Activity 2.3.2 – Parametric Constraints

Introduction

Have you ever received an advertisement in the mail that looked like it was tailored specifically for you? How could the company afford to spend so much time and money entering your name and other personal information into the various locations of the advertisement? The answer is the company took your personal information that it has within a database, and had a computer plug specific pieces of your personal information into various locations of a generic document that was set up with links to the database. The same thing happens with email advertisements. This type of work takes a great deal of preplanning to pull off, but the efforts are worth it if a number of customers respond.

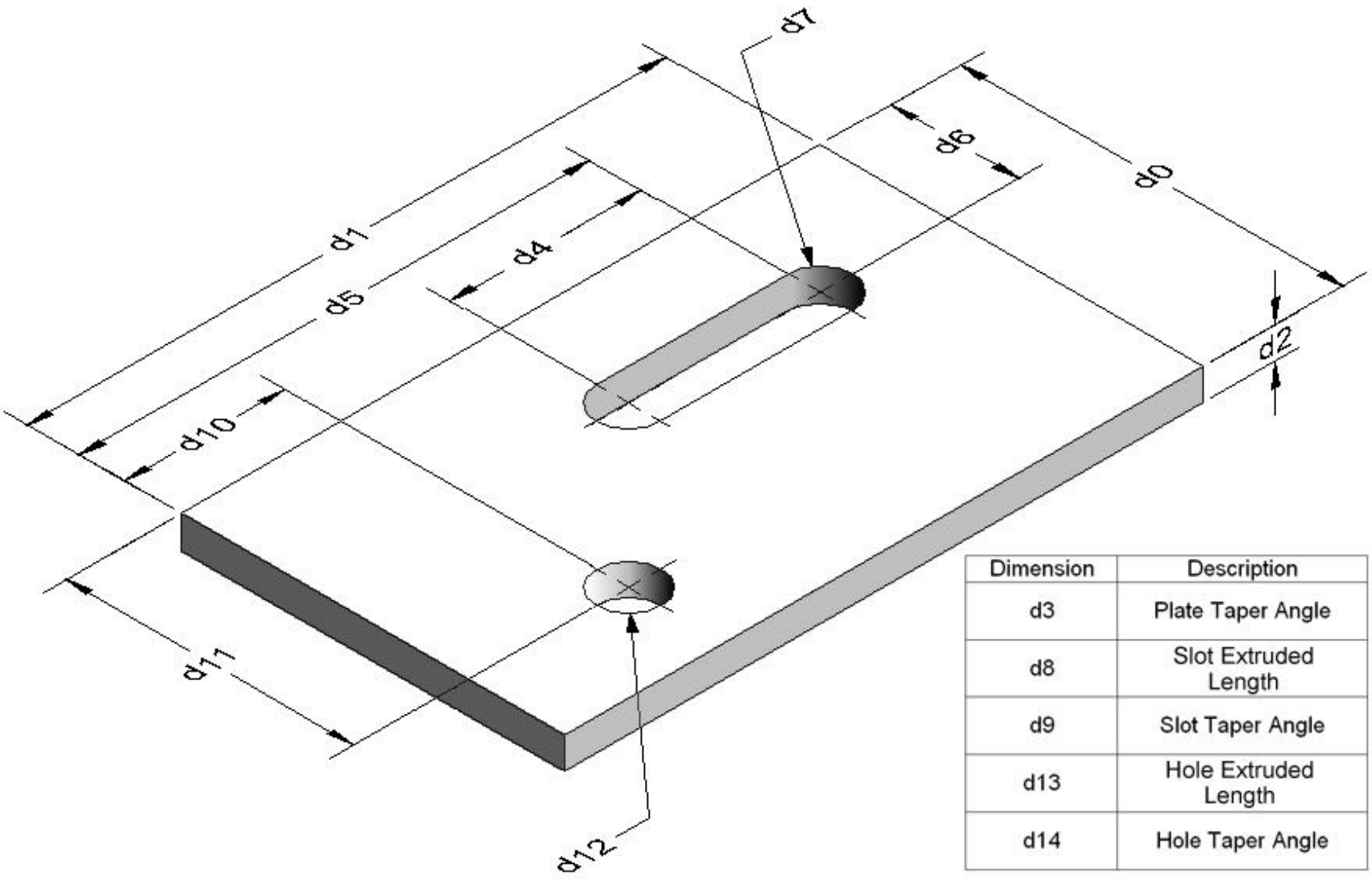
Engineers perform similar types of plug and produce operations, specifically in the area of 3D CAD solid modeling. Numeric constraints, also referred to as parametric dimensions, may not always have a fixed number value. Some objects must be customized, like a tailored suit or dress. If you were to return to one of your elementary school classrooms, you would think that someone took normal sized furniture and uniformly scaled it down. That could very well have been the case. If designed correctly in a 3D CAD solid modeling program, the furniture that you interact with as a young adult can be scaled down by changing one or more dimensions. Companies are beginning to build this type of design flexibility into their internet-based customer ordering systems. If the customer enters specific dimensional values, colors, and sometimes materials into the online database, the computer updates the sizes and features of the various associated parts and places and delivers an order to the company staff. This is only one example of the power of parametric modeling.

Equipment

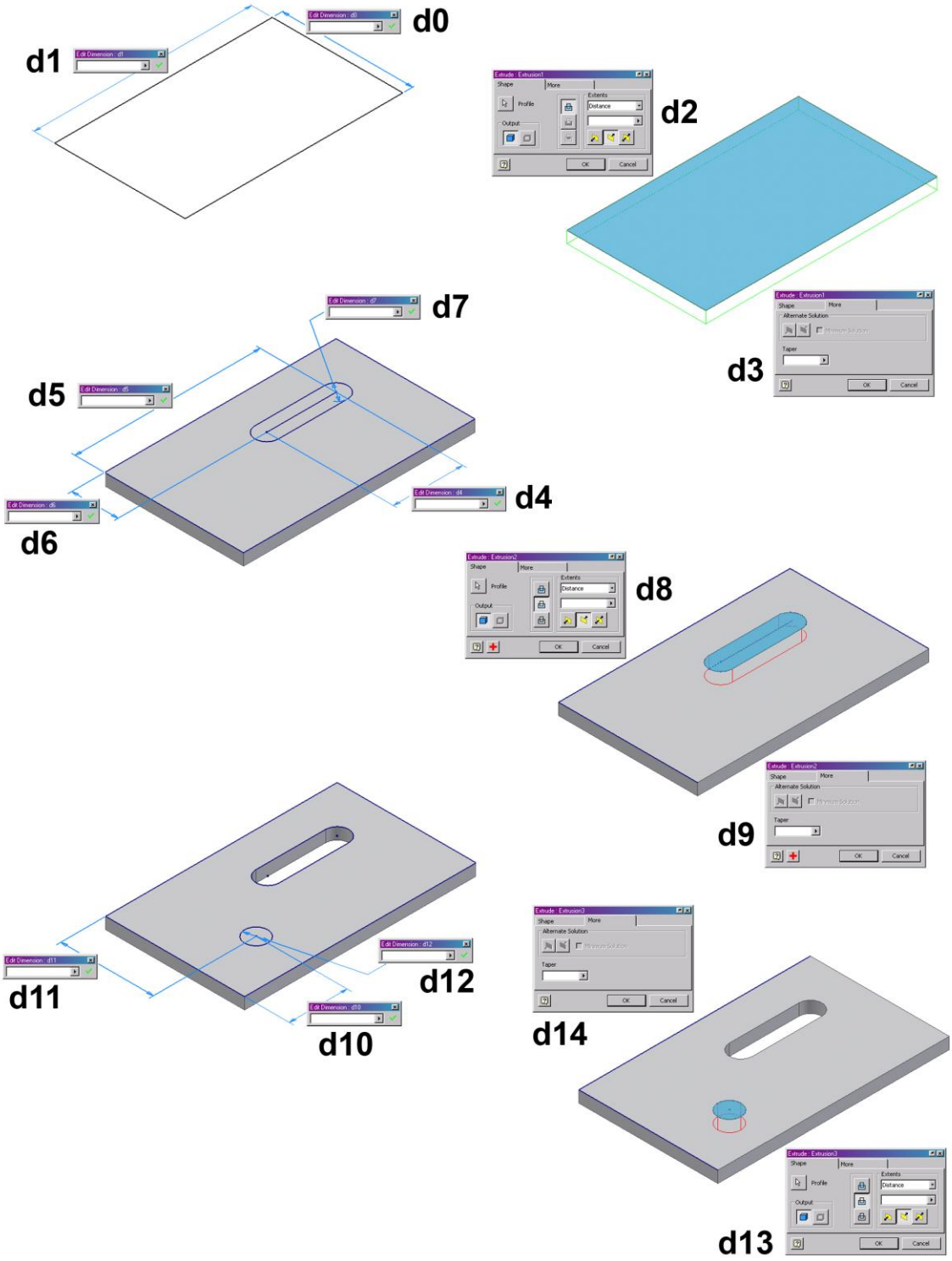
- Computer with 3D CAD solid modeling software
- Engineer's notebook
- Number 2 pencil

Procedure

In this activity, you will learn how algebraic formulas can be used to replace numeric values in a 3D CAD solid model.



Dimension	Description
d3	Plate Taper Angle
d8	Slot Extruded Length
d9	Slot Taper Angle
d13	Hole Extruded Length
d14	Hole Taper Angle



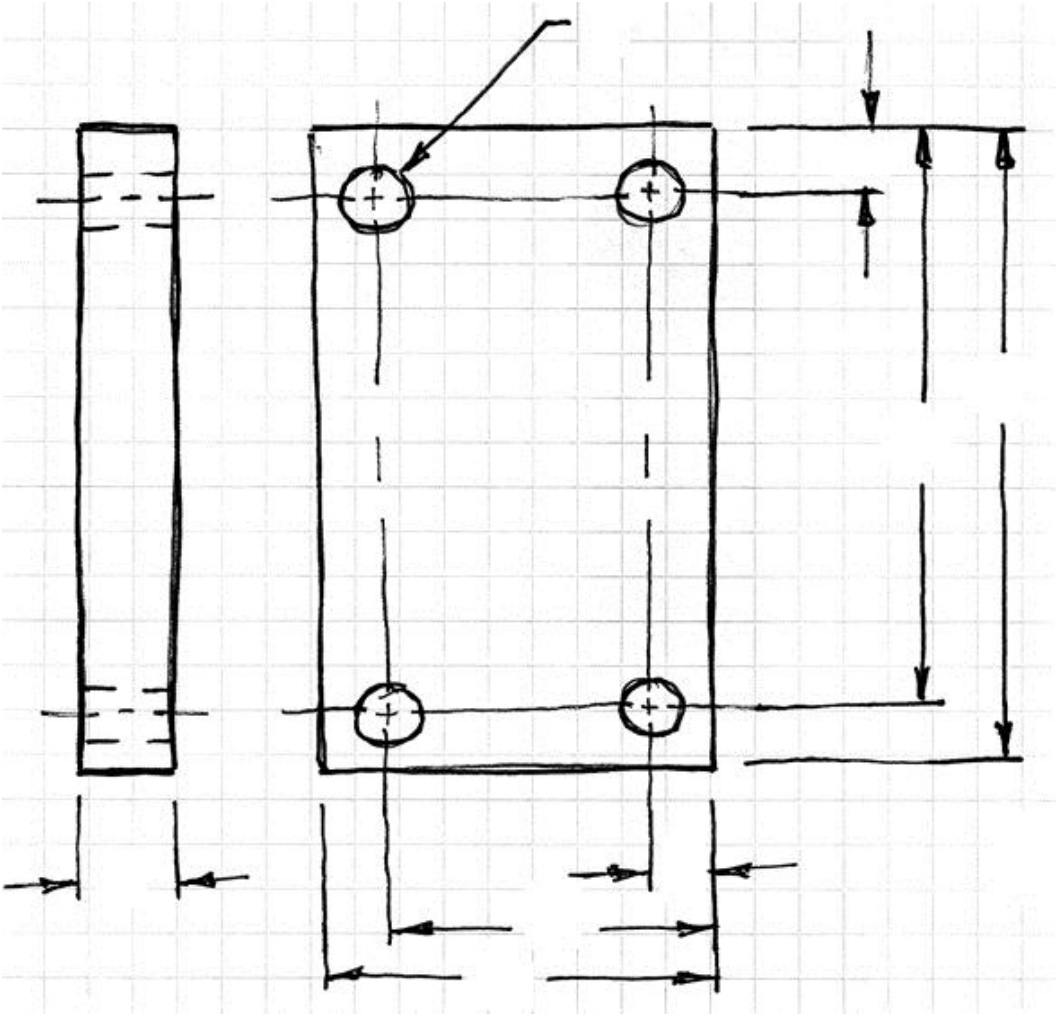
Study the images on the previous pages and the table below. Use the given information to create the missing Parametric Equations and to calculate the missing values. Then, use your parametric equations to create the object in a 3D CAD solid modeling program. The only numeric values that you should enter are 3 inches for dimension d0, and 0° for dimension d3. When finished, save the file and identify its

name and location in your student folder. NOTE: The hole (diameter d12) was created using the CIRCLE tool.

Dimension	Description	Geometric Relationship	Parametric Equation	Value
d0	Overall Plate Depth	--	--	3 in
d1	Overall Plate Width	5:3 ratio; overall plate width to overall plate depth	d0*(5/3)	
d2	Plate Thickness	20 times smaller than the overall width		
d3	Plate Taper Angle	perpendicular to the top and bottom plate surfaces	--	0°
d4	Slot Width	½ the overall plate depth	d0/2	
d5	Slot Width Location	4/5 of the overall plate width		
d6	Slot Depth Location	1/3 of the overall plate depth		
d7	Slot Diameter	two times the plate thickness	d2*2	
d8	Slot Extruded Length	same as the plate thickness		
d9	Slot Taper Angle	same as the plate taper angle	d3	
d10	Hole Width Location	¼ of the overall plate width		
d11	Hole Depth Location	2/3 of the overall plate depth		
d12	Hole Diameter	same as the slot diameter	d7	
d13	Hole Extruded Length	same as the slot height		
d14	Small Hole Taper Angle	Same as the slot taper angle	d9	

CAD file name and location: _____

Model the Arbor Press Cover Plate in a 3D CAD solid modeling program. You will need to use geometric constraints to limit the number of parametric dimensions that are needed. Test your results by scaling the object up or down. If all of the parametric equations are written correctly, the object should increase or decrease in size and maintain its geometric proportions. When finished, save the file and identify its name and location in your student folder.



Example Sketch of the Arbor Press Cover Plate

CAD file name and location: _____

Conclusion

1. What is the difference between a numeric and a geometric constraint?

2. What advantages are there to using parametric equations instead of numeric values?

3. What disadvantages are there to using parametric equations for numeric values?