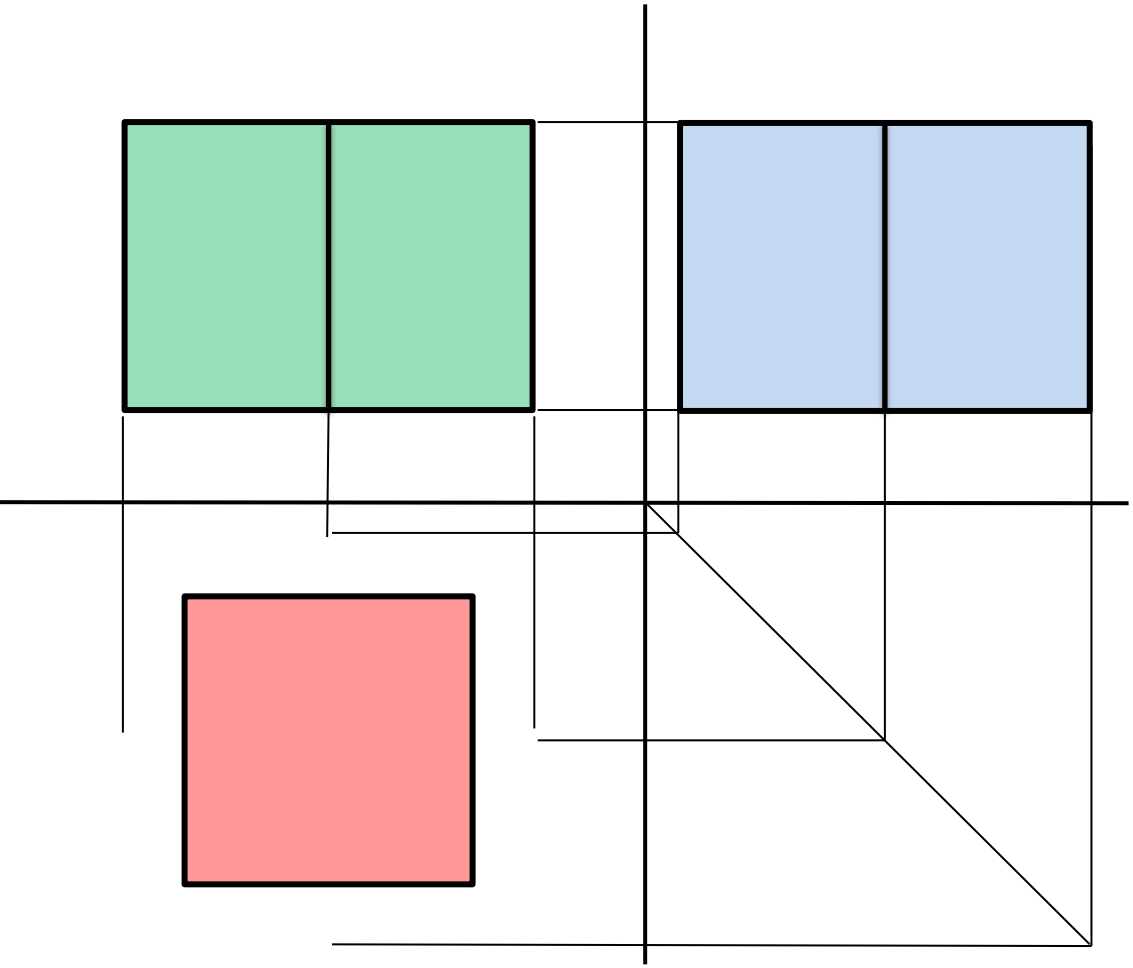
D. A. Madsen, D. P. Madsen, *Engineering Drawing and Design*, Cengage Learning, 6th Ed., Boston

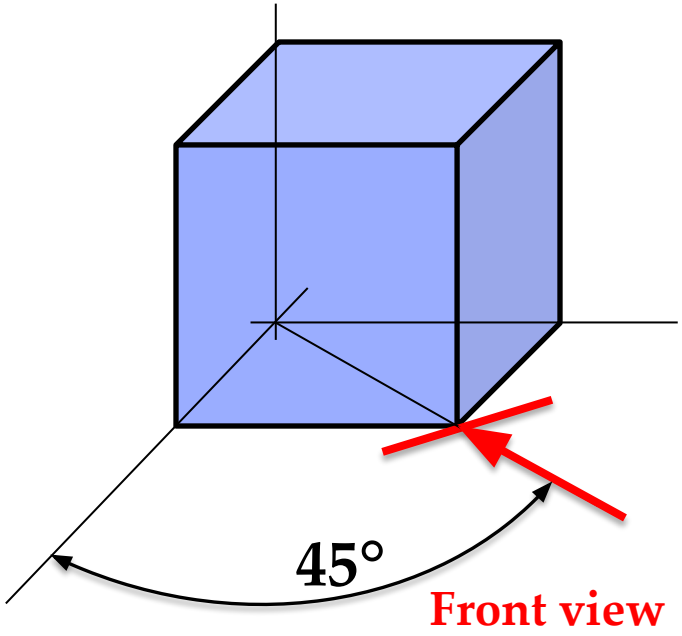
Isometric Projection: Step-1



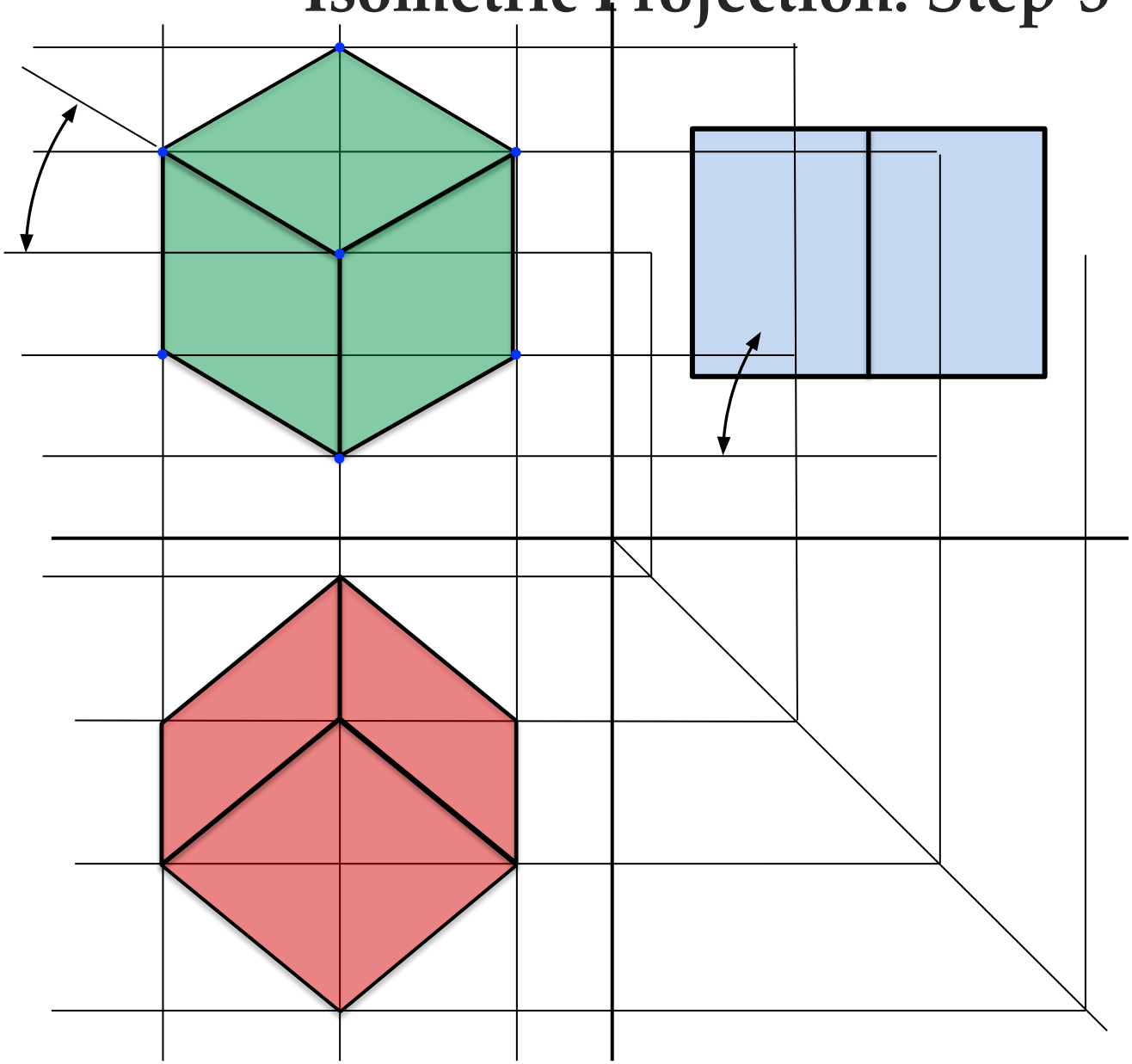


Isometric Projection: Step-2



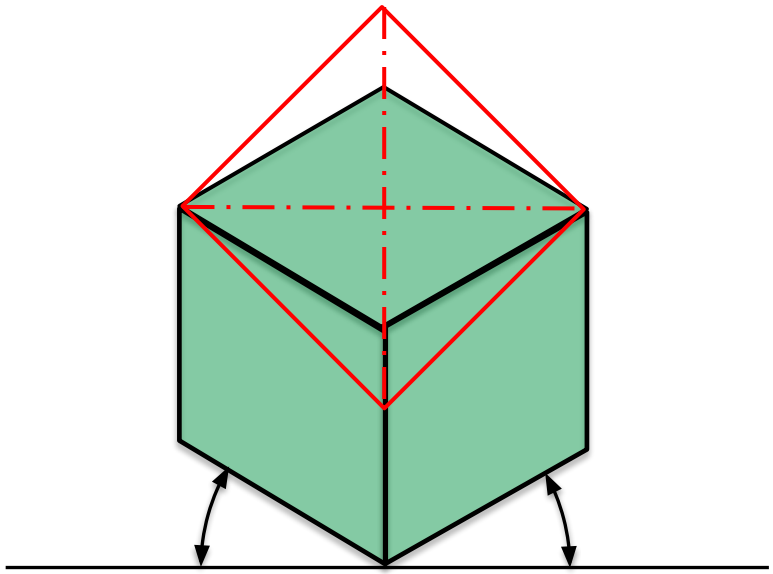


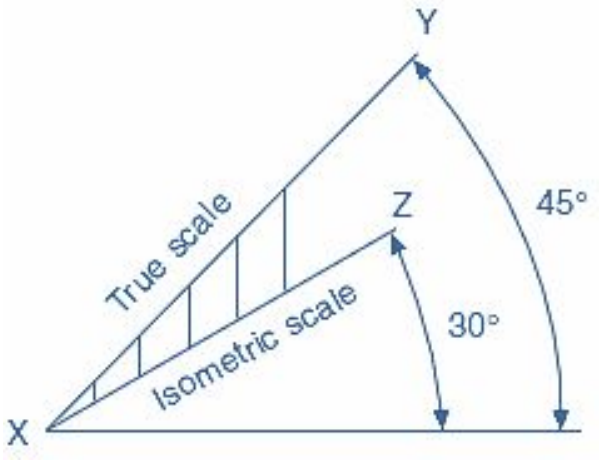
Isometric Projection: Step-3



Isometric Projection: Scales

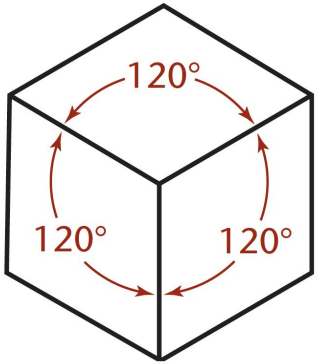
•

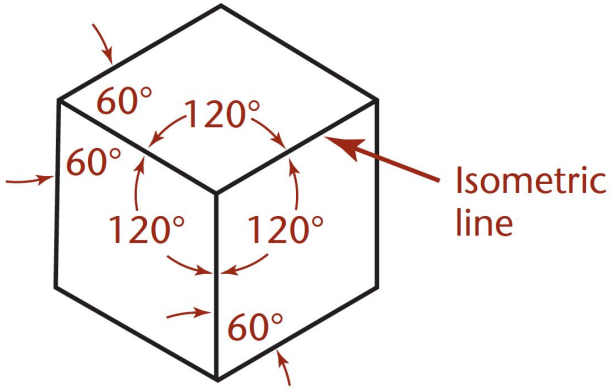




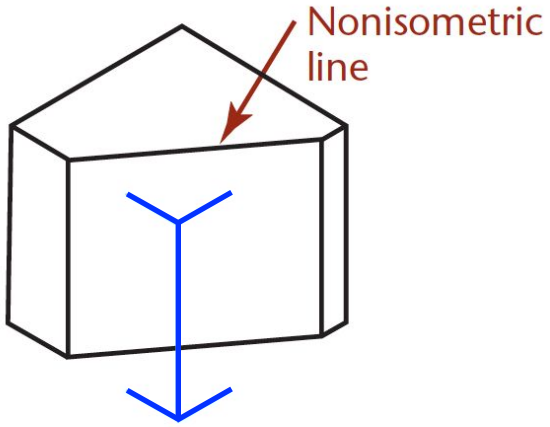
Isometric Projections

- **Isometric axes**: The projections of the edges of a cube make angles of 120° with each other and they form the isometric axes and can be used make measurements. Any line parallel to one of these axes is called an isometric line. Any 90° angle is seen as either 120° or 60° in the isometric projection. Lines of an object that are drawn parallel to the isometric axes are equally foreshortened (reduced in length). In an isometric projection of a cube, the faces of the cube, and any planes parallel to them, are called isometric planes





- **Non-isometric lines**: Lines of an isometric drawing that are not parallel to the isometric axes are called non-isometric lines. Nonisometric lines are drawn at other angles and are not equally foreshortened. Therefore, the lengths of features along nonisometric lines cannot be measured directly with a scale



F. E. Giesecke et al., *Technical Drawing*, Prentice Hall, 15th Ed., 2016

- Some interesting symmetry of the hour and minute hand that is aesthetically appealing
- Noting to do with isometric projection

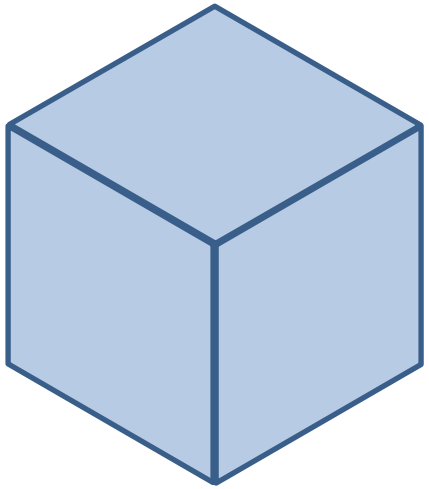
https://www.ethoswatches.com/the-watch-guide/10-10-myths-realities-behind-time-watches/

- Some arbitrarily different position of the hour and minute hand

Isometric Projection vs. Drawing

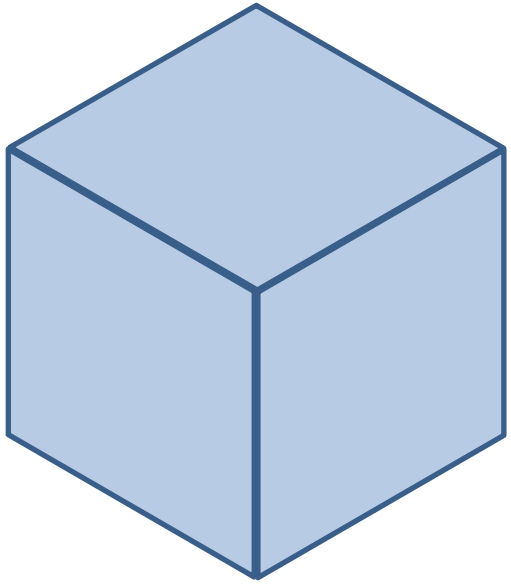
Isometric Projection

Dimensions along (parallel to) the isometric axes are reduced by 0.82

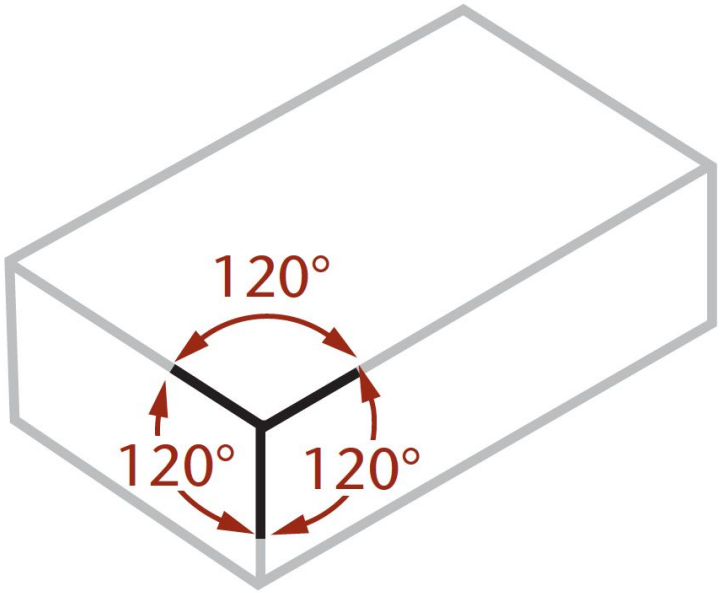


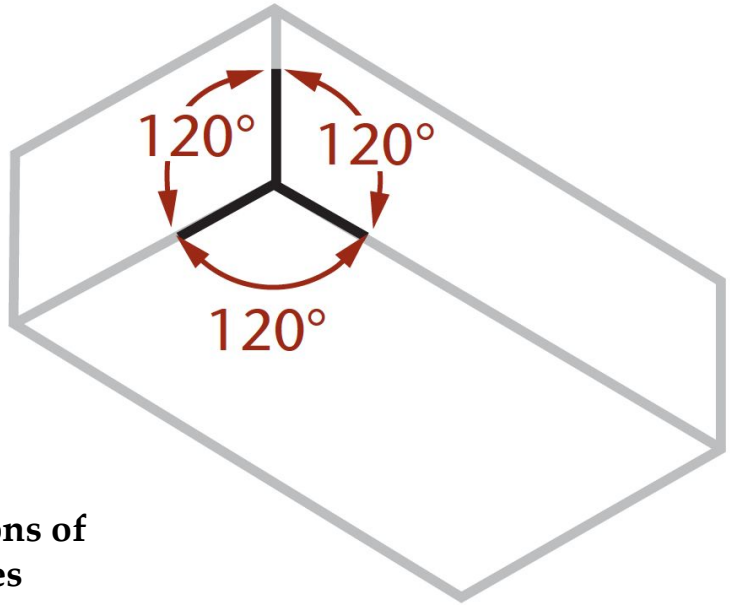
Isometric Drawing

Drawn to full scale as if the dimensions along (parallel to) the isometric axes are elongated by 1/0.82

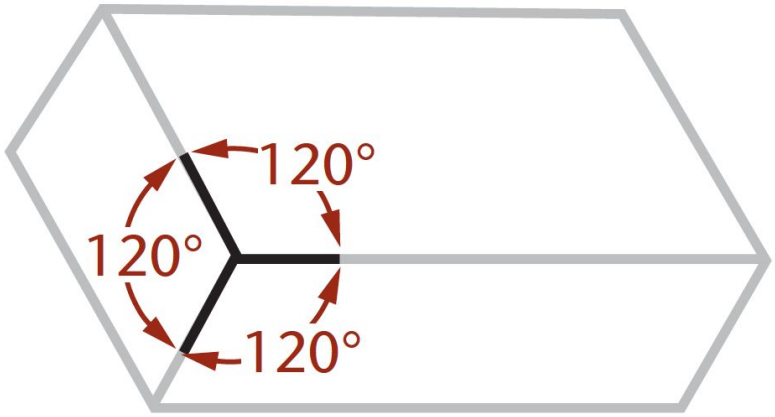


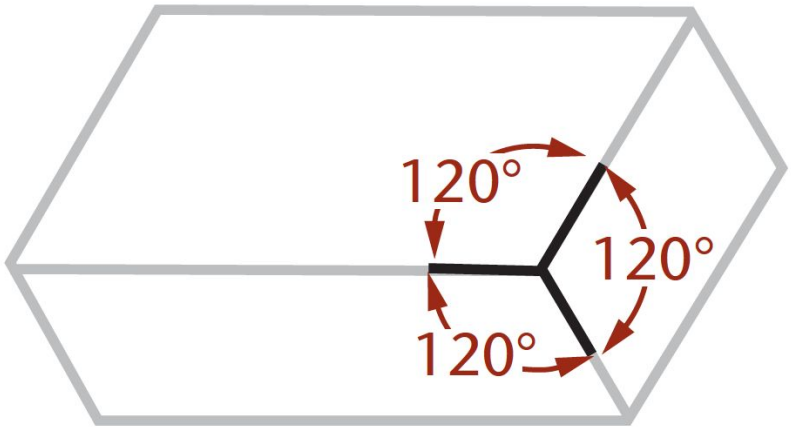
Isometric Drawing





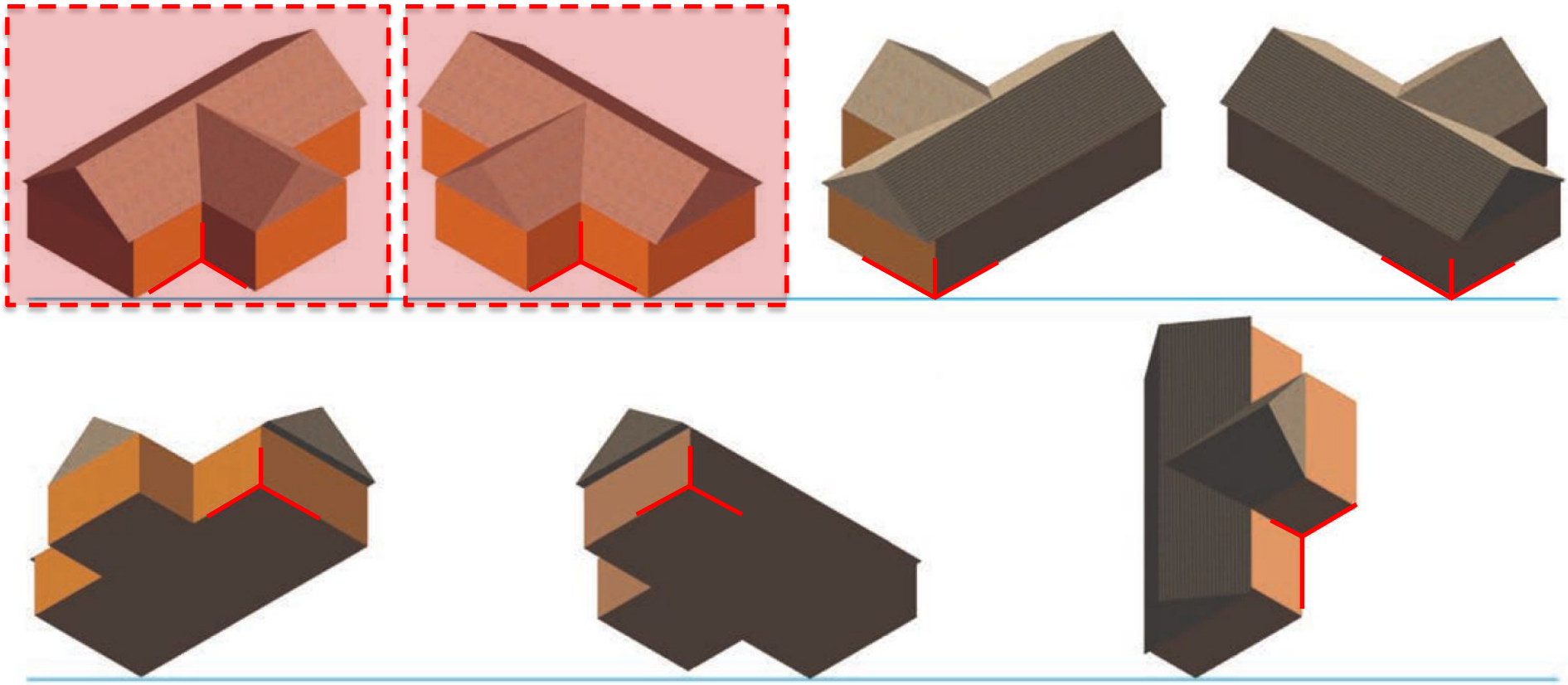
Different positions of isometric axes





F. E. Giesecke et al., *Technical Drawing*, Prentice Hall, 15th Ed., 2016

Isometric Drawing



Isometric options: These views of a simple model of a house are all isometric, but some show the features best

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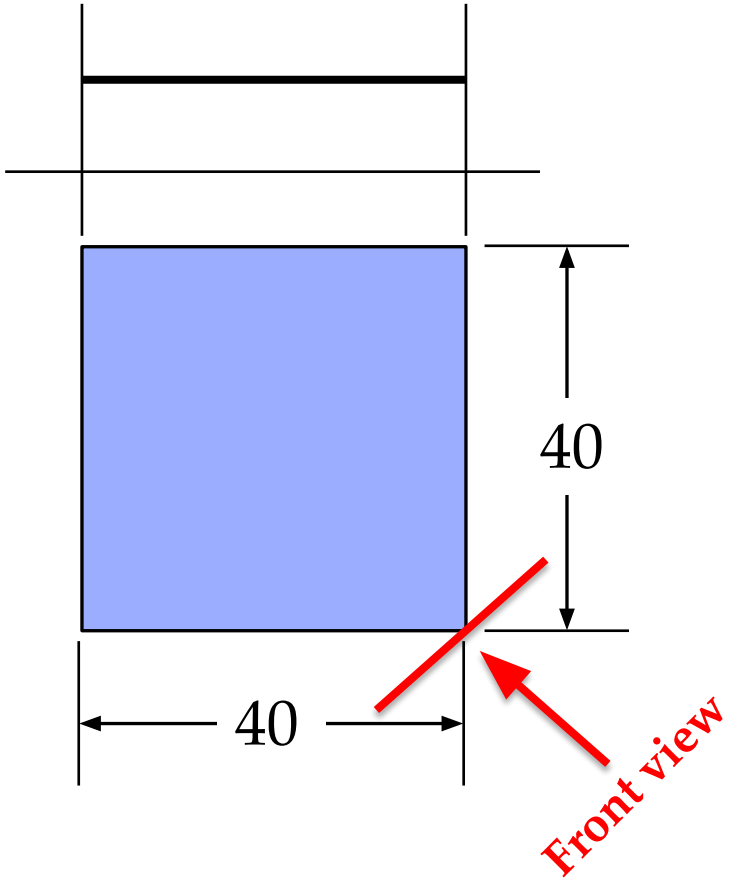
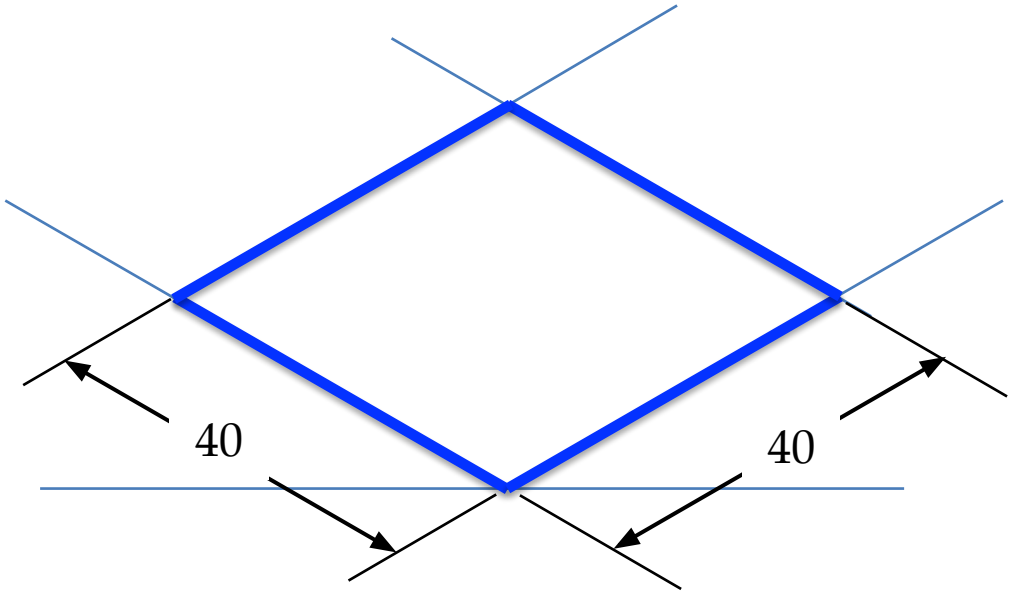
Isometric Projections

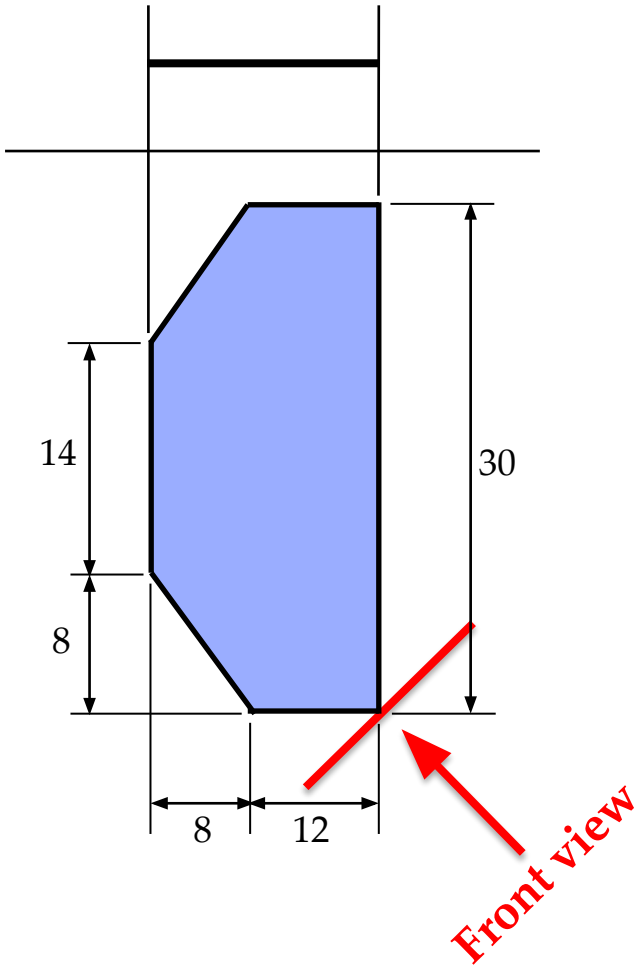
- The lines that are parallel on the object remain parallel
- Vertical lines on the object appear vertical
- Horizontal lines on the object are drawn at an angle of 30° with the horizontal
- A line parallel to an isometric axis is called an isometric line and it is foreshortened to 82%
- A line which is not parallel to an isometric axis is called non-isometric line and the extent of foreshortening of non-isometric lines are different depending on their inclinations. *How will you draw these?*

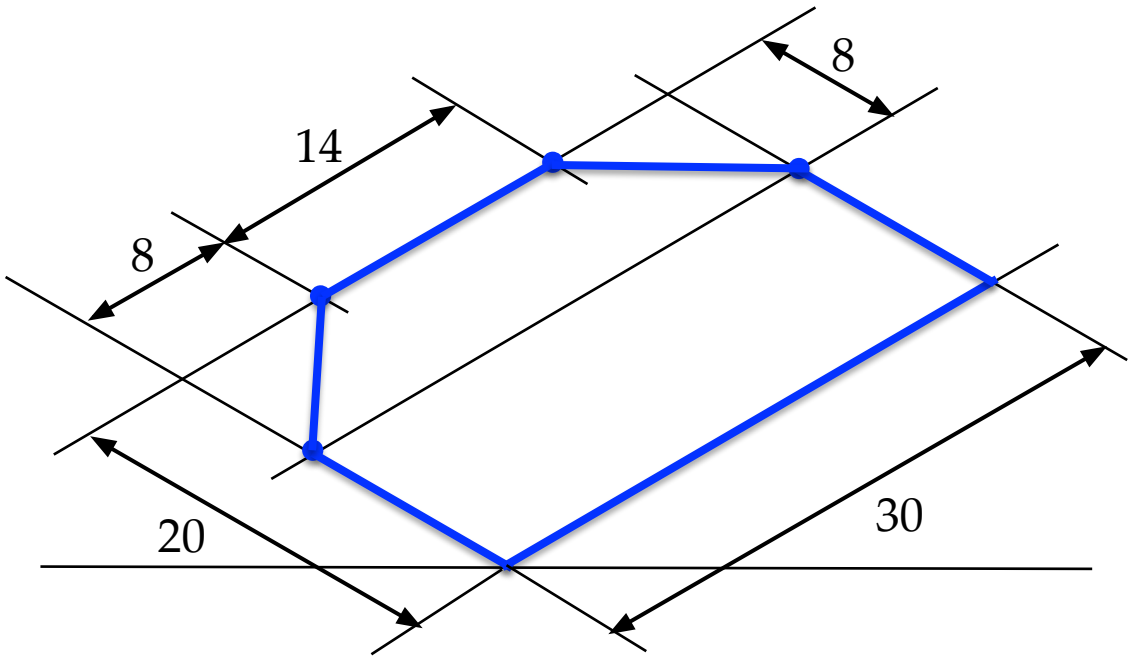
Example 1



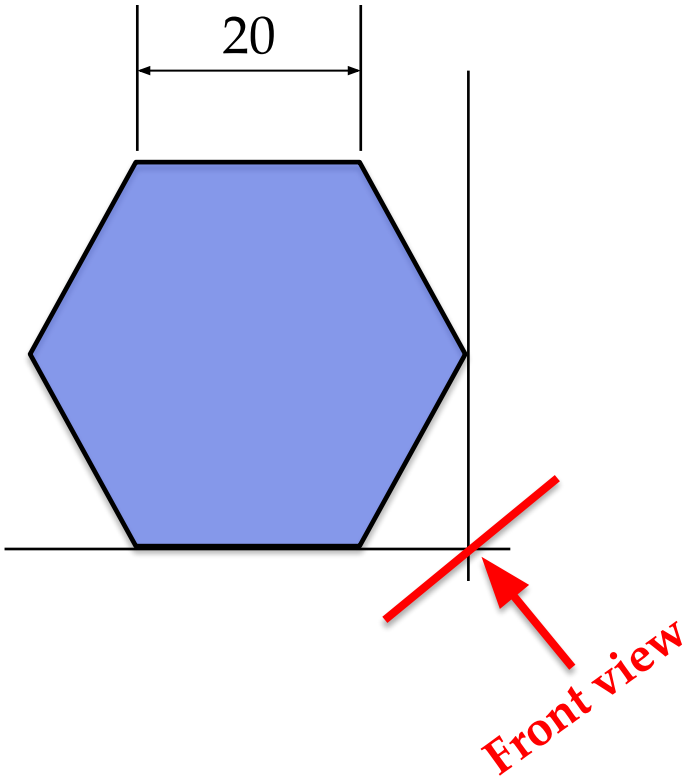


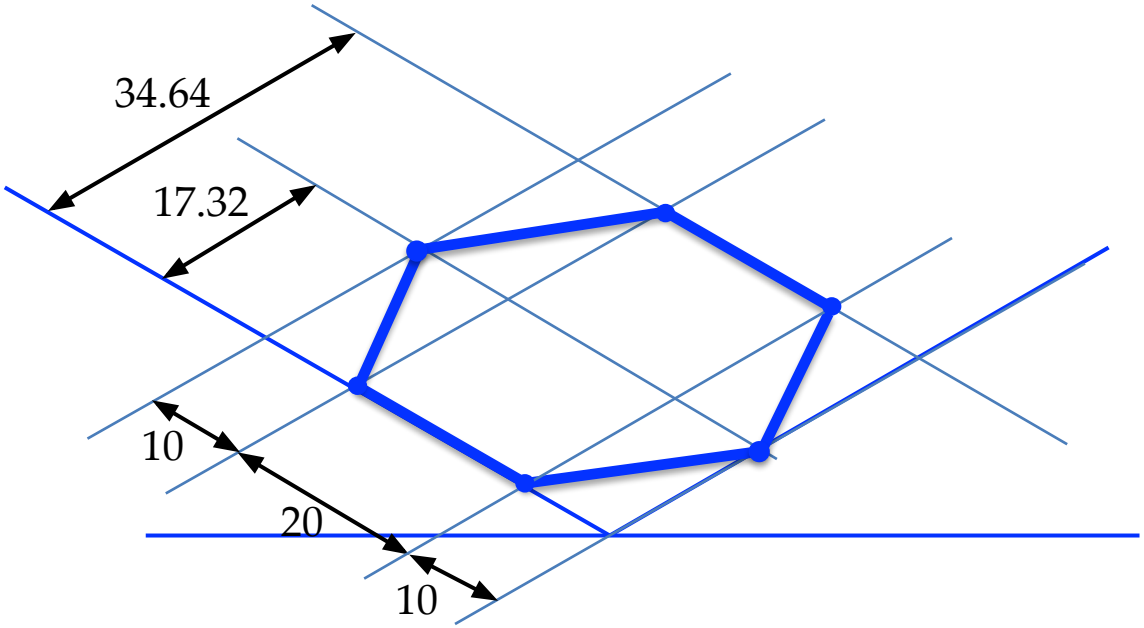
Example 2



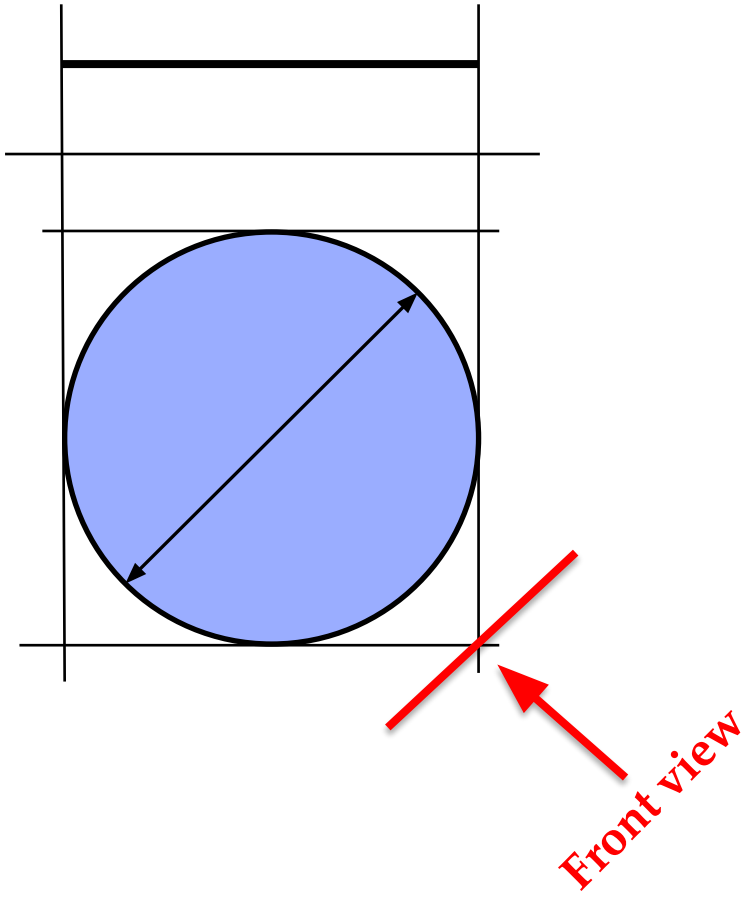


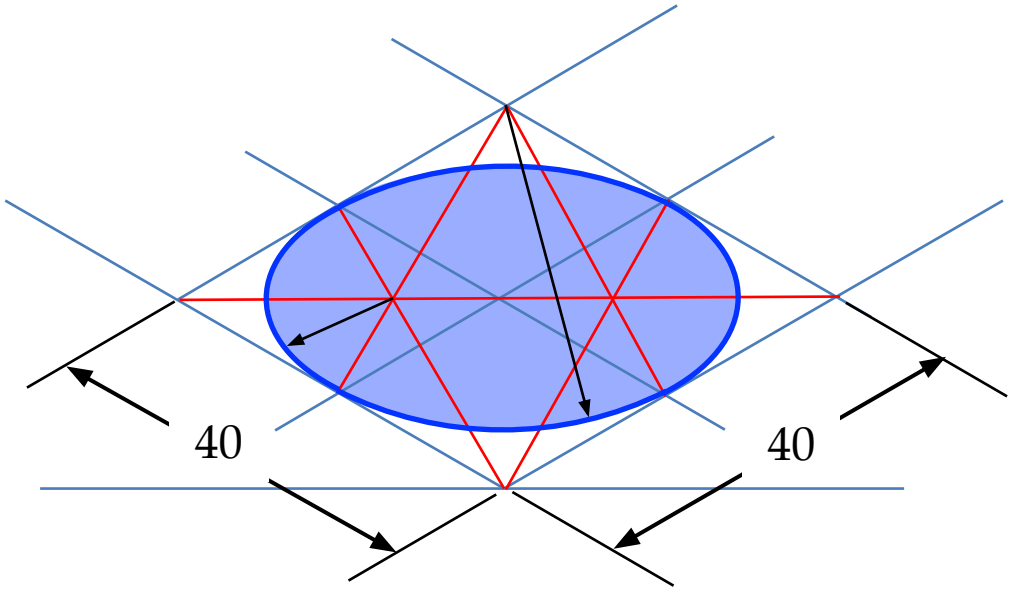
Example 3 (Regular Hexagon)





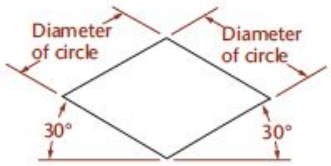
Example 4: Circle



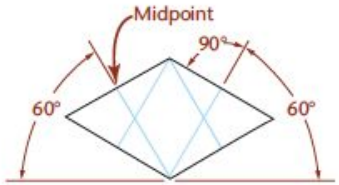


DRAWING A FOUR-CENTER ELLIPSE

1 Draw or imagine a square enclosing the circle in the multiview drawing. Draw the isometric view of the square (an equilateral parallelogram with sides equal to the diameter of the circle).



2 Mark the midpoint of each line and draw a perpendicular line from each.

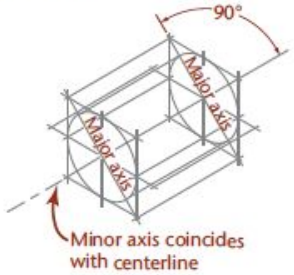


3 Draw the two large arcs, with radius *R*, from the intersections of the perpendiculars in the two closest corners of the parallelogram.

4 Draw the two small arcs, with radius *r*, from the intersections of the perpendiculars within the parallelogram, to complete the ellipse.

TIP

Here is a useful rule. The major axis of the ellipse is always at right angles to the centerline of the cylinder, and the minor axis is at right angles to the major axis and coincides with the centerline.

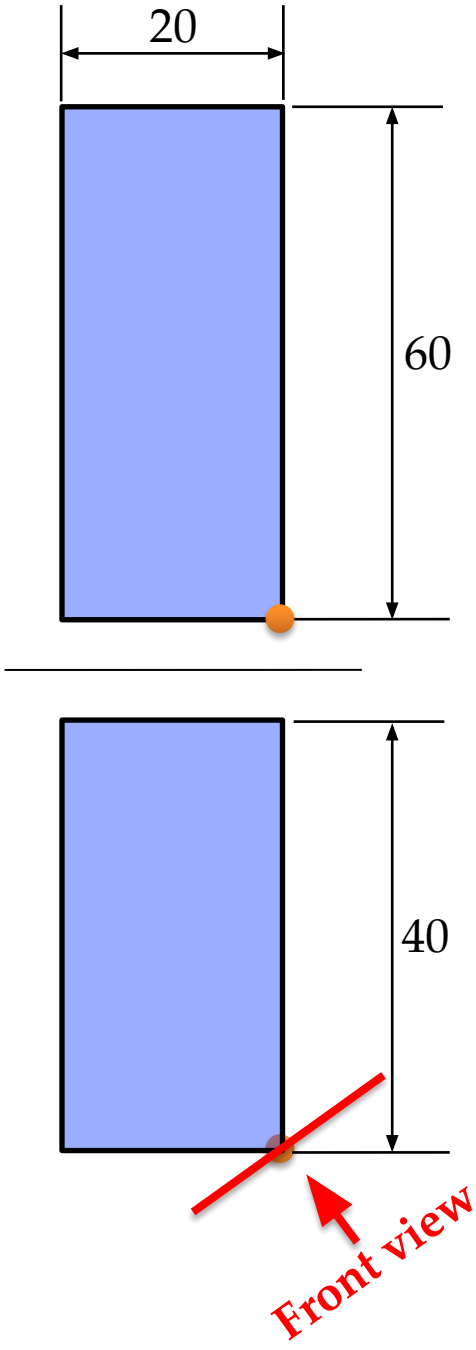


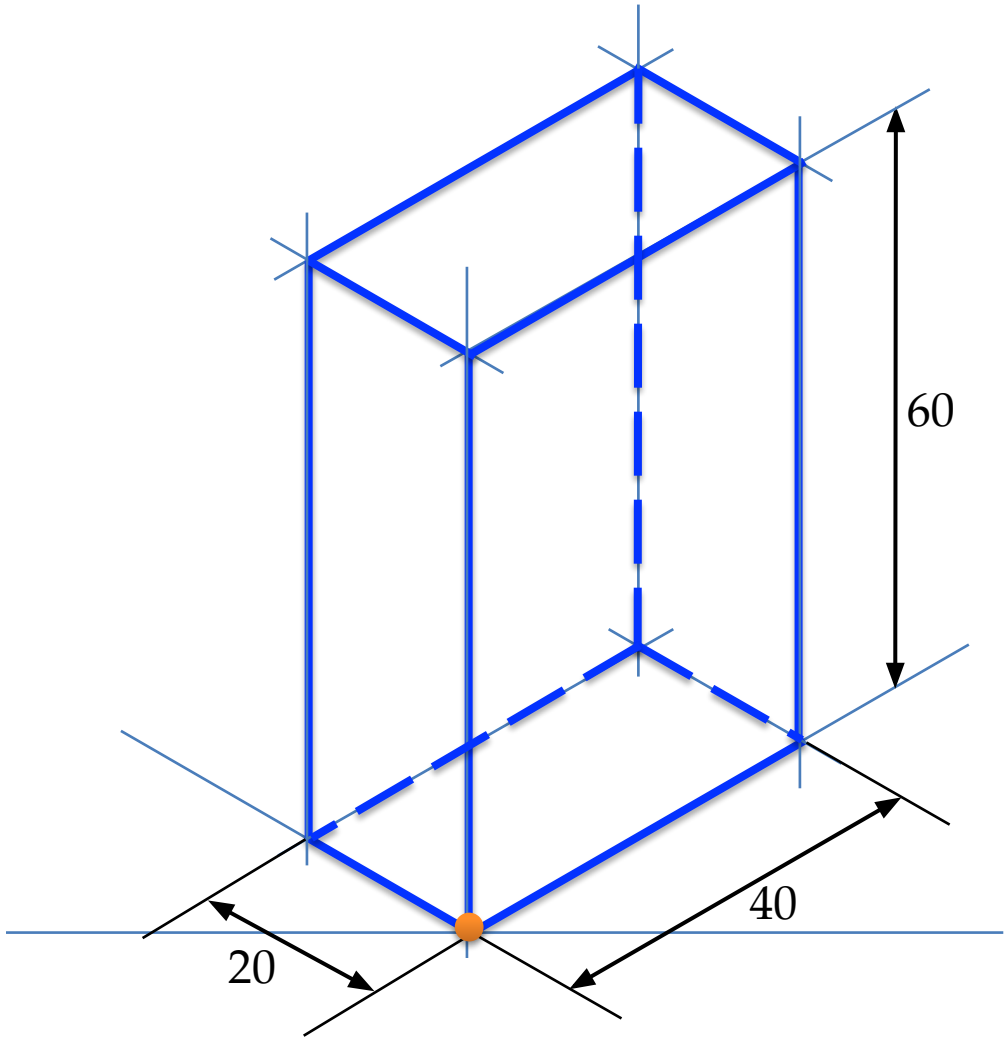
TIP

As a check on the accurate location of these centers, you can draw a long diagonal of the parallelogram as shown in Step 4. The midpoints of the sides of the parallelogram are points of tangency for the four arcs.

F. E. Giesecke et al., *Technical Drawing*, Prentice Hall, 15th Ed., 2016

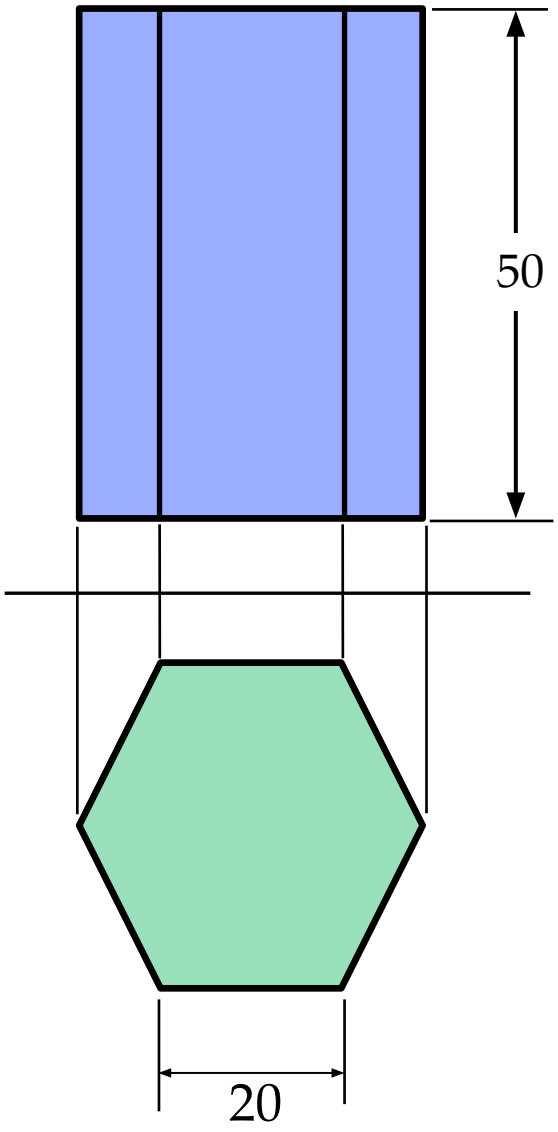
Example 5



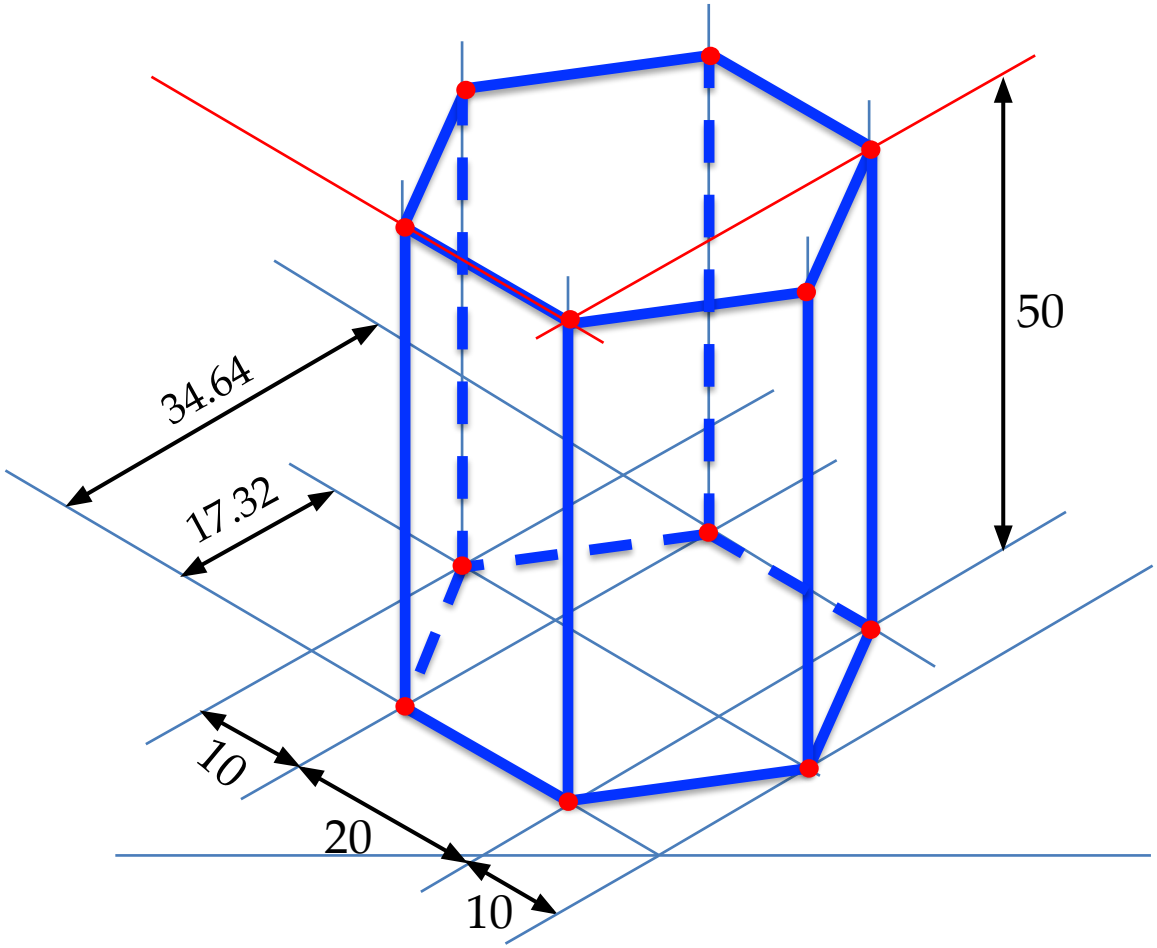


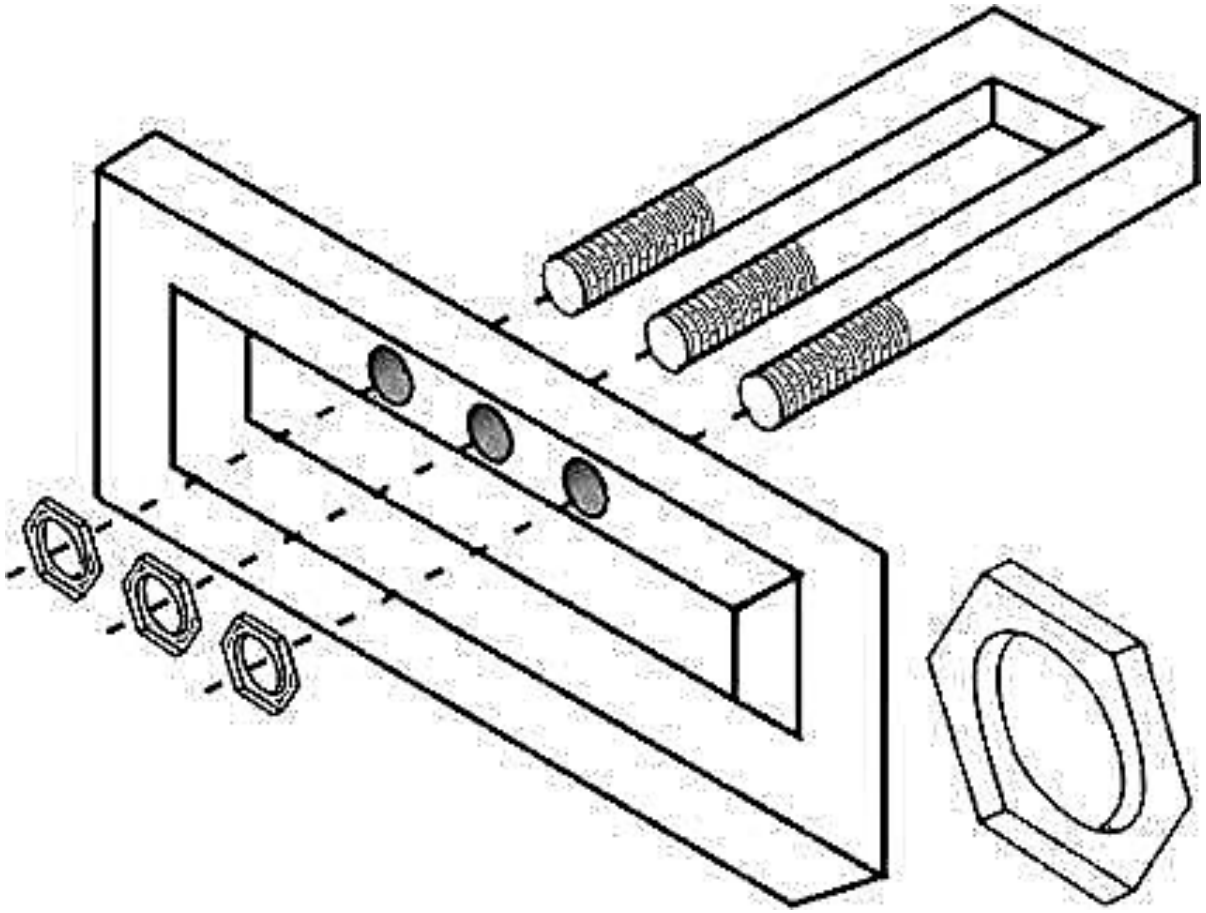
Hidden lines can be avoided in isometric projections/drawings

Example 6: Hexagonal Prism



Hidden lines can be avoided in isometric projections/drawings





Thank you

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