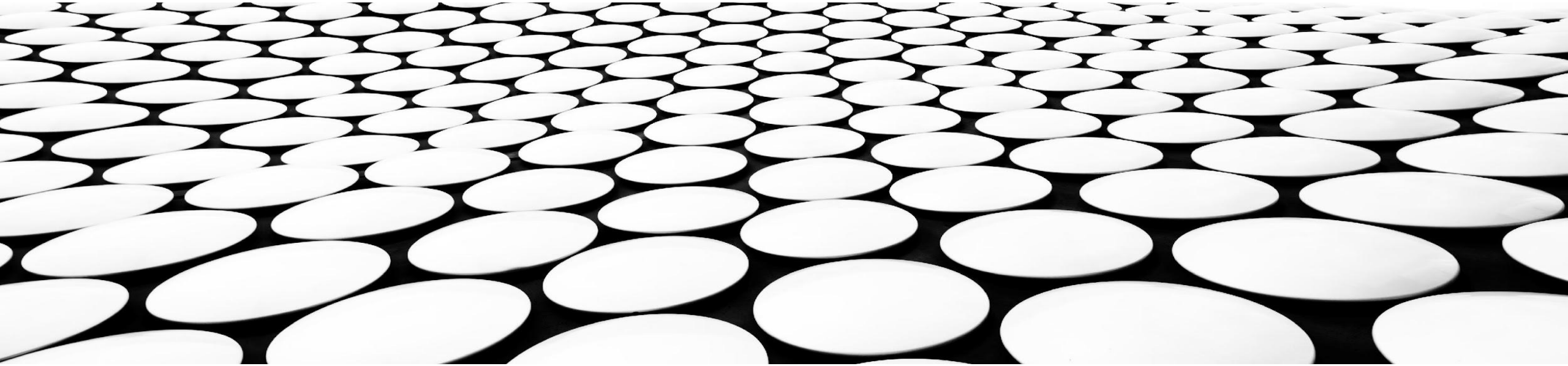
MATHEMATICAL PRACTICES AND THE 3-ACT TASK

GRADES 3-8: PREPARING FOR THE REVISED GSE IN MATHEMATICS

Terry Haney, Math Specialist
Northwest Georgia RESA
thaney@nwgaresa.com
256-630-8362 (CELL)
706-295-6189 (ext. 20)



NORTHWEST RESA VIRTUAL SIGN IN

August 30, 2022 ***TRION 3-8 MATH PL SESSION 1: USING 3-ACT TASKS***

Please use the QR code or the link below to sign in for this session.

nwgaresa.com/signin

GOALS FOR OUR SESSION…

Participants will be able to…

- describe the structure and purpose of a 3-Act Task.
- describe explicit connections between content standards and Mathematical Practices.
- choose appropriate tasks to enhance existing materials.
- explain the interconnectedness of current school math expectations with current and revised GSE.

GETTING READY FOR REVISED GSE IN MATHEMATICS

Revised GSE in math are to be implemented in the 2023-2024 school year, but we need to address some of the specific PROCESS expectations now.

Mathematical Practices (Problem Solving & Perseverance—Reasoning Abstractly—Constructing and Critiquing Arguments—Modeling—Using Tools Strategically—Attending to Precision—Looking for Structure—Patterning & Generalizing)

Mathematical Reasoning Framework (Reasoning—Evaluating—Problem Solving—Decision Making—Analyzing)

Mathematical Modeling Framework
(Exploring—Gathering—Creating—Analyzing—Evaluating)

GETTING READY FOR REVISED GSE IN MATHEMATICS

Revised GSE in math are to be implemented in the 2023-2024 school year, but we need to address some of the specific PROCESS expectations now.

Framework for Statistical Reasoning
(Asking—Collecting—Analyzing—Interpreting)

Computational Strategies (Balancing Computational and Procedural Fluency—Giving Students Flexibility and Choice Among Strategies)

GETTING READY FOR REVISED GSE IN MATHEMATICS: *THE BIG IDEAS*

<table>
<tr><th>K</th><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th><th>8</th><th>HS Algebra: Concepts & Connections</th><th>HS Geometry: Concepts & Connections</th><th>HS Advanced Algebra: Concepts & Connections</th></tr>
<tr><td colspan="12">Mathematical Modeling (MM)</td></tr>
<tr><td colspan="12">Mathematical Practices (MP)</td></tr>
<tr><td colspan="12">Data & Statistical Reasoning (DSR)</td></tr>
<tr><td colspan="12">Numerical Reasoning (NR)</td></tr>
<tr><td colspan="12">Patterning & Algebraic Reasoning (PAR)</td></tr>
<tr><td colspan="12">Geometric and Spatial Reasoning (GSR)</td></tr>
<tr><td colspan="6">Measurement & Data Reasoning (MDR)</td><td colspan="6"></td></tr>
<tr><td colspan="8"></td><td colspan="4">Functional & Graphical Reasoning (FGR)</td></tr>
<tr><td colspan="7"></td><td colspan="2">Probability Reasoning (PR)</td><td colspan="2"></td><td colspan="2">Probabilistic Reasoning (PR)</td></tr>
</table>

LET’S BEGIN WITH A…

TRAFFIC JAM

Set Up: We need 2 groups of 4 people to demonstrate, with everyone else making observations.

Goal: The goal of *Traffic Jam* is for people to move so that their order is preserved on opposite sides.

Start Order: **A B C D _ 1 2 3 4**

Final Order: **1 2 3 4 _ A B C D**

TRAFFIC JAM DIRECTIONS

- You cannot move backwards.
- A person can only move forward one space to the adjacent, empty space or “jump” over a member of the other team to an empty space.
- A person cannot “jump over” his/her own team mate.
- Only one person can move at a time.
- One spot per person, no sharing spaces.
- If any of these rules are broken, the group must begin again.
- Start Order:

A B C D _ 1 2 3 4

- End Order:

1 2 3 4 _ A B C D

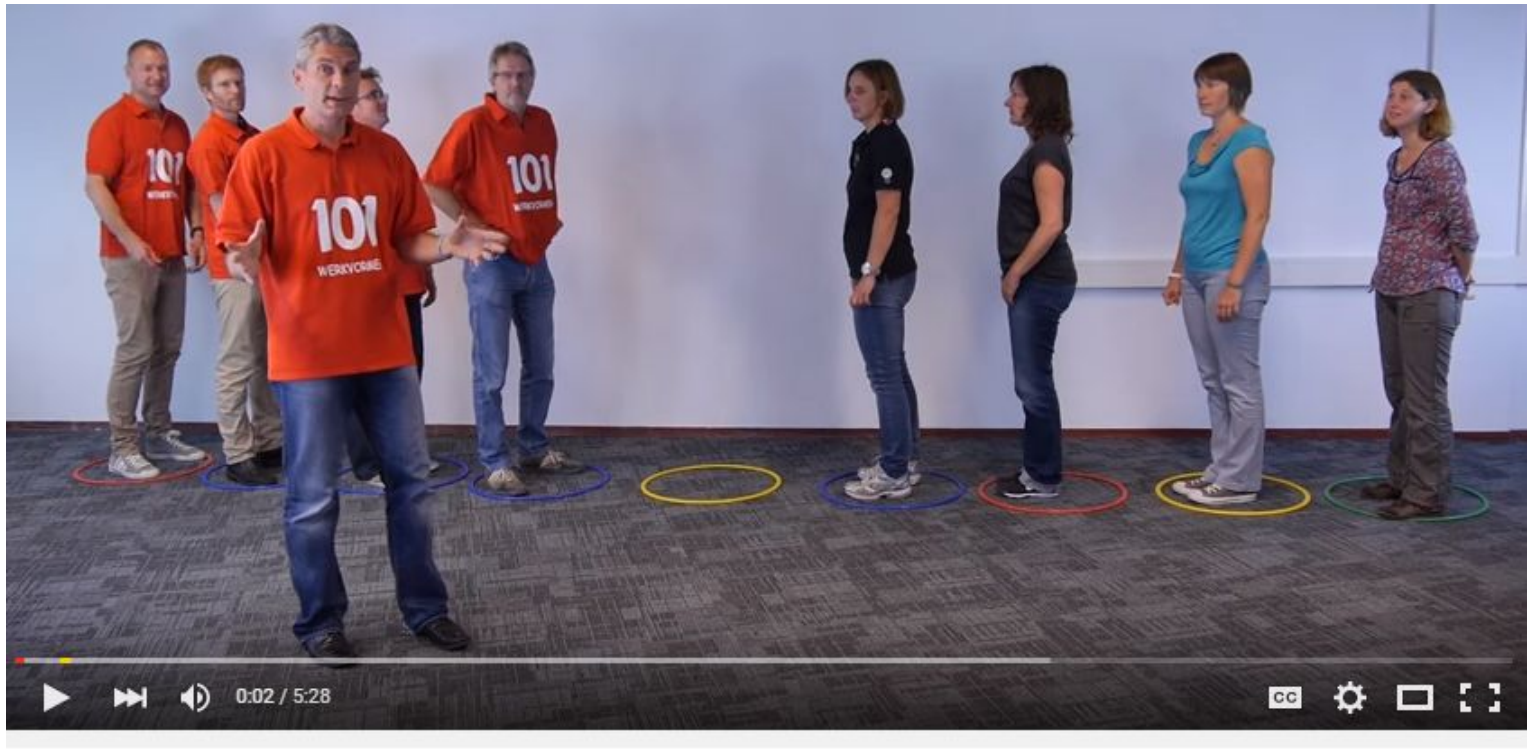
TRAFFIC JAM SCAFFOLDING AND EXTENSION

- Use the snap cubes to recreate the *Traffic Jam* and search for a solution.
- Consider simpler versions of the *Traffic Jam* problem to identify the pattern.
- Write out a description of your solution or solution attempts.
- Write a numerical and/or algebraic description of the total number of ”moves” based on the number of people. You may want to use an input/output table (T-chart).

TRAFFIC JAM: A SOLUTION

- Watch the following video clip for a solution to the traffic jam problem.

https://www.youtube.com/watch?v=74FERM9_Xmw



Traffic jam - teambuilding activity - 101werkvormen

TRAFFIC JAM--JOURNALING…

- Answer at least 3 of the following questions based on your experience in the *Traffic Jam* activity:
  - Where is the mathematics in this activity?
  - Which of the Mathematical Practices are evident in this activity?
  - How might you use this activity with your students?
  - How does this activity relate to student challenges in the classroom?
  - How does the activity relate to teacher challenges in the classroom?
  - What are any other “take-aways” from this activity?

STANDARDS FOR MATHEMATICAL PRACTICE **(HANDOUT)**

1. Make sense of problems and persevere in solving them
6. Attend to precision

2. Reason abstractly and quantitatively

3. Construct viable arguments and critique the reasoning of others

Reasoning and explaining

4. Model with mathematics

5. Use appropriate tools strategically

Modeling and using tools

7. Look for and make use of structure.

8. Look for and express regularity in repeated reasoning.

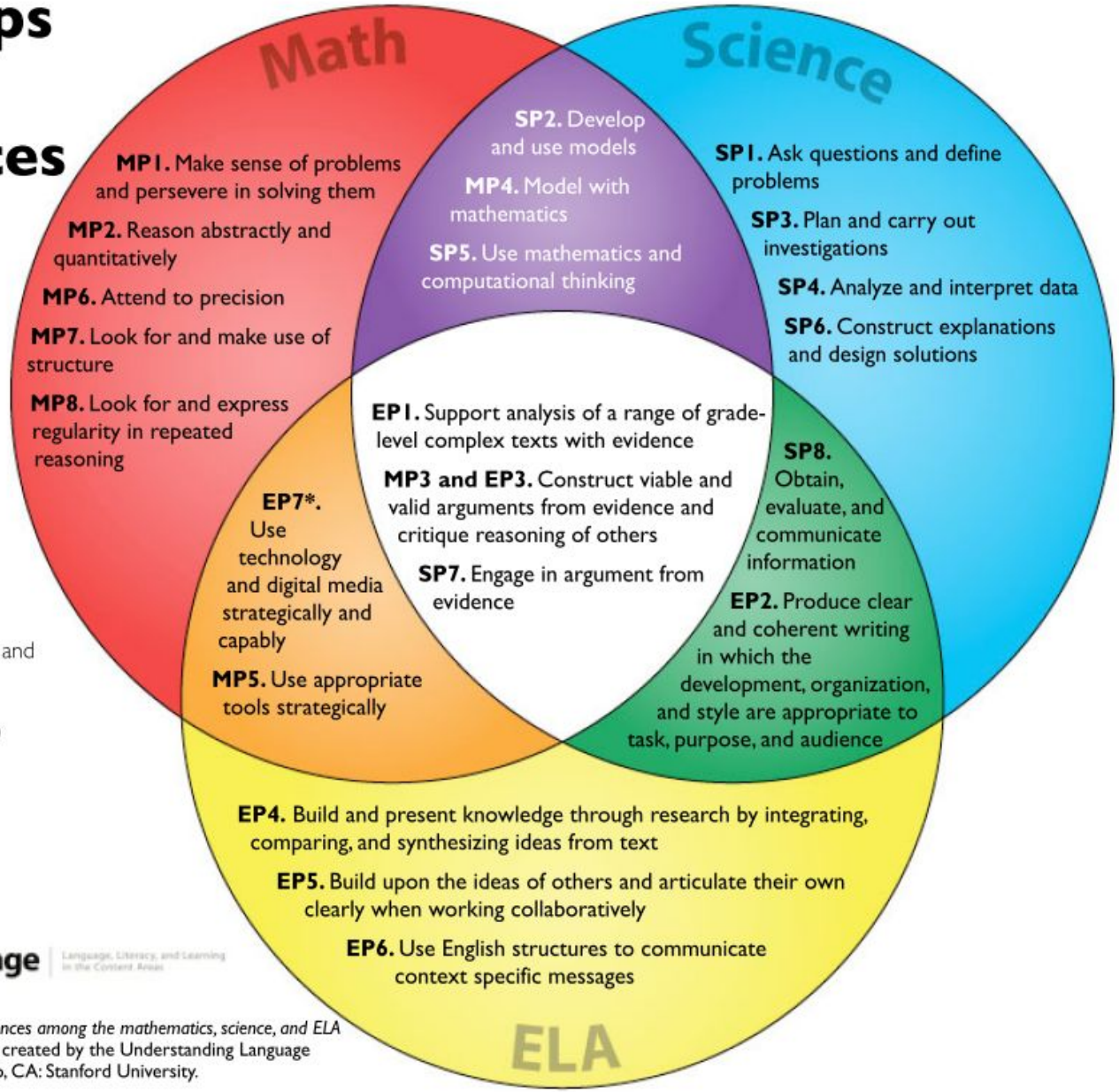
Seeing structure and generalizing

CONNECTING THE DOTS…

Relationships and Convergences

Found in:
1. CCSS for Mathematics (practices)
2a. CCSS for ELA & Literacy (student capacity)
2b. ELPD Framework (ELA "practices")
3. NGSS (science and engineering practices)

Notes:
1. MP1–MP8 represent CCSS Mathematical Practices (p. 6–8).
2. SP1–SP8 represent NGSS Science and Engineering Practices.
3. EP1–EP6 represent CCSS for ELA "Practices" as defined by the ELPD Framework (p. 11).
4. EP7* represents CCSS for ELA student "capacity" (p. 7).



Stanford GRADUATE SCHOOL OF EDUCATION

Understanding Language | Language, Literacy, and Learning in the Content Areas

Suggested citation:
Cheuk, T. (2013). *Relationships and convergences among the mathematics, science, and ELA practices*. Refined version of diagram created by the Understanding Language Initiative for ELP Standards. Palo Alto, CA: Stanford University.

- Mathematical Practices (Math)
- Science and Engineering Practices and Cross-Cutting Concepts (Science)
- Anchor Standards for Literacy (ELA and all other subjects)
- Information Processing Skills (Social Studies)
- Foundational Skills/Employability Skills/Soft Skills (CTAE/Connections)

DEFINITION…

A **Three-Act Task** is a mathematics task consisting of three distinct parts: an engaging and perplexing Act One, an information and solution seeking Act Two, and a solution discussion and solution revealing Act Three.

Information excerpted and modified from San Francisco Unified School District Mathematics Department Website

WHY WOULD I USE 3-ACT TASKS?

- provide an **engaging context** for the use of mathematics and the development of mathematical understanding
- create low barriers to entry, allowing the teacher to scaffold as necessary **(low floor/high ceiling)**
- provide an opportunity for **estimation and reasonableness**
- provide opportunities to **read, write, and talk about mathematics**
- provide opportunities for **oral and written reflection**
- access and use **prior knowledge** to build new knowledge
- encourage **multiple approaches**
- create situations which require students to engage in **mathematical modeling**
- **build relational understandings** among mathematics concepts
- shift student ideas about **justification** of thinking and answers

Information excerpted and modified from San Francisco Unified School District Mathematics Department Website

HOW DO I USE 3-ACT TASKS?

ACT 1: Engage and Perplex.

- In Act 1, the teacher may share an image, brief video clip, or a question/situation that is engaging and perplexing. Act 1 typically contains little or no numerical information.
- Students discuss/write what they notice and wonder. They generate questions to ask about the situation.
- Students decide on a question to answer and make estimates about the likely solution.

Information excerpted and modified from San Francisco Unified School District Mathematics Department Website

HOW DO I USE 3-ACT TASKS?

ACT 2: Seek Information and Solutions.

- In Act 2, students work on finding and documenting solutions to their problems. Solutions may include a combination of written explanations and computations.
- Students use information they have and ask for more information as needed.
- The teacher supplies more information as requested by students. ***(Teacher provides just-in-time information vs. just-in-case information.)***
- Students may edit and revise their work and may possibly revise their question(s) along the way.

Information excerpted and modified from San Francisco Unified School District Mathematics Department Website

HOW DO I USE 3-ACT TASKS?

ACT 3: Reveal, Discuss, Extend.

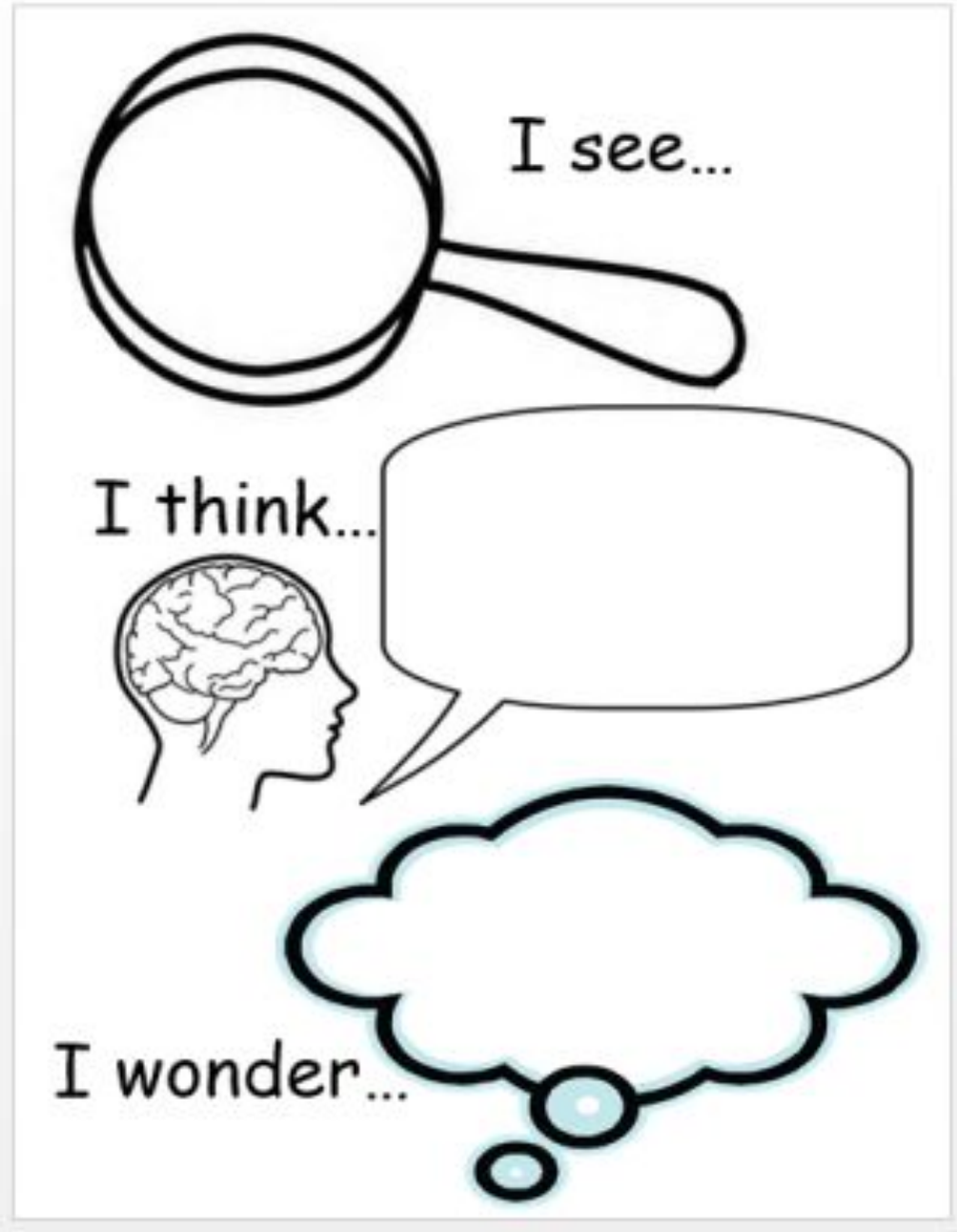
- In Act 3, students share their work, their thinking, and their solutions.
- The teacher may reveal a solution, and the discussion that ensues may take many directions:
  - Students compare/contrast their solutions to each others and to the reveal.
  - Students compare/contrast their solutions to their estimates.
  - Students discuss the assumptions that were made in the work.
  - Students generate other questions they could pursue next.
  - The teacher helps students connect their work to the core math of the task and to the Mathematical Practices.

A SAMPLE TASK…

3-ACT TASK: *KRISPY KREME ME*

https://gfletchy.com/krispy-kreme-me/

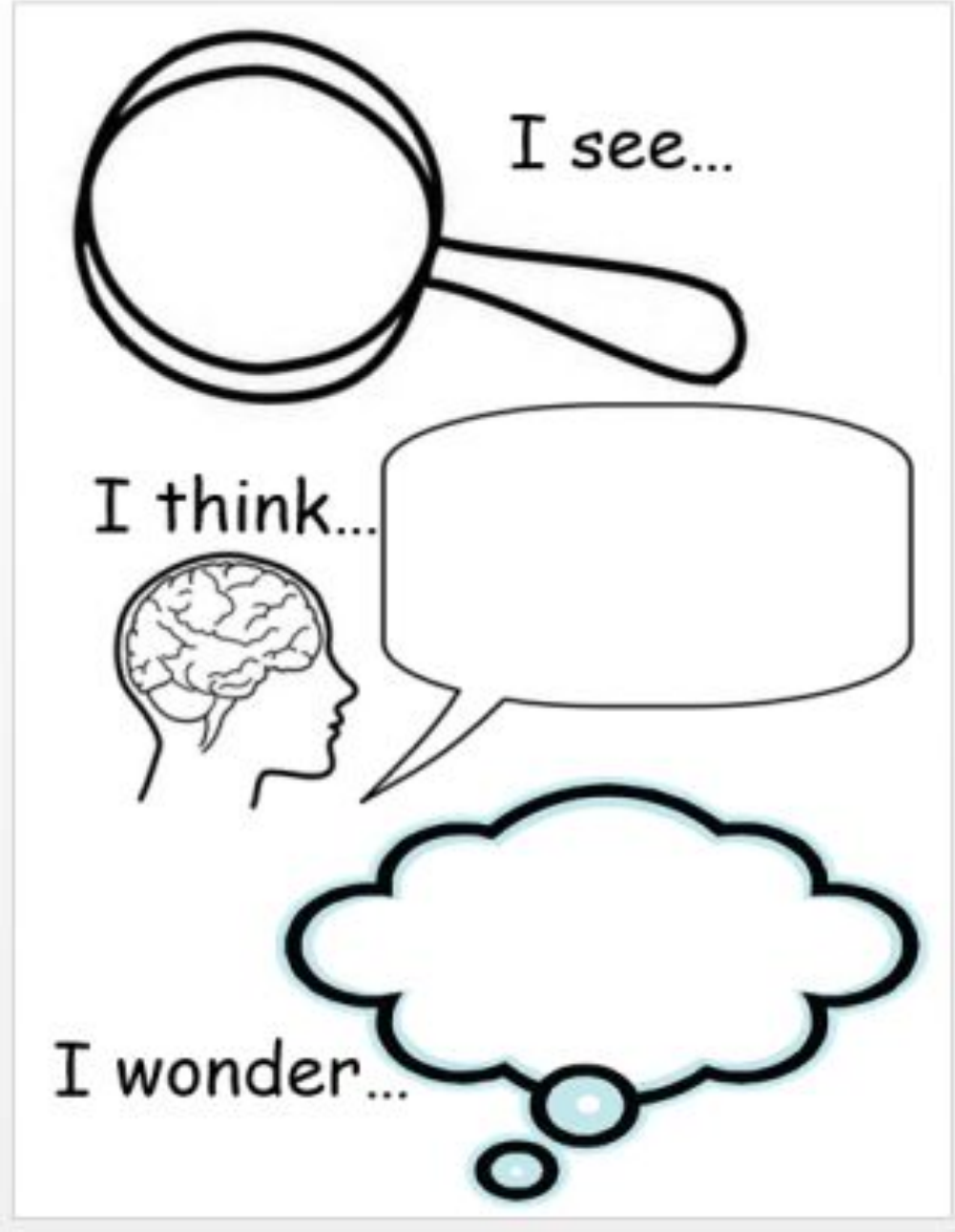
3-ACT TASK: *KRISPY KREME ME* ACT 1



As you view the next slide, use the graphic organizer to record observations (see and think) and questions (wonder).

3-ACT TASK: *KRISPY KREME ME* ACT 1

3-ACT TASK: *KRISPY KREME ME* ACT 1



Based on our observations, what question(s) do you think we are going to attempt to answer?

3-ACT TASK: *KRISPY KREME ME* ACT 2

3-ACT TASK: *KRISPY KREME ME* ACT 2

3-ACT TASK: *KRISPY KREME ME* ACT 2

3-ACT TASK: *KRISPY KREME ME* ACT 2

From: **HayleyHutchison**
07/10/2014 13:21:36

Hi Graham,
We hope the information below helps:
The box was created to allow 3 x layers of [redacted] doughnuts ([redacted] x [redacted] doughnuts on each layer)
Each doughnut is approximately 89 millimetres in diameter.
The box is 3000 mm x 2300 mm which allows a gap between each doughnut to sit comfortably.
We do not have any schematics to share as they are for internal use only but we wish you all the best with your class.
Kind regards,
Krispy Kreme

3-ACT TASK: *KRISPY KREME ME* ACT 2

From: **HayleyHutchison**
07/10/2014 13:21:36

Hi Graham,
We hope the information below helps:
The box was created to allow 3 x layers of 800 doughnuts (25 x 32 doughnuts on each layer)
Each doughnut is approximately 89 millimetres in diameter.
The box is 3000 mm x 2300 mm which allows a gap between each doughnut to sit comfortably.
We do not have any schematics to share as they are for internal use only but we wish you all the best with your class.
Kind regards,
Krispy Kreme

3-ACT TASK: *KRISPY KREME ME* ACT 3 (THE REVEAL)

Krispy Kreme 'Double Hundred Dozen' is a Dream Come True

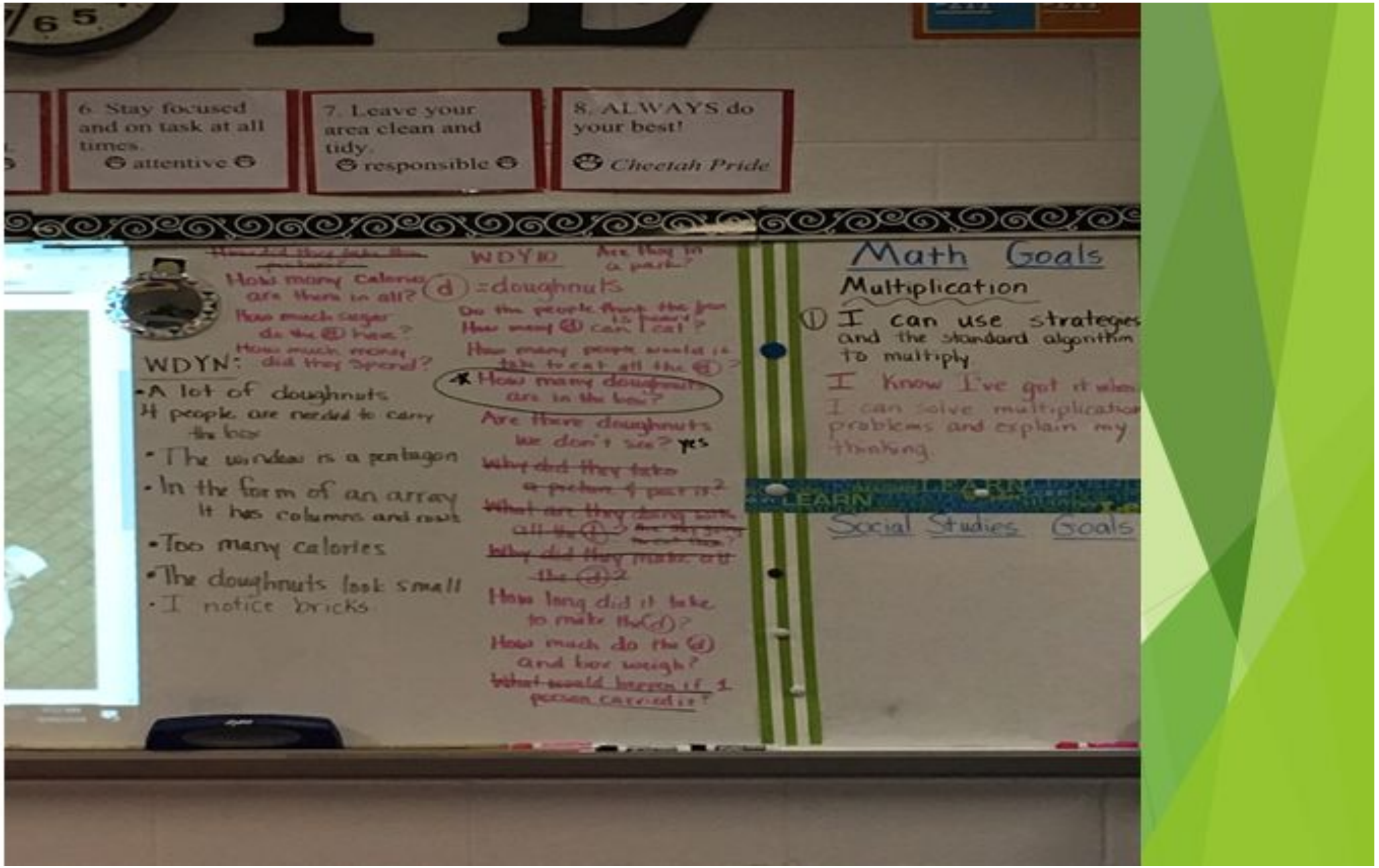
https://www.youtube.com/watch?v=wEmp_y9kAIU

3-ACT TASK: *KRISPY KREME ME*

3-Act Task: *Krispy Kreme Me*

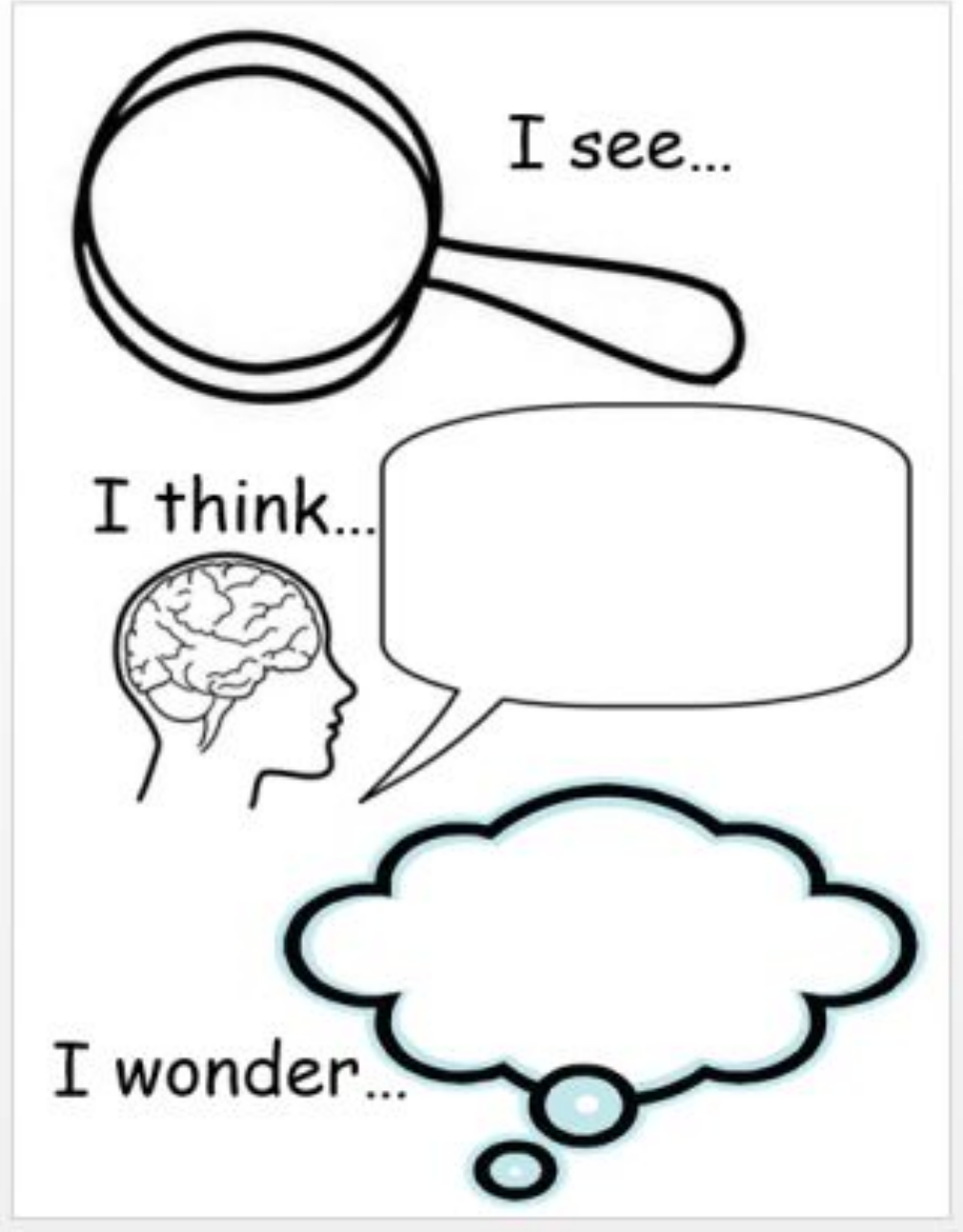
Observed on 9/10/2018 at Park Creek ES—Dalton Public Schools

3-ACT TASK: *KRISPY KREME ME*



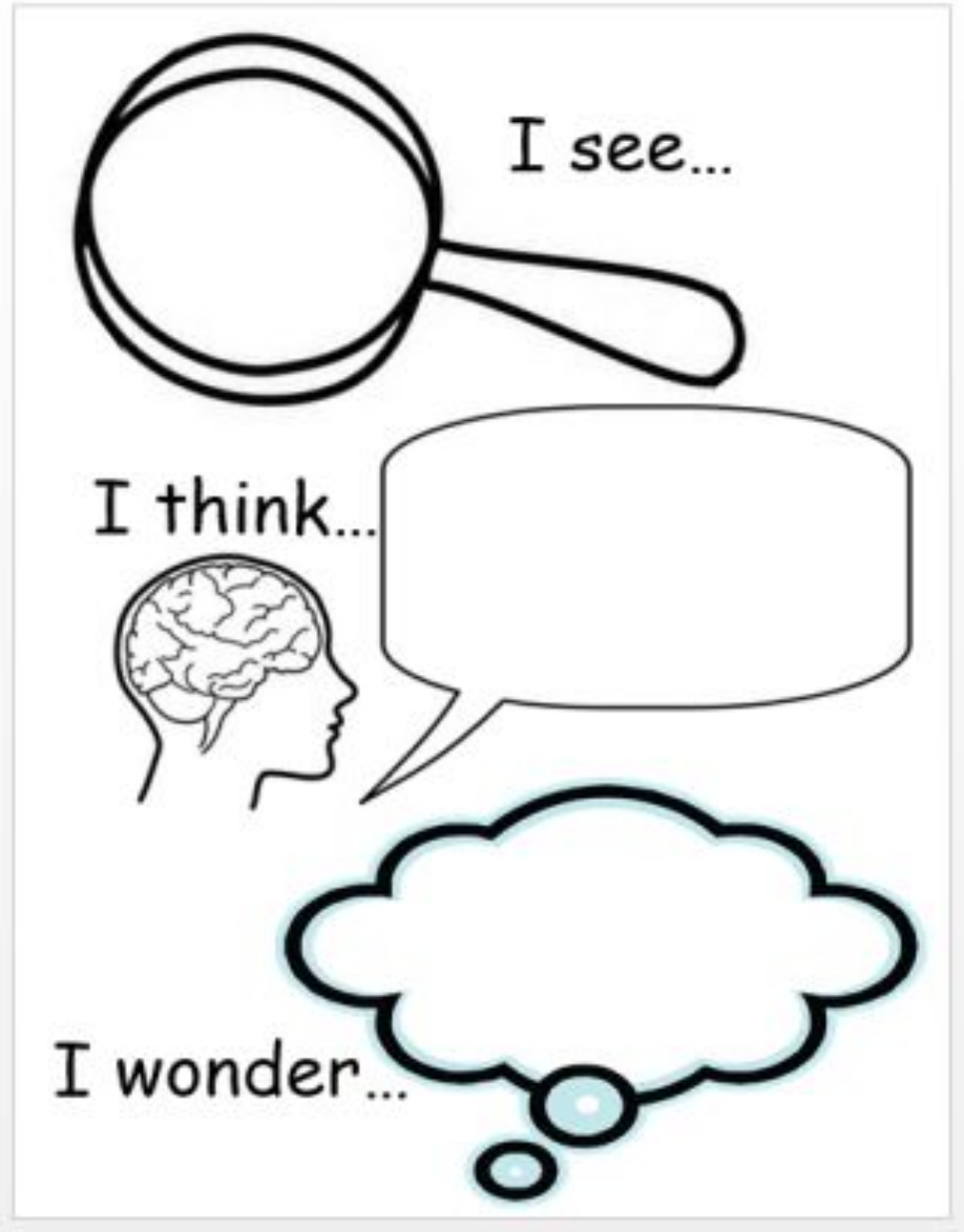
A SAMPLE TASK…

As you view the next slide, use the graphic organizer to record observations (see and think) and questions (wonder).



THREE-ACT TASK ACT 1: SEE…THINK…WONDER…

3-ACT TASK: ACT 1



Based on our observations, what question(s) do you think we are going to attempt to answer?

THREE-ACT TASK: *DUELING DISCOUNTS* ACT 2

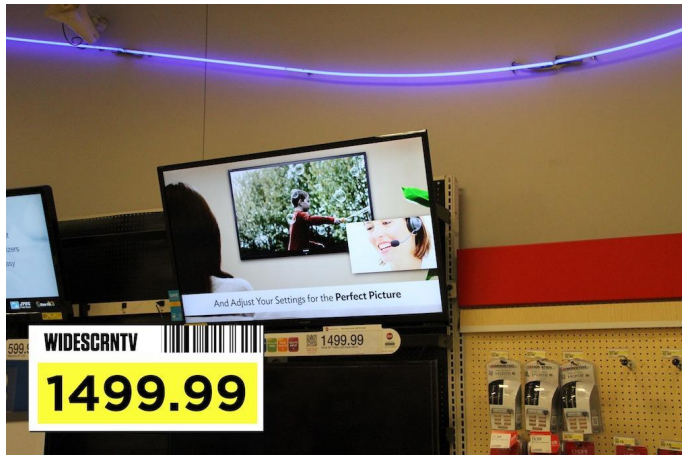
Building on your *See…Think…Wonder…d*ecide which coupon is best. Write an argument for your choice of at least 2 sentences. Provide a model and/or calculations to support your argument.

Work completely alone first! Once you have your argument constructed, share your thoughts with an elbow partner.

http://threeacts.mrmeyer.com/duelingdiscounts/

THREE-ACT TASK: *DUELING DISCOUNTS* ACT 2

Use the items below to practice your computations and to confirm or refute your argument.



QUICK WRITE/DISCUSSION: THREE-ACT TASKS

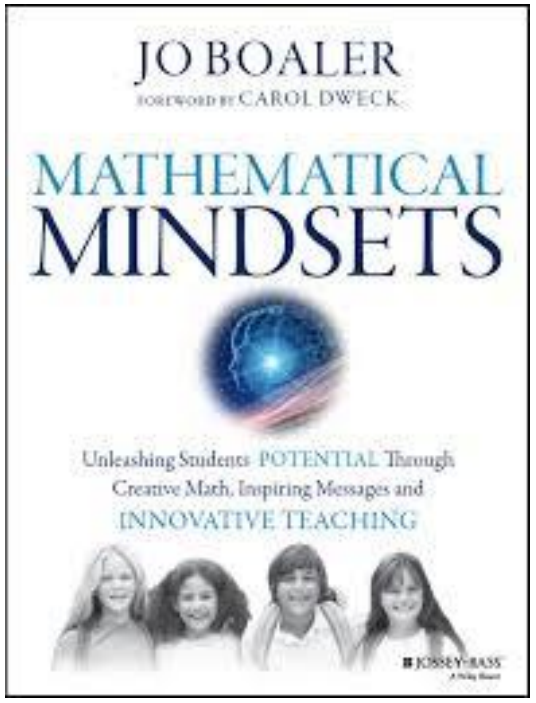
- What is the structure of a 3-act task?
- How can we use these tasks in class?
- What are the benefits and challenges of these tasks?
- How often might you engage students in 3-act tasks?
- What aspects of a 3-act task could be incorporated daily?
- How do the 3-act tasks (or similar tasks) help us prepare for the revised GSE in mathematics?

MATHEMATICAL MINDSETS—JO BOALER

According to Boaler, rich mathematical tasks create a *sense of mathematical excitement* that leads to the development of *insights into ideas and relationships*.

Curiosity
Connection Making
Challenge
Creativity
Collaboration

} **The 5 C's**



Six Questions for Designing and Adapting Tasks for Increased Rigor and Richness:

1. *How can you open the task to encourage multiple methods, pathways, and representations?*
2. *How can you make it an inquiry task?*
3. *How can you ask the problem* [question] *before teaching the method?*
4. *How can you add a visual component?*
5. *How can you make it low floor and high ceiling?*
6. *How can you add the requirement to convince and reason?*

GOALS FOR OUR SESSION…

Participants will be able to…

- describe the structure and purpose of a 3-Act Task.
- describe explicit connections between content standards and Mathematical Practices.
- choose appropriate tasks to enhance existing materials.
- explain the interconnectedness of current school math expectations with current and revised GSE.

NEXT STEPS

A follow-up PL session will be held on October 10, 2022. This gives you approximately 22 school days before our next session.

Please plan to explore and implement 2-4 Three-Act Tasks that align with the current state standards.

Use and/or modify existing Three-Act Tasks or create your own.

Be certain that reading, writing, and discussion of math are key aspects of the tasks (Mathematical Practices, Frameworks for Mathematical Modeling, Mathematical Reasoning, Statistical Reasoning). Explicitly identify in your lesson plans at least one Mathematical Practice in EVERY lesson you teach.

NEXT STEPS…

A Few Sources for Three-Act Tasks…

- Georgia Department of Education: https://www.georgiastandards.org/Georgia-Standards/Pages/Math.aspx
- Graham Fletcher: https://gfletchy.com/3-act-lessons/
- Dan Meyer: https://blog.mrmeyer.com/2011/the-three-acts-of-a-mathematical-story/
- San Francisco Unified School District Math Department: https://www.sfusdmath.org/3-act-tasks
- When Math Happens: https://whenmathhappens.com/3-act-math/
- Robert Kaplinsky: https://robertkaplinsky.com/

NEXT STEPS…

- Write one goal for yourself based on any of your “take-aways” from today’s session.

- What idea(s) from today’s session do you feel would have the most positive impact on mathematics instruction if implemented across all grade levels? Be specific!

- What questions, concerns, barriers, or additional support with respect to implementing the Mathematical Practices and more rigorous tasks need to be addressed in your school/district?