http://mashupmath.com/blog/2017/5/2/10-awesome-end-of-year-math-project-ideas
https://www.ducksters.com/science/physics/force.php
https://www.exploratorium.edu/snacks/bottle-blast-off

Basic Lesson Outline:

1. Build Bridges before lesson
2. Give Explanation on triangles, forces, force distribution
3. Build bridges again, see how much stronger they can make their bridges

Supplies Needed:

- Binder clips/paper clips/clay
- Popsicle sticks
- Duct Tape
- Measuring Tape

Concepts to Teach:

1. Forces
2. Distribution of Forces
3. Design Process
4. Triangles/Trusses

Overall course Outline:

INTRO:

1. **Ask:** How are rocket ships, planes, and bridges related?
    a. These things are made by people called engineers!
    b. **Ask** if they know what an engineer is, ask them to explain to the class (ans: someone who designs and builds complicated things)
        i. Lots of different types of engineers, those that make bridges/big things that are made to help a city run better are called civil engineers
    c. Engineers have to know a lot about math to make these things work. Entire towns and lives depend on it!

FORCES:

2. In addition to math, a very important thing that engineers have to know all about is **forces**!!
    a. **Ask** for someone to explain what they think a force is
        i. A force is a **push or pull** on an object
            1. If I push Cyrus, I'm applying a push force onto Cyrus

2. If I throw this pencil in the air, I'm applying a push force to it to get it up in the air, and gravity is applying a pull force to bring it back down
3. Before I explain any further, we're going to have a little competition!

FIRST BUILDING COMPETITION:

1. Pass out materials (Five binder clips, X amount of paperclips, some clay)
    a. If they ask why they can't have more, explain that engineers can only spend a certain amount of money to buy materials, and must make the best bridge with what they have
2. Instruct them to build a bridge stretching between two tables/chairs (Make sure their distances four feet, tape down before adding weights)
    a. At the end we'll place weights on it, and we'll see who's bridge was the strongest!
    b. Time allotment, 15 minutes?? Give or take a few minutes

EXPLANATION:

1. Equilateral triangles are the shape most commonly used in engineering!
    a. Use drawings: This is because when a force is placed down on a triangle with equal sides and angles, the force is equally sent down both sides
        i. Use drawings: show how this would be different with a square, and a different triangle
            1. Engineers use it to show how forces affect something!
            2. If we were to draw this for our bridge…
                a. Draw a small example bridge on board
                b. Show how to draw the forces being applied to the bridge
                    i. Weights, gravity
                c. Drop an object, ask them what happened
2. Now that you guys have a better understanding of how forces affect bridges, and how engineers make sure they're bridges are strong, we're going to build it again
    a. This is part of what engineers call the Design Process!
        i. Design It
        ii. Build it
        iii. Test it
        iv. Improve it
            1. Two most important things to remember:
                a. It's ok to fail, just try again and improve
                b. There's always ways you can improve on your design! You're never done!
    b. Now, we're going to build our bridges again, but now you guys are going to use what you've learned to improve on your bridges!

PART TWO BUILD:

1. Same activity
2. Test the bridge, hopefully they improved!
3. Kids can take them home :)