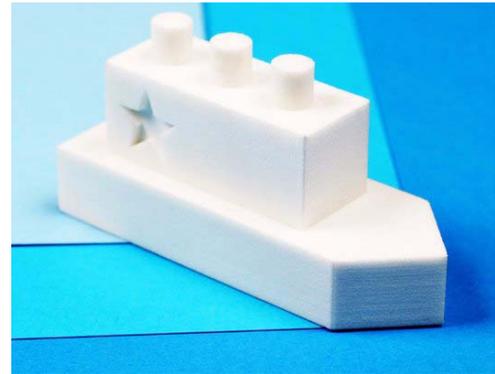
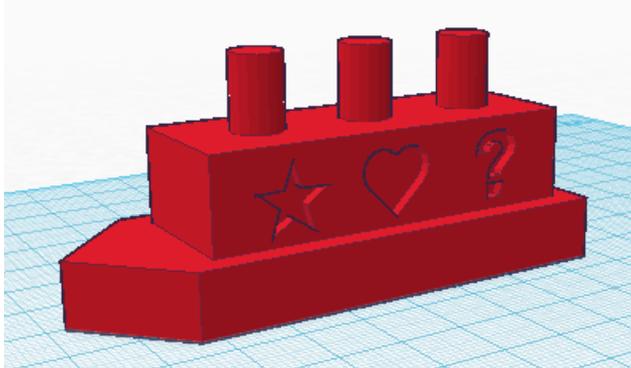


Getting Started in Tinkercad

By Bonnie Roskes, 3DVinci

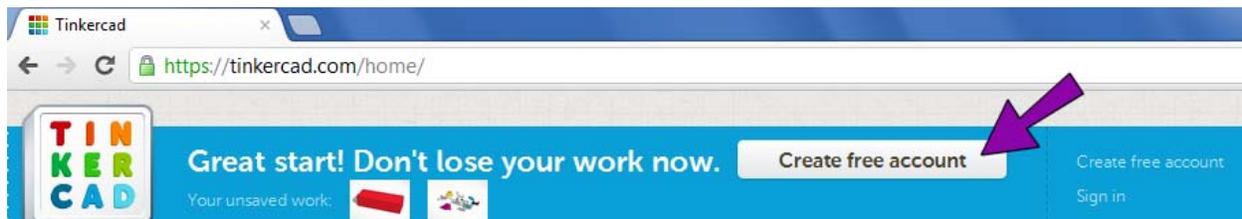
Tinkercad is a fun, easy to use, web-based 3D design application. You don't need any design experience - Tinkercad can be used by anyone. In fact, kids are Tinkercad's target audience, so don't worry - this project isn't complicated! Sit back, follow the steps, and in no time you'll be able to complete this cute little boat (shown in red below, next to a 3D printout in white, of a similar boat):



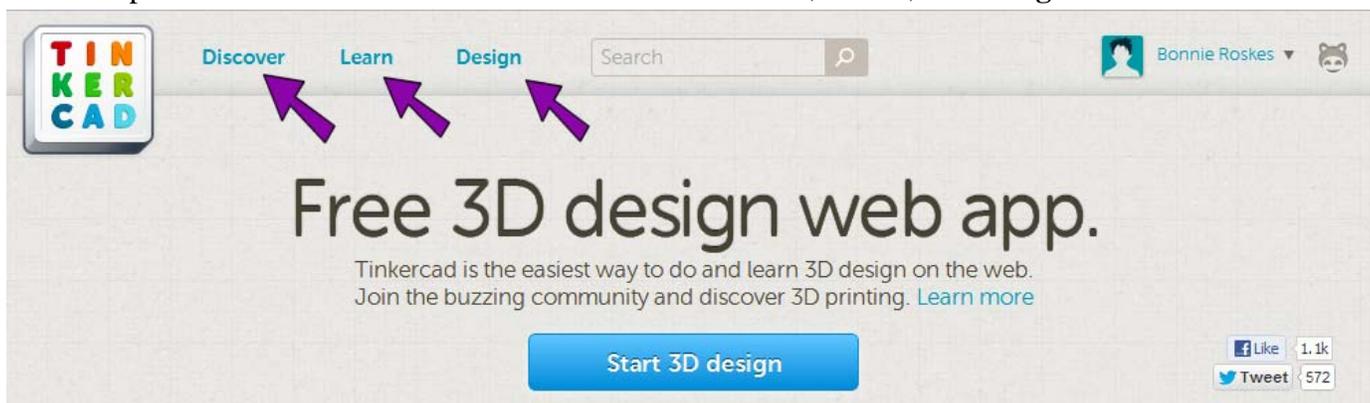
The cool thing about Tinkercad is that it's ideal for creating things that be *printed*. No, not printed on a boring and flat 2D sheet of paper! Tinkercad is made for producing *actual objects*: you can easily send your model to a 3D printer and end up with an actual object you can hold in your hand.

Step 1: Have a Look Around

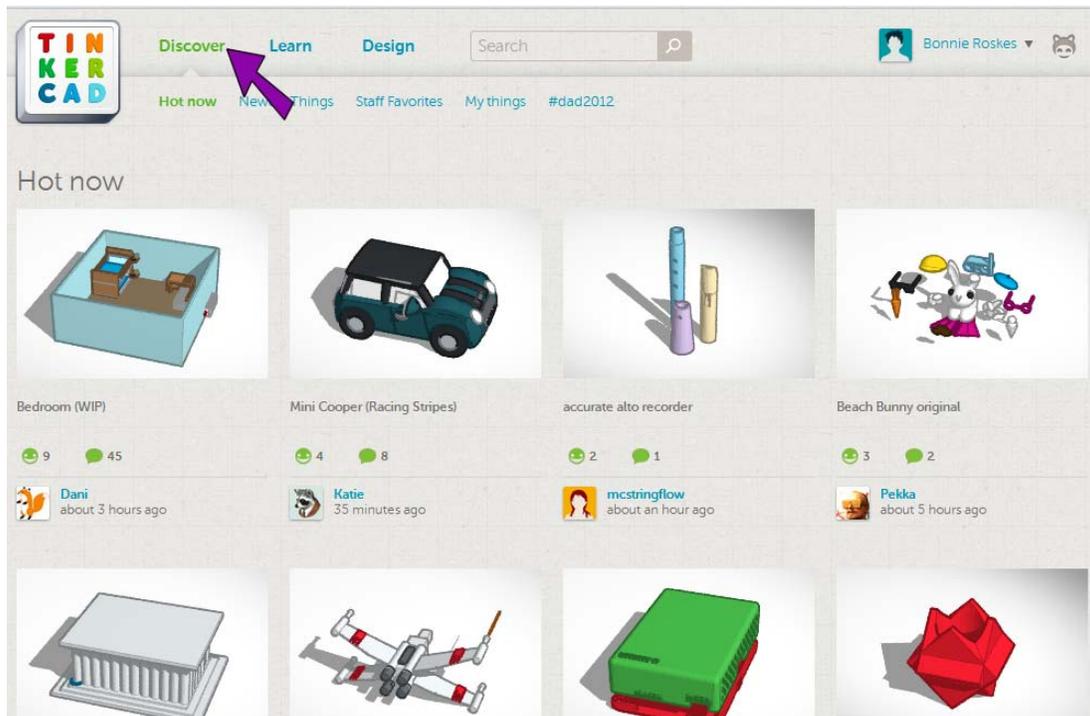
1. Tinkercad's website is (as you'd expect) www.tinkercad.com. All work is done and saved on the web; there's nothing to install onto your computer. You don't need a Tinkercad account to design things, but it's free to set one up, and with an account you get to save your work. So there's no reason not to create an account.



At the top of the Tinkercad site are three main links: **Discover**, **Learn**, and **Design**.



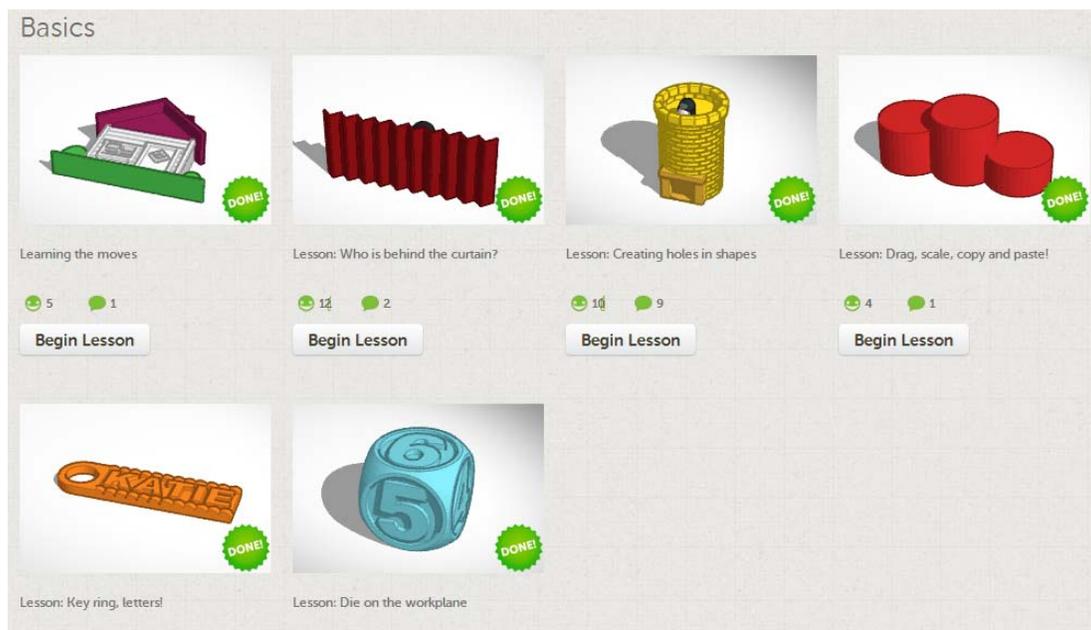
- Click the **Discover** link, which takes you to a page of interesting models you can peruse. At the top of this page you can also search for something specific, check out the newest models, see what models the Tinkercad staff loves, and sometimes you can even see special seasonal models (such as stuff for Father's Day).



If a model you see strikes your fancy and you want to see more, click on it to see a larger view. You can see a still view of the model, or view it in 3D so that you can turn it around and zoom in and out. The **Copy and Tinker** button lets you open it in Tinkercad so you can see how it was made; you can make any changes you like. And of course, you can send any Tinkercad model to a 3D printer, even if you didn't make it yourself!

Your browser's Back button will take you back to Tinkercad's main pages, when you're finished tinkering.

- The **Learn** link at the top of the main page takes you to a series of lessons. These are fun and short guided projects in which you follow directions in Tinkercad to create, move, and modify shapes. Try a few out.



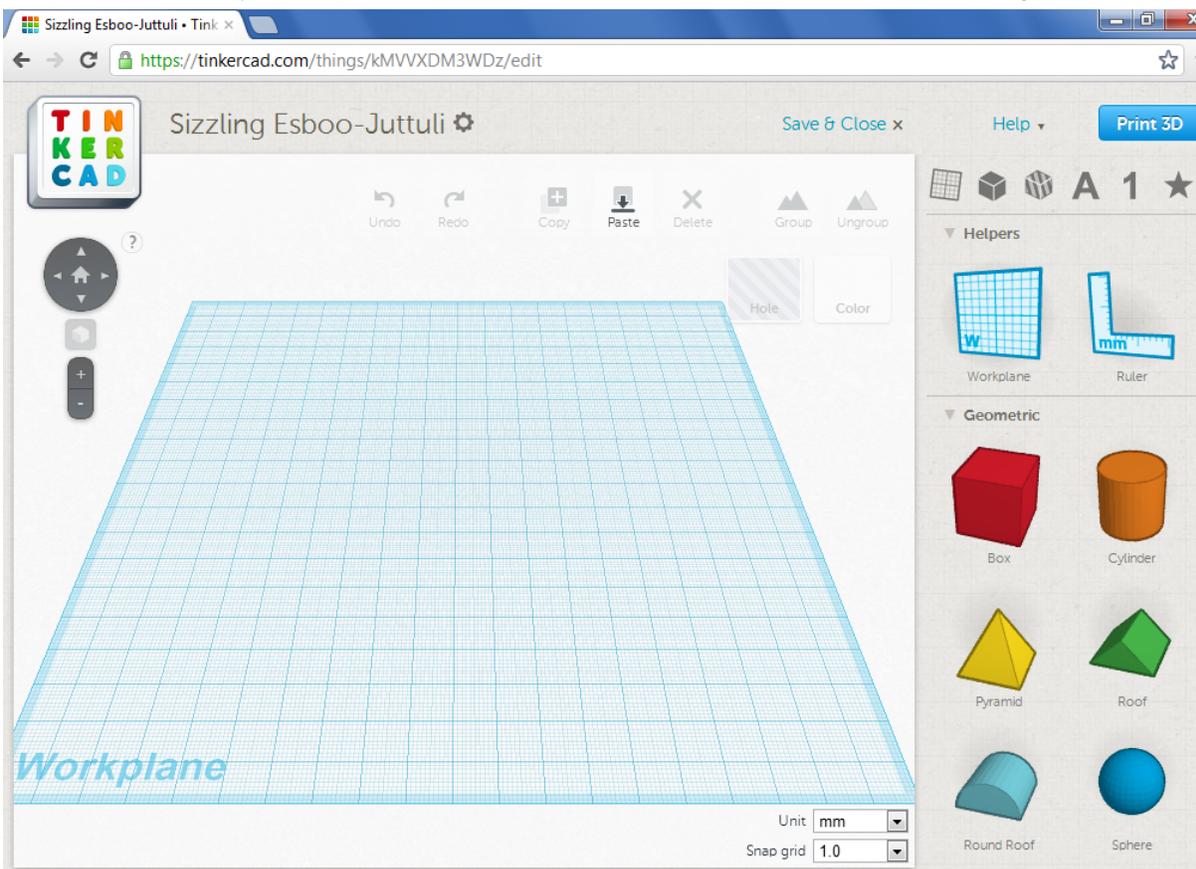
While Tinkercad's lessons are great for getting a feel for how Tinkercad works, they have you working in specific places with specific shapes, defined by guidelines. This project you're reading now starts from a blank workplane, and shows how to create a model from scratch.

Step 2: Start Your Thing - the First Shape

1. Ready to get started already? Click the **Design** link at the top, then click **Design a new thing**.



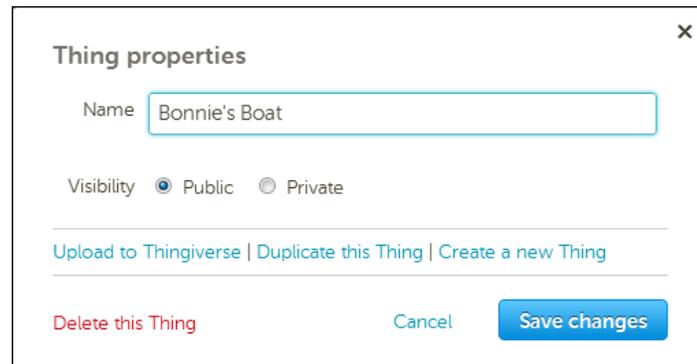
You're taken to a new web page set up for your model, and your model is assigned a crazy name (what on earth is "Sizzling Esboo-Juttuli"?). An empty workplane (the large, blue grid) takes up most of the screen. The grid lines are all 1 mm apart, which makes it easy to see how large things are. **Snap grid** is set to 1 mm, which means you can move things by 1 mm increments (but you can change this via the **Unit** box at the lower right corner). The design tools are on the right side: the row of icons across the top open the various sets of tools: **Helpers**, **Geometric**, **Symbols**, etc. Scroll down the tool lists to see what's there for you to use.



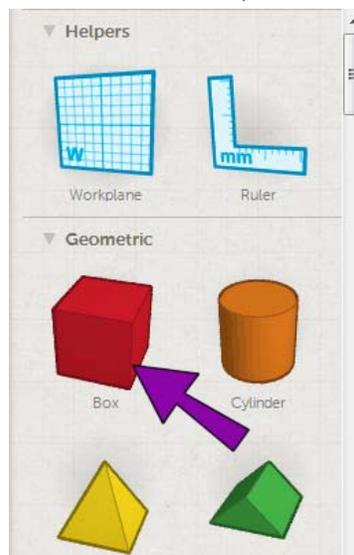
2. Unless you love the strange model name you get, click the gear icon next to the name, which opens the **Thing Properties**.



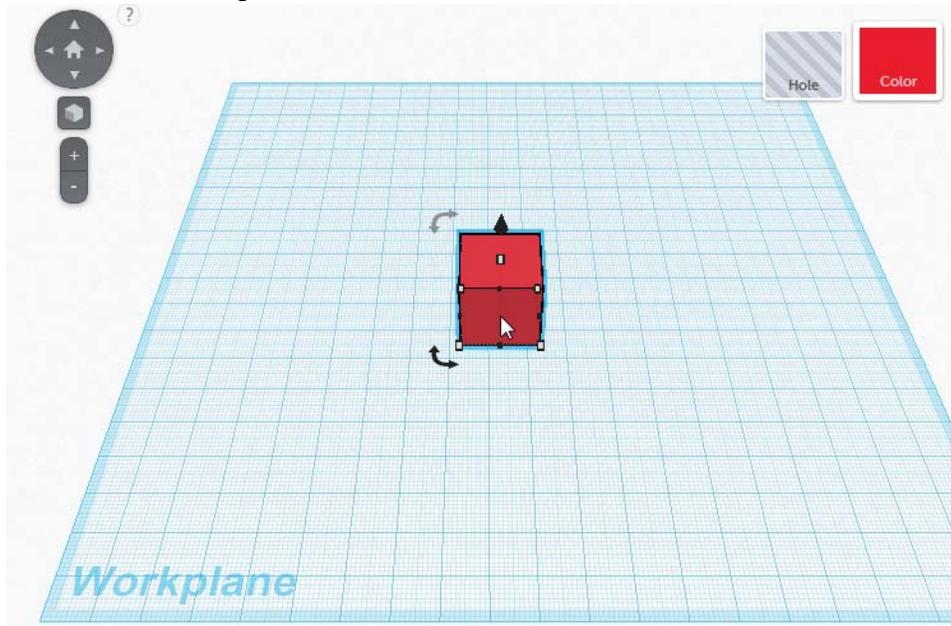
3. Set a new name, and choose whether it will be displayed for all to see (public) or just for you (private). Then click **Save changes**.



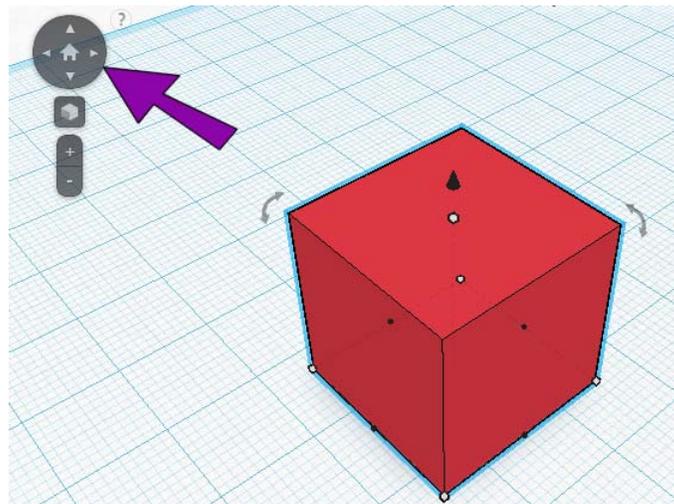
4. Let's start with the bottom of the boat. Click the **Box** tool, which is the first icon in the **Geometric** tool group.



5. Click anywhere on the blue workplane to add the box to the model.



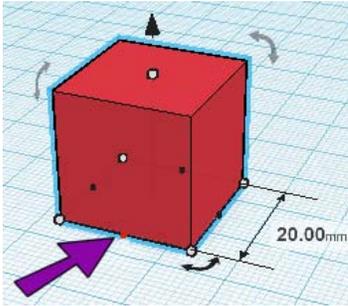
6. Before going on to make changes to this box, it's important to know how to "get around" in Tinkercad. The navigation tools in the top left corner are used to change your viewing angle: use the four arrows around the house icon to spin the model left or right, or to tilt the model up or down. You can also use the plus and minus icons to zoom in and out.



If you have a scroll wheel mouse, though, you don't need to use these navigation controls - you can rely on your mouse buttons, which is much more convenient. Press and hold the right mouse button and drag the mouse around - this is for spinning and tilting the model. Doing the same (holding the right mouse button) with the Shift key pressed lets you move the model. (Pressing and holding the scroll wheel does the same thing.) And finally, scrolling the mouse wheel up and down lets you zoom. Try out these moves with your mouse - once you get used to using these buttons, you'll never need to click those navigation buttons! (And if you forget which mouse buttons do what task, click the small question mark icon next to the navigation tools, for a reminder pop-up.)

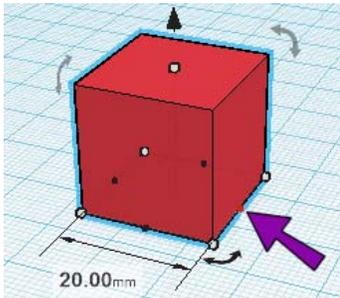
The red box is outlined in light blue, which means it's selected, and it has all sorts of little squares and arrows all around it. To see what all these squares and arrows do, we'll hover our mouse over them ("hover" means to move the mouse somewhere, without clicking).

7. First, hover your mouse on one of the small black squares in the middle of an edge on the “ground” (also known as the workplane). The 20.00 dimension appears, showing you how long the box is in that direction - 20 mm.

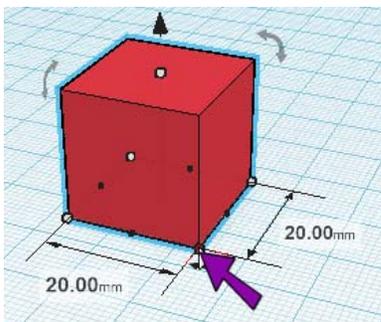


You could also use the grid lines of the workplane to figure out this distance. The lines are 1 mm apart, and there are bolder grid lines spaced 10 mm apart. So you can count grid spaces to come up with the 20 mm distance.

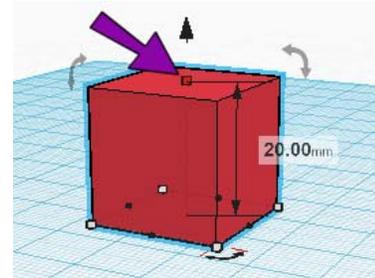
8. Hover over the same black square on another edge, and you’ll see the same 20 mm measurement in the other direction.



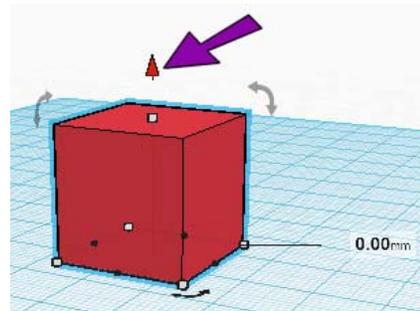
9. Hover over one of the white boxes on a corner, and you’ll see both dimensions listed: 20 by 20.



10. Hover on the white square at the top center of the box - it’s 20 mm tall.

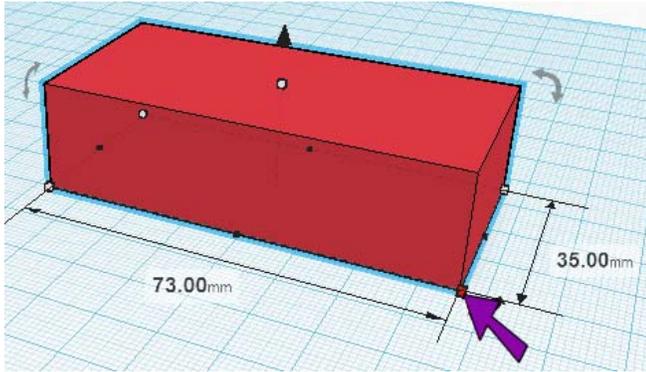


11. Hover over the round black arrow pointing up, above the top of the box. This measurement is zero, which means the box is sitting right on the workplane. (Say the box was “floating” 2 mm above the workplane - you’d see 2.00 instead of zero.)

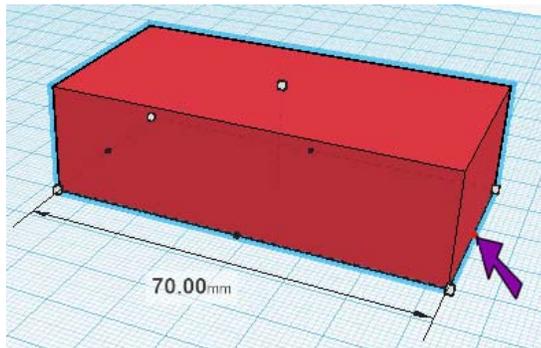


The curvy arrows are for rotation - we’ll use those later.

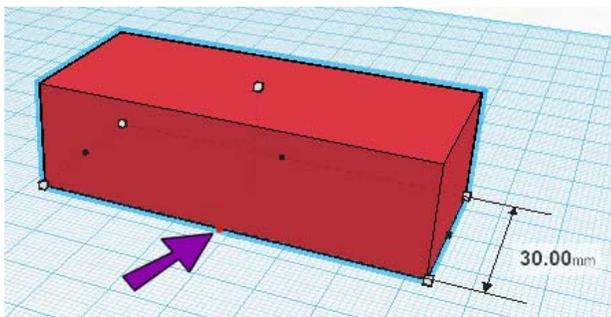
12. To make the box larger (but not taller), drag one of the white corner squares. Dragging a corner square lets you change both the length and width of the box. (It doesn't matter what size you make the box, since we'll give the box exact sizes in the next steps.) Because the snap grid is set to 1 mm, you move in distances of 1 mm all the time (no fractions).



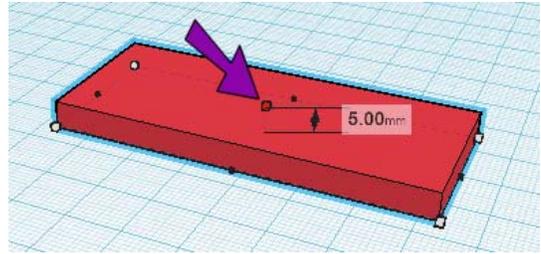
13. To set the box's length, click and drag the black square shown below, which resizes the box only in that specific direction. Stop when the box is 70 mm long.



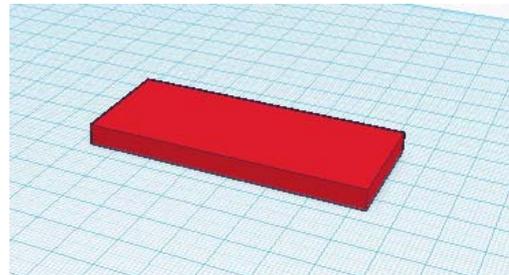
14. For the other measurement, use the arrow shown below, and stop when the width is 30 mm.



15. Next, use the white box on the top of the box to push the height down to 5 mm.



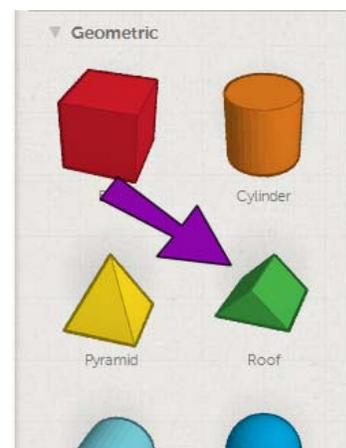
16. That's it for now with this box. To unselect it, click anywhere away from it.



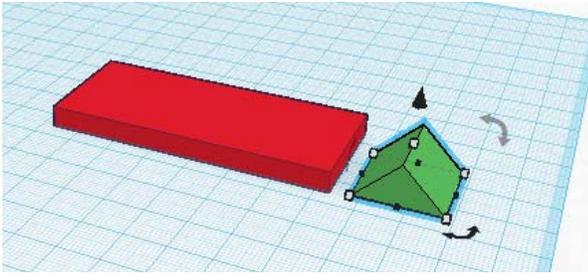
Step 3: Add a New Shape

The next part of the boat's base will be the sharp corner in front, which will help cut through the sea while this boat is speeding along. The trick with Tinkercad is to find a shape that resembles what you need, even if it takes a little tinkering to make the shape work.

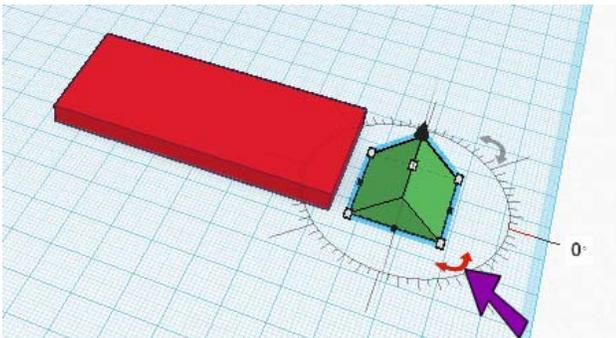
1. From the Geometric tools, click **Roof**.



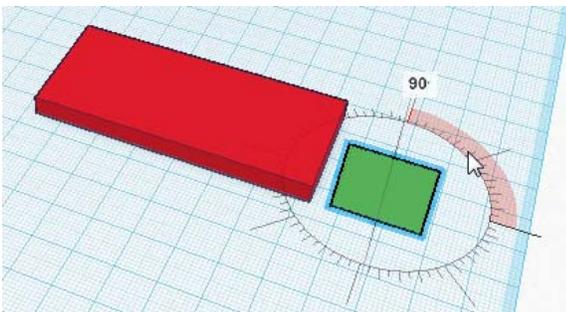
- Click to place the roof in front of the narrow part of the box.



- This shape isn't facing the right way, plus it's not exactly the right size. We'll tackle these problems one at a time. First, the shape needs to be rotated. Hover your cursor on the curvy arrow shown below, and you'll see a gray circle with degree markings appear. So now you know - these curvy arrows are used for rotation.

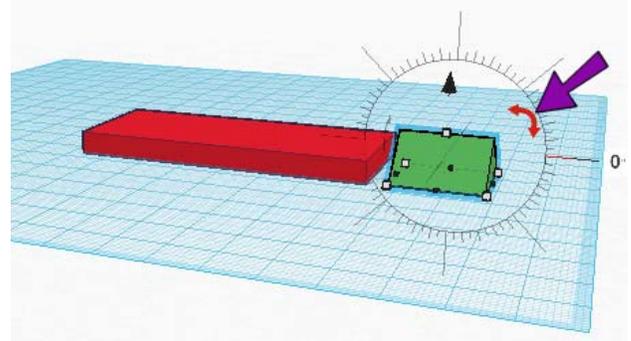


- Click this arrow and drag your mouse around the circle, until the roof shape has rotated 90 degrees.

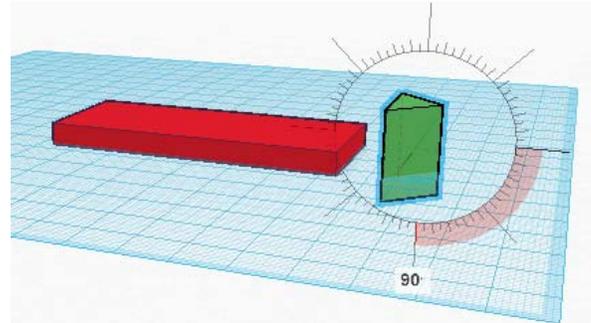


There's an easy way to rotate exactly 90 degrees. If you press Shift while rotating, you'll rotate 45 degrees at a time. So for 90 degrees, you just rotate 45 degrees twice.

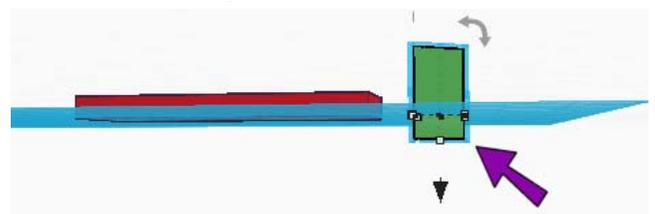
- The roof shape still isn't facing the right way; it needs to be rotated one more time. Turn the model so that the model looks like the picture below, and this time hover over the curvy arrow indicated below. The gray circle you see is now vertical, which is the way we want to rotate the roof shape.



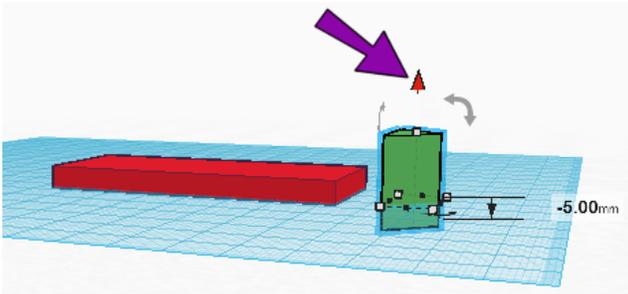
- Click and drag this arrow downward, again stopping when the angle is 90 degrees. Now the roof shape is facing the right way, with the flat side facing the box, and the sharp corner facing the other way. But the shape is entirely the wrong size.



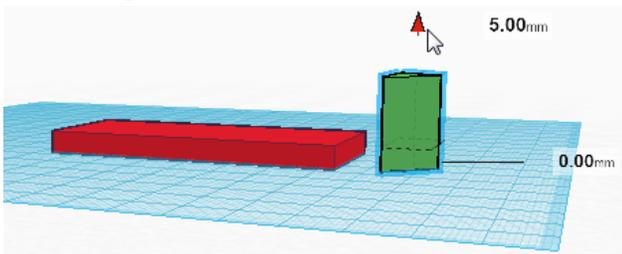
- The first problem to fix is that the shape is now sitting below the workplane. Turn the model so that you're looking straight on at the workplane, and you'll see the bottom of the roof shape sticking out below the workplane.



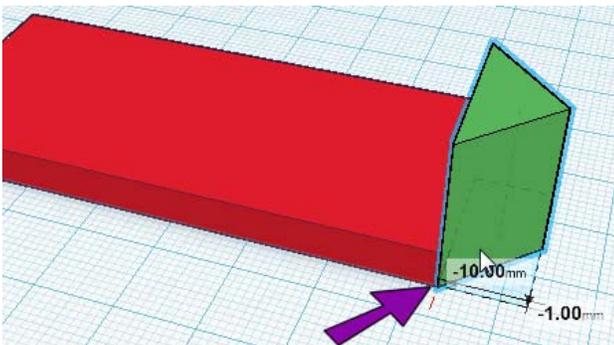
8. The round, black arrow pointing up above the top of the roof shape will let us fix this problem. Hover over this arrow, and you'll see that the bottom of the roof shape is - 5 mm below the workplane, which is why the distance has a negative value (-5.00 mm).



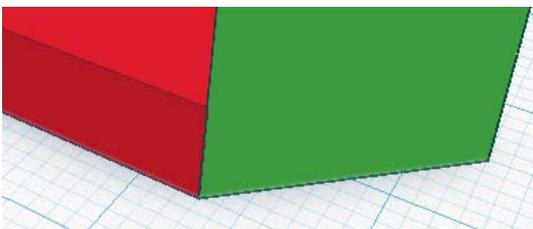
9. Drag this arrow up 5 mm, so that the distance above the workplane becomes zero.



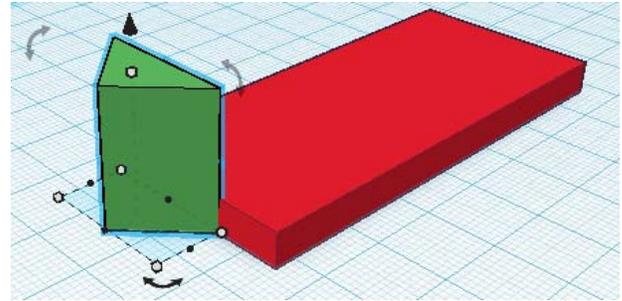
10. Now drag the corner closest to the red box to meet the box itself.



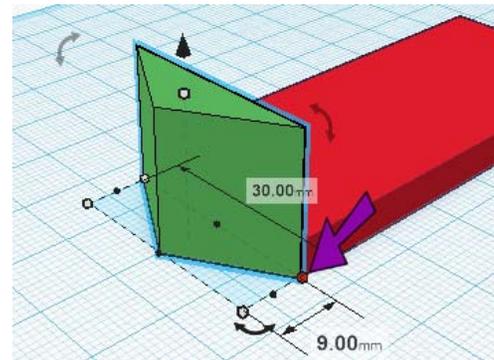
11. When connecting objects, it's always a good idea to zoom in closely to make sure they're connected, and there are no gaps.



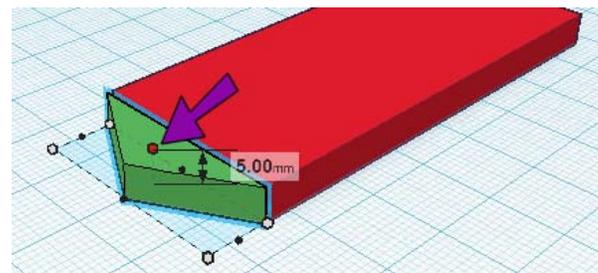
12. Spin your view around to see the other side of the model - this corner now needs to be fixed.



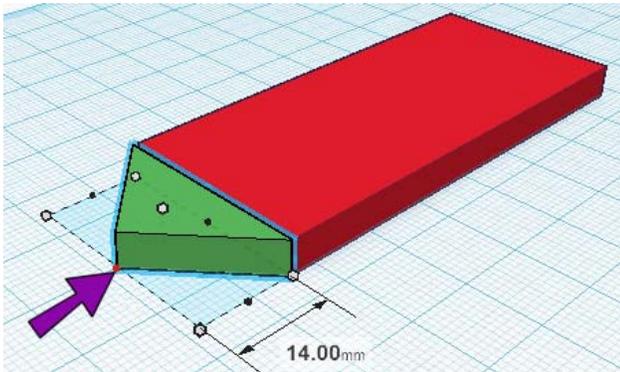
13. Drag this corner to meet the correct corner of the box. (And be sure to zoom in to be sure the two objects meet exactly.)



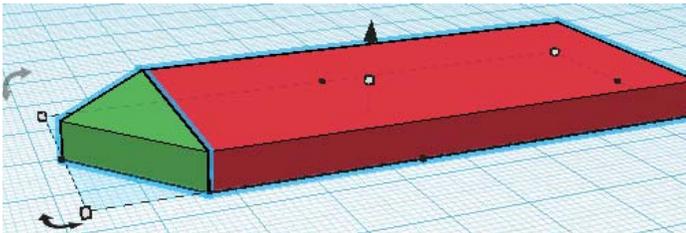
14. Use the white square on top of the green roof shape to push it down to be 5 mm tall, the same height as the box.



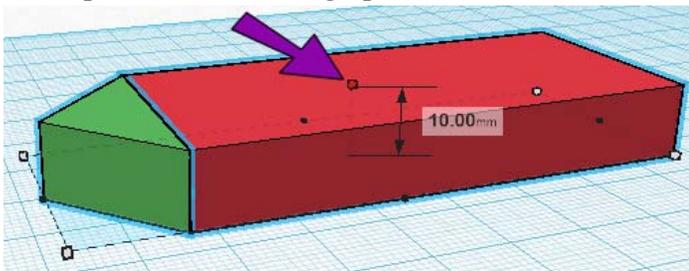
15. To make the sharp corner a little sharper, use the black arrow shown below to pull the corner a little farther from the box, so that the green shape is 14 mm long (or a little more or less, however you like it!)



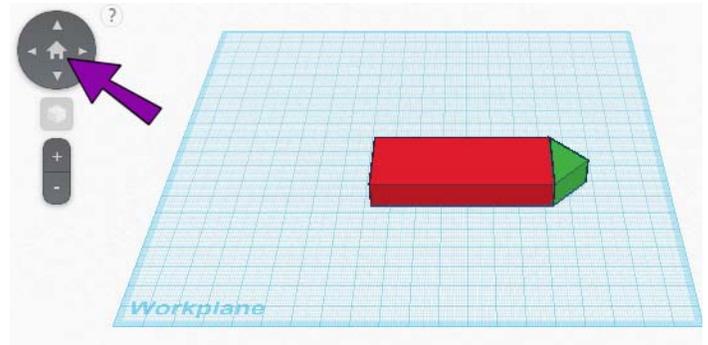
16. Say we want the entire base of the boat to be taller. You could pull up the box first, and then the roof shape. But you can also pull them both up together. The roof shape is already selected, and you can select the box shape as well. Just press and hold the Shift key and click the box. Now both shapes are selected.



17. Use the white square on the top of the two shapes, to pull the whole thing up to be 10 mm.



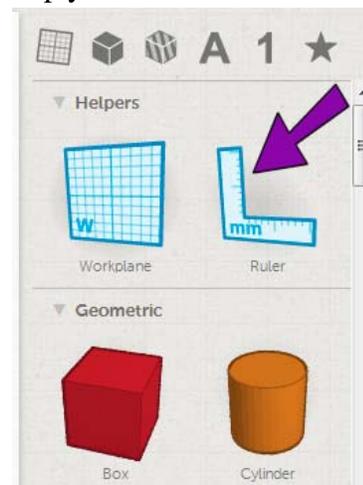
18. To get back to the default view, click the house icon at the center of the navigation tools.



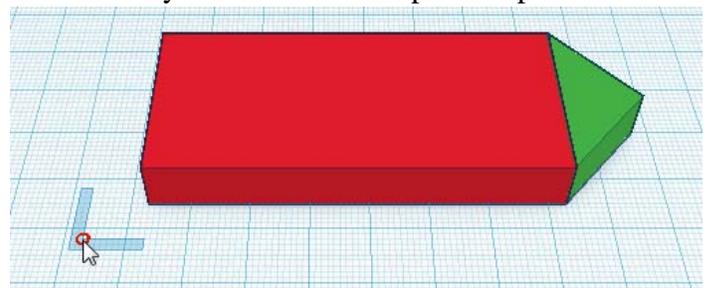
Step 4: Build the Boat Cabin

The cabin of the boat will sit on top of the base, just above the red box. It will be smaller than the red box: 4 mm in from the edges of the base.

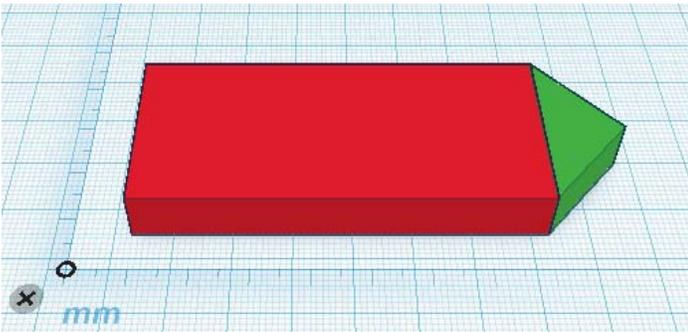
1. You probably remember that the red box is 70 mm long and 30 mm wide. But what if you forgot? Click the **Ruler** tool, located in the top row of tools, to help you remember.



2. Click anywhere on the workplane to place the ruler.

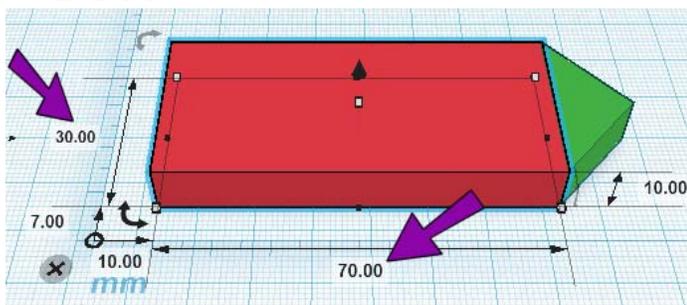


- After you click, the ruler appears in two directions, horizontal and vertical, set to measure in millimeters.

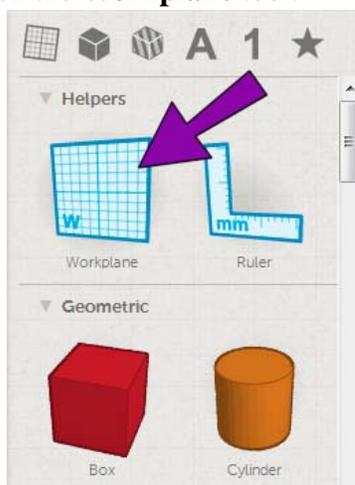


You can switch units to inches at any time, if you like.

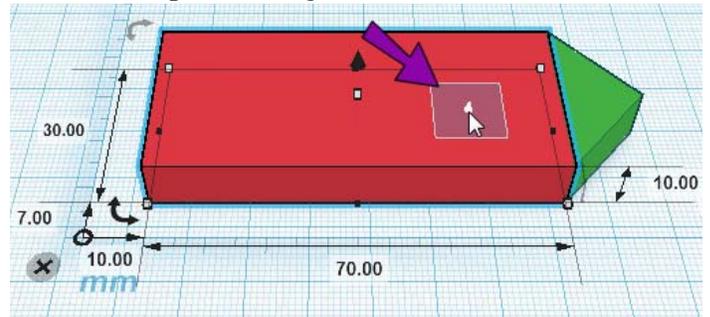
- Now click the red box. The important measurements are the 70 and 30 - now you officially “remember” the size of this box. The rest of the measurements, which we don’t need right now, tell you the box’s height (10 mm), and how far the box is from the spot where you clicked to place the ruler.



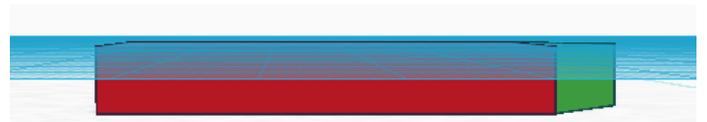
- The cabin is to go on top of the boat base, and all objects in Tinkercad are placed on the workplane. So we need to move the workplane to the top of the base. Click the **Workplane** tool.



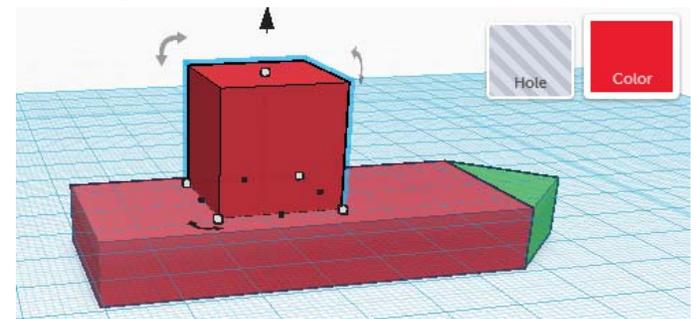
- Move your mouse to the top of the red box, and you’ll see a gray square appear, showing you where the workplane will go.



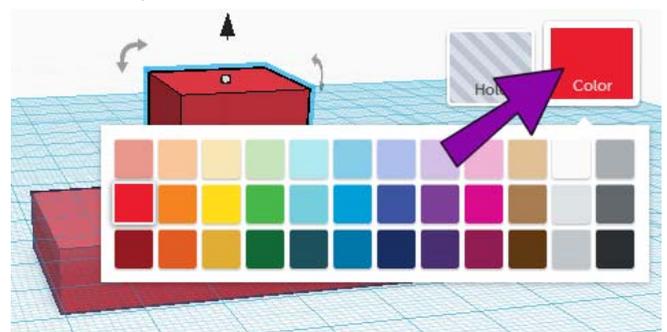
- Click to place the workplane there. The ruler disappears since its workplane is now gone. And if you tilt the model up to the view shown below, you’ll see that the workplane is now on top of the boat base.



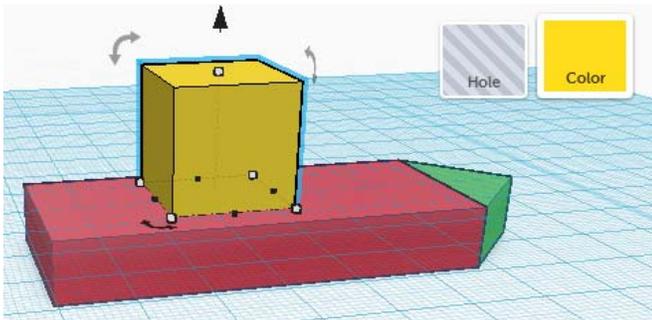
- Click the **Box** tool and place the new box on the workplane.



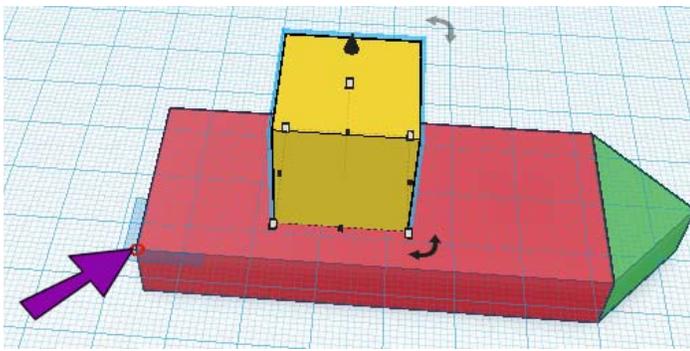
- Why have two red boxes? While the new box is still selected, click the **Color** box . . .



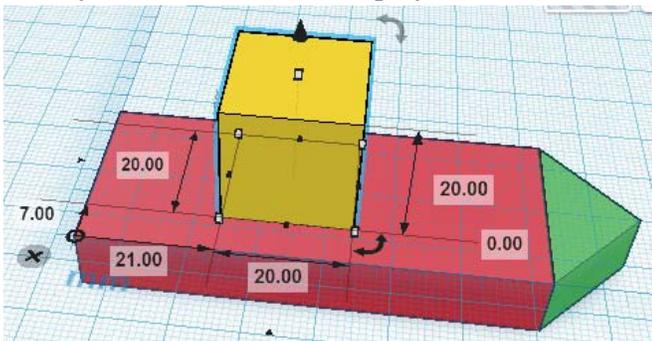
10. . . and choose the yellow color.



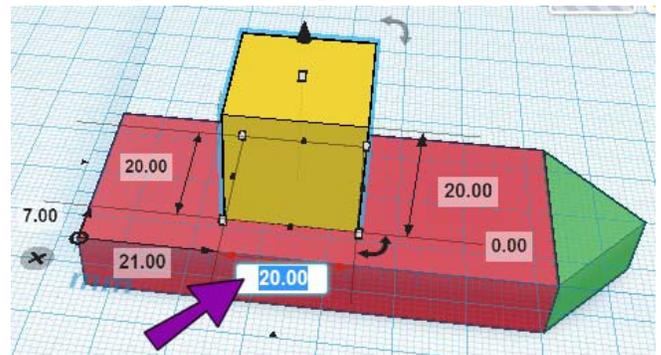
11. There are many ways to size this yellow box so that its edges are all 4 mm inside the edges of the red box. The way I'll show here uses the help of the Ruler. Click the **Ruler** tool and place it right at the corner of the red box.



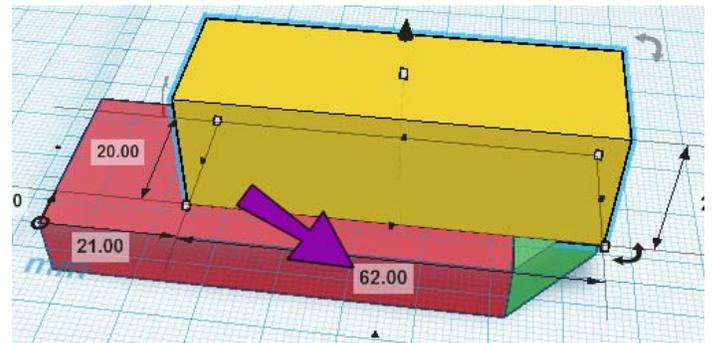
All the measurements and location information for the yellow box are now displayed.



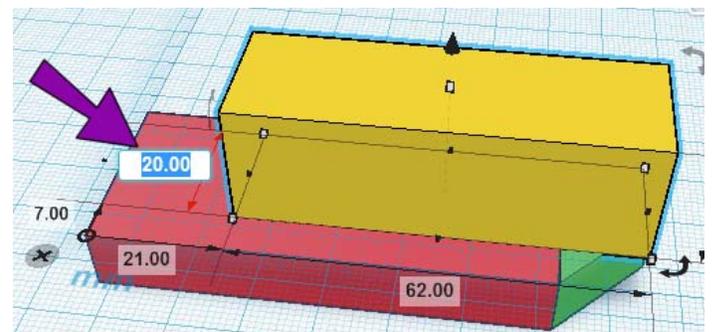
12. Click the 20 mm measurement that defines how long the box is. After you click the number, it can be changed by entering a new number.



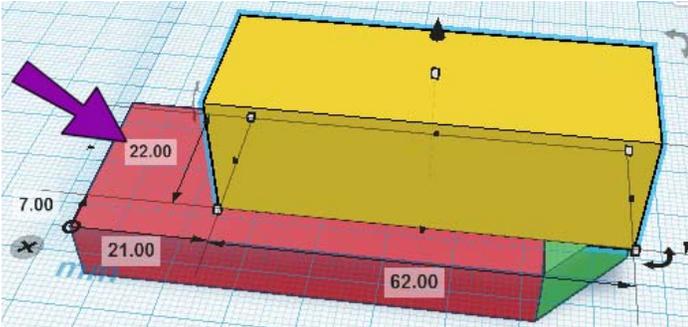
13. How long should this box be? The red box is 70 mm long, and the yellow one needs to be 4 mm shorter on both sides. So $70 - 4 - 4 = 62$ mm. Type 62 and press Enter, and the box becomes the correct length.



14. Now the width needs to be changed. Click this 20 mm measurement . . .

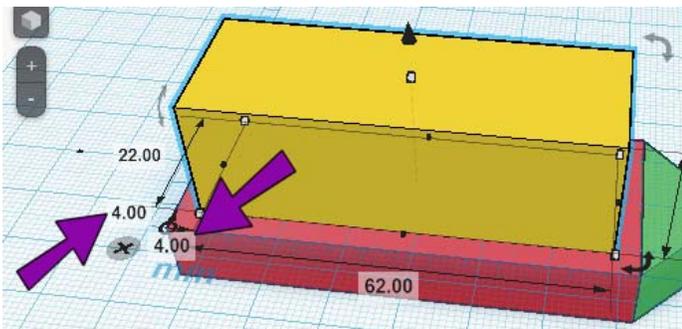


15. . . . and change it to 22 mm ($30 - 4 - 4 = 22$).

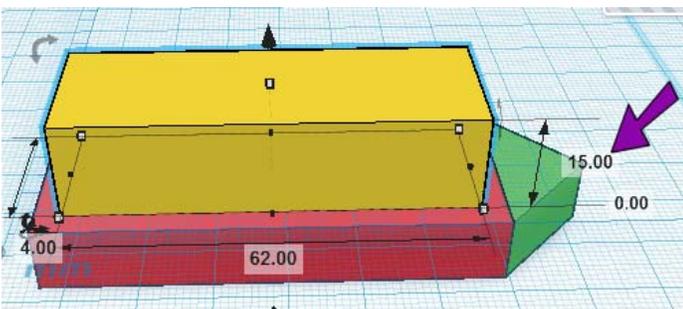


While the measurements are displayed, you can press the Tab key to jump from number to number.

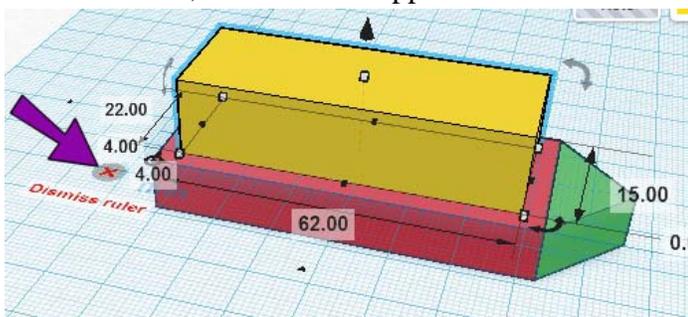
16. To move everything into the right place, change both two measurements shown below to 4 mm.



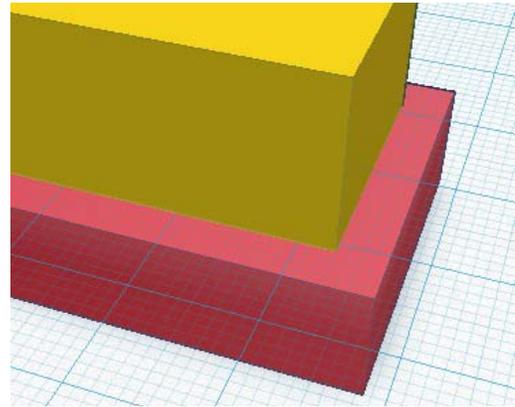
17. The cabin looks a little tall at 20 mm, so change the height dimension to 15 mm.



18. That's it for changing measurements, so click the X of the ruler, to make it disappear.



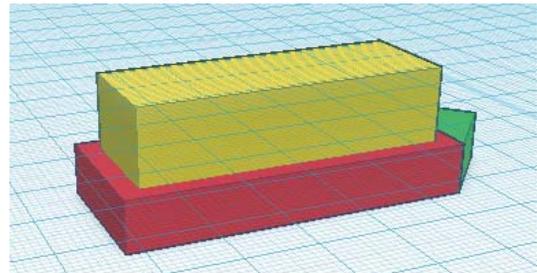
19. As always, make sure you did everything right - turn the model around and make sure you see four grid spaces between the red and yellow boxes.



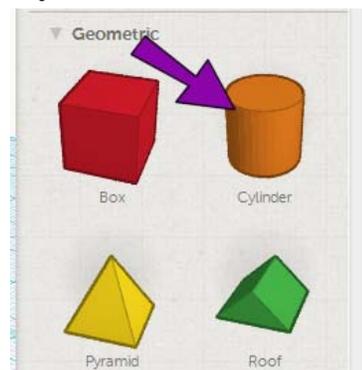
Of course, there are other ways to make the cabin box the correct size. For example, you could just drag corners, using the snap grid points to keep a 4 mm distance from the red box. You can also use the arrow keys to move an object. Pressing an arrow once moves 1 mm, and pressing Shift with an arrow moves 10 mm.

Step 5: Add Smokestacks

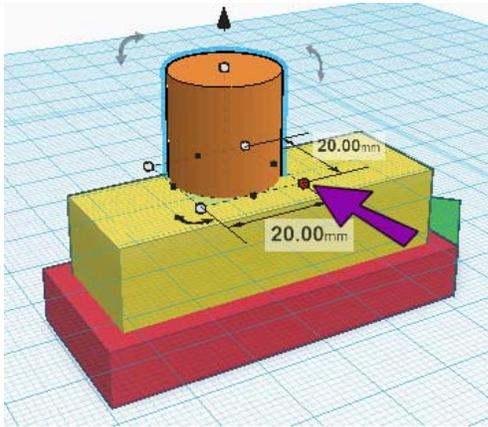
1. In order to place three smokestacks atop the cabin, place the workplane there.



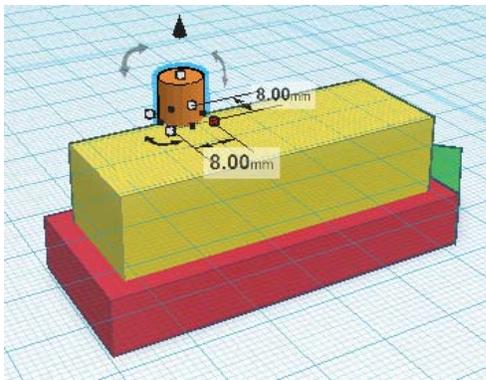
2. Click the **Cylinder** tool . . .



3. . . . and place it on the workplane, on top of the cabin. Way too big!

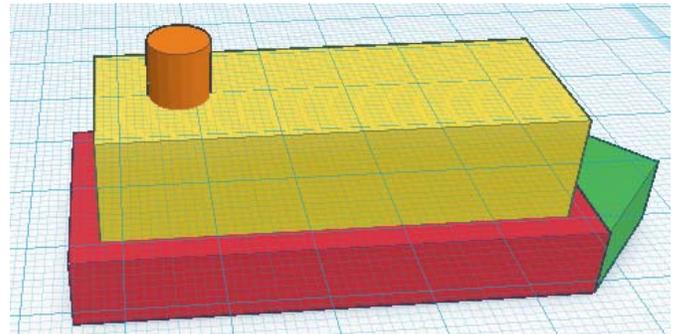


4. We've seen a few ways to change the size of an object. Here's another neat feature of Tinkercad: drag one of the black or white boxes along the bottom, keeping the Shift key pressed. This keeps the overall cylinder shape the same. Stop when the diameter is 8 mm.

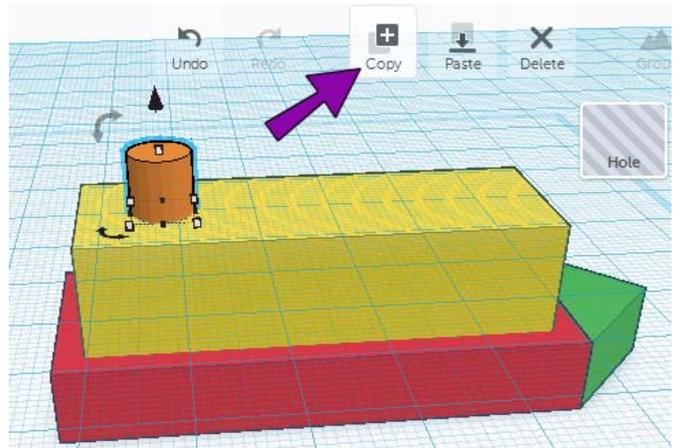


The way an object is resized depends on the square you drag. Try pressing Shift while dragging a black square then a white one. When dragging a black square, the cylinder center stays put. With a white one, the center will move.

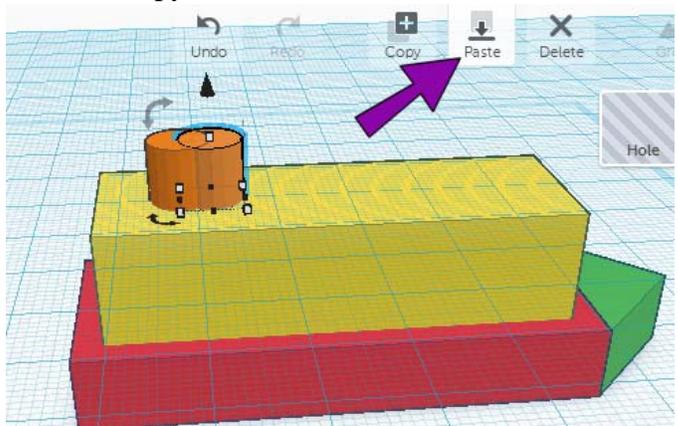
5. Move the smokestack (drag it or use the arrow keys) so that it's centered near the back of the boat. (If you want to be exact, there should be 7 grid squares of the cabin to the right, left, and back of the smokestack.)



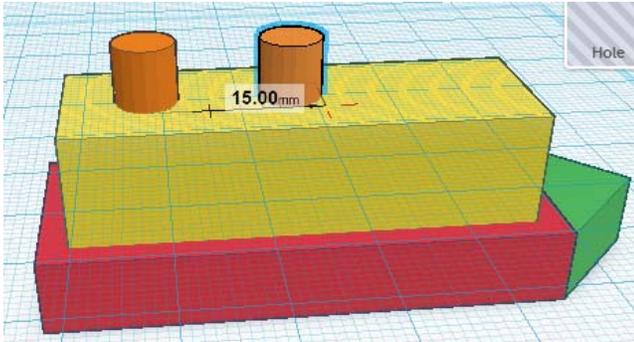
6. We need more than one smokestack on this boat. So click the smokestack, then click the **Copy** icon. (Or you can press the Ctrl+C keys together.)



7. Then click the **Paste** icon, or press Ctrl+V. This places a copy directly to the right, so where the copy goes depends on how you're looking at the model. And the distance between the two smokestacks is half the length of the smokestack cylinder. (The smokestack has an 8 mm diameter, so the copy distance is 4 mm.)

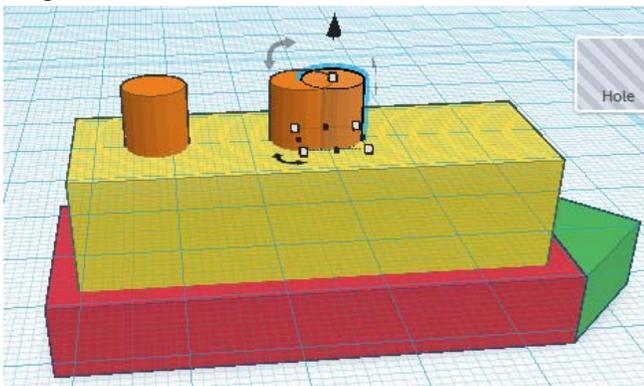


8. To move the new smokestack farther away from the first one, click anywhere on the new smokestack *except* on a black or white square. Drag it toward the front of the boat, keeping the Shift pressed so the move will stay straight. I've moved mine 15 mm to the right, so that the two cylinders are now 19 mm apart ($15 + 4$) between their centers.

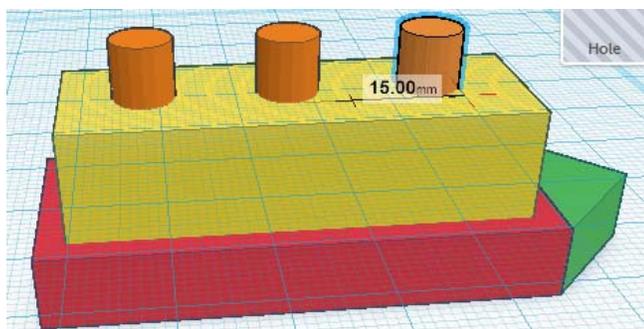


How else could you move this copy? You could press the right arrow 15 times. Or you could hold Shift and press the right arrow once, then press it 4 more times without Shift. There are always more than one way to do something!

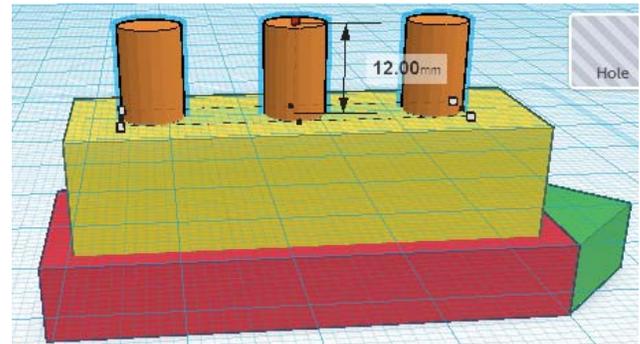
9. For a third smokestack, click **Copy** and **Paste** again . . .



10. . . . and move this copy using the same distance you used before.



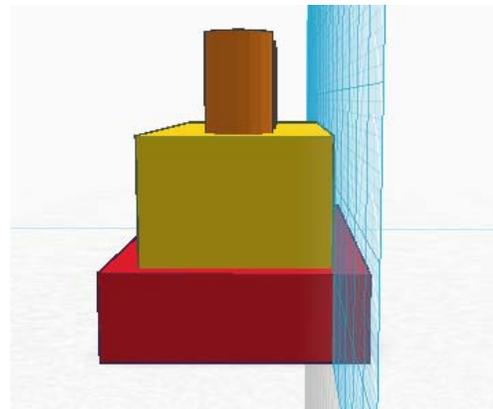
11. The smokestacks look a little puny, so select them all (remember to press Shift to select more than one object at a time), and use the white square at the top to pull them all up to 12 mm.



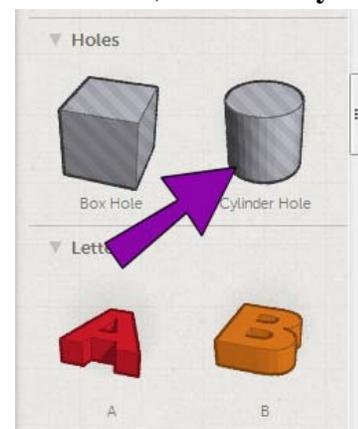
Step 6: Add Windows

In this step, we'll introduce the important concept of holes.

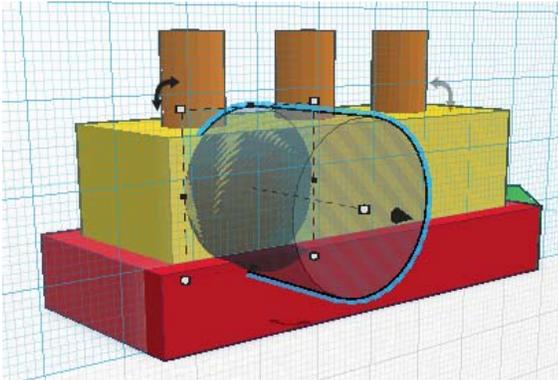
1. The first set of windows will be placed on one side of the cabin. So place the workplane on either side.



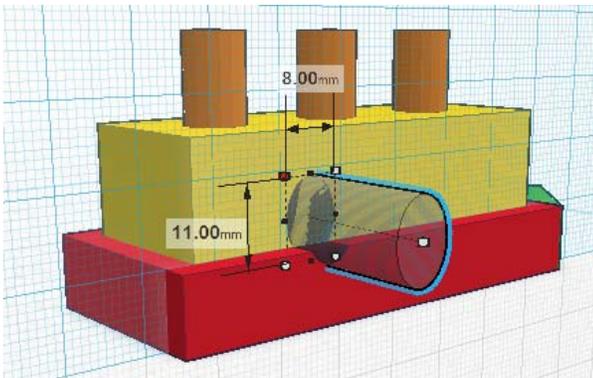
2. Find the **Holes** tools, and click **Cylinder Hole**.



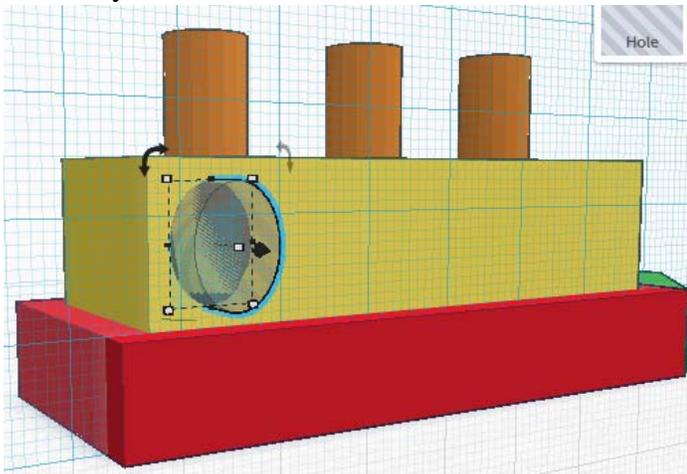
- Place the cylinder anywhere on the side of the cabin that has the workplane. Its color is gray, which is the Tinkercad color for holes, and it's translucent (you can see through it).



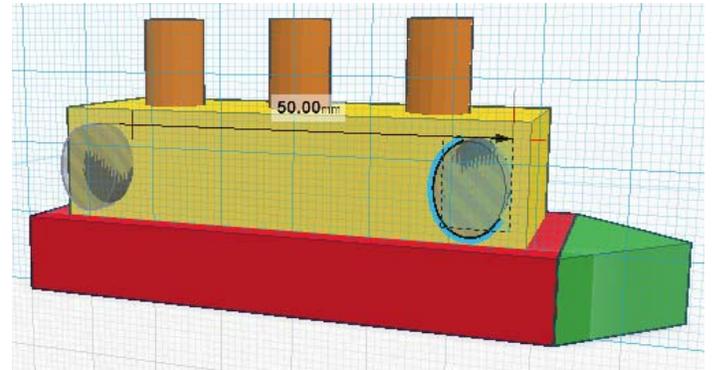
- Use one of the white squares to resize the cylinder so that it has an oval shape. It doesn't matter how wide the shape is (mine is 8 mm wide), but the height needs to be less than the height of the cabin itself, which is 15 mm. I set my cylinder height at 11 mm, so that it can have 2 mm above and below.



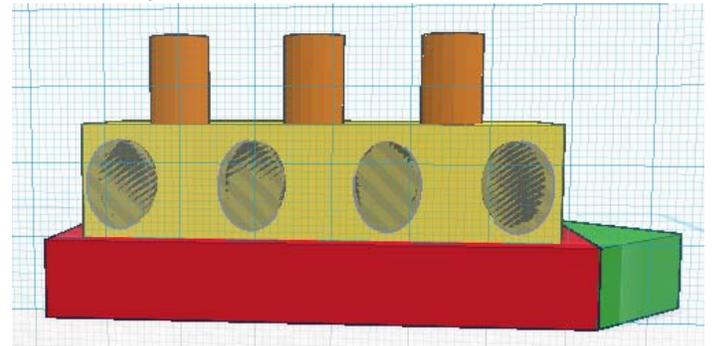
- Drag the cylinder, or use the move arrows, to place the cylinder on the left side of the cabin.



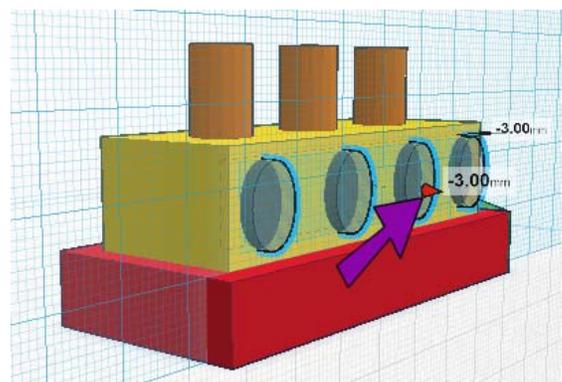
- We already saw how to use **Copy** and **Paste** to make copies. Here's another way: press and hold the Alt key, and drag a copy of the cylinder all the way to the right. (You can press Shift and Alt at the same time, if you want to be sure the copy goes straight across.)



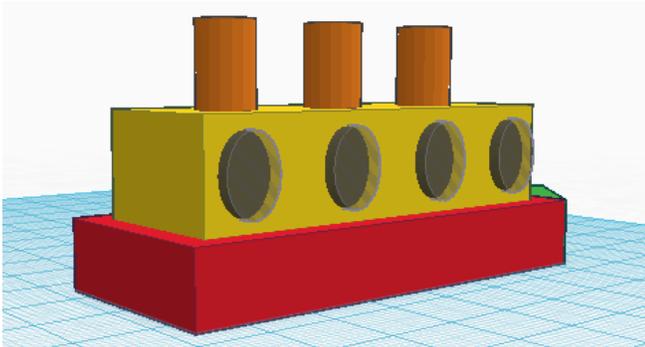
- Use the Alt key, or **Copy** and **Paste**, to add some more cylinders in between.



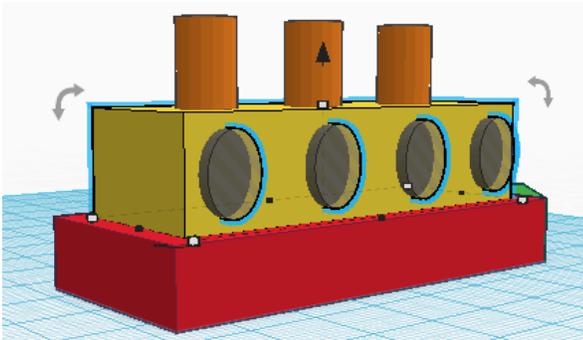
- These cylinders are like hole-punchers: they will poke holes in the cabin. But if the cylinders are sitting right along the wall of the cabin, no hole will be made. So the cylinders have to be pushed back a little bit, into the cabin. Select them all, and use the black arrow shown below to push in the cylinders 2 or 3 mm.



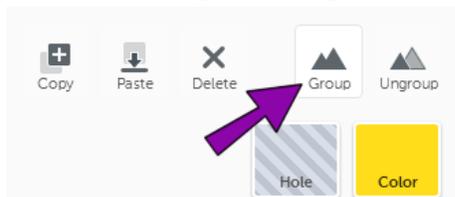
9. To make the model easier to see, we can get the workplace back to its original location. Click the **Workplane** tool and click anywhere in blank space. This places the workplace back on the “ground.”



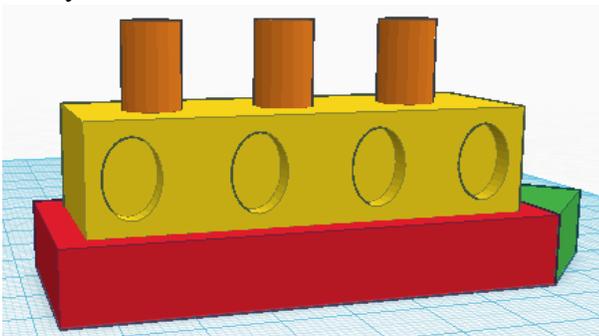
10. These cylinders have cut the cabin wall, and if you were to print the model now, you’d get window holes. But those gray cylinders can be removed from the display by using a group. Select all of the cylinders plus the cabin itself.



11. Then click the **Group** icon, or press Ctrl + G.

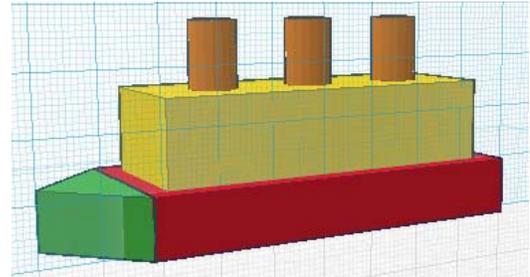


Making holes part of a group tells the holes to do their work, and now you have window holes where the cylinders used to be.

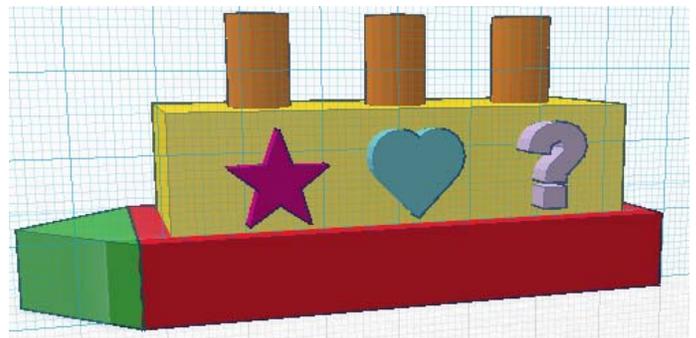


*If you want to get the cylinders back (maybe you want to move them around or change how many there are), select the cabin that now has windows, and click the **Ungroup** icon.*

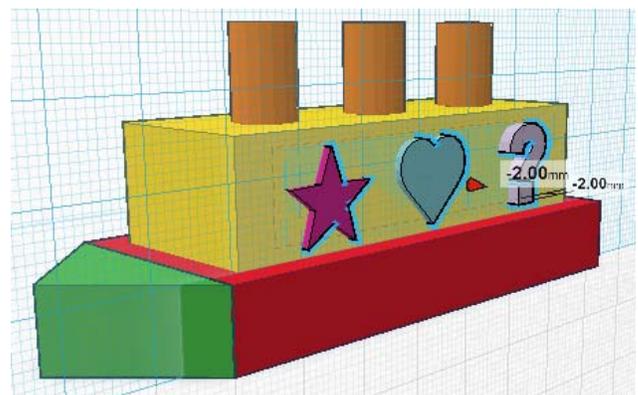
12. Let’s add some windows to the other side of the cabin. Place the workplane there.



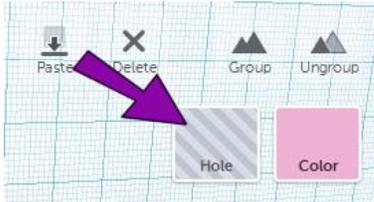
13. At the bottom of the list of tools, you’ll find some symbols, letters, and other fun stuff. Add a few of these to the side of the cabin, and size them to fit.



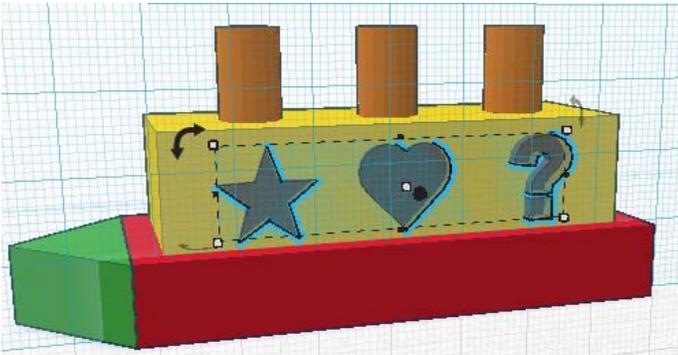
14. Select all of the shapes and push them a little bit into the cabin wall.



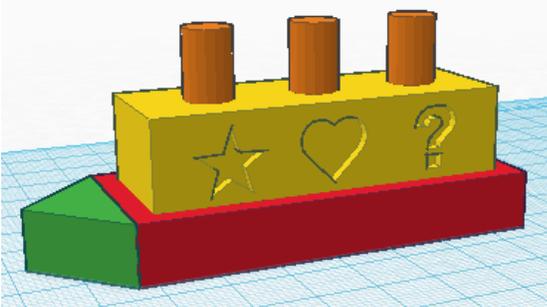
15. For the windows on the other side, we used cylinders that were already holes. But *any shape* can become a hole. It's easy: while the shapes are still selected, click the **Hole** icon.



Now the shapes are all gray and translucent.

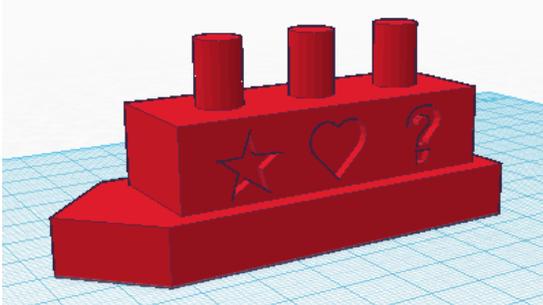


16. To complete the windows, select all of the shapes plus the cabin itself, and group them. Done!



Step 7: Finish Up

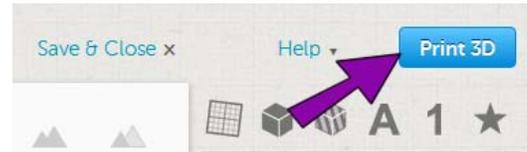
1. When you plan to send a model to a 3D printer, it's a good idea to make it all one object. So select everything by dragging a selection window around the whole boat, then make a group.



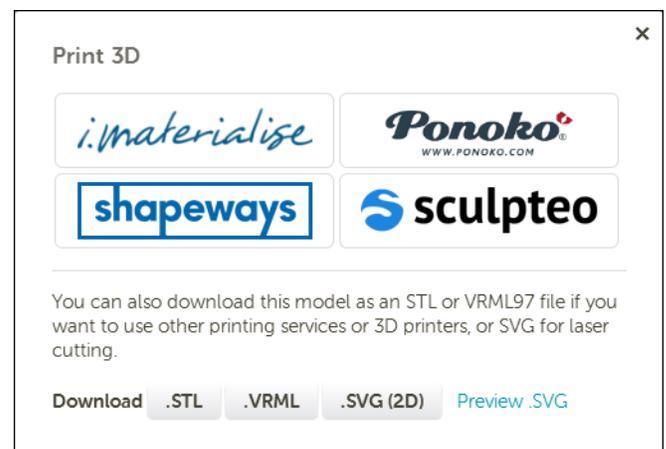
2. At the top of the web page, click the **Save & Close** link.



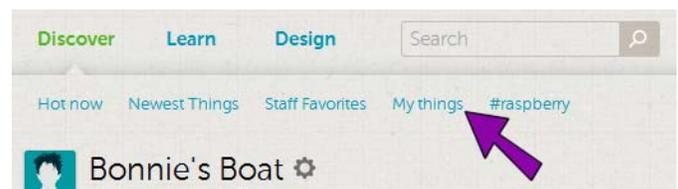
3. If you were planning to print this model, click the **Print 3D** button.



4. If you have your own printer, or you have access to one at a school or lab, you have a few formats you can choose from: STL, VRML, etc. If you don't have access to a printer, you can have it printed and sent to you by one of Tinkercad's printing partners: imaterialise, Ponoko, etc.



5. When you want to get back to the models you've created, use the **My Things** link at the top of the **Discover** page.



6. And if you want to delete something from your list of things, or change its status from public to private (so that only you can see it), use the **Thing Properties** icon.

7. Go make your own things, and HAVE FUN!