

MATHEMATICAL STORY PLANNING TOOL

A **mathematical story** is a framework for thinking about lessons, where one can consider the characters, plot, and setting within the context of our math classrooms. The characters are the mathematical objects, and the setting is where we operate on those mathematical objects (for example, on a graph, algebraically on a piece of paper, a table, etc.). Students and teachers can perform actions on these mathematical objects to arrive at new understandings. The plot is how these actions unfold in the lesson and what understandings or insights are reached through these developments. Successful stories are designed to provoke particular aesthetic reactions that spur student curiosity, captivate students with complex mathematical content, and compel students to engage and persevere.

Topic: Linear functions	
Objective/Moral of the Story: Students will be able to recognize key features of a linear function in many different representations.	Subject/Level: Integrated Math 1 (Algebra 1)
Aesthetic: Surprise	
Characters: What mathematical objects are important to this story? 18 different representations of the same linear function, representations include equations, graphs, tables, and verbal descriptions.	Setting: Where does the math happen? Students will receive 18 different cards that each show a different representation of the same linear function.
Plot Arc (one model): How will the mathematical story unfold? How do I expect that to impact the student experiences?	
<div style="display: flex; flex-direction: column; align-items: center;"> <div style="color: red; text-align: left; width: 80%;"> <p>Whole class: I ask students to present cards that they believe are connected. In this discussion, students present their reasoning and may add on/agree/disagree with other students' groupings. Through this discussion, students realize that many cards represent the same function! Could it be that all of the cards are represent the same function?</p> </div> <div style="display: flex; justify-content: space-between; width: 80%; margin: 10px 0;"> <div style="color: red; text-align: left; width: 30%;"> <p>In small groups: Students determine that pairs or small groups of cards represent the same function.</p> </div> <div style="color: red; text-align: left; width: 30%;"> <p>In small groups: Students verify that all the remaining cards in fact do represent the same function.</p> </div> </div> <div style="display: flex; justify-content: space-between; width: 80%; margin: 10px 0;"> <div style="color: red; text-align: left; width: 30%;"> <p>In small groups: Students will be asked to create groups of the functions they think are similar.</p> </div> <div style="color: red; text-align: left; width: 30%;"> <p>Whole class: Present final connections discovered. Opportunity to discuss how to recognize the y-intercept and the slope in many different representations of a linear function.</p> </div> </div> <div style="display: flex; justify-content: space-between; width: 80%; margin: 10px 0;"> <div style="text-align: center; width: 20%;"> <p>Hook</p> </div> <div style="text-align: center; width: 20%;"> <p>Rising Action</p> </div> <div style="text-align: center; width: 20%;"> <p>Unfolding Action</p> </div> <div style="text-align: center; width: 20%;"> <p>Resolution</p> </div> </div> </div> <div style="display: flex; justify-content: space-between; margin-top: 10px;"> <div style="font-size: small; width: 45%;">Mathematics Lessons as Stories: Engaging Learners with Plot Twists</div> <div style="font-size: small; width: 45%;">Laura Ryan and Leslie Dieker, Boston University</div> </div>	

Questions to consider while designing:

- What prior knowledge do students need to access this lesson? - I will use this lesson as a way to review linear functions with my Math 1 students. They have created tables, graphs, and equations of linear functions before, but I am not convinced that they necessarily understand different ways that slope could be represented.
- How will I facilitate the aesthetic responses from my students? During which moments? - I will ask students to create groups of functions that they feel are similar. I will not give any other criteria. I will position myself as a facilitator and not an evaluator. During small group discussion, circulate to ask students to explain their groupings and suggest ways that they might consider some of the more challenging representations (i.e. suggest that they make a table for an equation or a verbal representation). During whole group discussion, ask students to share their groupings and reasonings. Allow students to agree or disagree, as well as add additional representations that they think are connected.
- What are the transitions between the moments? How does each part lead to the next? What will progress the story? - There are enough representations that everyone should be able to make some connections with a small group. Working in small groups of students will also facilitate additional pairings, as each student may see a connection that their group members might not. Whole class discussion will generate some energy so that students are able to see that many representations are connected. Hopefully a student will recognize that perhaps they are **all** connected!
- How does my classroom culture facilitate this story? - Students in my classroom feel comfortable contributing and addressing each other. I required them to learn each other's names at the beginning of the year, and we switch seats often. We work in groups every day. Whole class discussions occur regularly in my classroom.

