

Math 7 - The Box Project

An introduction to engineering and design to meet customer specifications

Mr. Fruzzetti's Classes
Assigned 27E; Due 29E

READ IN ITS ENTIRETY WITH YOUR FOLKS BEFORE YOU GET STARTED

DISCUSS WHAT ITEMS (MATERIALS, TOOLS, ETC) YOU WILL USE BEFORE YOU BEGIN DESIGN OR PRODUCTION

PARENTS: *I challenge you to step into a very standardized, agreed-upon role in this assignment. I think they'll have the most fun and learn the most if you limit your offering to a conversation about what they'll be doing and using - your kid knows his / her limits, WITH YOUR GUIDANCE.*

Depending on what they decide to use, you know what phases of their project you may want to supervise (or cancel, if necessary) for safety. I suggest you also ask your child questions including my SUGGESTED QUESTIONS whenever you think it will help them understand the underlying math / engineering.

STUDENTS: *I'd like you to shoot for your personal best on all levels, like this should really showcase your ability to push yourself to what we call in RPGs a "level up." It's when you concentrate on doing the very best you can and experience makes you better at it. In real life, you get a level up EVERY TIME YOU DO SOMETHING, not once every fifty boss fights. (← video gamer jargon, not fomentation of rebellion)*

The Box Project has one simple real-life goal:

- 1) Build a box to my specifications.

Your box may be made of any combination of raw materials including:

- 1) Paper (including cardboard),
- 2) Wood (including dowels or craft sticks),
- 3) Metal,
- 4) Plastic,
- 5) Foam, hot-glue, PCB, RoHS-compliant components, or,
- 6) Just about anything else you can think of. Simple or Elegant. Whatever. Just make sure it does the work.

Try not to spend money on materials. If you decide to spend money, spend your own. If you do not and will not have any of your own money by due date, you must improvise from materials you already have.

You may use any tool of any type that you are able to operate solo and safely

(Your parents are given permission to limit you at no cost to your grade or pride):

- 1) Tape, staples, glue, scissors
- 2) Wood, nails, ...

When your Box Project is complete, name it. Literally any name will do. "TheBox," "Project Carry Case," "A+," or just give it some sort of coded number like 19A705. You can read about these numbers just the same way they're hidden in every Pixar movie since Toy Story.

The Box Project, as a way of learning, has two goals:

- 1) Teach you how to solve real-life math problems and equations involving real-life variables.
- 2) Show you what you are able to do in math by letting you work in all basic (pre-calculus) math fields using your body: visualizing, cutting, folding, connecting, testing, judging, (hopefully) deciding you've failed a couple times, setting clearer standards including asking my **suggested questions, MEASURING THAT PART THIS TIME**, cutting folding, ... get the picture?

Engineering: The materials, instructions and way to earn an 'A' are within everyone's solo reach. Pretend I've hired you to fabricate this for me; I'm a paying customer telling you what I want you to make me and what I want it to be able to do for my life.

An A+ Box Will meet these SPECIFICATIONS (no outsourcing allowed):

- 1) Be able to contain an average object weighing between ½ and 1 pound.
- 2) Fully enclose said object.
- 3) The lid does not have to be hinged, but it must be easy to secure and remove the lid repeatedly without failure. Lid should not fall off in transit.
- 4) Lid action, be it hinged or lift-off or something more creative, must be smooth and aesthetic.
- 5) Be sturdy enough that it can be picked up from either pair of bottom corners. If I can feel my object through it, then the bottom is too soft and you gave me a "bag." I want a box.
- 6) Tolerate having the object jostled around in there a little, like from being carried.
- 7) May be any shape, but must be able to contain that average object and stand upright.
- 8) Both the outside and inside must be "finished off" to give a pleasing look. So literally, think outside the box, but also think inside the box.

Engineering Suggestion: At the beginning of our Geometry segment, I told you, “The universe is easiest in triangles.” This applies here. What I mean is not that you want to make your box triangle-shaped, but that you’ll find featuring the triangle is a good / easy STRUCTURAL element, to make it more rigid. There are other rigid shapes like the arch but they’re harder to work with. Experiment a little and you’ll see what I mean.

Engineering Modus Operandi: Do not get attached to your first design. Be prepared to test it and say, “It’s terrible; this just won’t do.” Going back to the drawing board isn’t just an expression, it’s a way of life for people who succeed. In real life we just call this, “I’m not done yet,” and we analyze it to figure out what needs to be better, then we do it again over and over if necessary until it works the way we want. We do not lower our standards, we learn up to them. Even the SECOND time you try it, you’ll be surprised how much better you got at it even if you still decide to do it again. Maybe you rebuilt it with the same materials last time but you just can’t make them work, so you’ll have to use different or more materials next time!

Interview: I reserve the right to interview you about your creation. I will grill you worse than you’ve ever had it in detail to know just how much you know about what you did.

Scraps: Scraps are extra bits of materials and consumables you used: Extra bits of paper or wood or whatever that you didn’t use, including things like near-empty bottles of glue or paint, etc.

If you like, you may give me some or all of your scraps. Over Spring Break I’ll prepare a “response and interpretation” of the sum of your projects - my own Box Project, as scavenged as possible. I will try to use some scraps from every person who provides any. I am hoping to surprise you with my resourcefulness and show you a side of my education - the experience side - I otherwise could not possibly teach any other way. Everything I know how to do is something you could easily also know how to do - we’re made of all the same stuff, after all! I bet I’ll learn a lot about you and your Box Project from this.

Fact: “Ability to create by engineering with improvisation” is so critical to a good education that you cannot be a master of anything without it. Take the Box Project seriously and you will surprise yourself.

In Closing, A Rhyming Haiku:

I’m about thirteen,
Fruzzetti says I’m a ‘tween.
But I’m REALLY KEEN.

Questions to ask yourself:

(Each of these questions may come in handy at some point during your design and construction phases)

- 1) Is this the correct size? If not, what should I change?
- 2) Will this bottom hold the weight?
- 3) What fraction of this length is that length?
- 4) How will I improve on my first version?
- 5) How much longer or shorter does this need to be? What fraction is that?
- 6) How sturdy will this (wall, edge, corner) be? Do I need to strengthen it? How?
- 7) Why am I using these materials for this part of the construction?
- 8) Did I measure correctly? Do I need to measure again and reconsider my plan?
- 9) Am I on target to meet specification (#1, #2, ..., #8)?
- 10) What part(s) am I happy with? What part(s) should I re-do?
- 11) What went right, what went wrong?
- 12) What did I learn from this spectacular failed design? How did I get better with the materials?