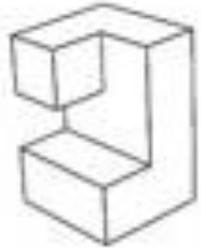


# Spatial Visualization

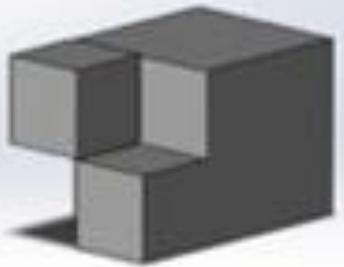
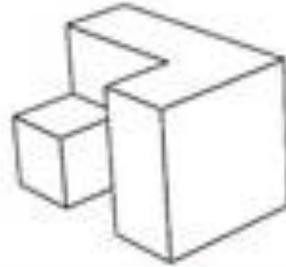
Let's Learn about Spatial Vis!



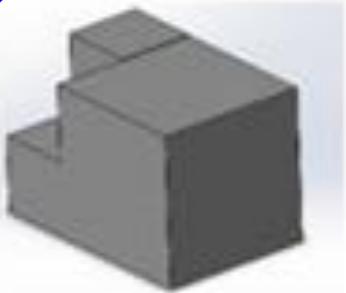
# Example spatial visualization quiz question



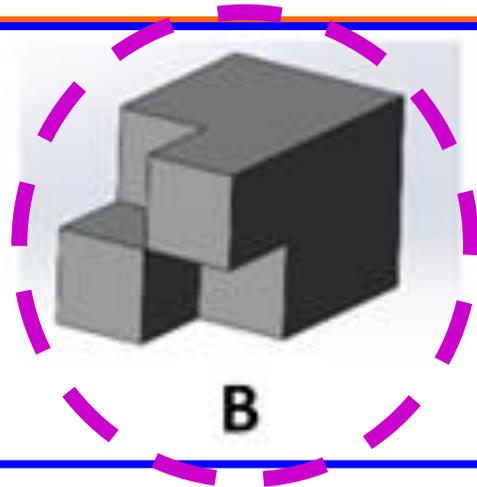
is rotated to →



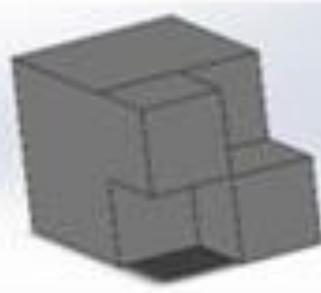
is rotated to:



A



B



C

1. Imagine rotating the top left (white) shape to look like the top right shape
2. Then imagine rotating the middle (gray) shape the same way
3. How would it look? Pick from the three choices provided

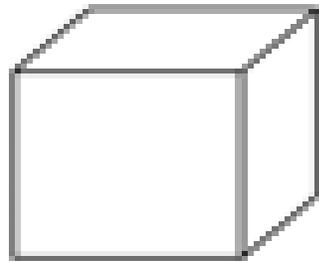
What is the correct answer?

## ACTIVITY 1:

# Connect the Dots: Isometric Drawings and Coded Plans

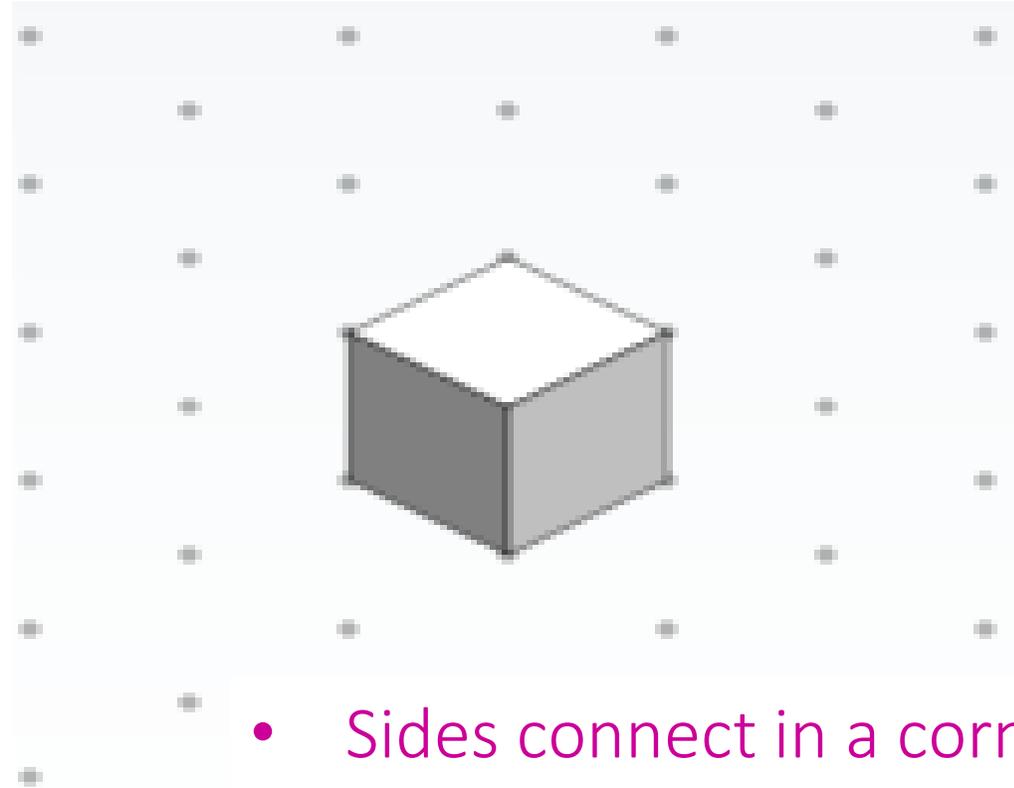
# Depicting a 3-D Cube

Non-isometric  
view of a cube ↘



- Corner angles are not equal
- Sides have different areas

Isometric view  
of a cube ↙



- Sides connect in a corner
- All corner angles are equal ( $120^\circ$ )
- Sides are the same size
- Shown on triangle-dot paper

# Isometric Drawing Example

Isometric means “equal measure”

A house depicted  
isometrically using  
AutoCAD →

Useful for blueprints  
and design plans



Think of the cube:

- Equal side faces
- Equal corner angles ( $120^\circ$ )
- Triangle-dot paper: dots are  $120^\circ$  from each other

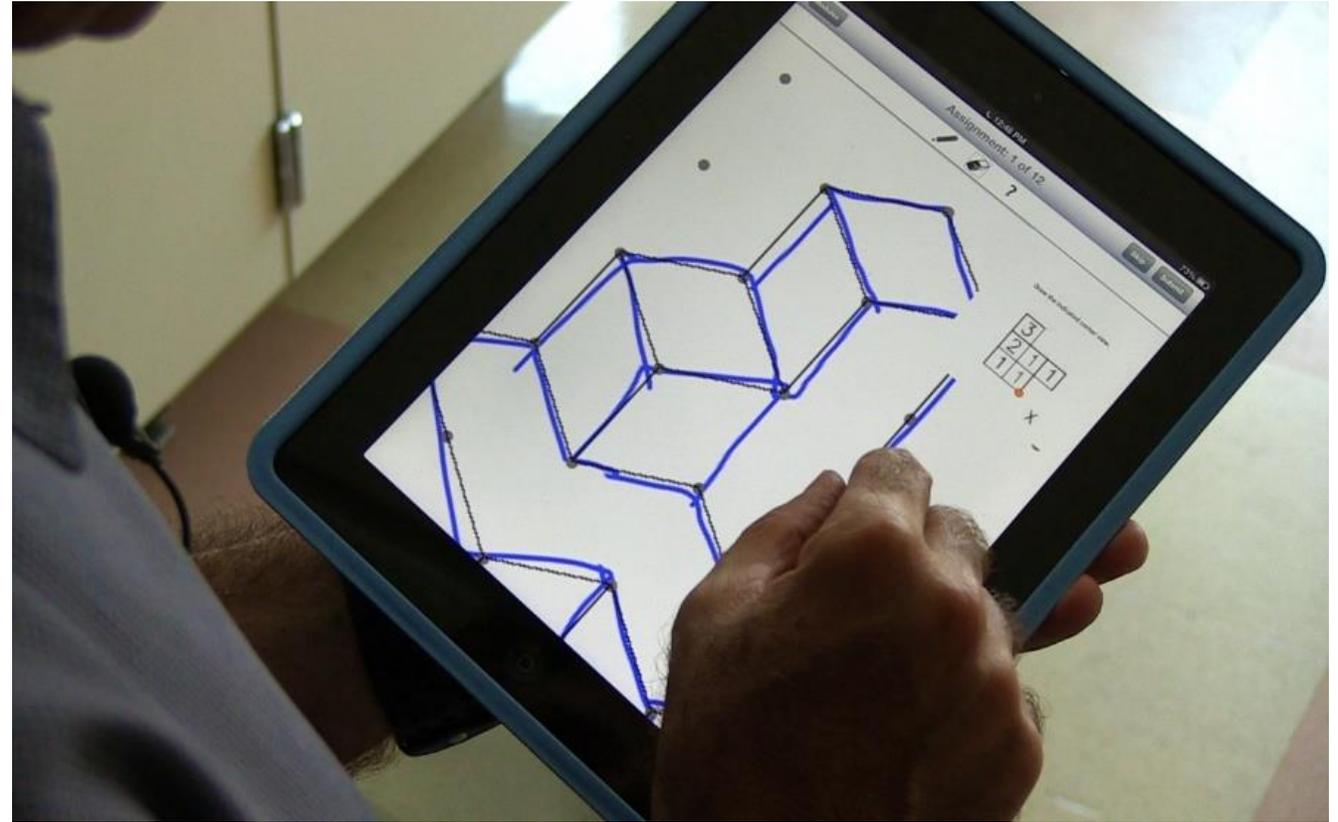
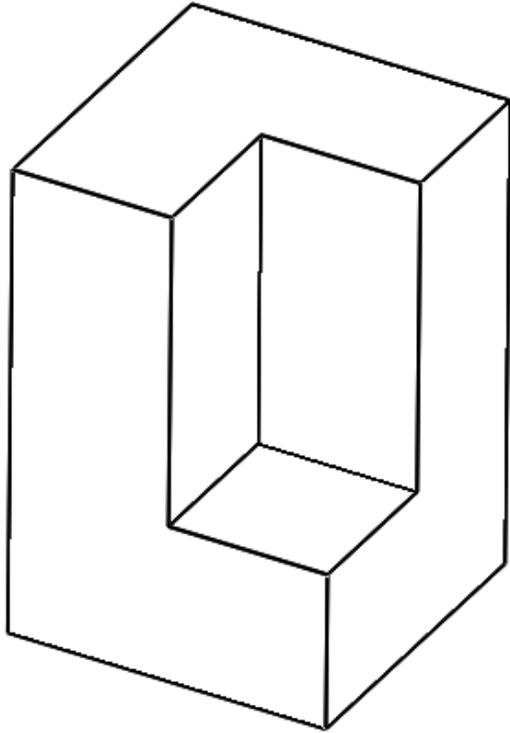
# Coded Plans

Once all partners' **eyes are closed**, click the mouse or keyboard to reveal the image...

↑ Describe this image for your non-seeing partner to draw

Click to reveal the solution

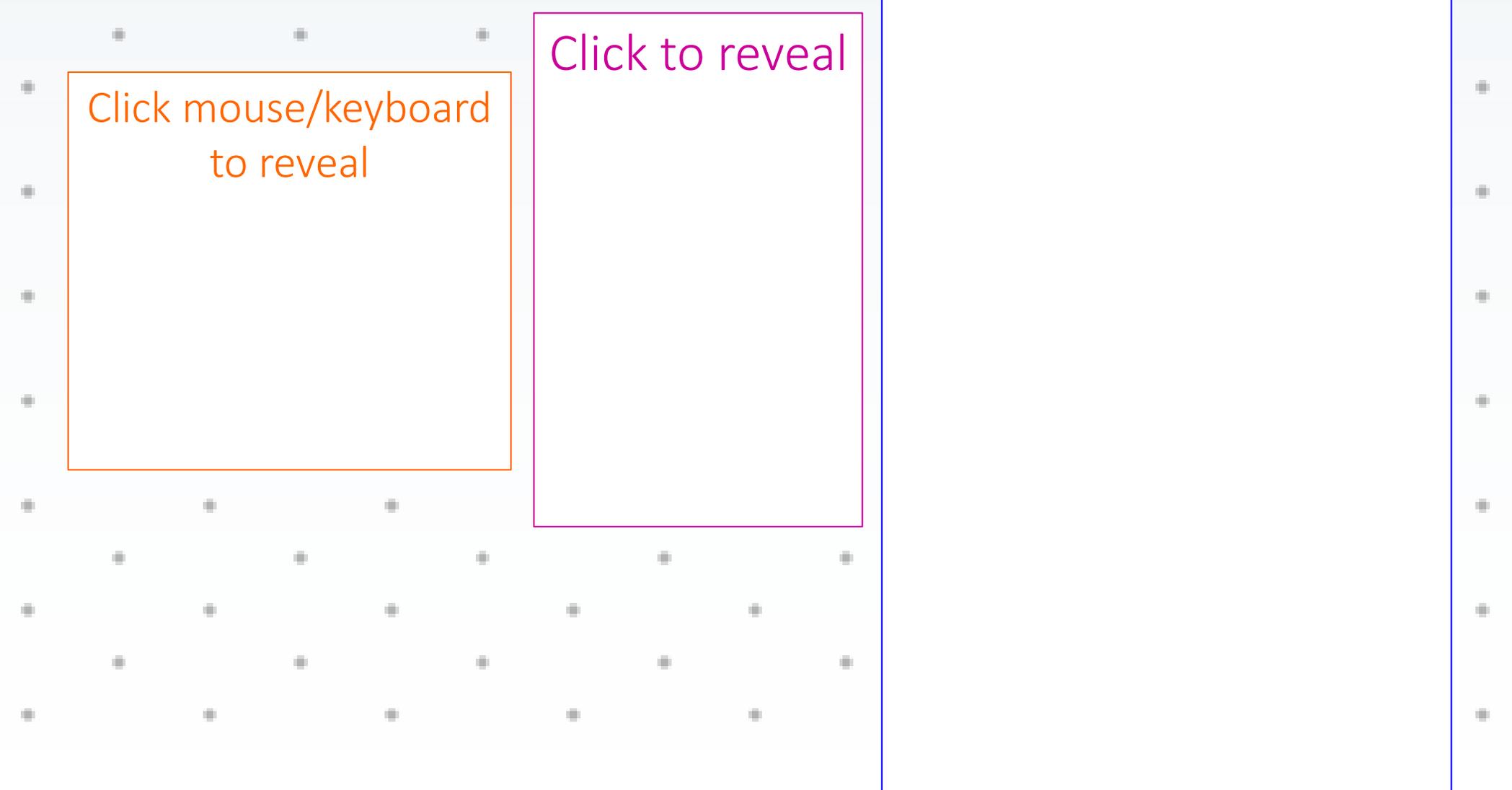
# Isometric Views



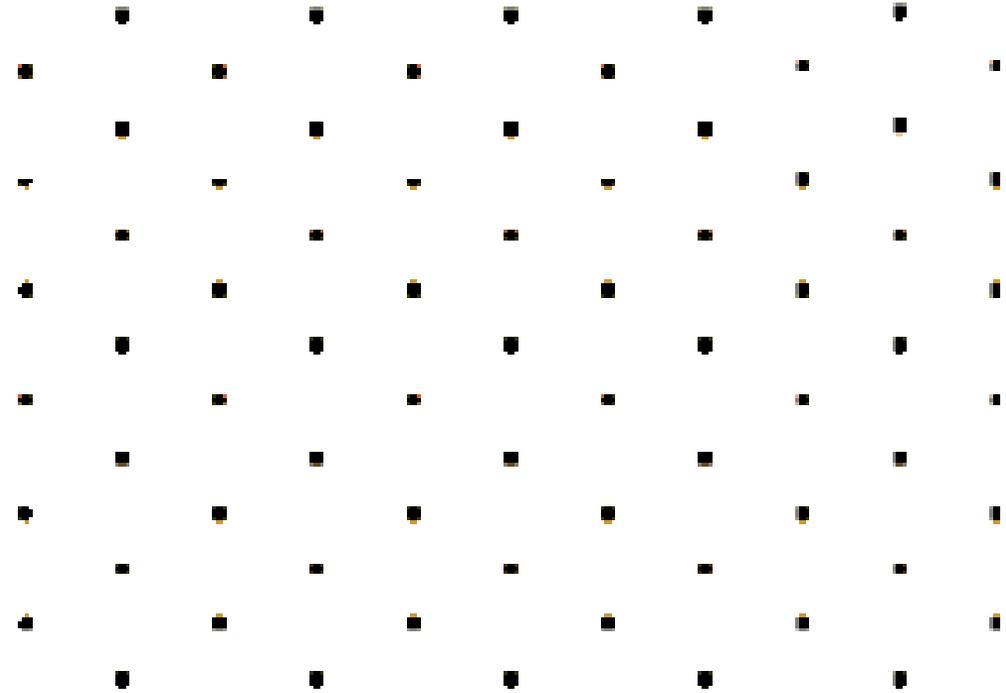
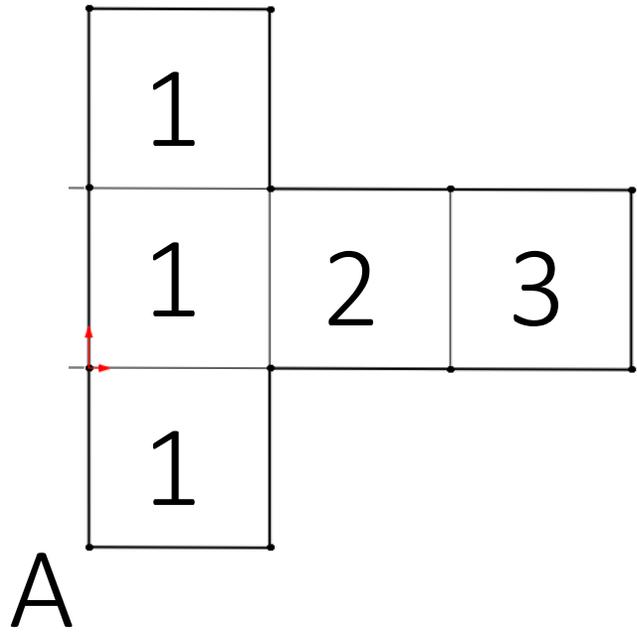
## Tips:

- Define your axes on the object and isometric paper
- Align paper in “landscape” orientation
- Only draw lines where there are edges

# Isometric Views



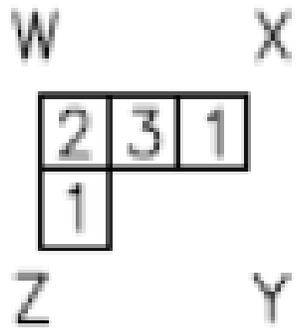
# Coded Plans > to Isometric Views



## Tips:

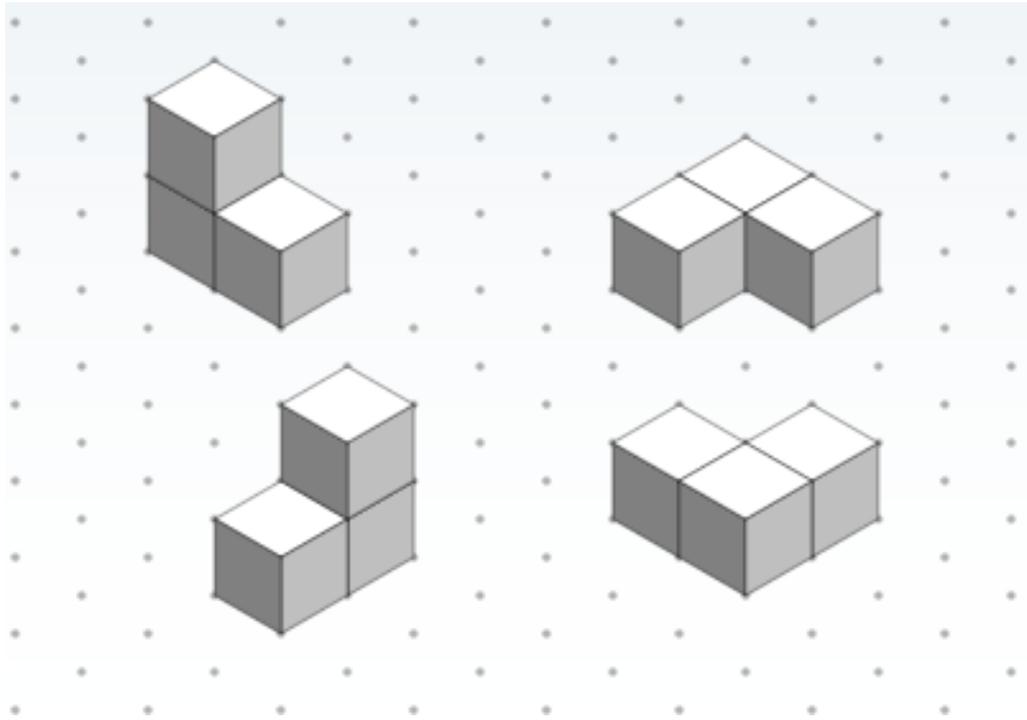
- Define your axes on a coded plan and isometric paper
- Start drawing from perspective

# Coded Plans to Isometric Views

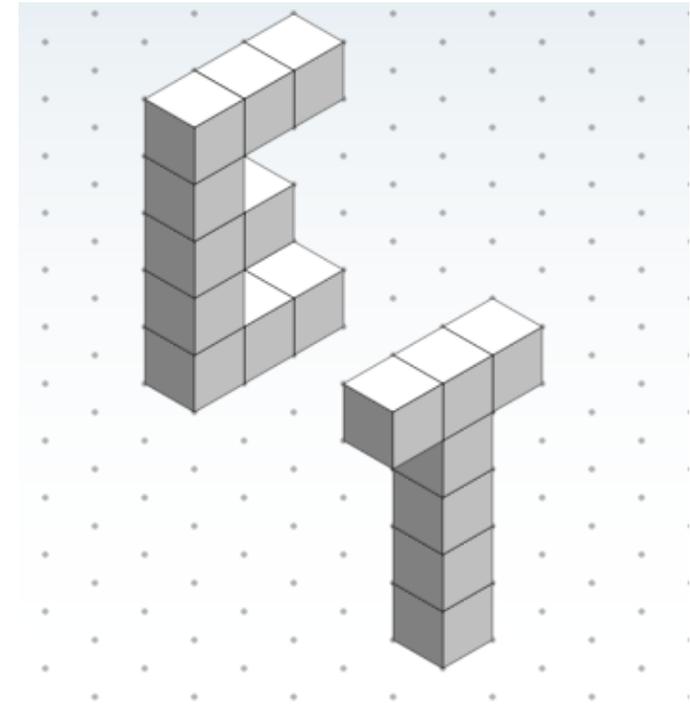


Click mouse/keyboard to reveal the possible solutions

# Isometric Views: Extra Credit



4 views of the same  
multi-cube object

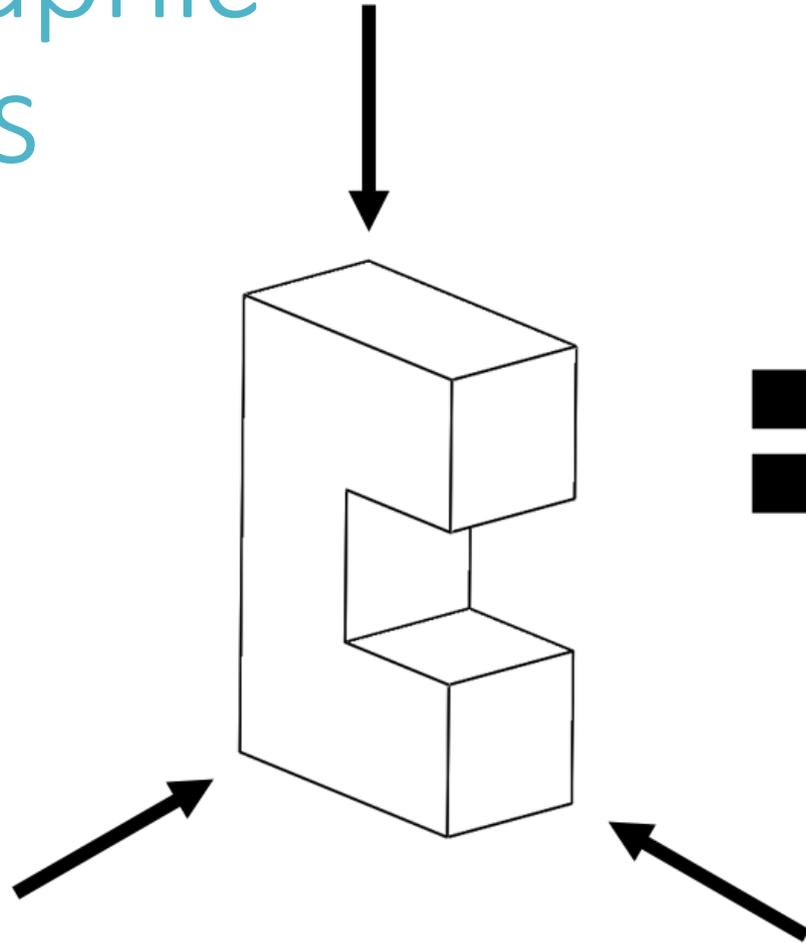


Two capital letters  
drawn isometrically

Activity 2:

Seeing All Sides:  
Orthographic Drawings

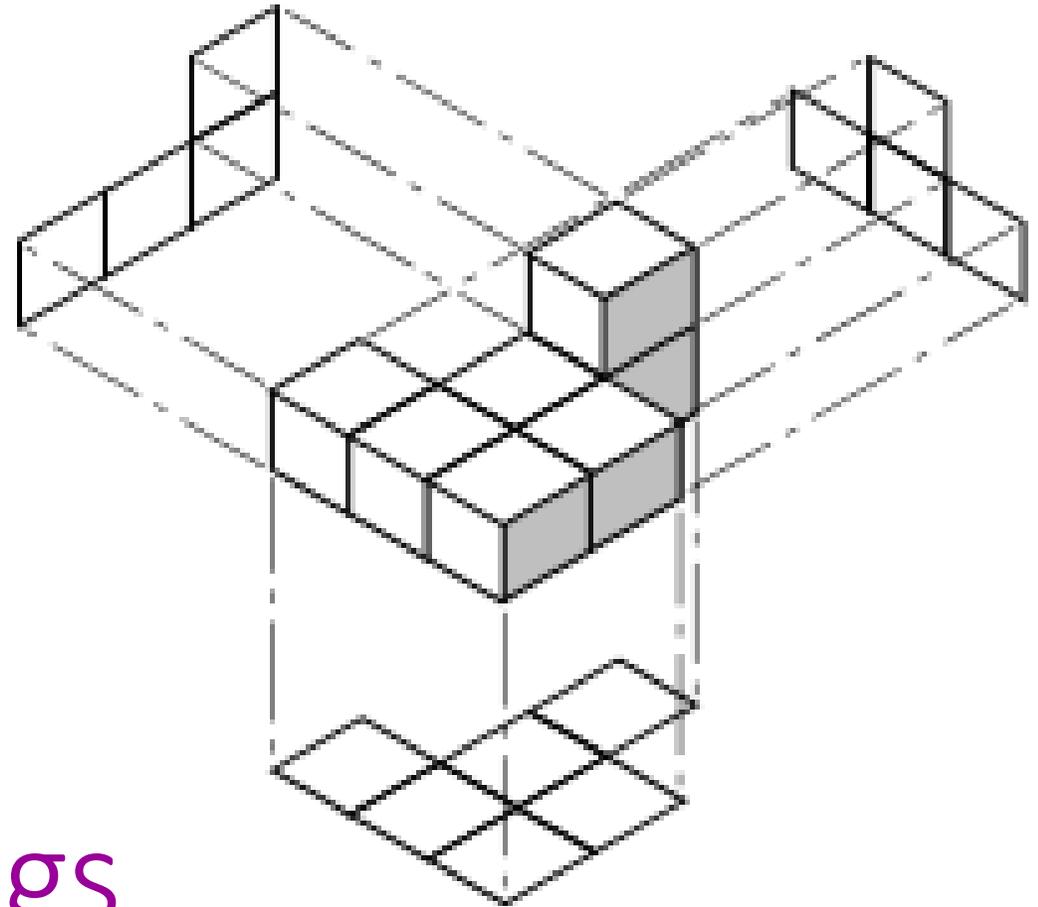
# Orthographic Drawings



Click to reveal

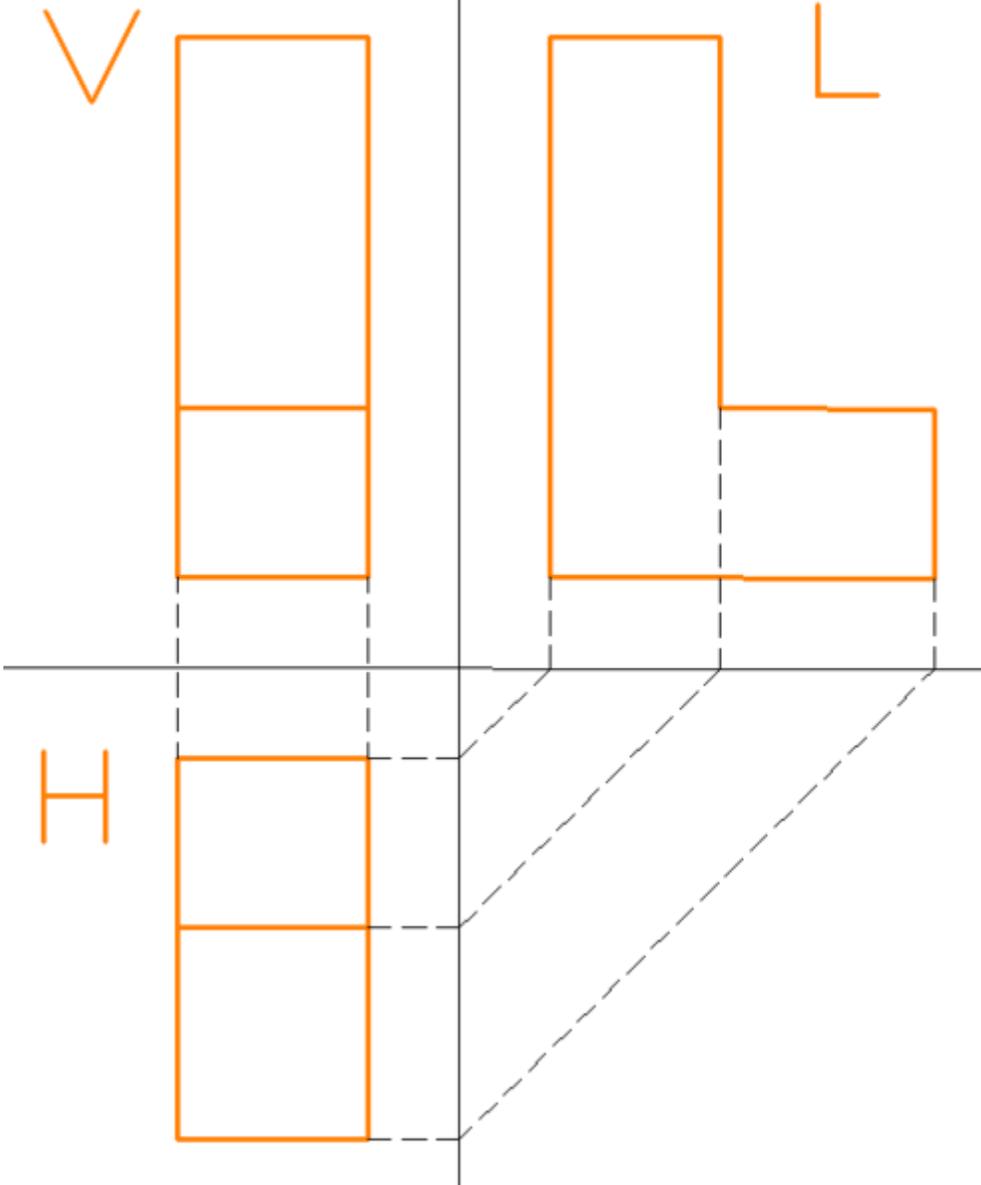
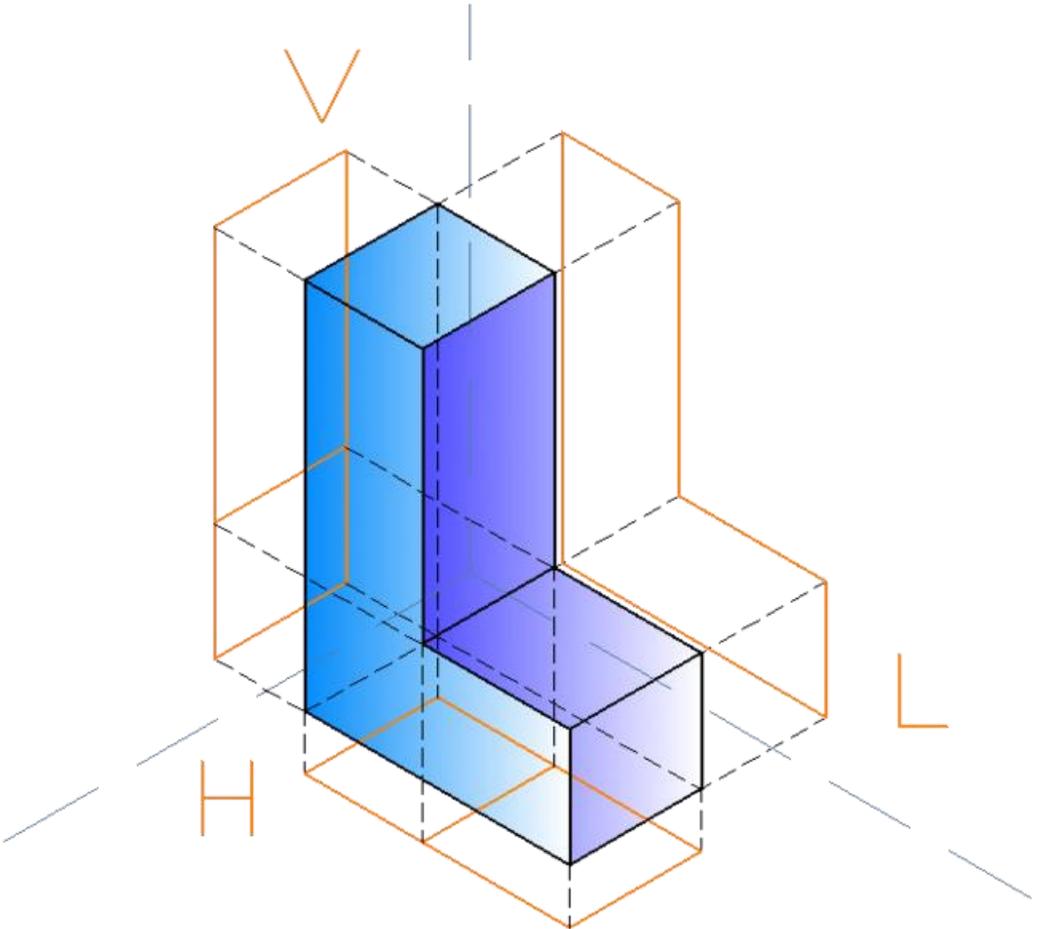
What are the three main orthographic views of an object?

# Orthographic Drawings

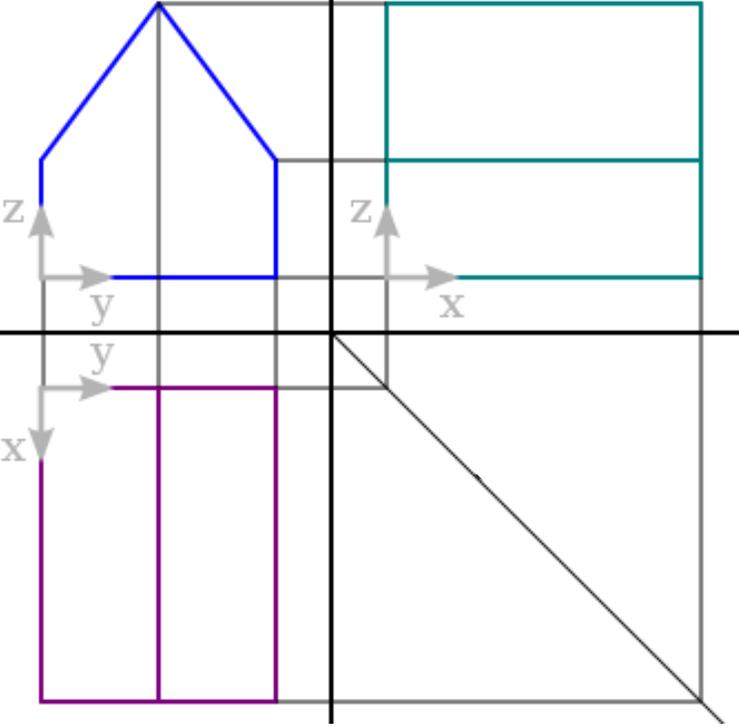


Also called:  
“multiview” drawings

# Orthographic Drawings



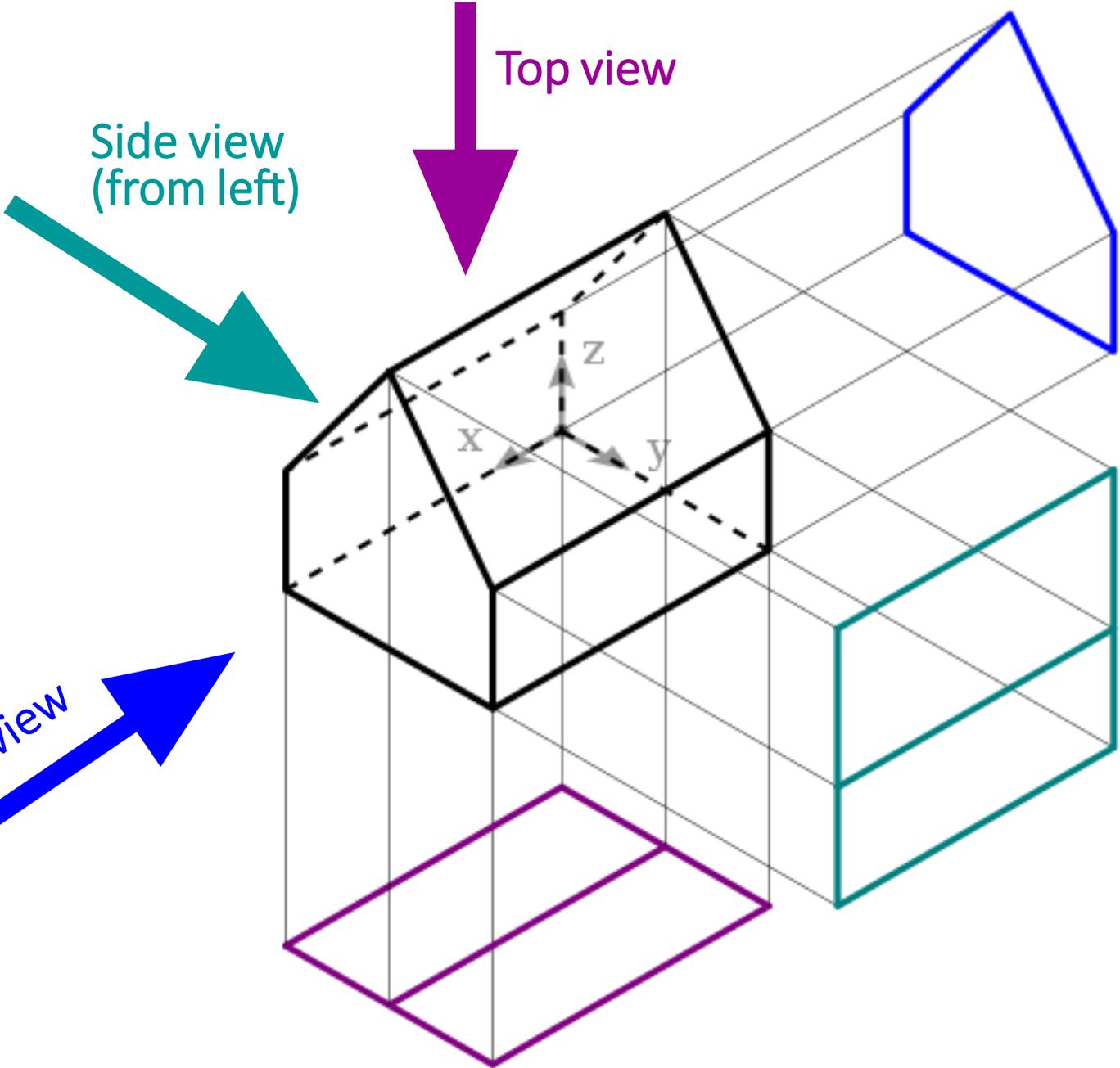
# Orthographic Drawings



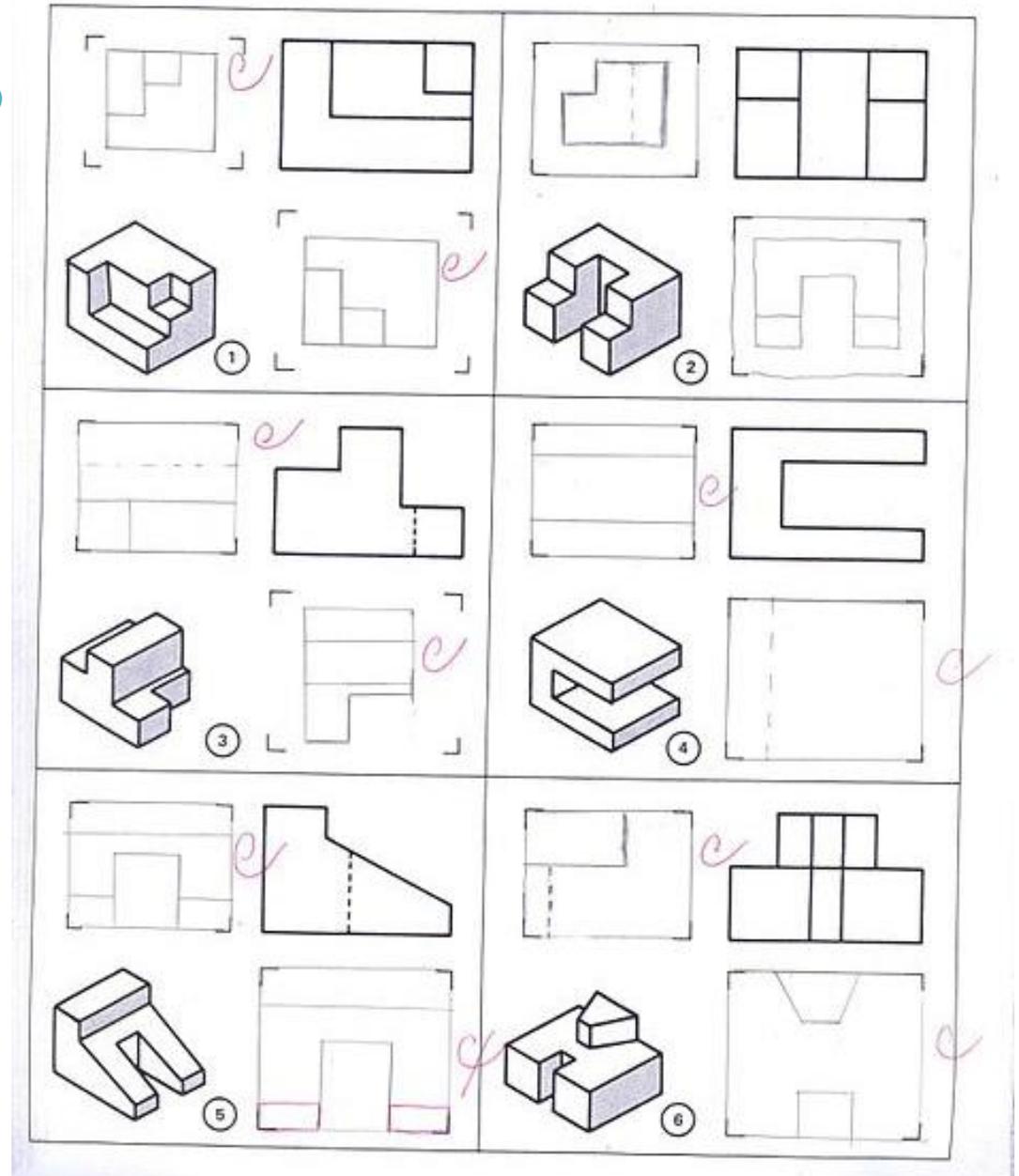
Front view

Side view  
(from left)

Top view

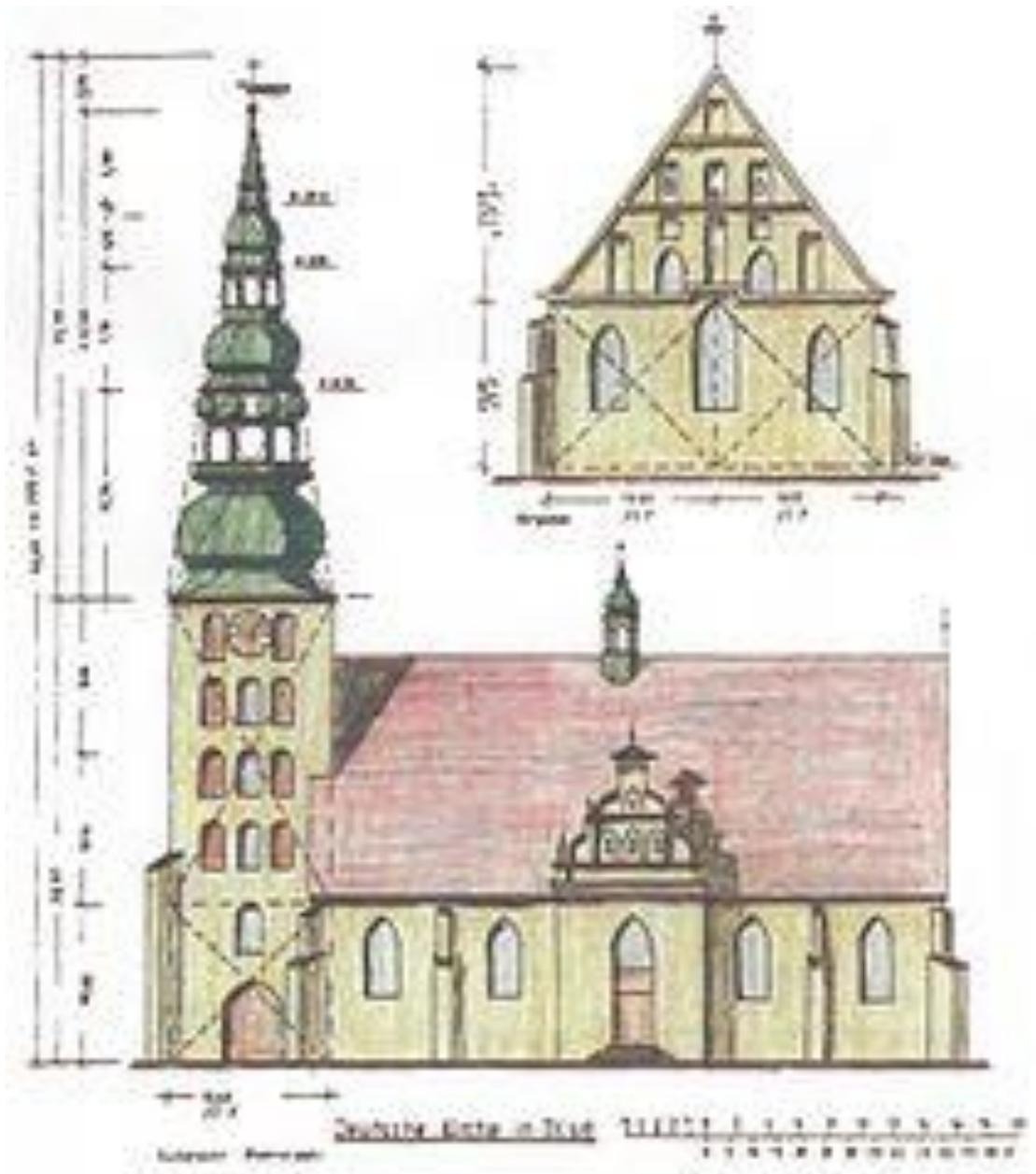
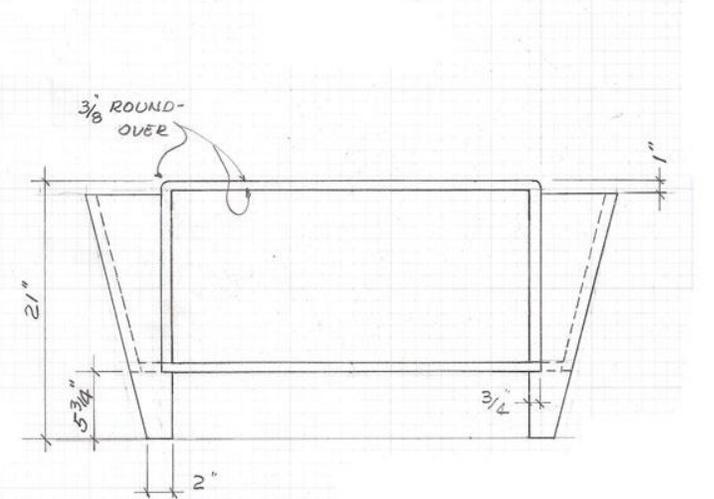
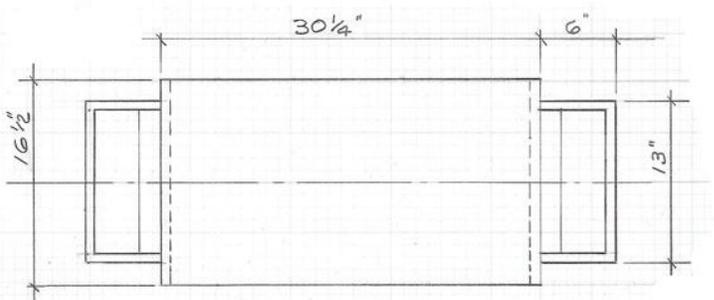
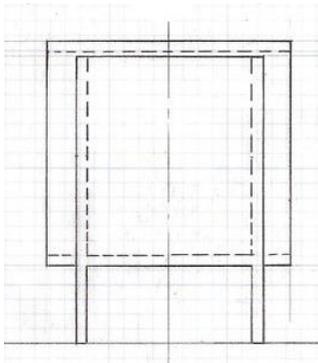


# Orthographic Drawings

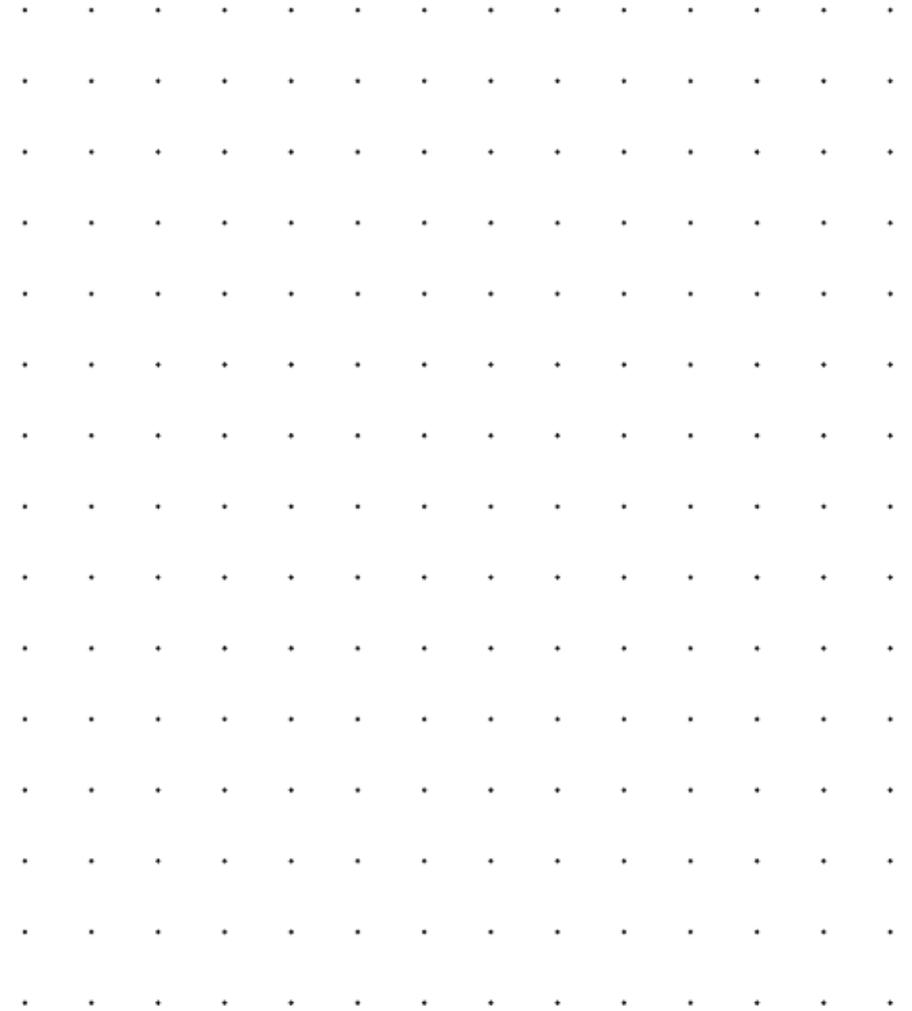
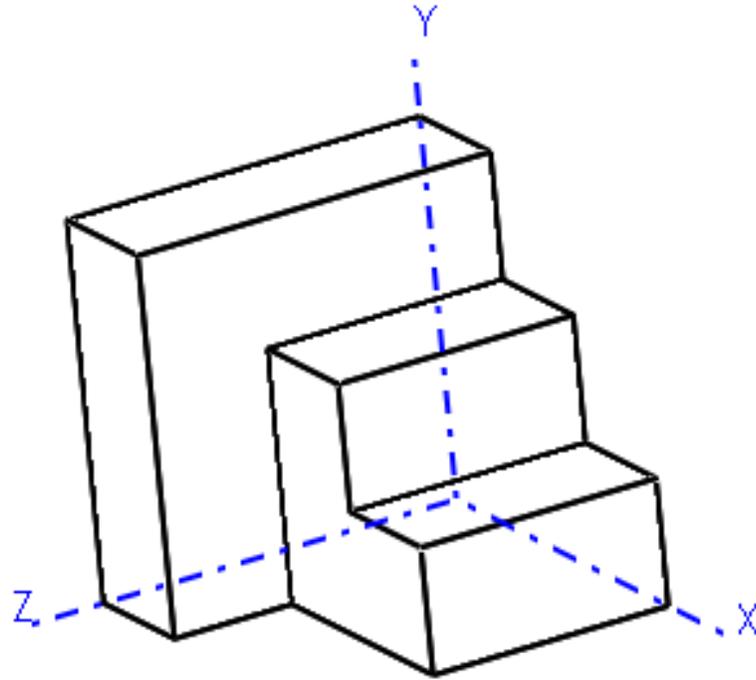


# Orthographic Drawings

Engineering examples



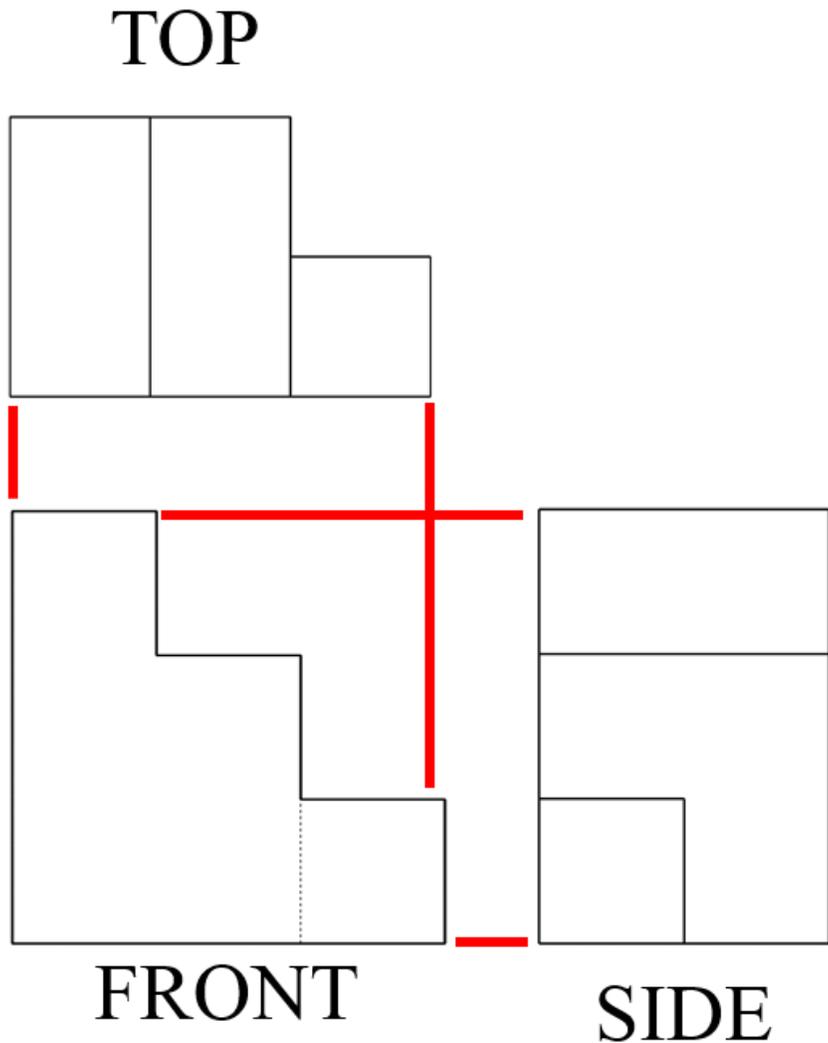
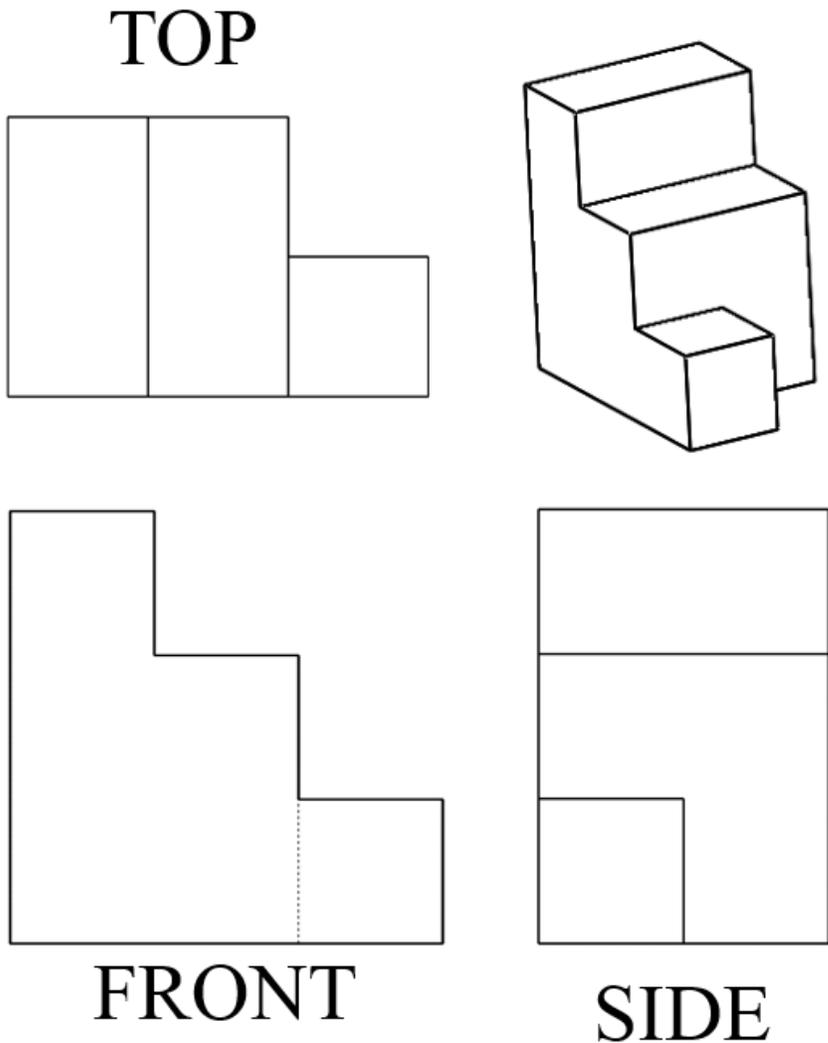
# Orthographic Drawings



## Tips:

- Draw views in order (top → front → side)
- Draw lines where there are edges (changes in plane)
- Use dotted lines to show hidden edges
- Solid lines trump dotted lines

# Orthographic Drawings



ACTIVITY 3:

Let's Take a Spin:  
One-Axis Rotations

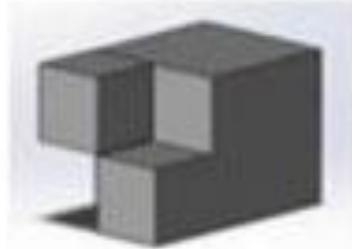
# One-Axis Rotations



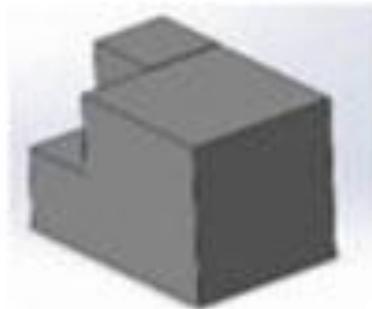
is rotated to →



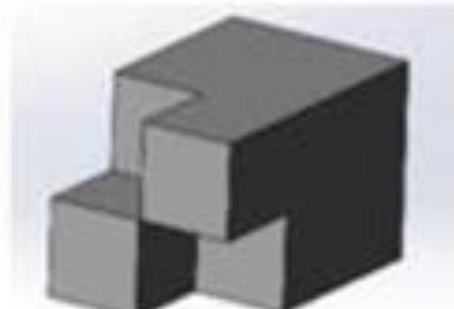
Can you find the rotation of the gray object that is analogous to the rotation of the white object?



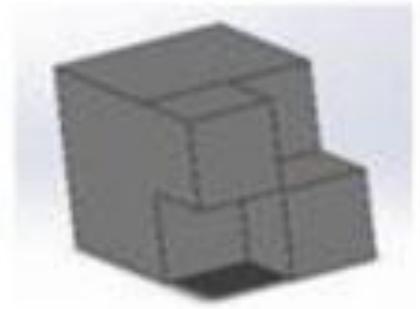
is rotated to:



A



B



C

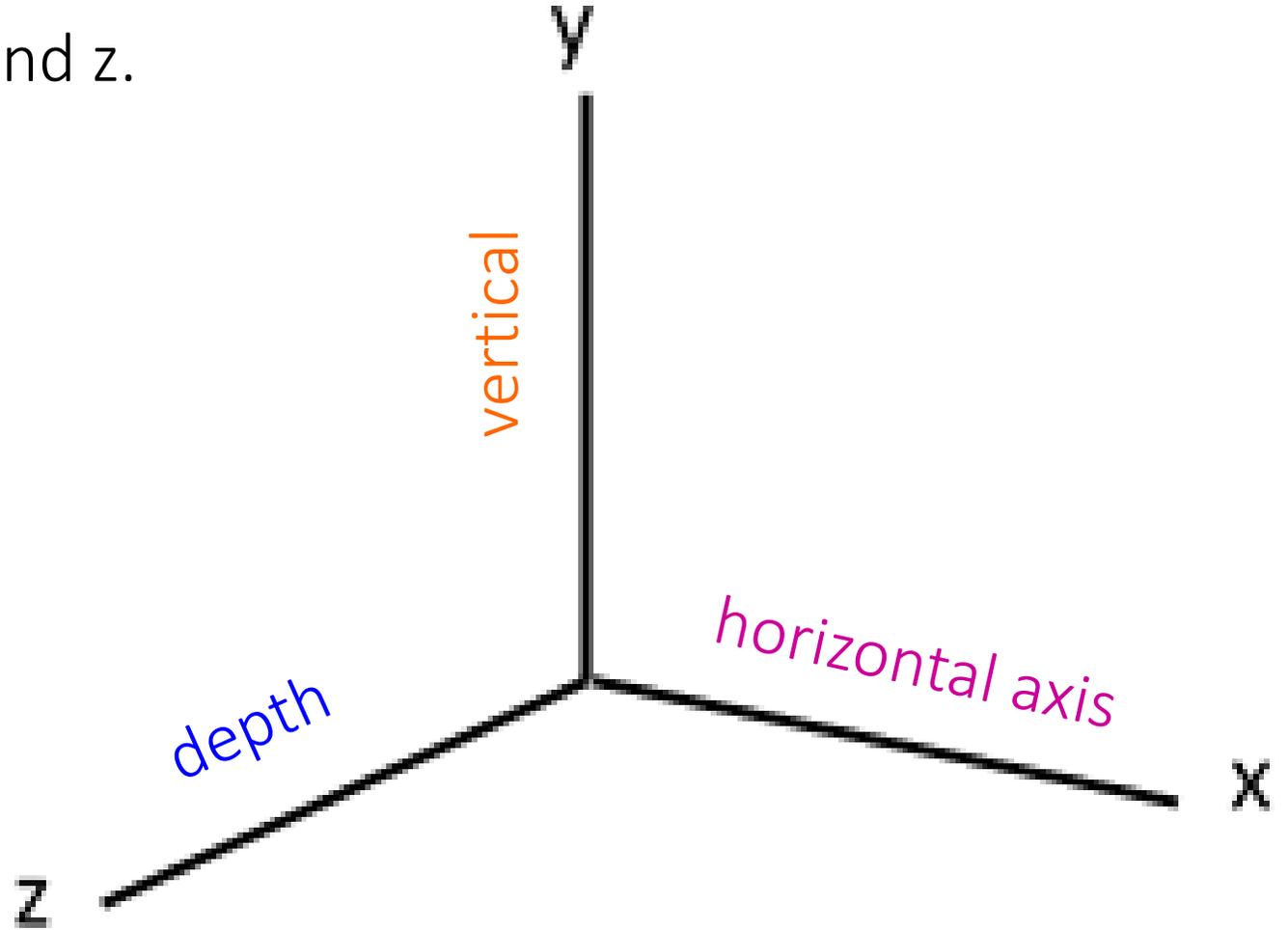
# One-Axis Rotations

Three positive axes, x, y and z.

X = horizontal axis

Y = vertical axis

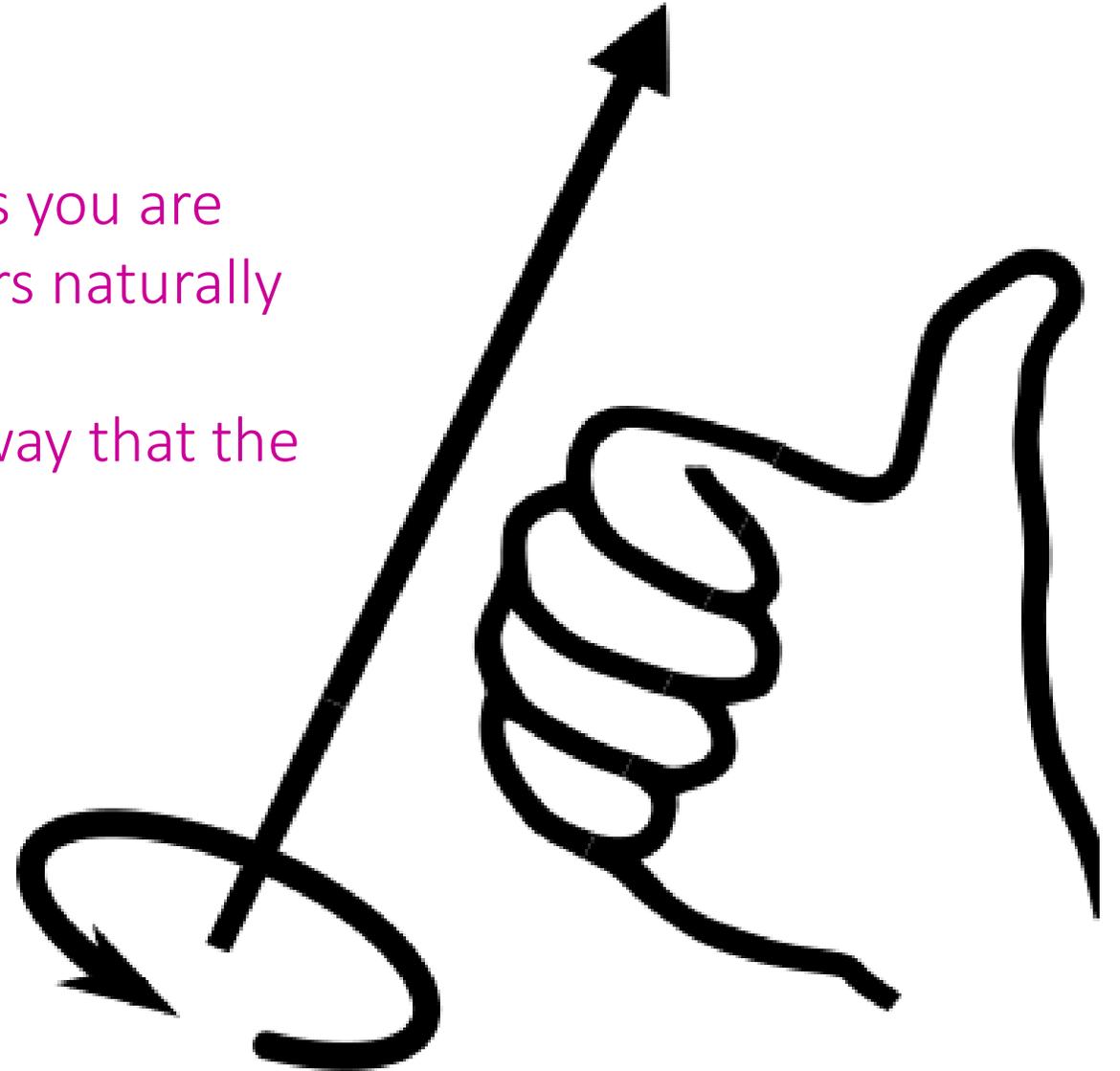
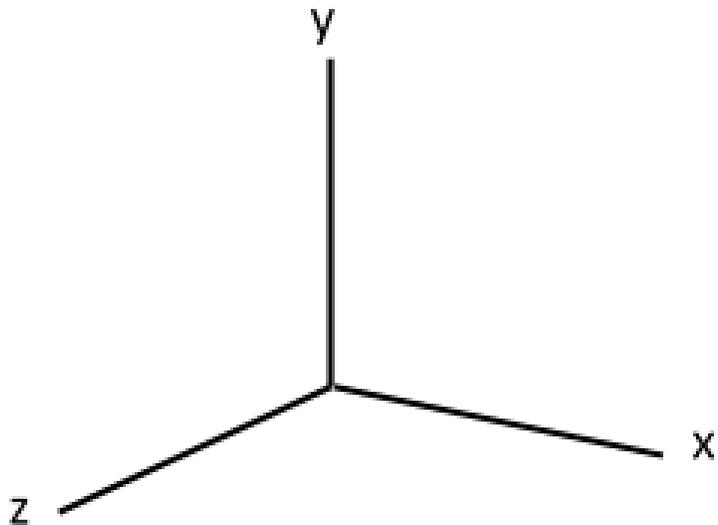
Z = axis coming towards us



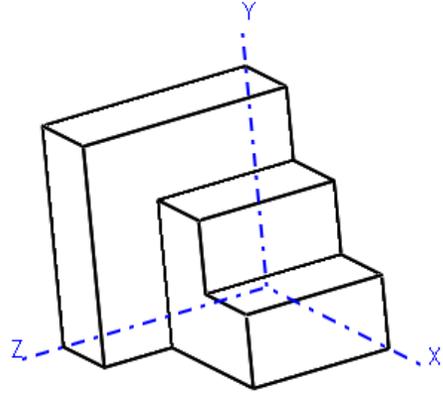
# One-Axis Rotations

How to do the right-hand rule

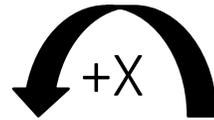
- Point your thumb parallel to the axis you are rotating about and curve your fingers naturally towards the palm of your hand
- Your fingers will move in the same way that the object will move



# One-Axis Rotations



original object position



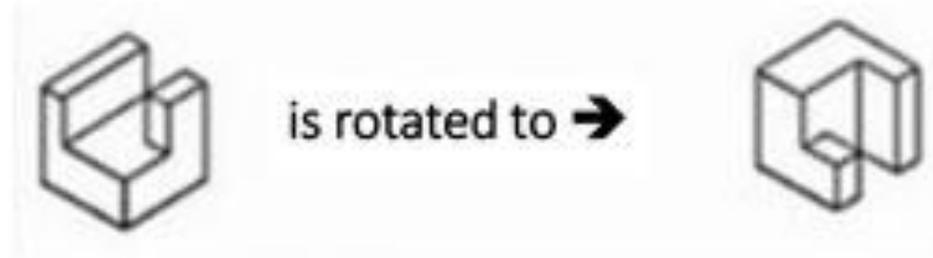
## Tips:

- Right-hand rule!
- Clockwise = negative rotation; counter-clockwise = positive rotation
- $90^\circ$ ,  $180^\circ$ ,  $270^\circ$  rotations only
- Think of a “flag around a flagpole”

ACTIVITY 4:

New Perspectives:  
Two-Axis Rotations

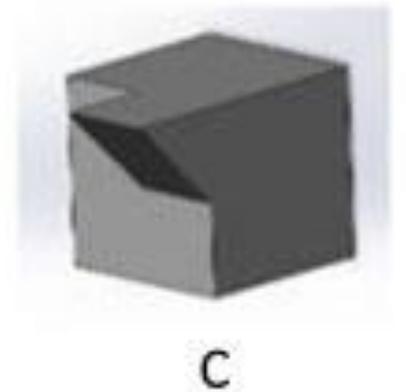
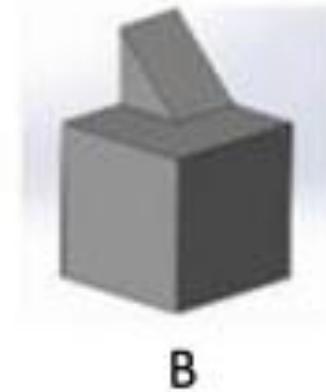
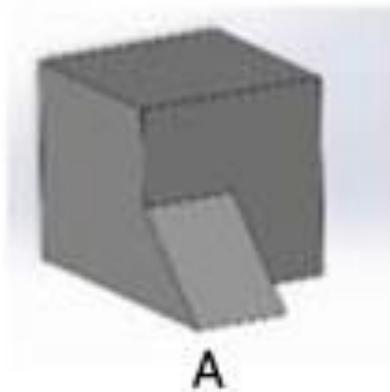
# Two-Axis Rotations



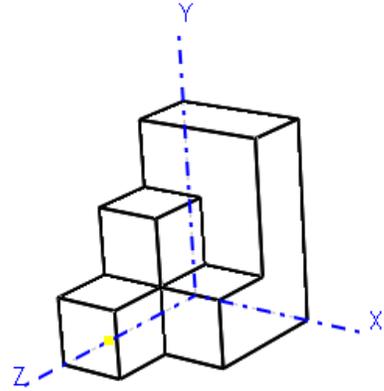
Can you find the rotation of the gray object that is analogous to the rotation of the white object?



is rotated to:



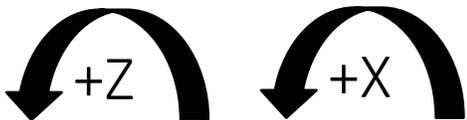
# Two-Axis Rotations



original object position

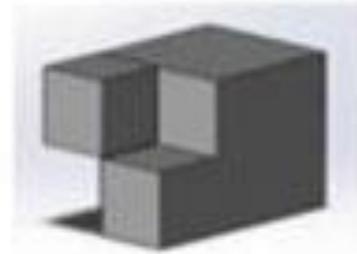
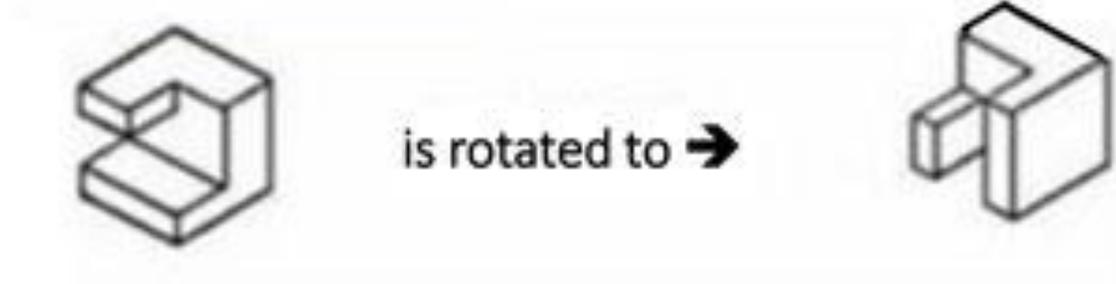
Tips:

- Use the right-hand rule!
- Clockwise = negative rotation
- Counter-clockwise = positive rotation
- Two-axis rotation is NOT commutative (order matters!)

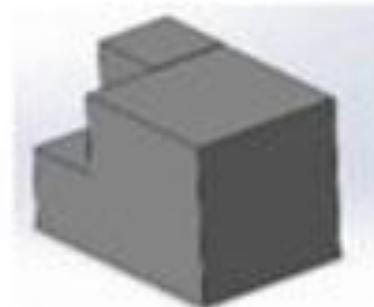


# Write a Rule Approach

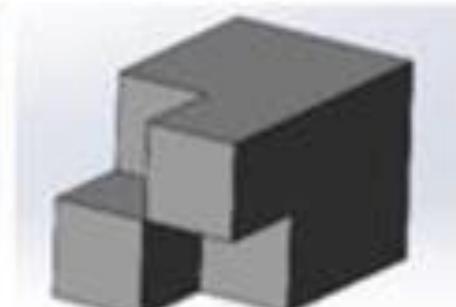
1. Pick a side
2. Find the same side after rotation
3. Write a "rule"!
4. Pick the same side on a new object
5. Follow your rule
6. Compare to answers



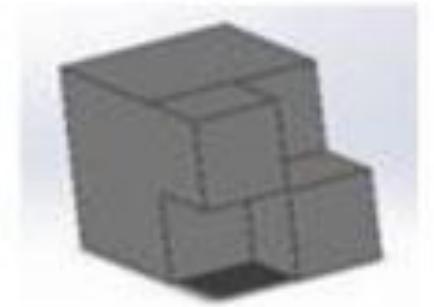
is rotated to:



A



B



C