Developing **math projects** that are **authentic** and allow student **voice** and **choice**

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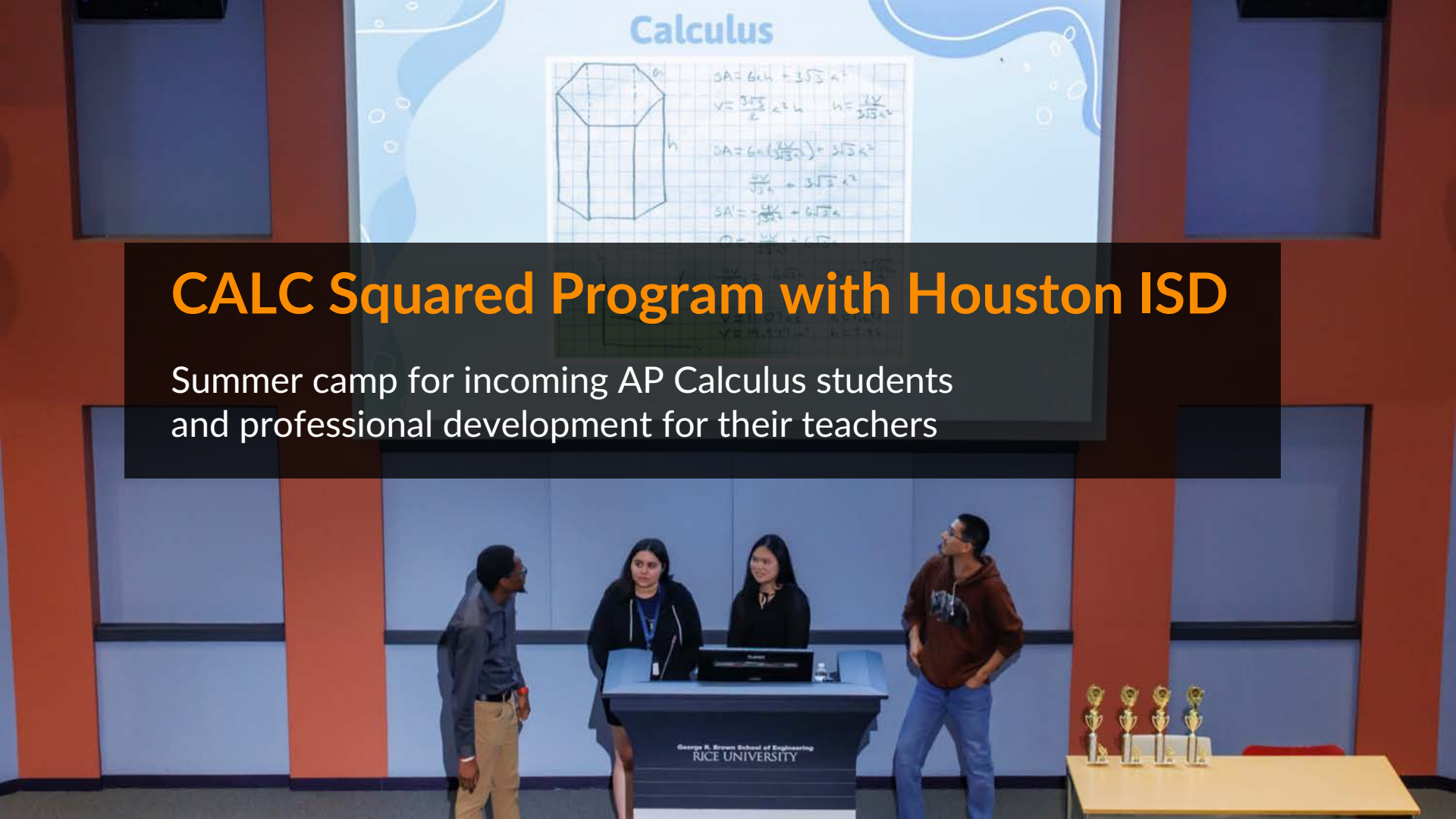
Tapia STEM Camps at Rice University

2000+ middle and high school students have attended
Project Based STEM Camp emphasizing communication and equity

Tapia PD Camps at Rice University

400+ K-12 educators students have attended
Professional Development Camp on Project Based Learning



CALC Squared Program with Houston ISD

Summer camp for incoming AP Calculus students
and professional development for their teachers

NSF Award with San Jacinto College

Supported 20+ college math professors
who built projects for their classrooms

We develop original STEM projects

These students are building a model underground reservoir for storing carbon to mitigate climate change

Gold Standard PBL

Seven Essential Project Design Elements

Even if you don't do projects

principles of PBL can be brought to your teaching.

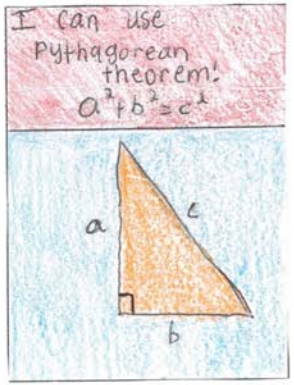
Authenticity

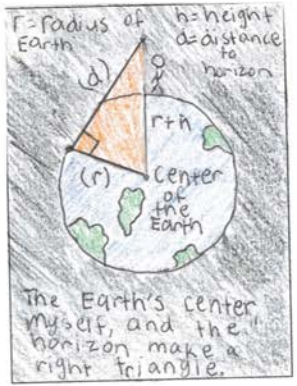
- ➔ Is it related to the students' lives?
- ➔ Is it related to what professionals do?
- ➔ Can the students actually create something with it?

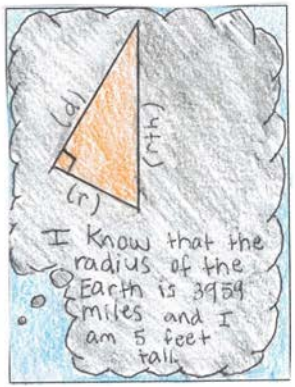
1. Should solar panels have motors so they always face the sun?

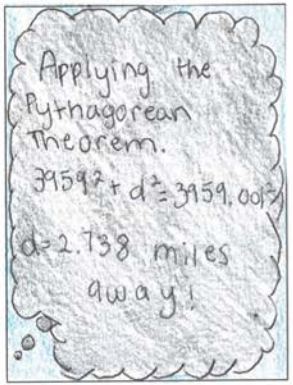
Students choose a context (geographic location, home vs company, etc.) and justify if they think it is worth it to purchase motors in addition to solar panels.

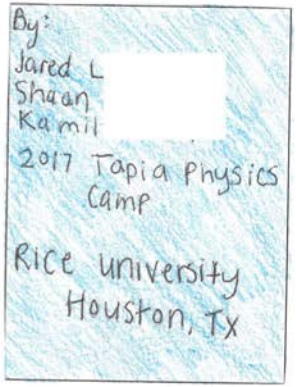
- ➔ **Many students care about climate change** and decisions they make that affects it.
- ➔ **Some households make this decision** and schools and businesses too.
- ➔ **Different groups may disagree** and that is fine, even in a math class!











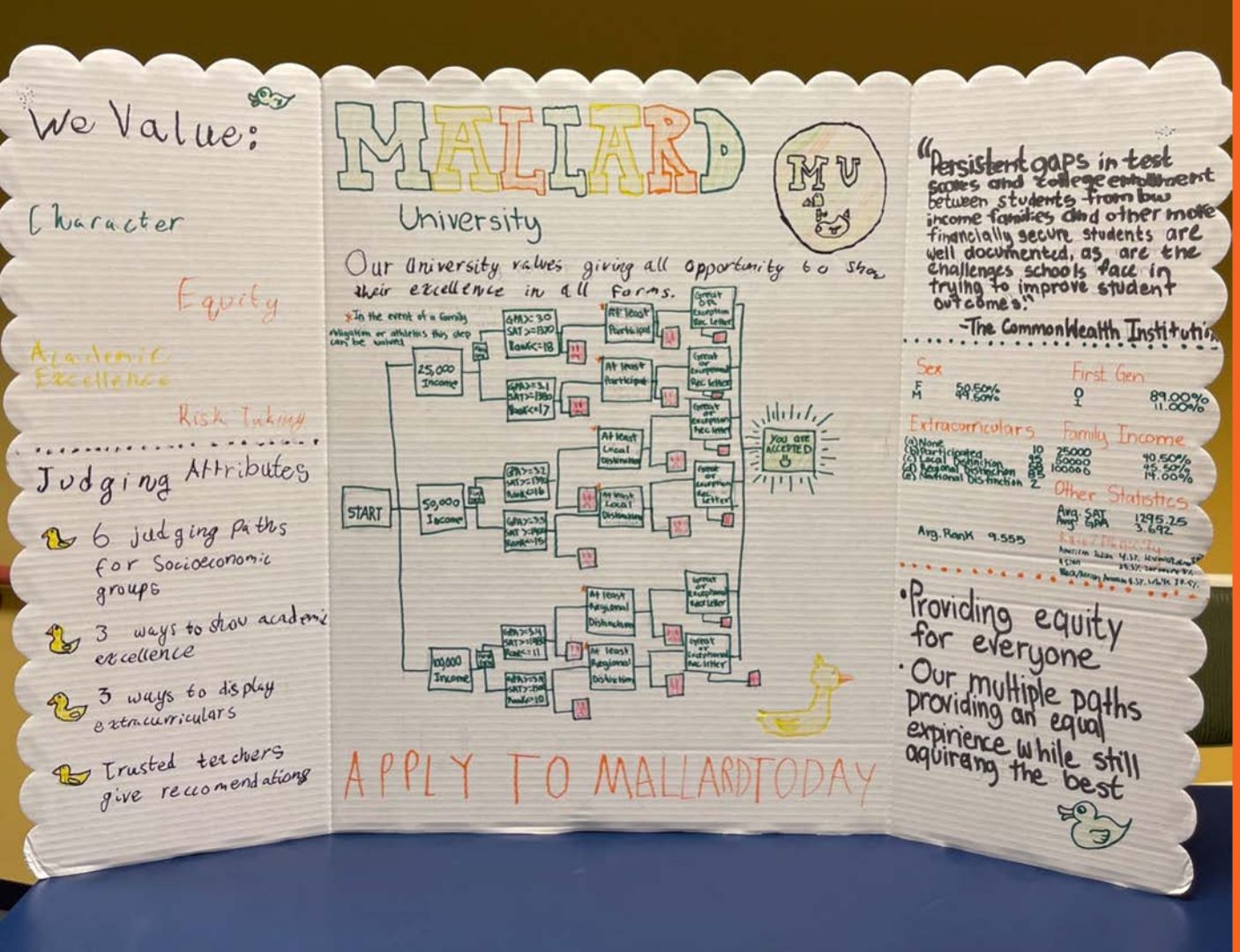
2. How far is the horizon?

Students compute how far away you can see what looking out to the ocean.

We no longer offer this project and now aim for projects with greater authenticity

Voice

- Can students express their unique values, background, and perspective?
- We strive to allow voice **even in a math project.**

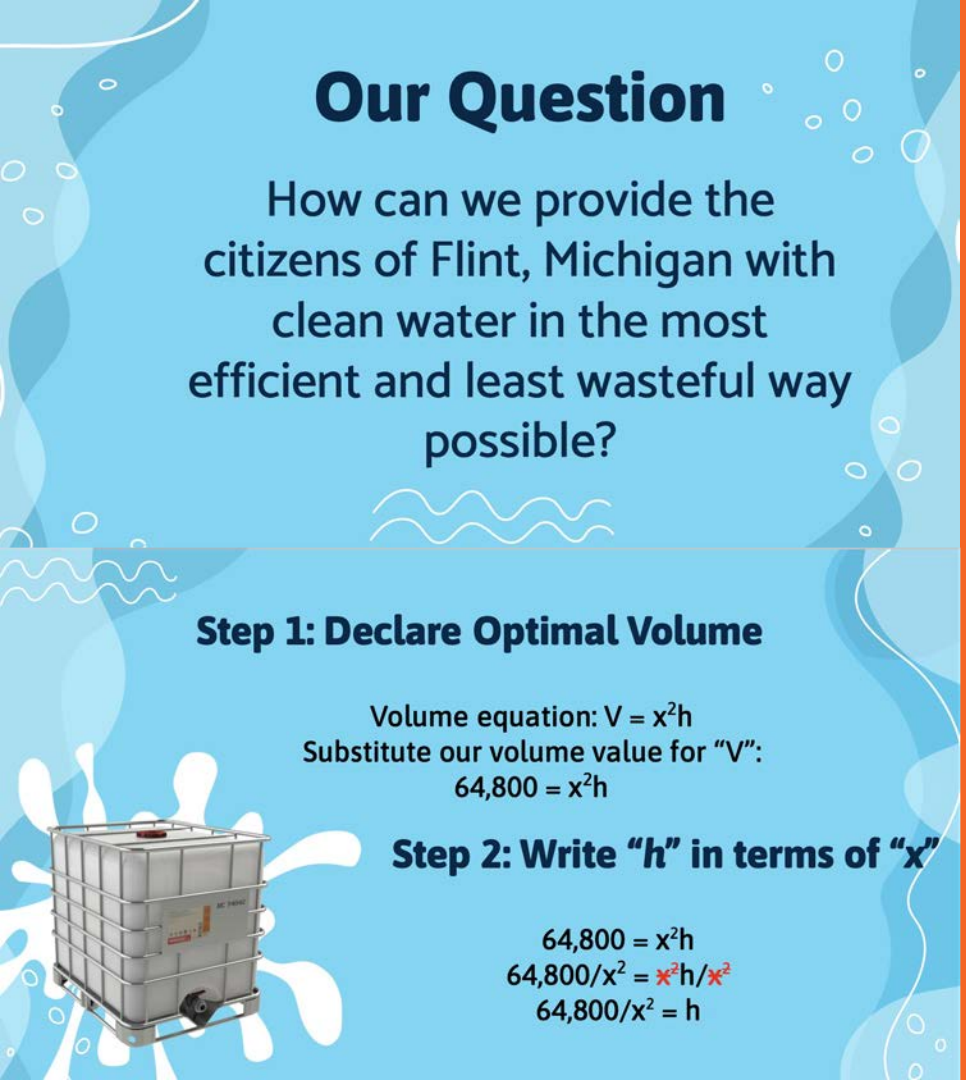


3. How can we develop an algorithm for admissions that is consistent with our values?

Students are given a spreadsheet of 1000 hypothetical college applicants and create an algorithm to decide who should get reviewed by a limited number of human admissions officers.

Choice

- ➔ Can students tailor the project to their interests?
- ➔ Will there be variability in student presentations?
- ➔ Example: students choose different contexts



4. How can you design a water bottle that is least wasteful?

Students choose a context:
Flint Michigan, Puerto Rico hurricane, marathon, summer camp, office workers, other context of your choice.

Students use calculus to determine the shape of their water bottle that they believe is optimal.

Some groups chose rectangular prisms, cylinders, hexagonal prisms, etc.

We aim for projects that can be engaged at many levels

- ➔ Our students have a wide range of backgrounds
- ➔ Could the project be engaging to a college student? A professional? An elementary school student?

We aim for projects that can be engaged at many levels

Examples:

- ➔ Water bottles
- ➔ College admissions
- ➔ Solar panels

Stories of building projects

Start with news/events

Examples:
- College Admissions
- Carbon Storage

Start with a guiding question

Example:
- How much time do you save by speeding?

Start with specific content

Examples:
- Piecewise functions
- Function transformations

Concluding thoughts

Building projects is difficult and time-consuming.

- ➔ **Implement the project yourself.**
  The smallest details may trip you up.
- ➔ **Give students feedback**
  well before a public product.
- ➔ **Integrate multiple disciplines,**
  especially literacy and communication.
- ➔ **Support with content knowledge.**
  Projects can inform what is worth practicing.
- ➔ **We'd love to work with you**
  and help build engaging math projects.

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