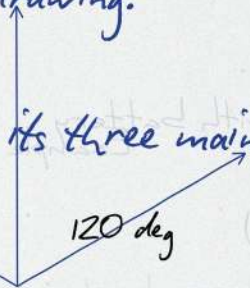


Isometric Projection

Isometric projection is a single pictorial view. It shows length, breadth and height in one drawing.

The object is imagined with its three main edges equally inclined to the picture plane.



- In the final view, the three isometric axes make equal angles of 120 degrees with each other.

Board-note checklist

- ① Use isometric length, not true length.
- ② Keep visible edges thick and construction lines light.
- ③ Always mark the viewing direction.

Pictorial Views

A pictorial drawing helps the examiner see the solid as a three dimensional object.

Perspective views look natural, but sizes change with distance.
Oblique views keep one face true.



Axonometric views rotate the solid. Isometric is the most useful axonometric view in this chapter.

isometric idea

Board-note checklist

- ① Perspective has a vanishing point.
- ② Oblique gives depth at an angle.
- ③ Isometric uses one common scale.

Isometric Scale

True lengths are longer than isometric lengths because the axes are tilted to the projection plane.

Draw PQ horizontally, PM at 45 degrees, and PA at 30 degrees. Mark true lengths on PM.

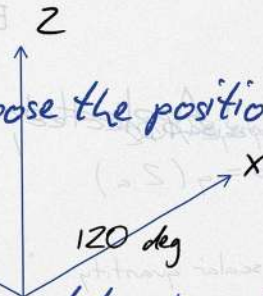
Project those points vertically down to PA. The divisions on PA give isometric lengths.

Isometric length is about $0.816 \times$ true length

How To Place The Solid

Read the condition about H.P. and V.P. before drawing any box.
This decides the base position.

If no position is specified, choose the position that shows the shape most clearly.



After the isometric view is complete, show V.P. side, H.P. relation and the front direction by an arrow.

Board-note checklist

- ① Axis perpendicular to H.P. means vertical axis.
- ② Axis parallel to H.P. and V.P. means horizontal axis.
- ③ Base side parallel to V.P. fixes the first edge.

Seven Step Method

First draw the helping figure using the given base shape and the correct position.

Enclose the helping figure in a rectangle, then transfer the centre and vertex positions.

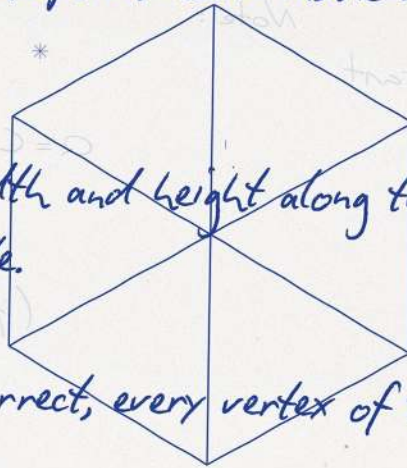
Draw the isometric box on the three axes, copy the coordinates, then join visible edges.

Board-note checklist

- ① Helping figure
- ② Enclosing rectangle
- ③ Isometric axes
- ④ Box
- ⑤ Coordinates
- ⑥ Visible edges
- ⑦ Dimensions and direction

Isometric Box

The box method keeps the solid inside an imaginary rectangular container.



Copy length, breadth and height along the three isometric axes using isometric scale.

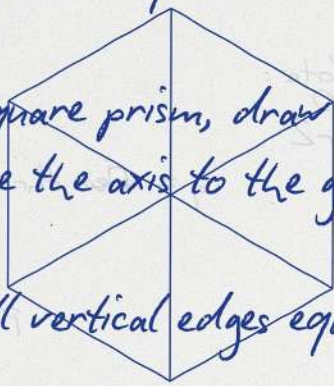
Once the box is correct, every vertex of the solid is copied from the helping figure.

Board-note checklist

- ① Draw box lightly first.
- ② Do not guess hidden vertices.
- ③ Erase or lighten construction later.

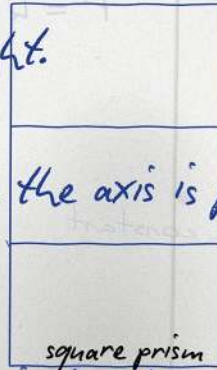
Cube And Square Prism

A cube is the easiest check for axis direction because all three dimensions are equal.



cube

For a square prism, draw the square base in the required plane and raise the axis to the given height.



square prism

Mark all vertical edges equal when the axis is perpendicular to H.P.

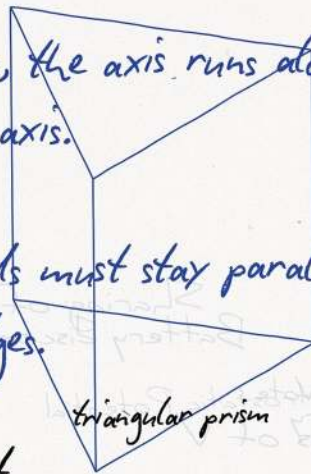
Common error: use ~~true~~ isometric lengths on the final axes.

Triangular Prism

Begin with the triangular helping figure. Enclose it in a rectangle so every corner can be transferred.

For a horizontal prism, the axis runs along an isometric axis instead of the vertical axis.

The two triangular ends must stay parallel. Check this before darkening the final edges.



Board-note checklist

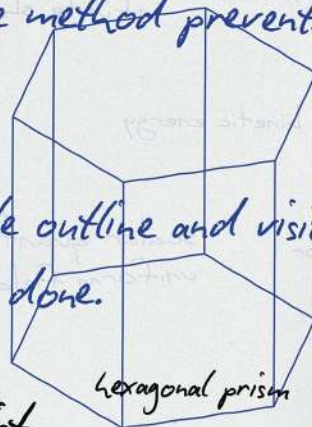
- ① Transfer three base corners.
- ② Keep the two end faces parallel.
- ③ Show the axis by a centre line.

Hexagonal Prism

A hexagonal prism needs a neat helping figure because six vertices must be copied.

The enclosing rectangle method prevents uneven side lengths in the final isometric view.

Darken only the visible outline and visible vertical edges after the coordinate transfer is done.



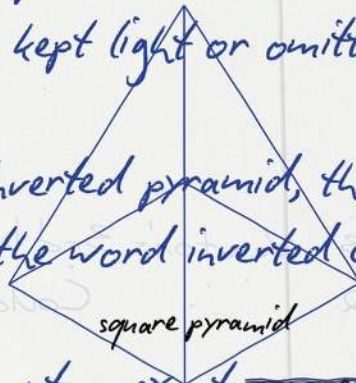
Board-note checklist

- ① Use ISO base side.
- ② Keep opposite sides parallel.
- ③ Centre line passes through both bases.

Pyramids

In a pyramid, the base is drawn first and the apex is located on the axis above the centre.

Join the apex to all visible base corners. Hidden slant edges are normally kept light or omitted.



square pyramid



pentagonal

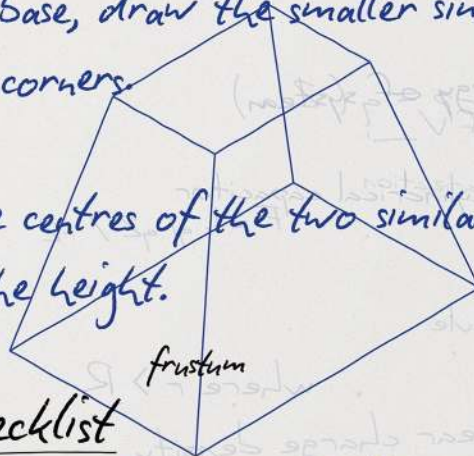
Do not put apex at ~~corner~~ centre of the base.

Frustum Of Pyramid

A frustum is obtained when the top of a pyramid is cut by a plane parallel to the base.

Draw the larger base, draw the smaller similar top face, then connect matching corners.

The axis joins the centres of the two similar faces. Dimension both base edges and the height.



Board-note checklist

- ① Top and bottom faces are similar.
- ② Connecting edges meet corresponding vertices.
- ③ Do not mix longer and shorter base positions.

Cylinder

A circle appears as an ellipse in isometric projection. Use a rhombus or box to place the ellipse.

For a vertical cylinder, draw the lower ellipse, copy it upward by the isometric height, then add generators.

Only the visible part of the lower ellipse is darkened in a clean board drawing.

vertical cylinder

Board-note checklist

- ① Ellipse sits inside an isometric square.
- ② Extreme generators are tangent to both ellipses.
- ③ Axis is drawn as a centre line.

Cone

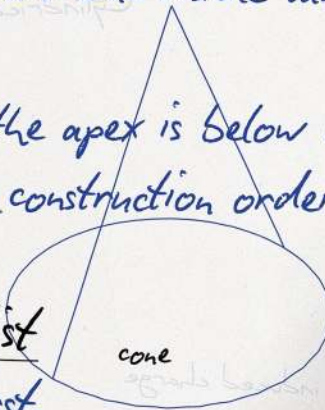
For a cone, the base circle becomes an ellipse and the apex lies on the axis through its centre.

Join the apex to the extreme visible tangent points of the ellipse.

In an inverted cone, the apex is below and the circular base is above, so reverse the construction order.

Board-note checklist

- ① Locate centre first.
- ② Draw ellipse carefully.
- ③ Use only tangent generators for outline.



Sphere And Hemisphere

The isometric projection of a sphere is always a circle with true radius.

Locate the centre by moving along the vertical axis by the radius from the resting point.

A hemisphere shows a circular face as an ellipse and a curved surface as the visible half outline.

Sphere: ISO ~~view~~ is a true circle Hemisphere

Combination Of Solids

For combined solids, draw the lower solid first. It becomes the support for the upper solid.

Use the centre of the contact face to place the second solid centrally.

When one solid rests on another, remove the hidden contact line from the final outline.



Board-note checklist

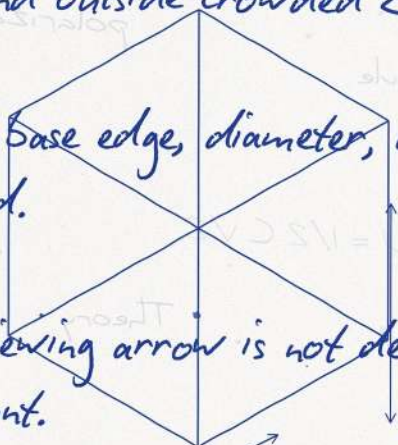
- ① Lower solid first.
- ② Locate ^{common vertical axis} common centre.
- ③ Match axes if the problem says centrally.

Dimensioning

Dimension lines follow the direction of the isometric axes. Keep arrowheads neat and outside crowded zones.

Write sizes clearly: Base edge, diameter, axis length and total height when needed.

The direction of viewing arrow is not decoration. It tells which face is taken as front.



Board-note checklist

- ① Use mm unless stated otherwise.
- ② Do not dimension hidden lines.
- ③ Place figures away from edge lines.

Line Types

Visible outlines are thick and dark. Construction lines and coordinate transfer lines are light.

Axis lines are centre lines. They pass through centres of bases, circles and symmetric solids.

Hidden edges are avoided unless the question clearly needs them for construction.

Board-note checklist

- ① Thick: final visible edge.
- ② Thin: construction and projection.
- ③ Chain: axis or centre line.
- ④ Arrow: direction of viewing.

Keep construction lines ~~dark~~ light until final darkening.

Exam Sequence

Spend the first minute reading the position statement. Most wrong answers start with a wrong base.

Draw small helping figures, then move to the main drawing. Do not start darkening early.

Leave enough page space for dimensioning and the direction arrow before starting the final view.

Board-note checklist

- ① Read condition.
- ② Make helping figure.
- ③ Construct box.
- ④ Transfer points.
- ⑤ Darken and dimension.

Common Mistakes

Students often use true lengths on the final view. The question asks for isometric projection, so use isometric scale.

Another mistake is drawing the base in the wrong plane. H.P. and V.P. words must be followed exactly.

Crowded labels, missing viewing direction and unequal transferred vertices reduce marks even if the shape is close.

Board-note checklist

- ① Wrong scale
- ② Wrong base orientation
- ③ No centre line
- ④ No direction arrow
- ⑤ Messy dimensioning

Quick Recall

Isometric axes: 30 degrees right, 30 degrees left and vertical.

All three axes have the same scale. That is the reason the method is easy to use in board questions.

For prism, copy two equal and parallel bases. For pyramid, draw base plus apex. For cylinder and cone, start with ellipse.

Axes: 30 deg, 90 deg, 30 deg

Practice Plan

Practice one prism, one pyramid, one cylinder, one cone and one combination every week.

After each drawing, check scale, axis, base position, visible edges, dimensioning and viewing arrow.

A clean construction with correct order usually scores better than a fancy but inaccurate sketch.

Board-note checklist

- ① Day 1: scale and axes
- ② Day 2: prisms
- ③ Day 3: pyramids
- ④ Day 4: curved solids
- ⑤ Day 5: combinations