

Isometric Drawing

Description

Isometric drawings use perspective to communicate a large amount of information in a single drawing. Isometric drawings show three sides of an object, making it easier to better understand how a finished object may look or how the pieces of the object will fit together. In this activity, students will draw an isometric drawing on a piece of paper with a title block. Students will also continue to practise lineweights and lettering techniques.

Lesson Objectives

The student will be able to:

- Complete a board set-up
- Identify and appropriately use drafting tools
- Create an isometric drawing of an object
- Differentiate lineweights
- Refine lettering techniques

Assumptions

The student will:

- Have a basic knowledge of drafting tools and equipment
- Have a foundational understanding of how to appropriately use drafting equipment
- Have created a title block on which to complete this activity

Terminology

Border or title block lines: thick, dark lines used to create a solid border around a blank page.

Drafting board: a flat, smooth surface usually covered in vinyl to which paper is affixed. The drafting board has square, parallel edges that allow a T-square to slide easily.

Drafting brush: used to sweep away debris from a drawing so the full drawing is not smeared.

Eraser shield: a micro-thin piece of metal with cut-outs that allow the user to erase detailed sections of a drawing without erasing the rest of the drawing.

Guide lines: thin, light lines, drawn when using the lettering guide for evenly spaced letters.

Isometric drawing: a two-dimensional drawing that looks 3D. This drawing will show three sides of the object in one view and will be created using lines primarily at 30 and 90 degrees from horizontal. When drawing on paper, you will use a 30/60/90 triangle.

Layout lines: very light lines used to lay out measurements before those measurements are drawn in heavy, dark lines.



Lettering guide: used to assist in the drawing of uniform lines to draw consistent, evenly spaced lettering.

Lineweight: the thickness and darkness of drawn lines.

Masking tape (drafting dots): holds drawing paper and/or vellum to the drafting board so the paper does not shift while drawing.

Pencil: a drawing utensil with a mechanical or solid core (lead). Leads range from hard to soft: 6H, 4H, 2H, H, HB, 2B, 4B, 6B. H is very hard with a fine point and B is extremely soft with a blunt point. A hardness of 2H will be used for these activities.

Precision drawing: the act of creating drawings with specialized tools and equipment.

Steel rule: a straightedge made of rigid material and divided into specific increments, found both in metric and imperial units.

Triangles (right angle and isosceles): drafting guides made of hard, clear plastic that are used to draw lines at vertical and set angles (45° – 90° – 45° , 30° – 60° – 90°).

T-square: precision drawing instrument that is used as a guide with other drafting equipment. The T-square has a 90° angle where the head and blade attach.

Estimated Time

60–90 minutes

Recommended Number of Students

20, based on the *BC Technology Educators' Best Practice Guide*

Facilities

- Regular classroom space with desks/chairs for all students
- Drafting boards would be ideal. However smooth, clean, flat surfaces will also suffice.

Tools

- T-square
- Steel rule
- Triangles (right angle and isosceles)
- Eraser shield
- Drafting brush
- Masking tape (drafting dots)
- Drafting board
- Lettering guide
- 2H mechanical pencil
- Isometric dot paper for practice

Materials

- Handout for students with instructions (this could be directly from this document—i.e., print the text under the Teacher-led Activity)
- Title-block drawing page (created in Introduction to Title Blocks activity)
- Isometric dot paper for practice
- Wooden block used in the Scale and Dimensioning and Orthographic Drawing activities

Teacher-led Activity: Isometric Notes

An isometric drawing is based on three axes that are equally spaced apart at 120° (Figure 1). Lines that run parallel to the axes are called *isometric lines*. Lines that are NOT parallel are called *non-isometric lines*.

An isometric drawing can be identified by several factors:

- Vertical planes or edges are still drawn vertically.
- Left and right planes are drawn at an angle of 30° above horizontal.
- No horizontal lines are found on isometrics.

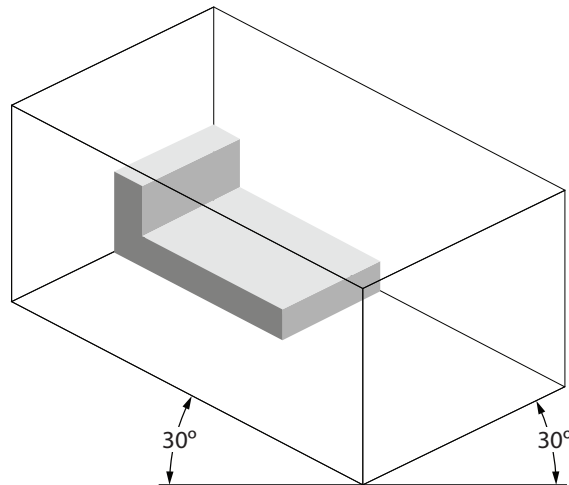


Figure 1—An isometric view. Isometrics show a three-dimensional object from three perspectives in a single drawing.

Teacher-led Activity

Have students sketch an object using correct isometric standards. Labelling the sides of the object with a sticky note may assist novices to differentiate between the different planes. Isometric paper (includes vertical axes as well as 30° axes already laid out) is an excellent way to begin.

1. Gather all materials listed above.
2. Demonstrate: Using the T-square and masking tape/drafting dots, align title-blocked paper to your drafting board and securely tape down (Figure 2).



Figure 2—Secure paper to board

3. The three dimensions of length, width, and height are drawn along the isometric axes shown in Figure 3. The lengths of objects running parallel to these axes can be drawn to scale. Lines at other angles will not be to scale.

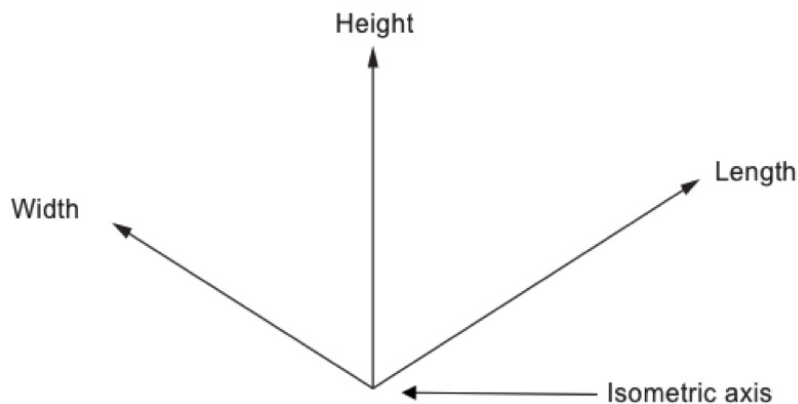


Figure 3—Height, width, and length drawn along isometric axes

4. Draw a small, six-pointed star-shaped axis on the bottom corner of your paper (Figure 4). The sloping axes should be drawn at a 30° angle from the horizontal grid line. The vertical axis of the star indicates height (H) or depth (D), and the two sloping axes indicate the length (L) and the width (W) of the rectangle. The vertical axis can be used as a reference guide when making lines on your drawing.

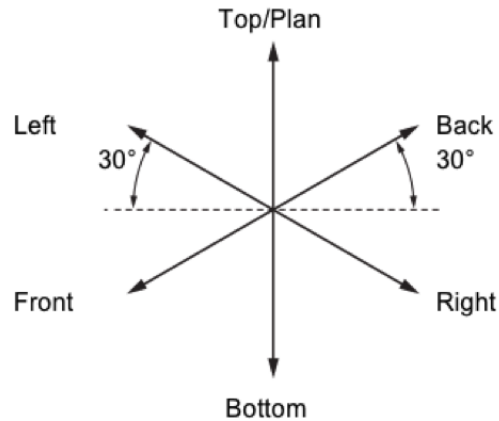


Figure 4—Six-pointed star-shaped axis

5. Sketch the top of the block by drawing two lines, one parallel to L and one parallel to W (Figure 5).

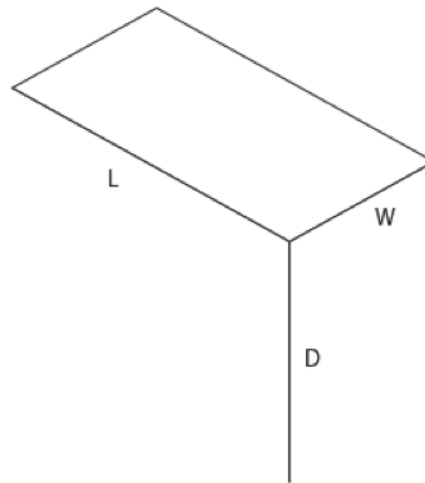


Figure 5—Sketching the top of the block

6. Sketch two lines, one parallel to L and one parallel to D as shown in Figure 6.

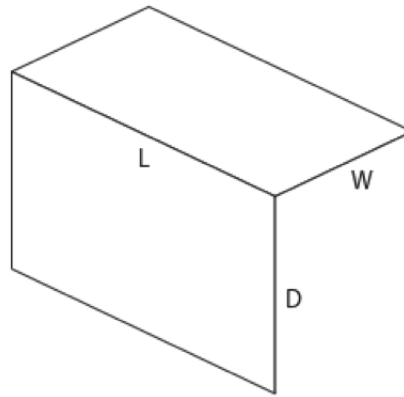


Figure 6—Sketching the side of the block

7. Sketch two lines, one parallel to W and one parallel to D, to complete the outline of the rectangular block (Figure 7). Begin with light layout lines so that you can make any necessary adjustments before darkening them. The finished isometric sketch is drawn with dark object lines in Figure 8.

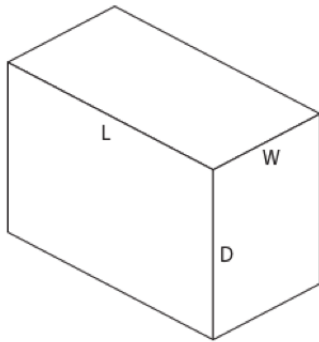


Figure 7—Full outline of rectangular block

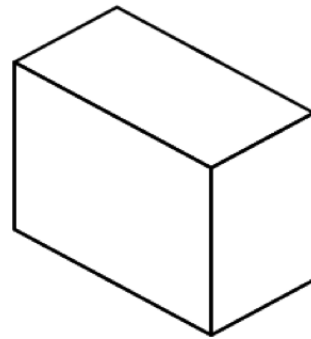


Figure 8—Isometric object

8. Complete the activity by filling in the title block as follows:

ACTIVITY # 6	NAME
	DATE
ISOMETRIC	SCALE OF DRAWING 1:1
	PAGE 1 OF 1

Extension Activity

Further drawing practice creating more isometric objects, using different wooden cut-out shapes.

Assessment

- Student participation in discussion/demonstration
- Completion of drawing with overall neatness:
 - Lines are concisely drawn.
 - Isometric object is accurate and proportional to page.
 - Border lines cross to ensure closed corners.
 - Lettering is done to a high quality (all uppercase).
 - Title block is filled out correctly with appropriate information.

Appendix Acknowledgment

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Appendix

Make isometric sketches of simple rectangular objects

Isometric sketches are useful because they are easy to draw and clearly represent an object or system. This clarity comes from using directional lines to represent the three dimensions of length, width, and height, much like a picture.

Construction methods

The following steps explain how to draw an isometric cube. The three dimensions of length, width, and height are drawn along the isometric axes shown in Figure 8. The lengths of objects running parallel to these axes can be drawn to scale. Lines at other angles will not be to scale.

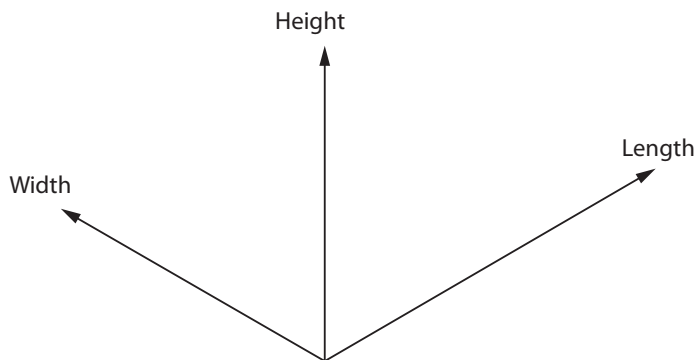


Figure 8— Isometric axes

Draw a small star-shaped axis on the bottom corner of your grid paper. The sloping axes should be drawn at a 30° degree angle from the horizontal grid line. The vertical axis of the star indicates height (H) or depth (D), and the two sloping axes indicate the length (L) and the width (W) of the rectangle. The vertical axis can be used as a guide when making lines on your drawing. Notice we have labelled the points on the star in Figure 9. These labels can change depending on the view that you may want when drawing a stationary object. The bottom two horizontal points indicate the view that is being drawn. In this case we would be creating a front-right view.

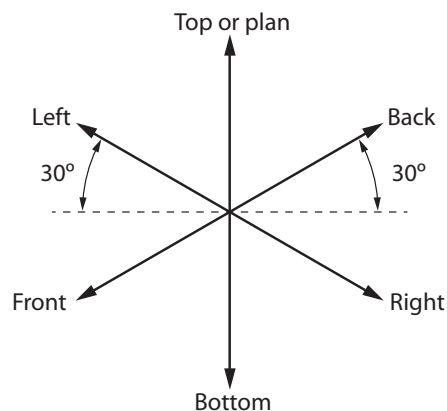


Figure 9— Step 1: Isometric guide for front-right view

Sketch the top of the block by drawing two lines, one parallel to L and one parallel to W (Figure 10).

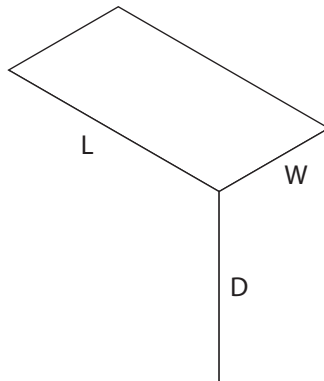


Figure 10 — Step 2: Isometric view of top surface of a rectangular block

Sketch two lines, one parallel to L and one parallel to D as shown in Figure 11.

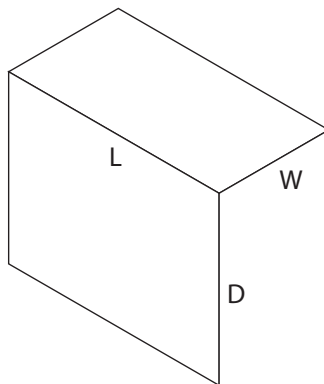


Figure 11 — Step 3: Lines parallel to L and D

Sketch two lines, one parallel to W and one parallel to D, to complete the outline of the rectangular block as shown in Figure 12. Begin with light construction lines so that you can make any necessary adjustments before darkening them. The finished isometric sketch is shown in Figure 13.

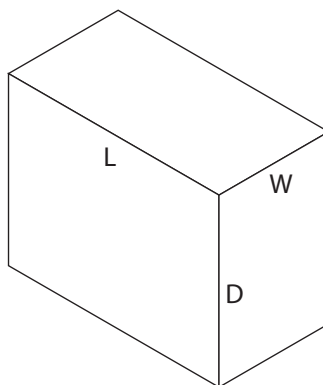


Figure 12 — Step 4: Completed outline of rectangular block

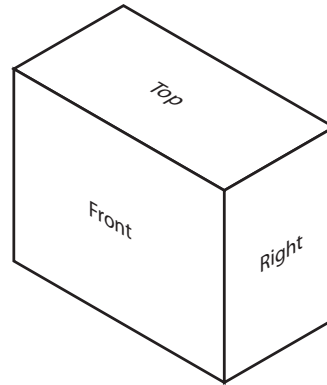


Figure 13 — Completed isometric sketch

Sketching irregular shapes with isometric lines

Not all rectangular objects are as simple as the block you have just sketched. Sometimes the shapes are irregular and have cut-out sections or some sides longer than others. All rectangular objects can be fitted into a box having the maximum length (L), width (W), and depth (D). Begin by sketching a light outline of a basic box that is the size of the object to be drawn.

As an example, consider the object shown in the three-view orthographic sketch in Figure 14. To produce an isometric sketch of this object, you need to find the maximum L, W, and D for the containing box (Figure 14). In this case:

L = 5 grid spaces

W = 3 grid spaces

D = 3 grid spaces

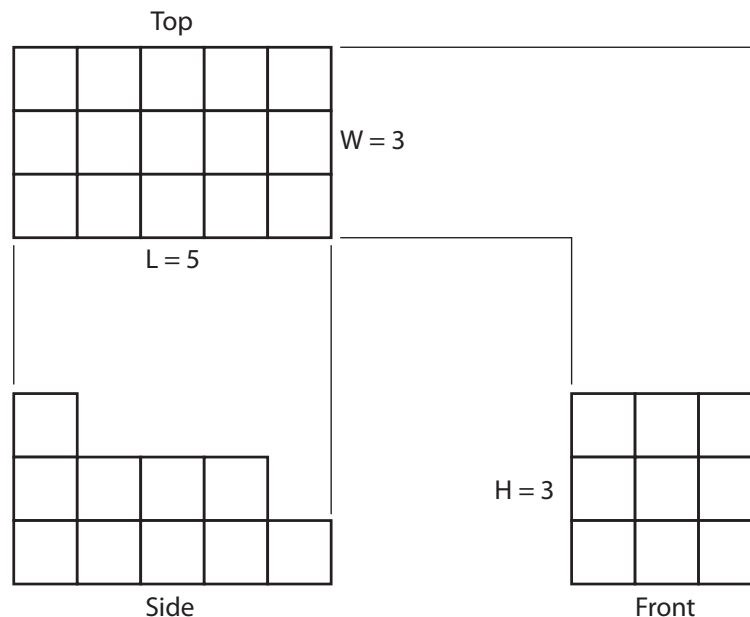


Figure 14 — Orthographic views

Sketch a light outline of the basic rectangular box to the required size, as shown in Figure 15.

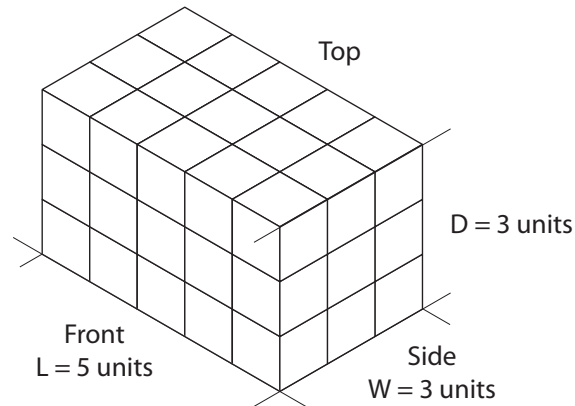


Figure 15 — Basic outline

The front view shows the outline most clearly. Place this view on the front surface of the isometric box. Use the dimension given in the front view of Figure 14 and mark the number of units indicated along the axes L and D (Figure 16).

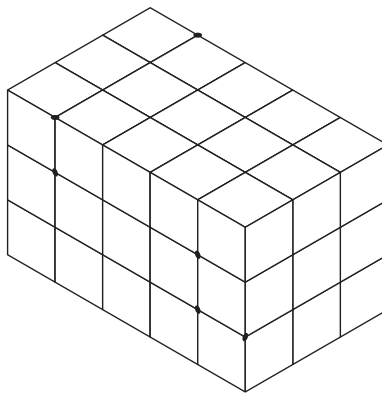


Figure 16 — Location of marks on axes

Lightly sketch lines parallel to the L and D axes from the marked points on the front surface (Figure 17). The step outline is drawn more heavily to emphasize the profile of the object, once you are sure your sketch is correct.

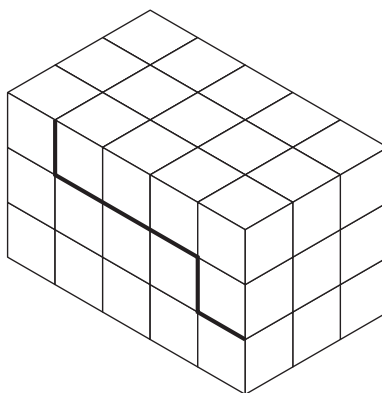


Figure 17 — Location of main features

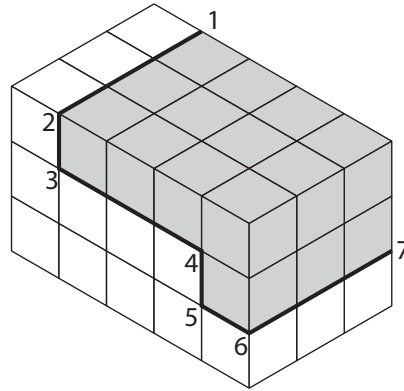


Figure 18—Location of outer surfaces

Sketch in a series of lines parallel to the axes (L, W, and D) from the corners numbered 1 to 7 (Figure 18). These lines establish the stepped outline as shown in Figure 19.

When you are sure your isometric sketch is correct, erase all unnecessary construction lines and darken the object lines. Your completed sketch of the rectangular object should be similar to that in Figure 20.

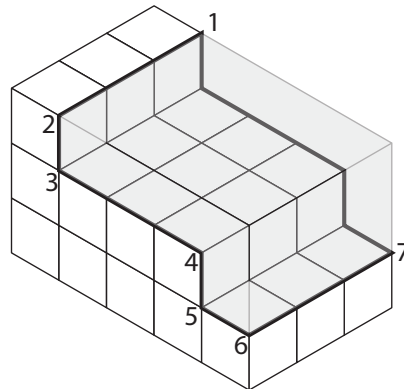


Figure 19—Internal features

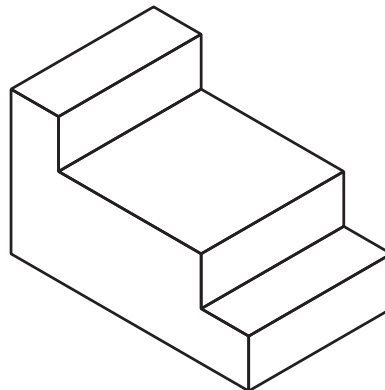


Figure 20—Completed sketch