

# Thinking Like a Designer

Designers **collect ideas** by doing research and talking to the people they are designing for.

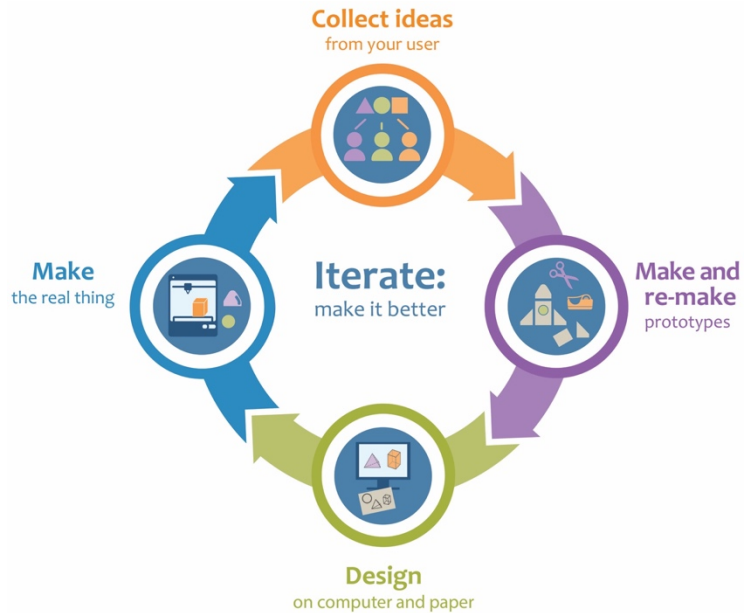
They **make and remake prototypes**. Prototypes are models they make quickly with common materials to work out how things will look and fix things they hadn't thought about.

They **design on computer and paper**, using more precise measurements.

Finally, they **make the real thing**. They might use cardboard, wood or even a 3D printer.

All along, they **iterate** their designs. When you iterate, you go back to improve the design as you learn along the way.

We will follow the same **design process** as we learn to be designers!



## Collect Ideas

You are going to use a Computer Aided Design (CAD) tool called Tinkercad™ to design a bookmark. Here is an example.



1. Describe the kind of bookmark you want to design. Who is it for?



# Make and Re-make Prototypes



1. Make a quick sketch of your bookmark.

A **sketch** is like a prototype but it is a drawing. You draw quickly so you can test out ideas.

2. How is your sketch different than what you had imagined?

## Ask Your Mentor

Mentors are adults who can help you solve problems. Your mentor for MPACT is an adult who uses 3D modeling and printing in their work. You can use the mentor's ideas to change your designs.

Learn about what kind of work mentors do by reading their profiles.

Tell the mentors:

- What subjects do you like in school?
- What do you like to do after school and on weekends?

# Design



## Measurement Check Up

Before you use Tinkercad to design your bookmark, do this activity to understand the relationship between millimeters (mm) and centimeters (cm).

1. How many millimeters (mm) are in 1 cm? Use the ruler to count.

1 cm = \_\_\_\_\_ mm



2. If you know a length in **cm**, how do you calculate the length in **mm**?

3. If you know a length in **mm**, how do you calculate the length in **cm**? (try this without the ruler)

## Design on Computer and Paper

4. The design requirements for the bookmark are:

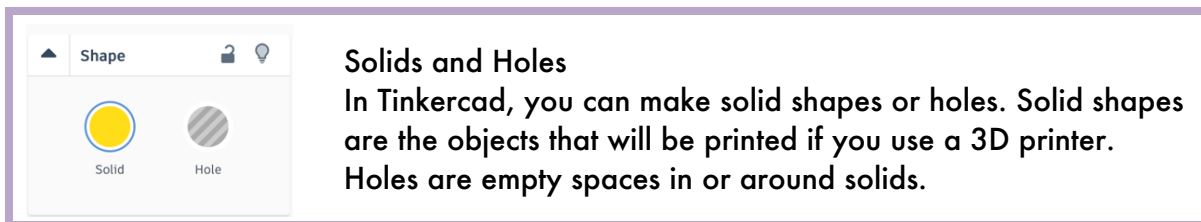
- Length: less than 120 mm
- Width: less than 50 mm
- Height: less than 3 mm

5. Convert the measurements from millimeters to centimeters.

- Length: less than 120 mm → \_\_\_\_\_ cm
- Width: less than 50 mm → \_\_\_\_\_ cm
- Height: less than 3 mm → \_\_\_\_\_ cm

6. Use Tinkercad to design your bookmark. Here are the basic steps:

- Name your Tinkercad design (for example: BookmarkSamR)
- Create a solid shape: A shape with flat sides for the top and bottom is best.
- Use the measurements in the design requirements to make sure you have the right length, width, and height.
- Create your text.
- Move the text and the solid shape together.
- Make sure the text sits on top of the solid shape with no space between the two.
- Select both the text & the solid shape, then **Group** them.



# Make the Real Thing



1. Before you print, check your work and have a classmate double-check.

Did your classmate:

<input type="checkbox"/>	Name their Tinkercad design?
<input type="checkbox"/>	Create a solid shape with a flat face?
<input type="checkbox"/>	Create a shape with a length less than 12 cm?
<input type="checkbox"/>	Create a shape with a width less than 5 cm?
<input type="checkbox"/>	Create a shape with a height less than 0.3 cm?
<input type="checkbox"/>	Create raised text on the shape?
<input type="checkbox"/>	Place the solid shape and text together?
<input type="checkbox"/>	Group the shapes together?

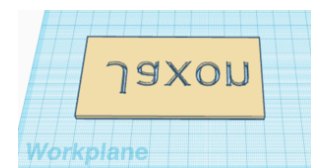
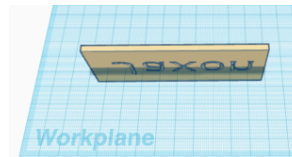
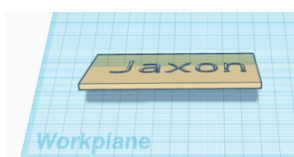
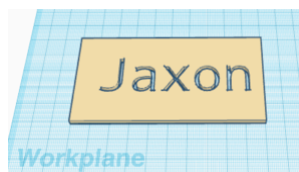
2. With your teacher's help, 3D print your design.

While you wait

3. Calculate the volume of the solid shape of your bookmark.
4. Explain how you calculated the volume of the solid shape.

## Brain Teaser

Jaxon flipped their bookmark upside down.



5. If you did the same, which letters in your bookmark will look the same?  
How do you know?

Joy has two designs for her bookmark.

**Option 1.** One-piece bookmark with 120mm length, 50mm width, and 3mm height.



**Option 2.** Two-piece bookmark that has the same dimensions. The length of the two pieces together adds to 120 mm.



6. Which bookmark design has greater volume? The one-piece bookmark, the two-piece bookmark? Or are they the same?

7. Joy wants to paint a bookmark. Which takes more paint? How do you know?

### *Reflect and Celebrate*

- Did the print turn out how you thought it would? Why or why not?
- What are two changes you would make to your bookmark?