

UNIT 2.1: TECHNICAL DRAWING (ORTHOGRAPHIC)

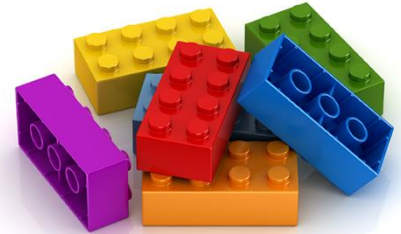


Engineers need to be able to communicate their ideas about designs to the people who will build them. There are several different types of drawings that are useful in different situations. In this task, you will learn about **orthographic, isometric, oblique and perspective drawings**.

The Lego® Game

In this exercise, you will attempt to communicate a design with your partner in different ways. Instructions:

1. Find a partner. Partner's name: _____
2. Each partner gets the SAME set of LEGO bricks.
3. Erect a barrier between you and your partner so that you cannot see each others' bricks.
4. Choose who will be *Partner A* and who will be *Partner B*.



First Exercise

Step 1 (30 seconds): Partner A will arrange his/her bricks in some kind of structure - they may be stacked or overhang in order to create some kind of complex structure.

Step 2 (1 minute): Partner A will briefly describe the arrangement of bricks using only words.

Step 3 (2 minutes): Partner B must replicate the design on his/her own side.

- Partner A may WATCH, but NOT give any feedback about accuracy.
- Partner B may NOT ask questions.
- Partner A may NOT say anything until Partner B says "finished."

How accurate was the reproduction? On a scale of 1 to 10 with 10 being perfect and 1 being completely wrong, how would you rate the result? _____ Reverse roles and play again. Rate the result: _____.

Second Exercise

Step 1 (30 seconds): Partner B will arrange his/her bricks in some kind of structure just as in exercise 1.

Step 2 (1 minute): Partner B will now sketch out the arrangement.

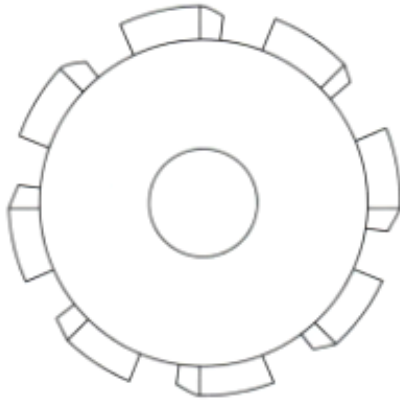
Step 3 (2 minutes): Partner A will take the sketch and attempt to replicate the arrangement ONLY from the sketch.

- Partner B may WATCH, but NOT give any feedback about accuracy.
- Partner A may NOT ask questions.
- Partner B may NOT say anything until Partner A says "finished."

How accurate was the reproduction? On a scale of 1 to 10 with 10 being perfect and 1 being completely wrong, how would you rate the result? _____ Reverse roles and play again. Rate the result: _____.

Practice with Scale

1. The actual gear represented in the drawing below has an outside diameter (including gear teeth) of 16". Measure the drawing and write the correct scale.



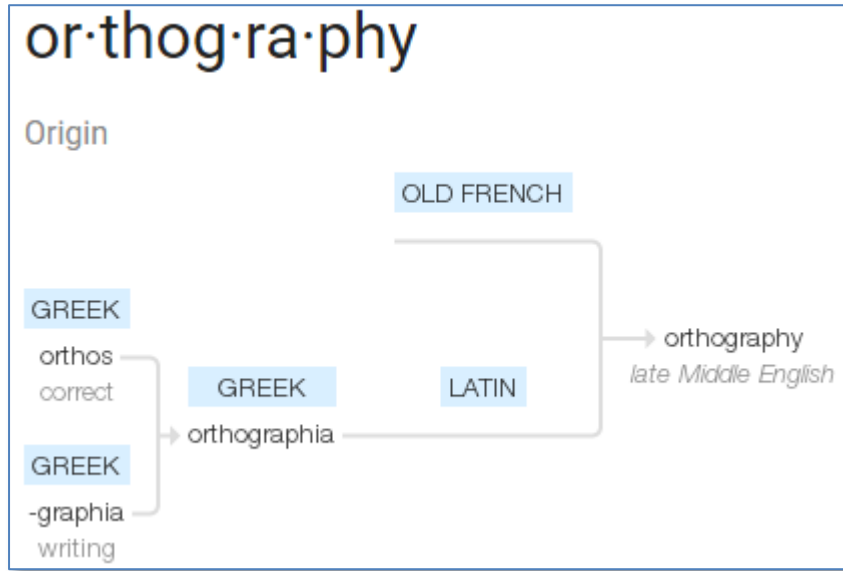
scale: $\frac{\text{_____}}{\text{model}} : \frac{\text{_____}}{\text{actual}}$

HINT: When writing the scale as a ratio, use the same units on both sides of the colon.
For example:

1:4 means 1 inch : 4 inches, or
1 foot : 4 feet
Do not mix units, always convert!

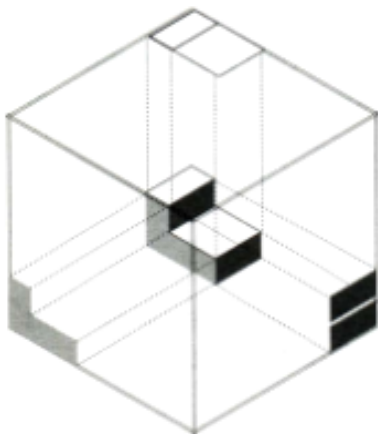
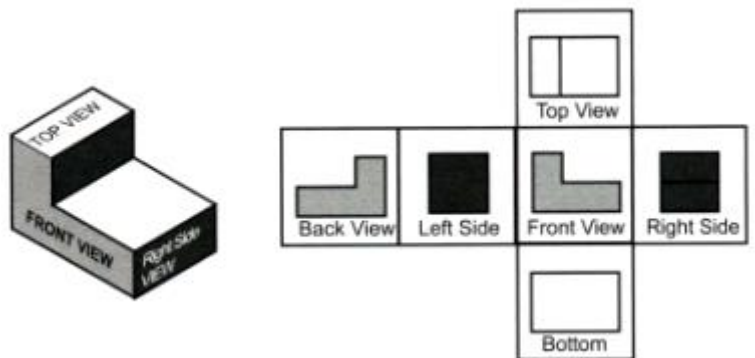
2. What is the scale if a 4" length on the drawing corresponds to a 4' length on the actual object? (*Remember that BOTH sides of the scale must be in the SAME UNITS!*)
3. A building has a wall of windows that is 12' across. If a scale of 1:24 is used, how wide is the wall of windows on the drawing, in inches?
4. Car designer build models of new designs because, unlike a drawing, a model can be seen from all sides. If you built a 1:10 scale model of a car that is 15' long, how long would the model be? Give your answer in inches.
5. If you are a carpenter following a 1:20 blueprint for a house and you measure one wall on the blueprint to be 8" long, how long should you build the wall for the house? Give your answer in inches.
6. If you discovered that the architect who made the blueprint made a mistake, and the scale should really have been 1:25, how would you need to change the length of the wall of the house?

Orthographic Drawings



Orthographic drawings show the top, sides, and bottom of an object, which is why they are also called “multi-view” drawings.

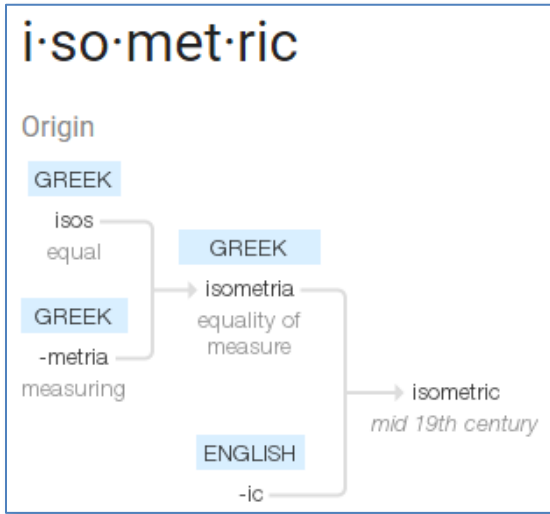
As you can see, there are six different drawings in all. If the box is then opened up and laid flat, you would see the six drawings shown here. However, people usually just draw the front, top, and right-side views, because the back, bottom, and left-side views are almost the same. The drawings are always drawn to scale.



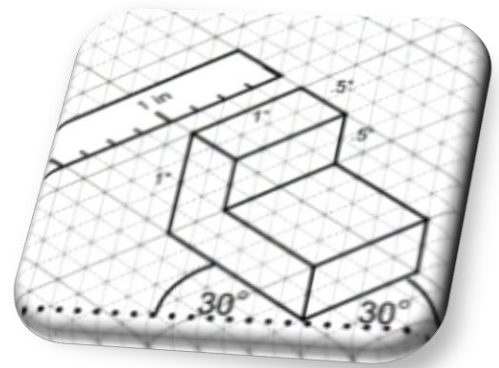
One way to think about how orthographic drawings are made is to imagine the object you are trying to draw inside a transparent plastic box. You could look at the box from the front side and trace the shape of the object on the box. You could then go around to all the other sides and trace what you see from that point of view.

As you can see, there are six different drawings in all. If the box is then opened up and laid flat, you would see the six drawing shown here. However, people usually just draw the front, top, and right-side views, because the back, bottom, and left-side views are almost the same. The drawings are drawn to scale.

Isometric Drawings



The L-shaped box drawing you’ve seen is an isometric drawing. **Isometric** drawings show the front, top, and right-side views, and all lines are drawn to scale. The word “isometric” is from the Greek, meaning “equal measure.” Depth is shown by slanting the edges up at 30° angle from the horizontal. This type of drawing is especially useful to engineers because it shows depth, and each line is drawn to scale.

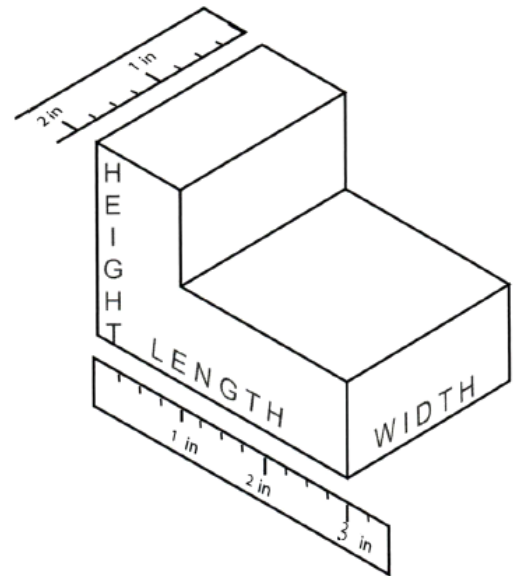


We will begin by drawing orthographic drawings based on isometric drawings. After that you will learn to draw isometrics drawings from orthographic drawings.

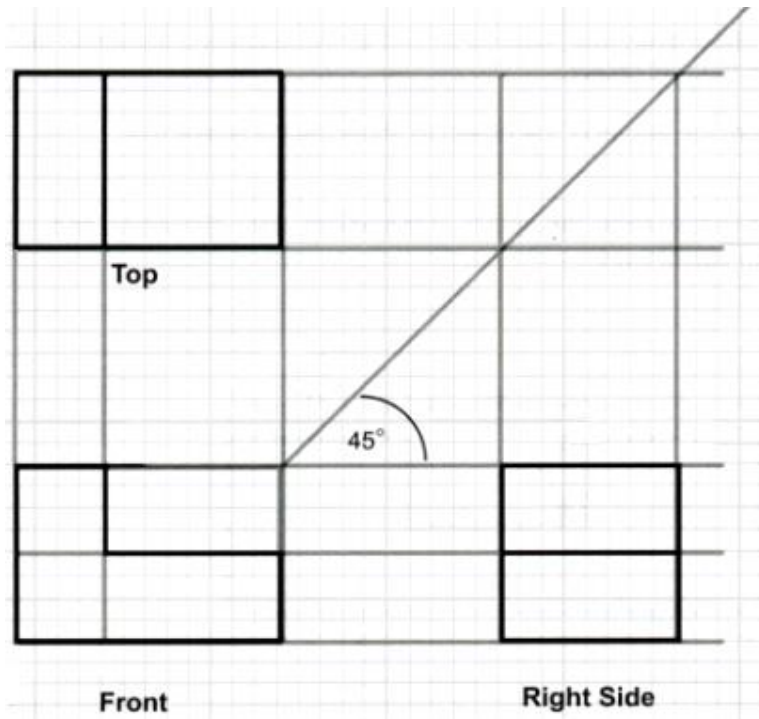
Make an Orthographic Drawing

When you make an orthographic drawing use a pencil for your drawings and draw lightly to start. That way you can draw guidelines (called “construction lines”) that you can erase later. The following are the steps to make an orthographic drawing of the L-shaped object on this page. **Follow along with the teacher and convert this image to an orthographic drawing.**

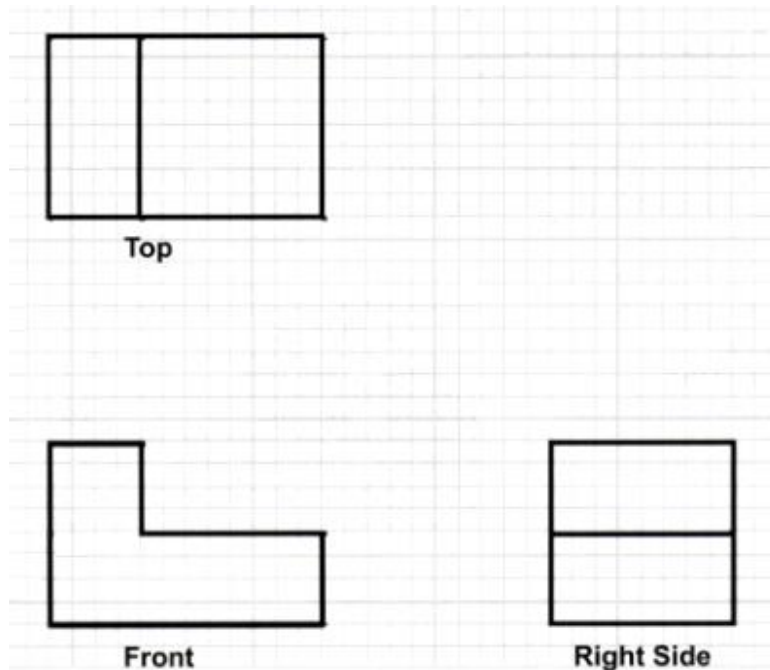
1. Front View. Measure the length and height of the object, and decide on the scale for the drawing. Draw light construction lines to frame the front view. Then make any other relevant measurements and draw the front view in the lower-left side of the paper within the construction lines.
2. Top View. Measure the width of the object. Draw construction lines extending upward and to the right from the front view as shown in the example. Draw the top view as shown, directly above the front view.



3. Right Side View. Draw construction lines from the top view to the right. Draw a line from the corner of the front view block at a 45° angle so it crosses the construction lines. Drop construction lines downward from where the lines cross to frame the right side view.



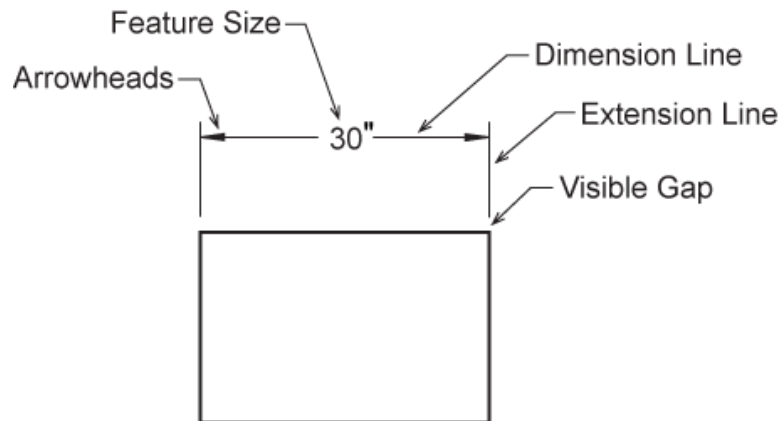
4. Erase the construction lines to make a nice, clean drawing.



Dimensions

All engineering drawings should indicate **dimensions** – the distances and locations on the ACTUAL object.

- Each dimension often consists of a **dimension line**, capped by two arrowheads and broken in the middle for the measured distance on the real object.
- Two **extension lines** may extend from the edges of the object to show clearly where the dimension line begins and ends.
- There should be enough dimensions to fully show the details of the object. Both dimension and extension lines should be lighter than object lines.




Title Blocks

Title blocks are used to give essential information on technical drawings. They typically include the name of the drafter, the title of the drawing, scale, and date, and are located on the lower-right side of the engineering drawing. In some cases they may appear in other locations where space is available.

Title Block	
Name: Mr. Rocheleau	
Title: L-Shaped Block	
Date: 2/5/18	Scale: 1:1

Title blocks often include information specific to the type of drawing and to how the drawing will be used. Information you choose to provide should be helpful and relevant.

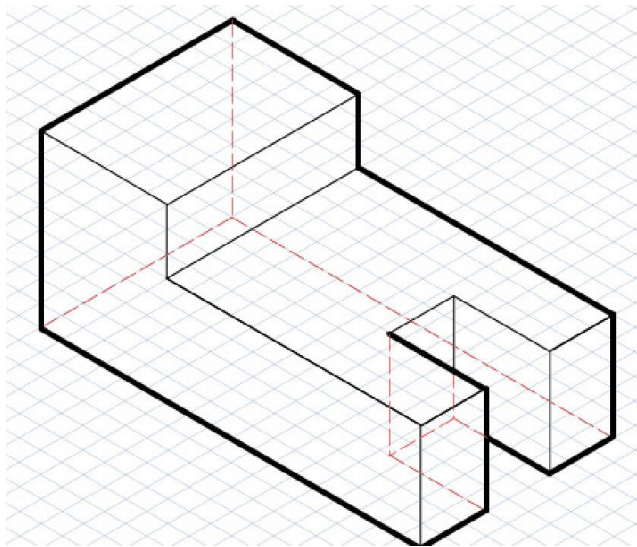
	PROJECT			
	TITLE			
APPROVED	SIZE	CODE	DWG NO	REV
CHECKED				
DRAWN	SCALE	WEIGHT	SHEET	

Practice Orthographic Drawing #1 and #2 (CP1 – Choose 1, Open Honors, do both)

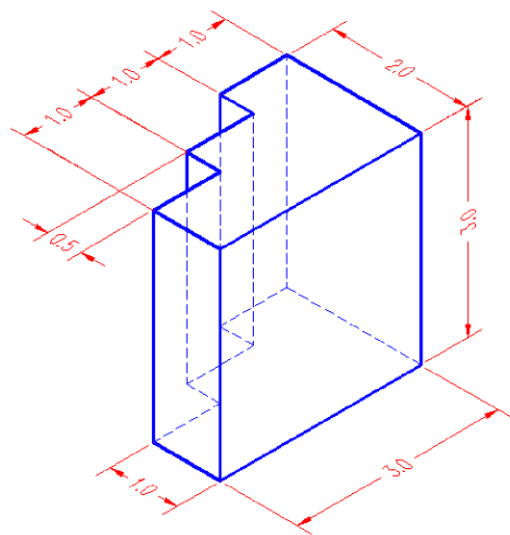
Practice drawing the following examples using standard graph paper.

- Draw construction lines to be sure you are placing your faces in the correct locations. Do not erase them until the teacher instructs you to do so.
- Label your front, top and right side faces.
- Include a title block with appropriate information and correct scale.
- Include dimension lines with dimensions and accurate units.

Example 1



Example 2



In the first example, assume each grid block is 1 inch. In the second example, be aware that the FRONT face is to your left and the RIGHT side face is, well, to your right. Units are again in inches.

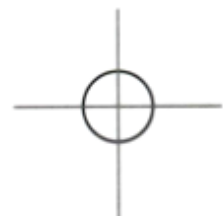
After you complete each one, bring it to the teacher for feedback. Do not proceed until advised to do so. Open Honors students must complete both of these drawings. CP1 may choose either drawing. **When you are finished, please turn them in for credit.** Once you do that, you may read ahead about holes and circles.



Check this box when you have completed these drawings and then proceed.

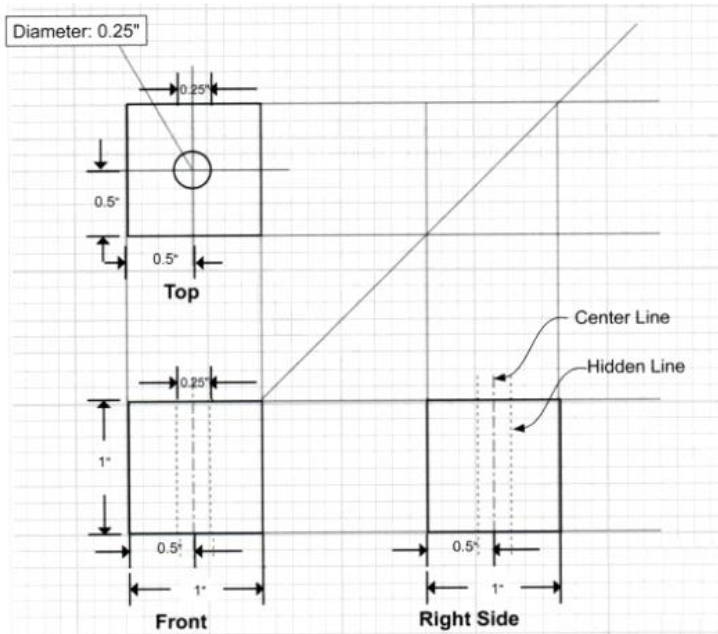
Holes and Circles

Circles: Top View. To draw a circle, start with a center point. Draw horizontal and vertical construction lines. If the circle is small, you can draw it with a plastic or metal template. For medium to large circles, to make them you will need a compass. As illustrated in the “Top” view below, you should indicate both the center of the circle and the diameter of the circle.



Circles: Front and Side Views. Because you cannot see the hole from the side, its location in the object is shown by hidden lines, drawn as short dashes. A **centerline**, drawn through the middle of the hole is indicated by alternating long and short dashes. Both hidden lines and centerlines are lighter than object lines.

Using the orthographic drawing below, sketch what you think the original object looks like.

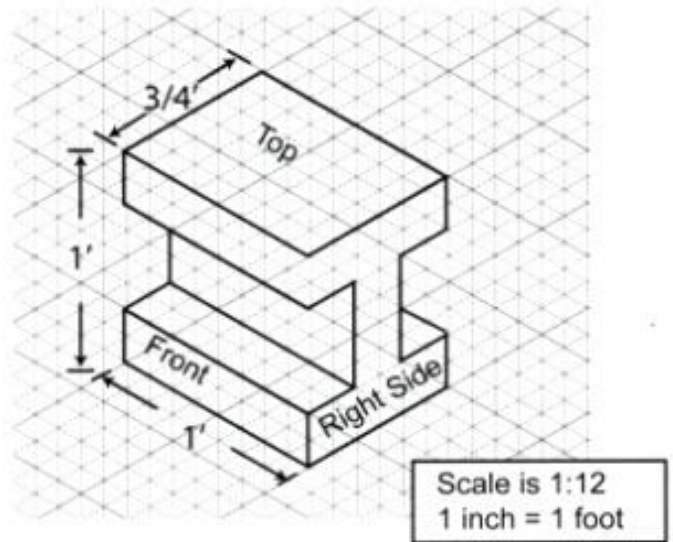


Draw the sketch here.

More Orthographic Drawing Practice #3 (I-Beam)

Convert this isometric drawing to an orthographic drawing.

- Sometimes you cannot see all details in an isometric drawing. Usually you can infer details unless additional views or hidden lines are used to advise you otherwise.
- Remember that in isometric drawings you can take accurate measurements of all edges directly from the drawing.
- Use solid lines to show edges that are visible to the viewer. Use dotted lines to show hidden edges that are not visible from the view. (Hint: The top view should show two hidden edges.)



Use standard graph paper. Make construction lines. Always include dimensions and title block.

When both sides of a page have been completed, please turn it in for credit.



Check this box when you have completed these drawings and then proceed.

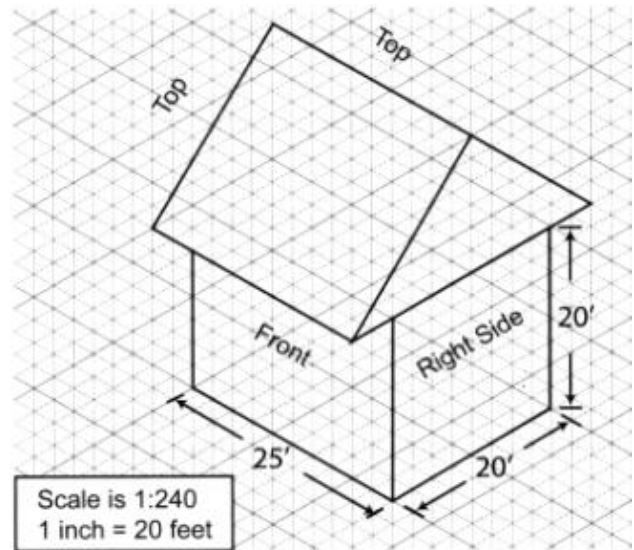
Even More Orthographic Drawing Practice #4 (The House – Open Honors Only)

Convert this isometric drawing to an orthographic drawing.

- Pay attention to the scale.
- Show BOTH SIDES of the roof in the top view.
- Make sure to include the roof in the front and right-side views.
- Be aware of the overhang!

Use standard graph paper. Make construction lines. Always include dimensions and title block.

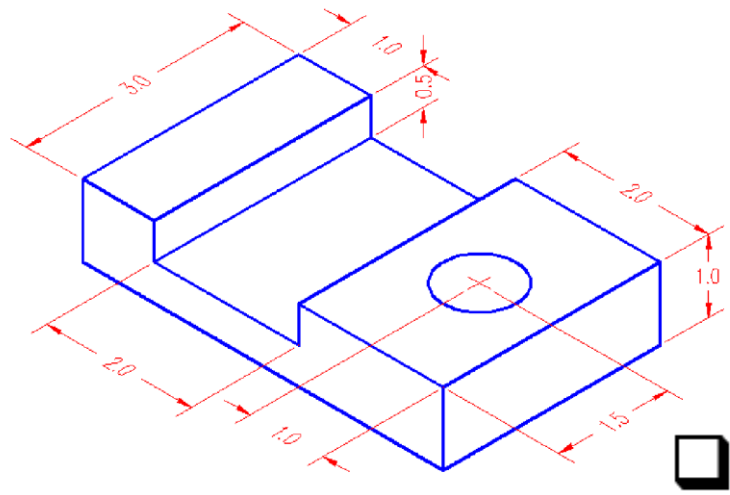
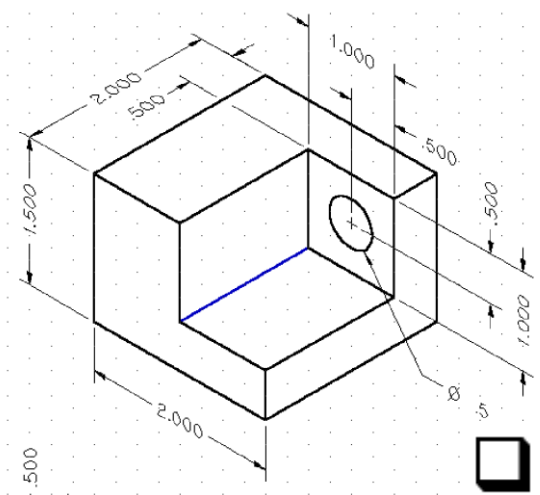
When both sides of a page have been completed, please turn it in for credit. Check the box!



Orthographic Drawing Practice #5 and #6 (CP1 – Choose 1, Open Honors, do both)

Practice drawing the following examples using standard graph paper.

- Draw construction lines to be sure you are placing your faces in the correct locations. Do not erase them until the teacher instructs you to do so.
- Label your front, top and right side faces.
- Include a title block with appropriate information and correct scale.
- Include dimension lines with dimensions and accurate units.
- All units are inches.



After you complete each one, bring it to the teacher for feedback. Do not proceed until advised to do so. Open Honors students must complete both of these drawings. CP1 may choose either drawing. **When you are finished, please turn them in for credit. Ask me about extra credit drawings!**