Math 577, Mathematics Education in the Elementary Schools Fernández, Fall 2019

WHAT:	Tinkercad Tutorial
WHEN:	Due ?????
WHERE:	Posted to Canvas Assignments
LINK:	Send me your link once you have completed the assignment
SAVE AS:	"LastNameFirstNameTinkercad", so I would save my assignment as
	FernandezEileenTinkercad
TO DO:	

In order to complete our manipulative project, I am going to ask you to learn Tinkercad, a free Web-based geometry software application. I wrote this handout to help introduce you to features of Tinkercad and to have a resource for its future use.

I appreciate how long this handout is, but I will ask you to go through it, completing the **STEPS** and the **MAKE!** instructions.

• The **STEPS** introduce you to features of Tinkercad you may use to create your manipulative. These **STEPS** may have a diagram associated with them.

• The **MAKE!** ask you to use the features learned so that we can make the object pictured below! I don't really know what the object is. I guess it looks like a *tunnel*, but to be honest, the object emerged as I was writing these instructions so it became our *target shape*!



If I ask any questions on this handout whose responses are not immediately forthcoming, answers can be elicited by emailing me! It'll be a good way for us to get know each other!

STEP 1: Please create an account at the link below. https://www.tinkercad.com

You can sign in by clicking on this menu:



STEP 2: After you sign in, click Create New Design and the following image will appear on your screen. (see Diagram) The red text contains descriptors I have added to help us talk about the parts of this platform.



STEP 3 (WORKPLANE ROTATE): Rotate your Workplane by clicking CTRL-Mouse or by using the *Cube* in the upper left corner of your space. See if you can get the views illustrated below to show up! (see Diagram) Watch the labels on the Cube as you rotate the Workplane.



STEP 4 (BASIC SHAPES/SHAPE): With your Workplane in a mostly Front Top view, drag a Box from *Basic Shapes* onto the Workplane (see Diagram). Notice that a *Shape* drop down menu emerges on your Workplane offering more tools for tinkering! You can make that drop down menu appear every time you click on a shape that is in your Workplane.



STEP 5: Click on the Workplane. The Shapes drop-down menu disappears. Rotate your Workplane and catch different views of your Box on the Workplane. Is the box sitting on the Workplane? Please play a little in this step! Put your mouse squarely on the Box and move it around your Workplane: watch the location markers change! Keep rotating the Workplane and catch different views! Just have fun! You can click CTRL-Z to undo anything you have done and put your Box back into the original position from Step 4. And even if something really goes awry, just click on box to delete it and drag a new box onto the plane to start over! ③

STEP 6 (HAT): Put your box into its original position and click on it. Can you see the little triangular "*Hat*" that appears above the Box? (see Diagram). Hold the mouse down on the Hat and drag up and down. What happens to the Box? Watch the location markers change! Move your Box above the Workplane and move it below! Change your views to see how the Box looks!



STEP 7 (SHAPES BUTTON DIMENSIONS): Making sure the Box is selected, let's begin looking at some Shapes drop-down menu features. Drag your cursor on the Length, Width and Height buttons and observe how the Box changes (see Diagram for buttons). (Tinkercad measures your objects in "mm")



STEP 8 (EDGE MARKERS): Did you see how the Length, Width and Height of the Box are being interpreted by Tinkercad? (that's a rhetorical question! ^(C)) Again, select the Box. Click the Shapes drop-down menu to go up (see Diagram in Step 7) to create room on the Workplane. Please find the White and Black Edge markers (see Diagram). Drag the White Edge Markers around and describe what they do. Drag the Black Edge Markers and describe what they do. Compare and contrast the effects of dragging the Black and White Edge Markers.



STEP 9 (MARKER DIMENSION FIELDS): Ahh. . . one more option for playing with dimensions! In this step, instead of dragging the White and Black markers, let's see what happens when we just click on them. Please click on the right front White Edge Marker (see Diagram). What color does it turn? What else appears? Now click inside either of the measurements displayed to highlight the measurement in blue (see Diagram) and type in any measurement you want. Please go around the Black and White Edge Markers, click on them, play with changing measurements, and observe the effect on the Box.



MAKE! Let's make the base of our tunnel! Using any of the features you prefer from above, please give your Box dimensions of 50 by 60 for length by width (or width by length) and give it a height of 40. (see Diagrams)



MAKE! I am placing my Box in the center of my Workplane. To do this, I rotated the Workplane view so I was looking straight down at the top of the Box and then I dragged the Box until the location markers read 0 and 0. (See Diagram)



STEP 10 (SHAPES SOLID AND HOLE): Let's return to our Shapes drop down menu. Make sure your Box is selected and that the drop down Menu is open. Locate the two features labeled Solid and Hole (see Diagram).

Click on Solid and see what pops up. Pick any color you want for your Box! (I am partial to blue and lavender tones! ③) Now pick the Hole option. What happens to your Box? Think on this: what do you suppose this feature is for? What do you think it does to the objects in your Workplane? How does the name of the feature (Hole) and its effect on the Box inform your thinking. I will let you wonder about this for just a bit before we return to this feature ③, but for now, click on the Solid feature again to get your pretty colored Box back.



MAKE! All right! Let's drag the "roof" of our tunnel onto the Workplane now. Scroll down the Basic Shapes option until you see a Shape called Round Roof. Drag that onto our Workplane and when you are done, why not make it into the same color as your Box. (see Diagram).



MAKE! Okay. A few problems have arisen for me, but let's take things one step at a time. First, rotate your Workplane so you can see the base of the Roof. Can you see that the Roof base is exactly the same rectangular shape as the Box top? Given this, what dimensions should we make the Roof base? Do you remember the dimensions of the Box top? Please keep in mind that we want the arched part of the Roof to lie over the shorter length of the Box's roof. (see Diagram)



STEP 11 (ROTATE WITH CURVED ARROWS): I think I have an orientation problem which you may or may not have. I want the arch of my Roof to align with the shorter Box top length. Thus, I want both 50 mm lengths to line up. I can think of two approaches for fixing this. One approach you can do yourself (!) with what you've learned already! Can you think of what it is?

Here's a second approach that will introduce you to yet another Tinkercad feature! Click on the Roof and please notice the Curved Arrows that appear. (see Diagram)



If you hover your mouse over the arrows, you will notice circular increments appearing in a "wheel." There is an interior wheel and an exterior one, with the latter having smaller increments than the former (see Diagram).



This feature allows you to rotate your shape!! Hold your mouse down on the Curved Arrows and slide mouse outward toward the Exterior circular increments (see Diagram). Then start turning the mouse along the circular increments in a clockwise or counterclockwise direction. Degree measures will start popping up! Keep turning until you get the 50mm roof length to align with the 50mm Box top. How many degrees should that be? (see Diagram)



MAKE! Now we have to get our Roof on top of the Box. Do you remember how high the Box is? And do you remember which feature enables you to "lift" the Roof so that you can move it? (see Diagram) After you lift the Roof, slide it over to the top of your Box with your mouse!



STEP 12: (COPY AND PASTE) Here's how my shape looks so far. (see Diagram). My Roof feels like it's a little off so I double checked the dimensions and also tried to Rotate it to tweak, but I am going to leave it as is. We have to construct the Opening going down the middle of our target tunnel. If you look at the shape of the Opening, it's similar to the shape of the Roof. Rather than drag a new Roof onto the Workplane and reorient things again, let's make a copy of the current Roof and copy it into our Workplane. You can do this by selecting the Roof and hitting CTRL-C or by selecting the Roof and clicking the Copy button (see Diagram). Use CTRL-V to Paste.



MAKE!: Use the Hat to lower the Opening to ground level. Watch the measurements as they are relative to the 40 mm height, so I lowered to -40mm. (see Diagram)

Next adjust the measurements! It has to fit inside the Box, so I made the width 20 mm for symmetric centering within the 50 mm Box width (15 + 20 + 15 = 50). I also raised the height a smidge from 10mm to 15 mm. (see Diagrams) I then moved the Opening with the left-right arrows on my computer to center it along the Box width.



STEP 13 (SHAPES HOLE): Here's what my Workplane currently looks like from the perspective of the Opening looking at the Box. (see Diagram on next page)

Now, please recall when I asked you to guess the purpose of the Shapes Hole feature in Step 10. Click on our Opening and select Hole in the Shapes menu. What happens to the Opening? (see Diagram) Now try this: click on the Opening and use the arrows on your computer to move it *into* the Box. (see Diagram) Can you tell yet what it's doing? It's actually creating a Hole in the Box in the shape of your Opening!

In order to ensure that the Opening goes all the way across your Box, it helps to give the Hole a length that is *longer* than the Box into which we are fitting it. So click on your Opening, change the length to anything longer than 60mm, and slide it into the Box!



STEP 14 (GROUP): Hmmm. . . Our shape's Opening still doesn't look like a tunnel going through. (See Diagram) That's because we have one more feature to learn! Using your mouse, select everything on your Workplane. When you do this, a tool shows up called Group. (see Diagram) When you click on this tool, it will cement together all the shapes that are selected. That is, all the selected shapes will become one shape and can be moved and treated as one entity! Okay! Group all our pieces together and watch what happens! Rotate your Workplane to see different perspectives! (see Diagram)



STEP 15 (UNGROUP): Just to finish up on Grouping, if you ever want to separate out shapes that have been grouped, there is an Ungroup tool that enables you to do that. (see Diagram) No need to do that now! But in case you need it, you are now good to go! ③

