

# **MAKEngineering Kit**

## **Facilitation Guide:**

### **Trendy Tennies**

Task adapted from Teach Engineering STEM curriculum developed at the University of Colorado Boulder. Images from previous families who completed this kit.

## **ENGINEERING TASK**

You have been asked by a popular shoe company to design a new trendy tennis shoe. The company's only request is that the shoe be an original design—your design. You decide to use everyday products to construct the tennis shoe prototype.

## CUSTOMER 1—OLAF

**Age:** 3 (Frozen 2)

**Shoe size:** Kid's 3

**About:** Olaf has a layer of permafrost to keep him from melting. He enjoys riding Sven and hanging out with Else in



## CUSTOMER 2—SERENA WILLIAMS



**Age:** 39

**Shoe size:** Women's 10.5

**About:** Serena is an American professional tennis player and has won 23 Grand Slam singles titles.

## CUSTOMER 3—HULK/BRUCE BANNER

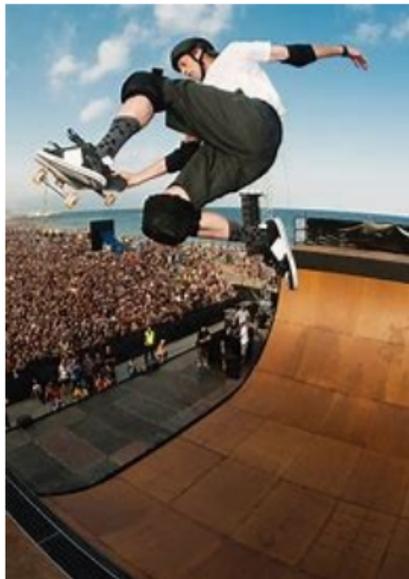
**Age:** 49

**Shoe size:** Unknown; feet change sizes

**About:** Bruce is a brilliant scientist. As Hulk, he has unlimited superhuman power, can leap great distances, and can heal injuries within seconds.



## CUSTOMER 4—TONY HAWK



**Age:** 42

**Shoe size:** Men's 8.5

**About:** Tony is a famous skateboarder who was the first person to land the 900, a trick where he spins 2.5 times on a board.

## MATERIALS IN KIT

- \* ~20 Cotton balls
- \* 3-4 Sheets of White Cardstock
- \* 3 rolls of ribbon (different colors)
- \* Pieces of Fabric and/or Felt
- \* ~20 Velcro dots
- \* 3-4 Sheets of Sandpaper
- \* Tape
- \* Pair of Scissors
- \* White Glue
- \* Hole puncher
- \* ~10 Pipe cleaners
- \* ~2-3 Foam sheets
- \* 3-4 Markers

We also encourage you to use materials and tools in and/or around your home environment.

# PROTOTYPE

Prototype is a term we will use often, so what does it mean? One way to think of a prototype is a rough draft on a paper. Here are two videos that explain a prototype in engineering.

[https://youtu.be/\\_1bOaNSy5XY](https://youtu.be/_1bOaNSy5XY)

[https://youtu.be/k\\_9Q-KDSb9o](https://youtu.be/k_9Q-KDSb9o)

## STEP 1—RESEARCH

Let's do research on the customer or user you selected as we want to design an appropriate shoe. As you search and find interesting things about your customer, be sure to write them down.

Next think about how you will use the information about your customer in the design of the shoe. For example, what is the intended purpose (e.g., running)? How will you make your prototype uniquely stylish, a one-of-a-kind design?

## STEP 1—RESEARCH

Below is another place to learn more about the design of the shoe such as the thickness of the sole or bottom of the shoe.

<https://naturalfootgear.com/blogs/educational-articles/problematic-shoe-design-features>

Additional shoe design elements for you to research may include (a) flexibility, (b) traction, and (c) ankle support.

## STEP 1—SUPPORT

Optional questions to ask:

- What other things should we consider for the shoe?
- How important is comfort and flexibility?
- What material would be strong and supportive for the bottom of the tennis shoe prototype?
- Will your shoe have laces, straps, or both?
- What material will support the arch of the foot? Is this important in your design?

## STEP 1—EXTENSION

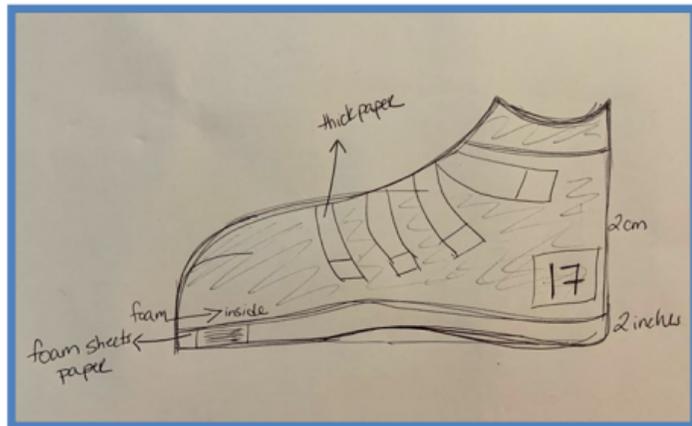
Watch the YouTube video entitled “How as it made?  
The art of shoe making?”

<https://youtu.be/Xd7j0mJ1OSo>

One possible question to ask is “What did you notice?” Another is “What did you notice that we can use in the design of our shoe?”

## STEP 2—DESIGN

On a sheet of paper, sketch your shoe design and list the material you will use for your prototype shoe. You are free to use the material in the kit and/or material in your home.



## STEP 2-SUPPORT

Optional questions to ask:

- How might we use \_\_\_\_\_ (e.g., ribbon) in our design?  
What is its purpose?
- How is \_\_\_\_\_ based on your research?
- Again, let's think about the user. What might they think about \_\_\_\_\_?
- What additional tools (e.g., scissors, screwdriver, tape) might we need? How will we use them in the design of the prototype?

## STEP 3—TRACE

Trace someone's foot to use in your design.  
Next, estimate the length of the foot print in inches.



## STEP 3—DID YOU KNOW?

You can use the middle part of your pointer finger as a way to measure the length in inches. Check out this video for additional ways to use your body to measure objects.



<https://youtu.be/FnTGpnl2lXY>



## COMMUNICATE

Have a conversation around the planning process.  
The camera can be focused on the sketch.

- Explain your design. How does your design meet the needs of your user?
- What will make your shoe unique?
- Let's imagine we gave your plans to someone else. Do you think they would be able to create your shoe prototype? Why or why not?



**STEP 4**

**CREATE AND  
TEST YOUR  
PROTOTYPE.**

## STEP 4-SUPPORT

Here are a few questions to consider asking.

- This is not working as we planned, what might we do differently?
- I like how you are \_\_\_\_\_.
- Explain to me the purpose of \_\_\_\_\_ (material).  
What function does it serve?
- Can I show you something that I was thinking about? (ask for permission)

## STEP 5—IMPROVE

How would your user rate your prototype?



Based on your user and your research, what changes and/or additions might you make to improve your prototype? Explain why. Continue to redesign the prototype until you get a 5-star rating.



## COMMUNICATE

Have a conversation around the prototype. The camera can be focused on the shoe.

- Does your prototype look similar to your plan? Why or why not?
- In your opinion, what is the most unique use of material? Why?
- What name would you give your shoe? How does this name represent the purpose and/or look of the shoe?

## DID YOU KNOW?

Biomechanical engineers are involved in designing shoes and other products such as backpacks and child safety car seats. They must understand the mechanics of how our bodies move to design products that are comfortable, safe, and enhance human performance.

Check out <https://youtu.be/Pu0lp7apU1Y>

# WHAT TYPE OF ENGINEER ARE YOU?

Add a sticker to your Engineering Passport that identifies the type of engineer you were most like in the design of trendy tennies. Don't forget to write why you chose the type of engineer.

**\*\*We also conclude with a video highlighting the trendy tennies design process.\*\***

<https://youtu.be/svGia40SYm4>



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