**Youth Explore Trades Skills Design and Drafting – 3D Modelling (Architectural CAD)**

# Drawing a Simple Building

## Description

In this activity the teacher will give an introduction to the principles of designing and drawing a simple structure. This activity is an opportunity for students to think through the basic practical and aesthetic considerations of the design process.

## Lesson Objectives

The student will be able to:

* Identify and itemize design characteristics
* Sketch out the ideas on paper in near scale
* Draw out a simple building based on the defined space limitations
* Design a simple building using the predefined template created in the Symbols and Standards activity, or design a simple building from scratch
* Plot to fit the drawing to letter-sized paper

## Assumptions

The student will:

* Know how to login to a computer and open up the software
* Know how to save the drawing as a named file in their own directory
* Have been introduced to the basic drawing commands for drawing 2D objects

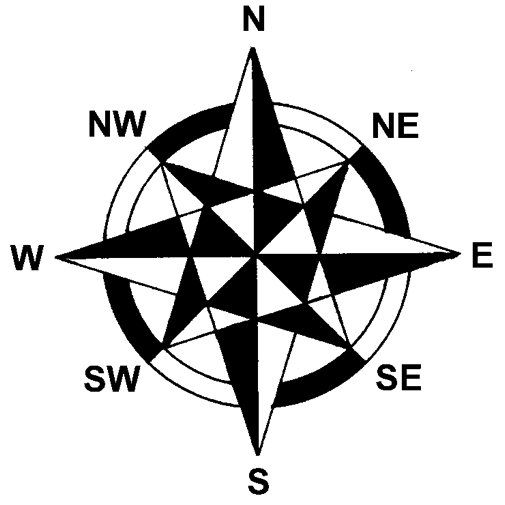
## Terminology

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

**Cardinal direction**: from the origin of any starting point, a line can be drawn in the cardinal directions: North, South, East, and West (Figure 1). In AutoCAD, East is the 0° (zero) direction, North is the 90° direction, West is the 180° direction, and South is the 270° direction. One can draw angled lines in negative directions as well. For example, –90° is the same as 270°.



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**Figure 1**—Cardinal directions

**Design**: a plan or drawing produced to show the look and function or workings of a building, garment, or other object before it is built or made.

**Floor plan**: a scale drawing of the arrangement of a building.

**Plot**: to set up your drawing to print to a file or paper.

**Polyline**: a continuous line that is made up of connected line segments.

**Scale**: a drawing that is enlarged or reduced from its original size, usually expressed as a fraction in imperial measurement (e.g., 1⁄16 to 1') and as a ratio in metric measurement (e.g., 1:50, where

1 mm in the drawing equates to 50 mm in the actual work).

**Spline**: a linetype that draws curved lines in non-specific curves from point to point. They are made up of arcs that go through small, continuous points along the line until the spline is finished. They are often used for topography maps where specific elevations and their locations are known and a curved line can connect points on the same elevation.

## Estimated Time

4 hours

## Recommended Number of Students

20, based on *BC Technology Educators’ Best Practice Guide*

## Facilities

Computer lab installed with CAD software (Google SketchUp, AutoCAD, Cadopia, Vector works, etc.) and Internet access

## Tools

Projector with computer and speakers installed with CAD software

## Materials

Student activity with instructions

## Resources

Instructional video for teacher and students to follow:

* 12.1: Drawing the External Walls of a Building
* 12.2: Placing Architectural Blocks into a Drawing
* 12.3: Scaling Your Border and Dimensioning a Floor Plan

## Architectural and design journals:

#### The Frank Lloyd Wright Foundation

<http://www.franklloydwright.org/>

#### Design Boom Architecture

<http://www.designboom.com/architecture/>

#### A/N Blog (Architects Newspaper)

<http://blog.archpaper.com/2016/01/87th-birthday-frank-gehry-embraces-yacht-life-gehry-> designed-sailboat/#.VpPLA0\_mjU8

#### Architecture and Design

<http://www.architectureanddesign.com.au/projects>

## Teacher-led Activity

The intent of the teacher-led activity is to demonstrate opening the previous *myblocks.dwg* file and renaming it as *mybuilding.dwg*. This imports the core settings from the Symbols and Standards activity (window, door, wall, switch, receptacle, light), which are the same for this activity. The teacher will demonstrate:

* Projecting the completed drawing
* Using the function keys to turn on and off the Snap, Grid, and Ortho dynamically
* Drawing lines that indicate the exterior of the building to a maximum size of 12' × 12'
* Using the Offset command to offset the exterior walls to the inside for a distance of 6" as per construction standards of BC
* Trimming off the intersections of the interior offset corner intersections
* Inserting one of the fixtures into the drawing to give an example of placement
* Setting the grid and snap to 1’ to draw the border lines 1’ within drawing limits (32' by 24')

## Teacher-led Extension Activities

A variety of artistic renderings of architectural plans may be used to communicate what a building is going to look like once it is built:

* One-, two-, and three-point perspectives give a range of views from a variety of angles.
* Elevations are straight-on views from all sides of a building, as it would look after it has been built.
* The best resource to understand these views is Google Images. Look at examples of “one-, two-, and three-point architectural perspectives” and “architectural elevations.” Present these to students as examples of artists' and professional architects’ renderings.

Landscape architecture is a whole field unto itself and example plans from the Internet can be presented.

* When developing a plan, ideas must be listed for the purpose of the building, its contents, the interior layout, windows, lighting, electrical outlets, and switches (e.g., you do not want a switch behind a door). A sketch on paper should have the fixtures placed roughly as they would be in the completed building.

## Student Activity

Students will follow the Student Activity and draw their own small building, complete with border, inserted title block, and placed blocks.

## Assessment

The student’s work will be assessed on a “done, not done” basis:

|  |  |  |
| --- | --- | --- |
|  | **Done** | **Not Done** |
| Building ideation with a list of the building’s features, including all the required fixtures, windows, and doors |  |  |
| Sketch of the interior layout (scale is not important in the ideas phase) |  |  |
| Exterior walls and interior walls placed and trimmed |  |  |
| Switch and outlet fixtures placed appropriately |  |  |
| Window(s) inside the walls |  |  |
| Door placed in the wall |  |  |

## Extension Activities

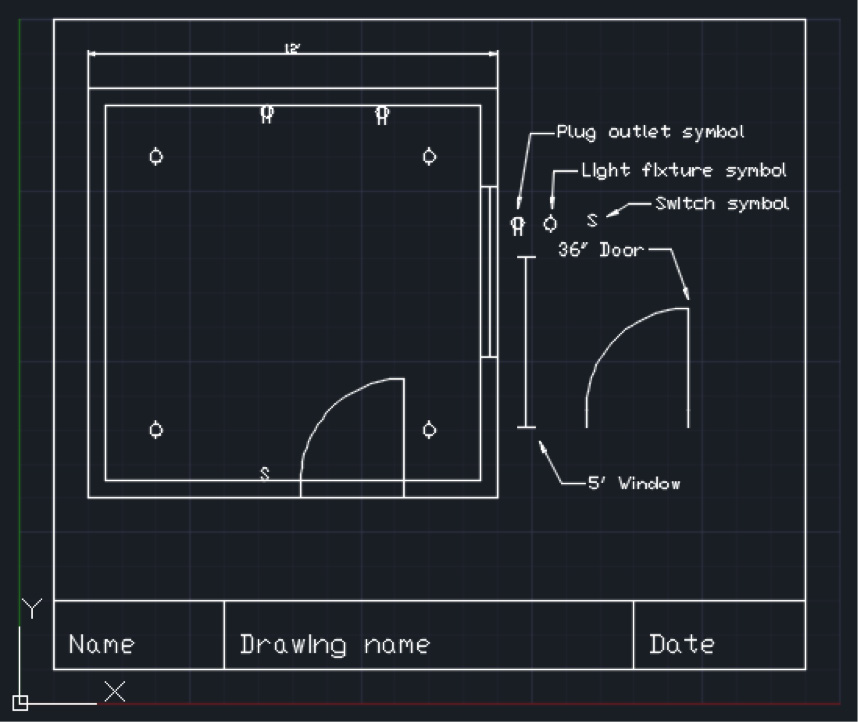
Have students draw elevations, one- and two-point perspective, presentation, site plans and landscape architecture:

* In one-point perspective all horizontal and vertical lines remain as in the plan.
* In two-point perspective only the vertical lines are as in the plan.
* Elevations are the various side views of the plan and are taken directly from the plan, point for point.

# Student Activity

### Activity Description

Using the software, create the drawing and produce your own small building using the drawing set-up and the commands that have been demonstrated for you. An alternative is to open your *myblocks.dwg* and use its predefined state to transfer its settings into your new drawing. The units will be the same as they were in the *myblocks.dwg* and are architectural/imperial. See Figure 1 for an example of a finished drawing.



**Figure 2**—Example of a finished drawing

### Generating ideas

In this activity you are limited to a building no more than 12' by 12'. You must create a list on paper or a text file of all the things you want inside the building. That includes all the fixtures, windows, and doors you drew in the Symbols and Standards drawing, and can also include other items such as sinks, a toilet, and counters you may want in the building as well. You then must sketch out on paper an approximation of your building with the things you want inside.

Once your ideas are checked, you can then begin the CAD drawing.

### What you must draw

You need to draw a complete building with a door, a window, at least one light fixture, light switch, and wall outlets placed 8' apart around the inside of the building. The window(s) and door should be placed in the CAD drawing so it “works” with the features you’ve previously listed and the use of your building.

**Commands to Use/Learn**

#### Cardinal directions Circle

**Copy Dimstyle Grid Limits Line Linetype Midpoint Move**

**Offset Polyline Print/plot Snap Spline Text**

**Trim Units Zoom**

**Part 1: Starting Your Drawing**

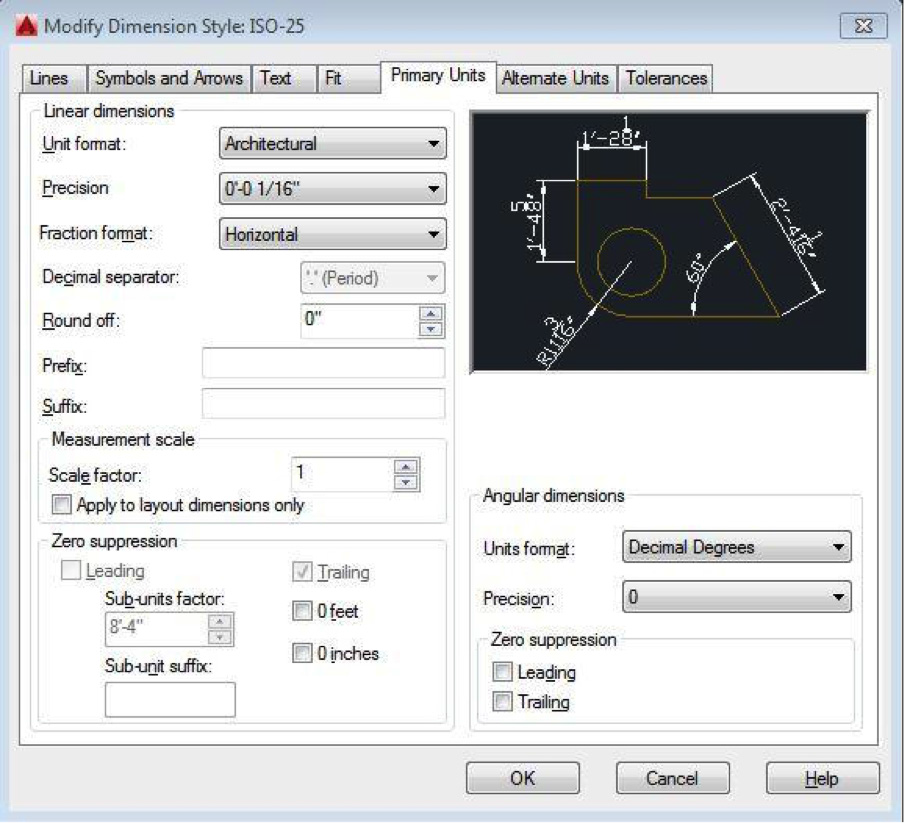
1. **Starting with a New Drawing**

To start a new drawing from scratch, follow the steps below:

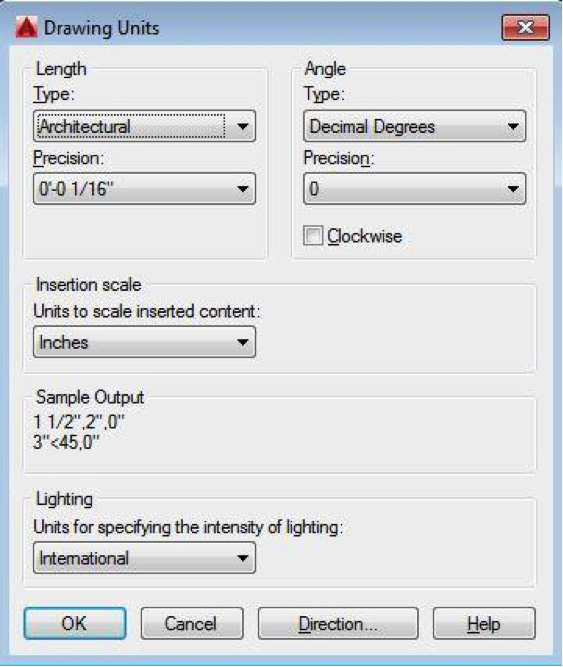
* 1. Open up an imperial border template drawing in your CAD software.
  2. Grid and Snap set-up: set both to **2'**.
  3. Limits set-up: **0,0,0** and upper right corner **32',24'** are set at the command line by typing

**LIMITS** and pressing **enter** to cycle through the choices to ensure they are correct.

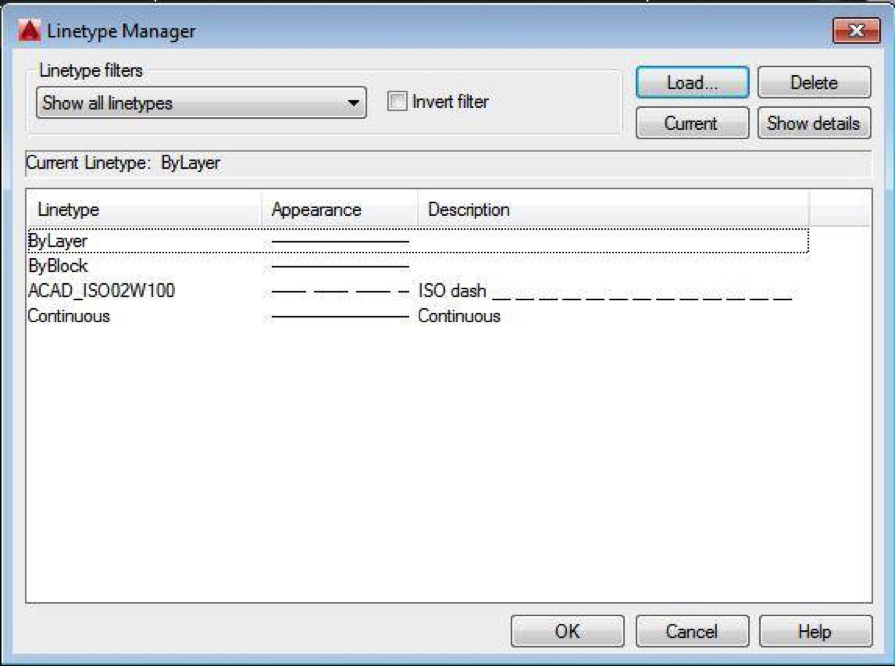
* 1. Dimstyle, Units, and Print/Plot MUST be set to the values in the screen captures for architectural drawing:
     + Under Dimstyle, set “Unit format” to “Architectural” (Figure 2)
     + In the Units window, set “Type” to “Architectural” (Figure 3)
  2. Look at Figures 2, 3, and 4 and apply all settings carefully in AutoCAD. All other Default settings are satisfactory, though they can be changed if required.
  3. **Save** your drawing as *mybuilding.dwg*.



**Figure 3**—Dimstyle window



**Figure 4**—Units window



**Figure 5**—Linetype Manager window

1. **Starting with a Predefined Drawing**

If you are using a previously created drawing as the starting point for this activity, follow the steps below:

* 1. Open your *myblocks.dwg*.
  2. Resave this drawing as *mybuilding.dwg*.
  3. Check that the drawing has the same start-up Units (Figure 3), Limits, and Dimstyle as in the

*myblocks* drawing.

* 1. You will have all the blocks you made before in the Symbols and Standards activity and you may have to move them to the outer edges of the drawing space to make room for the actual building you will draw.

## Part 2: Scaling the Title Block and Border

Type **SCALE**; then highlight the border and title block. Pick the bottom left corner of the title block. Enter the scale factor of **32**, to match how big you changed the drawing limits. The border should now almost fit the limits of the drawing.

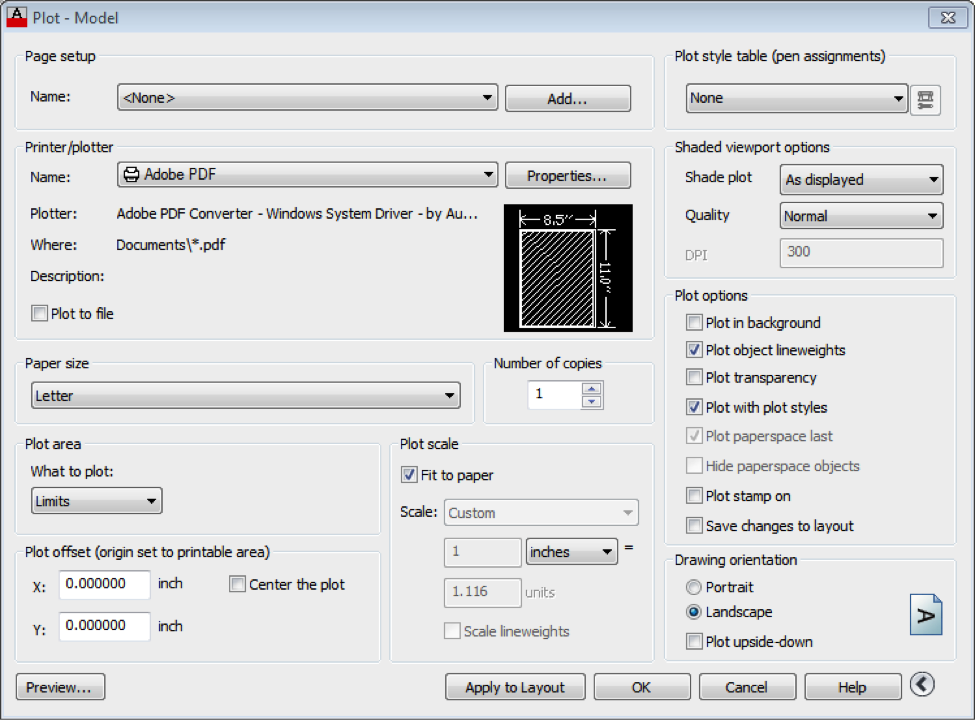
## Part 3: Drawing the Building

1. Ensure that Snap and Grid are on and set to **1'**.
2. Start at least 2' into the drawing space and draw a 12' by 12' box.
3. Type **OFFSET** and set it to **6"**. Press **enter**.
4. Offset all the walls inside the 6" and trim out the excess lines at the corners.
5. Copy the original blocks you made before to place them wherever you choose in the drawing. You may have to rotate them, but you should not have to scale them if you did the *myblocks* drawing correctly.
6. After placing the switch and light fixture blocks, type **SPLINE**. Start the line at the switch and click on all the light fixtures you placed before.
7. Type **LINETYPE** to open the Linetype Manager (Figure 4). You will see some linetypes already loaded, but not the dashed line. Click on Load and choose the dashed line from the selection set.
8. Select the completed polyline and type **PROPERTIES**. A dialogue box will open. Look for the linetype; because you already loaded the dashed line into your drawing, you can select it from the list and your line will change to a dashed line when you do. You must change it back to “continuous” if you wish to continue drawing with continuous lines.
9. Type **DIM** and select the lines you wish to dimension. Make sure the dimensions are outside the building. You should dimension the position of the door and the window as well.
10. Delete out of the drawing the extra blocks you are no longer using.
11. Save the drawing.
12. Plot/print the drawing. Refer to Figure 6.

## Part 4: Printing Your Drawing

### Print/Plot Window

When you want to print your drawing, you must type **PLOT** and make the choices indicated in Figure 6. In this case, the plot is set to save to a PDF file. Otherwise, you can print to your local or network printer by selecting it in the “Printer/plotter” name list. Do not forget to set the orientation to “Landscape” and the “What to plot:” drop-down selection to “Limits,” to plot to a standard letter-size paper.



**Figure 6**—Print/plot window