0. Sign up for Tinkercad and Create a new design

- On one of the library Macs, single left click one of the icons for Safari, Chrome, or Firefox web browsers in the bottom bar.

- On one of the library PCs, single left click one of the icons for Internet Explorer or Google Chrome in the bottom bar.

- All of the web browsers have a large bar across the top. It should say www.eapl.org. Type Tinkercad.com in that bar instead and then press the Enter key on your keyboard.

- Once it loads, click Sign up (or Sign in if you have an account) in the upper right corner.

- Fill out the information they ask for to create an account. Or type your username and password.

  Username: __________________  Password: __________________

- On the page that loads, click the multicolor Tinkercad logo in the upper left corner.

- Click the Create new design button in the middle left of the page.
Design the Hancock Building

1. Right side menu
   - The Tinkercad right side menu has lots of the buttons you need for designing objects.

2. Design & Insert shapes
3. Moving shapes
4. Changing the view
5. Measuring shapes
6. Resizing shapes
7. Change colors
8. Insert and resize wedges
9. Copying and Rotation
10. Workplane tip
11. Holes
12. Grouping
13. Complete the corners
14. Move the workplane
15. Shape generators
16. Top and antennas
17. Rename your design
18. Download to your computer
19. Upload for 3D printing
20. Keyboard shortcuts

1. Right side menu
   - **Import** lets you to bring in pre-made 3D files to add/modify your design.
   - **Export** lets you create a 3D printable file of your design such as .STL.
   - **Share** allows you to create a link to send your design to others.
   - **Workplane** lets you change the surface where objects are initially placed.
   - **Ruler** tool helps do advanced measurement and placement of pieces.
   - Below those is a drop down menu that allows us to select from sections of shapes that either Tinkercad employees or other Community members created. These include geometric **Basic Shapes**, **Text** letters and numbers, @&!? and other **Symbols**, **Connectors** for designing objects like robots, and a few **Extras**. Click the drop down arrow an extra time to hide the menu.
   - **Basic Shapes** includes two premade holes (a box and a cylinder), although any shape can be turned into a hole in Tinkercad (more on this later).
2. Design & Inserting shapes

- We’re designing the John Hancock building today!
- Let’s think of this building as 9 vertical sections.

- We’ll use a red box for the center core.
- We’ll use 4 wedges for the slanted sides.
- And 4 modified pyramids for each of the slanted corners.

- Insert the center core by finding and clicking the red box in the basic shapes section of the right side menu, and then drag your mouse to the right and click to put it down somewhere.

3. Moving shapes

- It’s easiest to design an object when it is in the middle of the screen.
  - Click and hold and drag the red box into the middle of the grid so it will be easier to see for later. Make sure NOT to click on any of the square or arrow handles before dragging. Use a location like this one on a shape to move it.
  - Labels on the screen will let you know how far left/right and forward/backward you’ve moved the shape.

4. Changing the view

- This design requires us to rotate around a bunch to check our work.
- Drag the box in the upper corner side to rotate around the current center.
- Use the home button to return to the original starting view.
- Right click anywhere and drag to rotate around the center of your view. Do this often!
- Select a shape or shapes then click the 2nd circle fit view to selection to focus on them.
- Click + / −, use your mouse scroll wheel or 2 finger swipes on a trackpad to zoom in / out.
- To move left/right or forward/backwards without rotating, hold the Shift key and then right click and drag in any direction. This pan move changes the center around which you rotate.
A slightly downward looking diagonal view is usually the best. Downward diagonal views allow you to see the top and at least two other sides of your object(s) and most if not all of the on-screen controls. You may want to rotate to make controls bigger and easier to click as well. Zooming in can also help.

Right click and rotate to see the red box at a downward angle.

5. Measuring shapes

- Let’s see how big the red box is by default.
- Click on the red box to select it.
- Without clicking, place your mouse over any of the square resize handles and wait. In a few seconds, the measurements of your shape will appear. To see the height of the object, hover on the white resize square at the top. It should measure 20 x 20 x 20 millimeters.

6. Resizing shapes

- We’ll build Hancock from the inside out, starting with the center core, so we can see everything easily.
- Change the dimensions of the red box that is your center core to be 20 x 20 x 110 mm in length x width x height. You shouldn’t have to change the length or the width.
- Use the white resize handle at the top of your box to increase the height.
- As soon as you start increasing the height, a text box listing the height will appear. You can single click into it, type the height you need (110) and then hit enter on your keyboard.

7. Change colors

- To change the color of any shape click on it.
- Its Shape menu should appear in the upper right.
- Click on the Solid circle to pull up color options.
- Single click on one of the dark gray or black colors.
8. Insert and resize wedges (Slanted sides)

- Now, from the right side menu insert a dark blue wedge.
- Place it next to one of the four sides of the center core.
- Leave its width alone at 20 mm. Decrease its depth to 10 mm. Increase its height to 110.
- Make sure it’s perfectly even with the edge of the center core.

9. Copying and Rotation

- We need three more copies of the slanted side.
- After clicking on your first slanted side, Ctrl+C and Ctrl+V on a PC or Command+C and Command+V on a Mac work just like usual.
- Or after clicking on your first slanted side, hold the Alt key and then click and drag away from your first slanted side to create a copy.
- You’ll need to rotate each copy of the slanted sides by 90°. To do this click on the slanted side, and use the curved double sided arrow that’s even with the base of the workplane. Drag it left/right around the circle that appears. Stay inside the rotation circle to do 22.5° rotations. Move outside the circle to do 1° rotations. Labels appear on screen to let you know how far you’ve rotated. You can click into the text that says how far you’ve rotated and type in a custom amount and then hit enter to apply it.
- Remember to change the colors of the slanted sides to match your center core.
- Your design should look like the picture to the left when you’ve completed step 9.

10. Workplane tip
- The four corners are a bit tricky. We can’t use wedges like we did for the slanted sides.
- We can modify pyramid shapes to fill in the corners though!
- From the right side menu, click a pyramid and insert it a ways away from your design.
- We’re going to show you how to remove parts from an existing shape, so it’s really important to be very accurate.
- You can use the darker blue grid lines on the workplane to align the default sized 20 x 20 mm pyramid on top of four of the 10 x 10 mm squares.

11. Holes
- Now, from the right side menu, find and insert a box hole.
- We can use holes to remove parts from our design after grouping.
- Place it to cover half of the yellow pyramid. You may want to use the workplane grid lines to line up the hole with the pyramid.
- Create another box hole either by the Alt+drag, copy+paste, or right side menu methods. Whichever method works best for you is fine. Place the second box hole so that 3/4s of the yellow pyramid is covered.

12. Grouping
- Unselect the last box hole you inserted by clicking on any blank space on the workplane where there aren’t any parts of our design.
- Now, click and hold and drag from space near our yellow pyramid and two box holes to select them. You only need to overlap a part of each shape, not every part of all three.
From above the Shapes(3) menu, click the joined circle and square Group button.

This will remove 3/4s of the pyramid and make it the exact shape we need to fill the gaps left by the slanted sides we designed earlier.

13. Complete the corners
   - Change the height of the pyramid to 110mm. We’ll leave them yellow for now to make it easy to see them as we position them in the four corners.
   - Use your keyboard shortcuts Ctrl+C and Ctrl+V, Command+C and Command+V, or Alt+drag to create three extra copies of our completed slanted corner.
   - Drag them to the four corners.
   - Rotate them using the curved double sided arrow rotation handles on the base of the workplane.
   - Also, make sure to change the color of each one to match the center core.

14. Move the workplane
   - The X lines along the edges of the Hancock building are right on top of the slanted sides.
   - If we tried to manually rotate X shapes ourselves, we would likely not be able to perfectly mirror that slanting edge.
   - We can use the workplane tool to perfectly mirror that side of our object.
   - At the top of the right side menu, click the workplane button.
   - Drag your mouse around the sides of our shape.
   - When we click one of the sides, that side becomes the new base. Any shapes we insert after moving the workplane around are inserted perfectly even.
   - Click on one of the four slanted sides.
   - Right click and drag to rotate around to get a feel for what this did.
15. Shape generators

- Now that we’re even with one of the four slanted sides, let’s use a basic shape generator to automatically design the X lines for us.
- Although there are two whole menus of shape generators under the Community section of the right side menu, there is one Text shape generator under the Basic shapes section of the right side menu.
- Click to insert one of these Text shape generators and place it in the middle of one of your slanted sides.
- In its shape menu, there should be a list of variables or parameters we can change.
- In the first Text box, let’s change it to have six or seven Xs. XXXXXX
- And let’s change the Font to Sans.
- Use the rotation handle to make the text is oriented correctly. You’ll probably need to rotate it 90°.
- Using the white resize handle just beneath the up arrow lifting tool, decrease the height of your text to 1 mm. Or change the height just beneath Font in the shape menu.
- Use the resize handles to change the length and width of the text sections to make sure they cover the entire slanted side.
- Do this three more times to complete the other three sides.
- Move the workplane by clicking the workplane button from the right side menu and then simply click another one of the sides of the shape you need to add XXXXXXs to.
- Remember to change the colors to black when you’ve complete all four sides.
- Put the workplane back to its default location by clicking on the workplane tool from the right side menu, and then click in any blank space away from your design.
16. Top and antennas

- The Hancock has a mini building and antennas on its top. Let’s make those to finish our design.
- Use the keyboard shortcut **Shift+right click and drag** to move up to the top of our model, and use the + button, your scroll wheel, or your trackpad to zoom in.
- Place the workplane on top of the building.
- From the right side menu, insert a red box on top of the building.
- Change the size of the red box to about 7 x 12 x 4 (length, width, height).
- After you’ve resized it, drag it to about the center of the top, and change its color to black.

- Move the workplane on top of this new section.
- From the right side menu, insert an orange cylinder.
- Change the size of the cylinder to about 2 or 3 mm long and wide, and leave its height at 20mm. (If you manually type in your sizes, you can do something like 2.5.)
- Change the color of this cylinder to white.
- Use the Alt+drag, Ctrl+C and Ctrl+V (PC), or Command+C and Command+V (Mac) shortcuts to create another copy of your resized cylinder.
- Put the workplane back to its default location by clicking on the workplane tool from the right side menu, and then click in any blank space away from your design.

17. Rename your design

- To rename your design, click on the funny name Tinkercad gave it automatically in the top left corner.
- Type a new name, it can be whatever you like, but we recommend something you’ll remember, like “[Your name’s] Hancock Building”.
- Hit Enter on your keyboard when you’ve finished typing in the name.
18. Download to your computer

- Now, let’s download your model.
- Above the right side menu, click Export.
- In the menu that appears, make sure Everything in the design is selected.
- Then click .STL. Use the next window that appears to pick where to save your model.
- Make sure to save it somewhere you’ll remember. We recommend the Desktop.

19. Upload for 3D printing

- Go to [http://www.eapl.org/create/forge/3d-print-job-submission](http://www.eapl.org/create/forge/3d-print-job-submission) in a web browser.
- Scroll down to see the form. Fill out your name, library card #, email address, phone number. We ask for this contact info so we can get back to you with any questions.
- Click the circle button for the single color you would like your object printed in.
- (Our 3D printer filament can be painted over if you want to make the antennas white.)
- Click Choose File and then find the 3D file you want to submit and click Open.
- Click Upload to the right once the file name of your 3D model appears. Uploading may take a while, please be patient. As soon as it says your file name next to Choose file, you're ready to submit your design – you don’t have to click the extra Upload button
- Type in any Comments. You say something like “Reduce the size by 10%, please.”
- Click the button pictured below once.
- Our Hancock model will print fine. Our 3D printer can print volumes of up to 145 x 145 x 150.7mm or 5.7 x 5.7 x 5.9 inches (length x width x height).
**Tinkercad keyboard shortcuts**

### Moving object(s)

<table>
<thead>
<tr>
<th>Key Combinations</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 / ← / → / 1</td>
<td>Move object(s) along X/Y</td>
</tr>
<tr>
<td>ctrl + 1 / 1</td>
<td>Move object(s) along Z</td>
</tr>
<tr>
<td>Shift + 1 / ← / → / 1</td>
<td>×10 Nudge along X/Y</td>
</tr>
<tr>
<td>ctrl + Shift + 1 / 1</td>
<td>×10 Nudge along Z</td>
</tr>
</tbody>
</table>

### Keyboard + mouse shortcuts (press and hold mouse button, then move mouse)

<table>
<thead>
<tr>
<th>Key Combinations</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alt + left mouse button</td>
<td>Duplicate object(s)</td>
</tr>
<tr>
<td>Shift + left mouse button</td>
<td>Select multiple object(s)</td>
</tr>
<tr>
<td>Shift + hold while rotating</td>
<td>45° rotation</td>
</tr>
<tr>
<td>Alt + hold side handle</td>
<td>Scale (1D)</td>
</tr>
<tr>
<td>Alt + hold corner handle</td>
<td>Scale (2D)</td>
</tr>
<tr>
<td>Shift + hold corner handle</td>
<td>Scale (3D)</td>
</tr>
<tr>
<td>Shift + Alt + hold corner handle</td>
<td>Scale (3D)</td>
</tr>
<tr>
<td>Shift + Alt + hold top handle</td>
<td>Scale (3D)</td>
</tr>
<tr>
<td>Shift + right mouse button</td>
<td>Pan view</td>
</tr>
</tbody>
</table>

### General shortcuts

<table>
<thead>
<tr>
<th>Key Combinations</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ctrl + c</td>
<td>Copy object(s)</td>
</tr>
<tr>
<td>ctrl + y</td>
<td>Paste object(s)</td>
</tr>
<tr>
<td>ctrl + z</td>
<td>Undo action(s)</td>
</tr>
<tr>
<td>ctrl + shift + z</td>
<td>Re-do action(s)</td>
</tr>
<tr>
<td>ctrl + g</td>
<td>Group object(s)</td>
</tr>
<tr>
<td>ctrl + shift + g</td>
<td>Un-group object(s)</td>
</tr>
<tr>
<td>ctrl + p</td>
<td>Duplicate in-place</td>
</tr>
<tr>
<td>ctrl + l</td>
<td>Lock object(s)</td>
</tr>
<tr>
<td>ctrl + a</td>
<td>Select all object(s)</td>
</tr>
<tr>
<td>alt + d</td>
<td>Delete object(s)</td>
</tr>
<tr>
<td>m</td>
<td>Workplane toggle</td>
</tr>
<tr>
<td>r</td>
<td>Ruler toggle</td>
</tr>
<tr>
<td>s</td>
<td>Fit view to selected object(s)</td>
</tr>
<tr>
<td>d</td>
<td>Drops object(s) to work plane</td>
</tr>
</tbody>
</table>

**Legend**

- 1: Press the number 1 key.
- alt: Press the alt key.
- shift: Press the shift key.
- ctrl: Press the ctrl key.
- space: Press the spacebar.

Go to [https://www.tinkercad.com/quests/](https://www.tinkercad.com/quests/) and scroll down all the way to the bottom to see the most up-to-date list of Tinkercad keyboard shortcuts.
Design the Hancock Building

Recommended Additional Resources:

Other technology classes
Go to http://www.eapl.org/events to view and signup for other computer classes.

Class handouts
Go to http://eapl.org/events/computer-programs/class-handouts to download copies of class handouts and exercise files.

Librarians, Computer Aides, and Makerspace Assistants
We are glad to help you out at the second floor reference desk or in the Makerspace as best we can while helping others.

Help appointments
Ela Library cardholders can schedule one-on-one appointments with librarians for further help. We can help with our Digital Media Labs or with general technology questions in our areas of expertise. Appointments last up to one hour. Paper appointment request forms are available at the 2nd floor reference desk. You can also request appointments online:

- Go here http://www.eapl.org/DMLhelp to sign up for a Digital Media Lab appointment.
- Go here http://www.eapl.org/one-one-technology-help-appointment-request to request a general tech help appointment.

Tech Tutoring
The last Wednesday of some months, a tech savvy librarian is available for six 30 minute tech tutoring appointments. Bring a list of questions and we’ll help with as many as possible. Limit one tutoring appointment per month per patron. First registered first served, no library card required. Go to http://www.eapl.org/events to register for a session.

Databases
The Library offers card holders access to many premium databases. These include two which can help you learn more about technology.

- Gale Courses offers a wide range of highly interactive, instructor led courses that you can take entirely online. As an Ela Area Public Library card holder in good standing, you are entitled to these courses at no cost. Courses run for six weeks and new session begin every month.
- Lynda.com offers technology training with over 20,000 training videos on over 300 topics with exercise files included. The Library pays for you card holders in good standing to access this resource, however you will be required to create a free account. *Please remember to log out when you are finished.

Access both of these databases from the library Research page: http://www.eapl.org/resources

Books
A few books in the library collection related to this book are:

- 3D modeling and printing with Tinkercad: create and print your own 3D models by James F. Kelly
  Call Number: 006.686 TINKERCAD
- 3D printing with AutoDesk 123D, Tinkercad, and Makerbot by Lydia Sloan Cline
  Call Number: 621.988 CLI

Free online tech training websites
Forge Class Evaluation

Class Title: Design the Willis Tower taught by Brian and Chris Date: 3/14/2017

In terms of your skill with technology, how do you consider yourself?

□ Absolute Beginner (no or little experience with computers, NOT yet comfortable using a mouse and keyboard)
□ Beginner
□ Intermediate
□ Advanced

In terms of your skill doing 3D design or using Tinkercad, how do you consider yourself?

□ Absolute Beginner (no experience)
□ Beginner (some experience, but not comfortable using)
□ Intermediate (some experience, comfortable with the basics)
□ Intermediate/Advanced (experienced with basic and intermediate functions, but require training on advanced functions)

How much do you feel that you learned?

□ I learned a lot
□ I learned some
□ I didn’t learn much
□ I learned nothing

How did you perceive the pace of the class?

□ Too Fast
□ Just Right
□ Too Slow

Were the handouts helpful?

□ Yes □ No If no, why not?

What did you like most about the class?

What did you like least about the class?

What other topics would you like to see in a future Forge classes?

How do you normally find out about library computer classes?

□ Footnotes (Library Newsletter)
□ Library Website
□ Other ________________________________

If you are not an Ela Area Public Library card holder, where is your home library?

Any additional comments: