

# Math Throughout the Challenge

This document describes how the Design & Pitch (D&P) Challenges in STEM framework was designed to support the learning of targeted math content. While completing each phase, teachers are likely to see students engage in activities that **(1) establish a foundation that supports students' understanding of formal math concepts, (2) require the use of the formal math concepts, or (3) are an essential component of real-world problem solving.** Each cell in the following table includes a list of some of these key activities and links to these three goals.

Launch		
<p>Students reason mathematically as they work to understand the challenge and brainstorm solutions. They:</p> <ul style="list-style-type: none"> <li>• Determine whether potential solutions fit the challenge criteria <b>(3)</b></li> <li>• Identify real-world factors that should be considered in a viable solution <b>(3)</b></li> <li>• Develop a deep understanding of the challenge context <b>(1)</b></li> </ul>		
Design		
Research	Prototype	Justify
<p>Students dig deeply into the details and process of building their solutions. They:</p> <ul style="list-style-type: none"> <li>• Learn about companies that have designed similar solutions <b>(1,3)</b></li> <li>• Establish real-world constraints for their solutions <b>(1,3)</b></li> <li>• Research the information they need to prototype their solutions <b>(1,3)</b></li> </ul>	<p>Students build, test, and refine their solutions during the prototype phase. They:</p> <ul style="list-style-type: none"> <li>• Explore math resources to learn the content needed to build a prototype <b>(1,2)</b></li> <li>• Use technology tools to build prototypes of their solutions <b>(2)</b></li> <li>• Test solutions under real-world conditions and make improvements based on their and their users' expectations <b>(2,3)</b></li> </ul>	<p>Students describe the specifics of their solutions during the justify phase. They:</p> <ul style="list-style-type: none"> <li>• Show how specific features of their solution meet the needs of consumers <b>(3)</b></li> <li>• Describe the details of their solutions, including the formalized math content targeted by the challenge <b>(2)</b></li> </ul>
Pitch		
<p>Students deepen their understanding of their solutions as they practice succinctly and clearly convincing the judges of the viability of their solutions. They:</p> <ul style="list-style-type: none"> <li>• Describe and show the features of their solution <b>(2,3)</b>.</li> <li>• Explain how they developed their solution and the “behind-the-scenes” details that make it work <b>(2,3)</b>.</li> </ul>		

## What can you do when the math is not showing up as intended?

### Launch

At this early stage of the challenge, be sure to allow students the autonomy to pursue solutions they find meaningful. If it seems a group is likely to miss key challenge criteria, especially ones that explicitly call for the intended math content, consider:

- Continually pointing students back to the challenge statement.
- Exploring students' solutions with curiosity and interest. Ask students what problem they are solving and how their solution addresses the challenge criteria.

### Design

Research	Prototype	Justify
<p>Encourage students to attend to the math-focused criteria through researching the context and existing solutions. Consider asking questions like:</p> <ul style="list-style-type: none"> <li>• How have companies solved this problem?</li> <li>• What makes these solutions a good fit for this challenge?</li> <li>• How will you incorporate features of these solutions in your solution?</li> <li>• What would you change about these features?</li> </ul>	<p>Draw on students' experiences as designer and consumer to encourage them to revisit the math-focused challenge criteria. Consider asking questions like:</p> <ul style="list-style-type: none"> <li>• How does your solution address the challenge criteria?</li> <li>• How does your solution meet the needs of your consumers?</li> <li>• What will an investor need to see before investing in your solution?</li> <li>• Consider holding a math or tech tool workshop</li> </ul>	<p>Follow student thinking and draw on their knowledge of their solutions to focus their attention on the math-focused criteria in the Technical Brief. Consider asking questions like:</p> <ul style="list-style-type: none"> <li>• What information will the judges need to be confident your solution will work??</li> <li>• Will someone who has not talked to you about your solution know what it does or how it works?</li> </ul>

### Pitch

Draw on students' excitement about the pitch competition and sharing their work with outside judges to draw their attention back to the math-focused challenge criteria. Consider asking questions like:

- What would you want to know before investing in a product?
- What does your product/solution look like and what does it do? Will the judges know this from your pitch?

For students who have not completed the technical brief, encourage them to use it to show the detailed mathematics that informed their solution.

## More Resources About the Math in D&P Challenges

Check out the "Where's the Math?" section in the teacher guide for a specific challenge to understand what the content standards are that are associated with the challenge. You can find the guides and the math topics for a challenge in the [Challenge Overview Matrix](#).