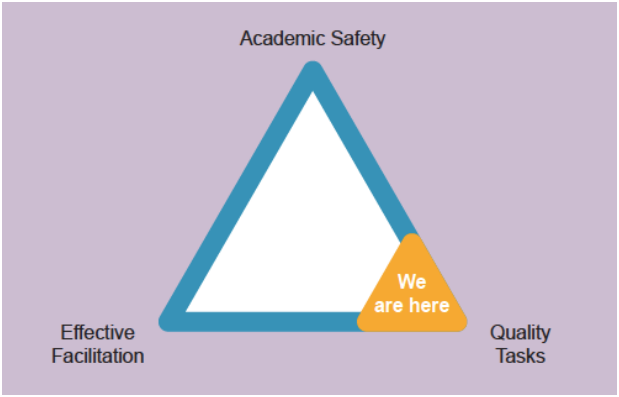
QUALITY TASKS



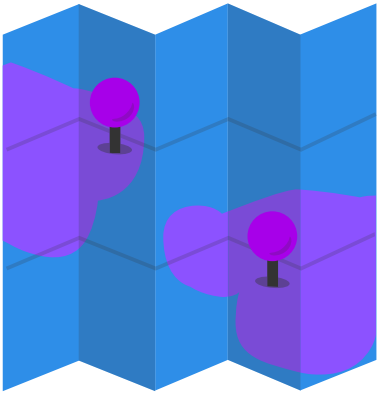
A card set based on Quality Tasks from Necessary Conditions: Teaching Secondary Math With Academic Safety, Quality Tasks, and Effective Facilitation by Geoff Krall

A high quality task offers immediate engagement and deep learning for all students. By inviting all students, a quality task naturally promotes academic safety. The complexity of a task can open up pathways for effective facilitation.

The following are five hallmarks of quality tasks. Quality tasks do the following:

1.Spark curiosity and foster engagement
2.Yield creativity and lead to new ideas
3.Promote access for all students in the classroom
4.Require and convey deep, crucial mathematical content
5.Connect and extend content

Design for Engagment



Use these five principles to increase curiosity about and engagement in a task.

WHY: One of our hallmarks of quality tasks is "spark curiosity and foster engagement." While it's impossible to always predict how engaging a task will be, there are research based guideposts to push a task in the right direction.

Guideposts for Engagement

1) Consider your own curiosity. Rely on your own excitement about a task. If you are engaged by it, your students might be as well.
2) Elicit student questions. Ask students to define the problem or co-design the driving question. Provide the scenario; let students develop the question.
3) Keep information or know-how just out of reach, rather than distant. Curiosity is increased when the knowledge gap is small. Make sure crucial information or knowhow is attainable for students.
4) Solicit predictions. Predictions are catalysts of curiosity. Have students make predictions before setting to a task.
5) Break expectations. Provide opportunities to surprise students with mathematical outcomes. Students will then be primed for learning - and possible even delighted.

Do now: Incorporate guideposts 2 and/or 4 for your next lesson.

Extend: Take a sample task and discuss how it measures up to these guideposts for engagement.

Task Quality Checklist

Use this checklist while designing tasks to ensure as high quality tasks as possible. It aligns with our five hallmarks of quality tasks.

WHY: This checklist offers a quick review of a task and hopefully illuminates potential ways to improve it..

Do now: Use the checklist with an existing task. For the boxes left unchecked, how could you modify the task to fill the gaps?

Extend: Develop strategies to fill each box on the checklist.

Task Quality Checklist

Spark curiosity and foster engagement

- ☐ Task stirs curiosity in the teacher.
- ☐ Task elicits student questions and questioning.
- ☐ Task contains just-out-of-reach information.
- ☐ Task elicits a student prediction.
- ☐ Task breaks expectations in some way.

Yield creativity and lead to new ideas

- ☐ Task invites new definitions from students.
- ☐ Task has multiple solution paths.
- ☐ Task has multiple solutions.

Promote access for all students

- ☐ Task is clear and to the point.
- ☐ Task includes or necessitates a diagram.
- ☐ Task ensures all students can get started.
- ☐ Task includes multimedia.

Require and convey deep, crucial mathematical content

- ☐ Task is aligned to important standards.
- ☐ Task results in long-term conceptual understanding.
- ☐ Prompt contains qualifying words such as most, least, highest, lowest, closest, etc.
- ☐ Task involves a comparison.

Connect and Extend Content

- ☐ Task uses know-how from previous lessons.
- ☐ Task hints at future lessons.
- ☐ Task contains concepts from other content areas (math or otherwise).

Task Quality Scoring Guide

When assessing the quality of a task, consider using this quick, informal scoring guide. It incorporates our five hallmarks of a quality task.

WHY: This rough guide can yield insight into the quality of a task. You may wish to also use this as a calibration exercise, much like the on Task Sort card.

Do now: look through previous lessons, assessments, and assignments and select a task to score. Did it perform as well as you expected? Is there a certain type of task that performs consistently exceptionally well?

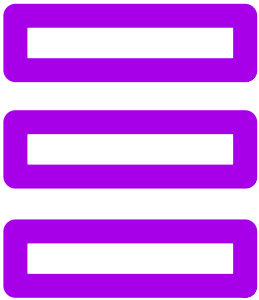
Extend: when you finish scoring a task, consider or discuss what would it take to bump up its score.

Task Quality Scoring Guide

Hallmarks of Quality Task	1	2	3
Sparks curiosity and fosters engagement	I'm not immediately curious about the task scenario.	I'm intrigued by the task scenario and would consider working through it, if I had the time.	I am compelled to attempt this task.
Yields creativity and leads to new ideas	The task is straightforward; students don't have the opportunity to test out ideas.	Students will have the opportunity to create new artifacts or test out ideas within this task.	Students will naturally create a new, never-before-seen mathematical artifact while completing this task.
Promotes access for all students in the classroom*	Some students will not understand or be able to access this task.	Every student will be able to engage with the task on some level.	Every student in the classroom will be able to access and be challenged by this task.
Requires and conveys deep, crucial mathematical content	The task is unaligned to crucial content and/or is rote or procedural.	The task is aligned to crucial standards for my course.	The task necessitates the use of mathematical content on a deep and permanent level.
Connects and extends content	The task basically "stays in its lane." It doesn't require or hint at other content.	The task draws upon content from previous or different content areas.	Students will notice that the task draws upon content from previous or different content areas.
Total =			

*This row is non-negotiable. A quality task *must* be accessible.

Task Sort Protocol



Use a task sort protocol with colleagues to discuss and calibrate on what makes a quality task. Or, what could make a task high quality.

WHY: A task sort protocol can result in rich discussions about task quality and how to make tasks better.

Prework
Facilitator identifies four to six tasks or problems. These may be from common assessments, from textbooks, or a mixture of the two. Ideally there will be a variety of types of tasks (word problems, card sorts, multiple-choice problems, and so on).

Protocol
The facilitator hands out paper copies of each task to pairs of participants and asks them to sort out the tasks from highest quality to lowest quality. Each pair must come to consensus for their rankings.

Once every pair has their rankings, the facilitator asks each duo to share their rankings, making notes on a whiteboard or poster paper.

The facilitator asks and the group discusses the following questions:

On which problem or problems do we have similar rankings? On which do our rankings differ significantly? Why do you think that is? What was it about this task that yielded such calibration?

The facilitator asks and the group discusses the following questions:
On which task or tasks does it appear we are not well calibrated?
Who had it ranked higher than the rest, and why?
Who had it ranked lower, and why?
After hearing one another, are there any tasks that you would consider moving in your rankings?

Facilitator debriefs the conversation. Each participant completes the sentence by filling in the blanks: “I used to think _____, but now I think _____.”

Ten Essential Task Types

This set of cards provides ten different types of tasks. These ten task types are not exhaustive but provide a template of routines, lessons, problems, and projects that a teacher should have in their "tool box." Certain tasks are better suited for some content areas.

WHY: If you're stuck on how to provide a quality task for a certain lesson, consider flipping through these ten essential task types and using one of them as a jumping off point.

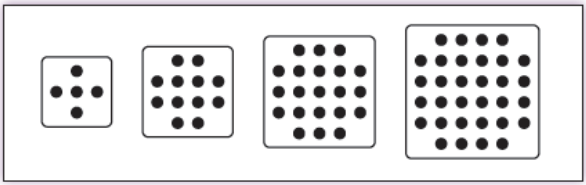
The following chart displays ten essential task types and which hallmarks of quality they match well with.

	Initiate curiosity and foster engagement	Yield creativity and lead to new ideas	Promote access for all students in the classroom	Require and convey deep, crucial mathematical content	Connect and extend content
Three-Act Math	▲		▲	▲	▲
Project-Based Learning	▲	▲	▲	▲	▲
Problem-Based Learning	▲	▲	▲	▲	▲
Would You Rather . . .	▲		▲	▲	▲
Polygraph or Guess Who?	▲	▲	▲		
Card Sorts and Dominoes	▲		▲		▲
Which One Doesn't Belong?	▲	▲	▲		
Estimation	▲		▲		
Number Talks		▲	▲		▲
Always/Sometimes/ Never		▲	▲	▲	▲

Do now: Discuss with your peers a time you've implemented one of these task types.

Extend: Identify a new task type and find and design a task.

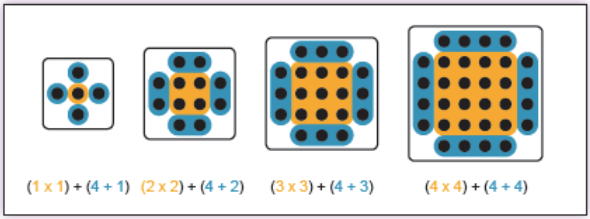
Number Talks

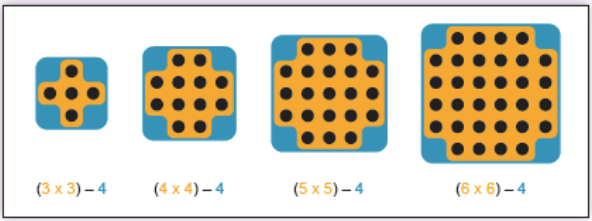


A number talk (or math talk) allows students to develop and discuss different solution methods for a given task.

WHY?
Number talks promote discourse and academic safety by honoring all solution paths. They can also help students practice arithmetic skills and building expressions.

Good for SMPs 3, 5, 6, 7, 8



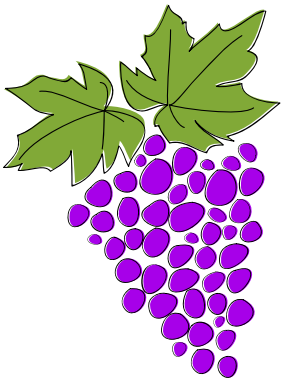


Number Talk Process

Step 1: Give students an arithmetic problem, visual counting problem, or pattern. Ask students to solve it silently for one minute.
Step 2: Ask students how they solved it. Have them work it out on the board or be the scribe for their method.
Step 3: Ask if the solution is correct. Ask if anyone else solved it using the same method.
Step 4: Ask if anyone solved it using a different method. Repeat steps 2 and 3. Continue until all methods have been exhausted, checking for
Step 5: If applicable, synthesize the different methods to demonstrate they point towards the same solution (as shown on this card).

Supporting resources:
www.visualpatterns.org
ntimages.weebly.com

Estimation



Estimation can be a tool preceding a task or a task itself. Students give a best guess at a counting artifact or a given scenario problem. Teachers may also prompt students to identify a "too low" or "too high" answer.

WHY: Having students estimate helps flatten academic status and helps them hone that skill over time. When used as a tool preceding a task, it also gives students natural buy-in.

Good for SMPs 1, 2, 3, 6, 7

IMAGE FROM ESTIMATION180.COM

Estimation Process
Step 1: Post a picture or problem.
Step 2: Ask students, "what's your best guess?" Optional: prompt for students' "highest 'too-low' answer" and "lowest 'too-high'" answer.
Step 3 (Optional): Have students place their estimates on a numberline.
Step 4: After revealing the solution or solving, revisit students' estimates in the debrief.

Supporting resources:
Estimation180.com
The camera inside your phone

Do now: Look for some potential estimation pictures. Look around the room, go on a quick walk, look through your photo roll.

Extend: Have students track their estimation skills over time. By what percentage are they off?

Always / Sometimes / Never

Always	Sometimes	Never

Give students statements to classify into “always true,” “sometimes true” or “never true.”

WHY: Always / Sometimes / Never allows students to test out hypotheses and creates natural opportunities for discussion. Teachers also use it effectively to review concepts and practice algebraic manipulation.

Good for SMPs 2, 3, 6, 7

Let students practice with non-mathematical statements first. For example:

Computers keep getting better.

The temperature is higher in Fahrenheit than it is in Celsius.

Lying down requires less energy than standing up

Then give them mathematical statements. For example:

2x is greater than x + 2.

A rectangle with a larger perimeter will have a larger area.

log(x) z > log(z) x

Let them test out their claims. Encourage the search for counter-examples.

Supporting resources:
Postulates, theorems, and definitions from your textbook.

Do now: Try to come up with a few potential Always / Sometimes / Never statements, either non-mathematical or for your next unit.

Extend: Have students develop a few Always / Sometimes / Never statements of their own. They can even test them out with their peers.

Which One Doesn't Belong? (WODB)

24	81
1	-36

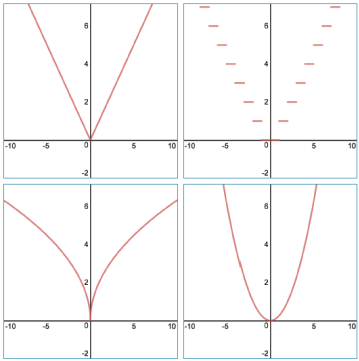
Post four objects, numbers, or artifacts and ask students to develop reasons why one (or several) don't belong and why.

WHY: WODB allows all students to engage in the task on some level. It honors all student responses. Teachers can also effectively utilize WODB to review, reinforce, or fine-tune vocabulary.

Supporting resources:
WODB.ca
Which One Doesn't Belong? by Christopher Danielson (2016)

Good for SMPs 2, 3, 6, 7

$x^2 + 8x + 16$	$16 - 8x + x^2$
$x^2 - 16$	$x^2 - 4$



Step 1: Post four artifacts (numbers, shapes, graphs, tables, etc.). Ask students to silently decide which one doesn't belong and why.

Step 2: Ask one student to share their idea. Confirm that their reasoning appropriately excludes the chosen artifact.

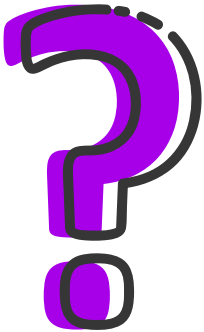
Step 3: Ask if other students excluded the same one for the same or different reasons.

Step 4: Ask if other students excluded a different artifact and for their reasoning. Repeat steps 2 and 3 until you've identified reasons to exclude all four.

Do now: think about your most recent (or upcoming) content. Create four different variations of that content (such as parent functions). Or select four relevant numbers or expressions that could serve for a WODB.

Extend: Provide students three out of the four WODB elements. Have students develop the fourth.

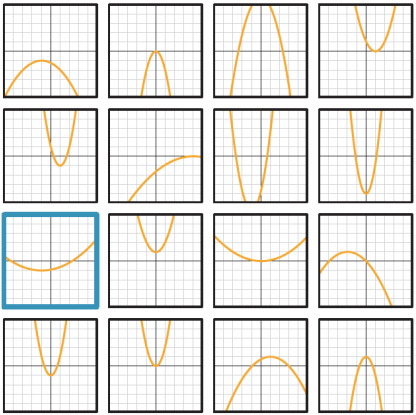
Polygraph or Guess Who?



Students ask yes or no questions to identify a "mystery object" from several artifacts. This can be done in pairs or as a class, using technology or physical sets.

WHY: This strategy helps "gamify" and solidify definitions and allows students to put mathematical concepts in their own words. Students also make connections between multiple objects regarding their distinguishing characteristics.

Good for SMPs 2, 3, 6, 7



Step 1: Create a set of eight to twenty mathematical artifacts, numbers, or shapes.

Step 2: Either using a technology platform such as Desmos or physical cuttouts, present the artifacts. This can be done in pairs competitively or with an entire class.

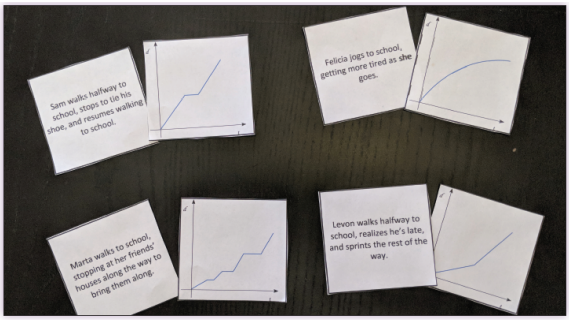
Step 3: Without telling which one it is, select one of the artifacts (either strategically or at random).

Step 4: The other student(s) ask yes or no questions to narrow down which artifact it is, eliminating possibilities along the way. If competitive and in pairs, students take turns until someone gets the mystery artifact first.

Do now: Identify 16 different mathematical artifacts from your content area and create a 4x4 box in which to put them. You can even hand draw them.

Extend: Consider having students create part or an entire set as a review. Ask students to communicate what would be an effective strategy to win the game.

Card Sorts and Dominoes



Use physical cards for matching tasks. Teachers can effectively have students make connections between multiple representations or solutions by creating multiple card sets.

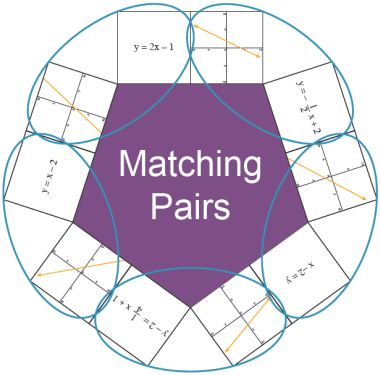
WHY: Using physical cards lowers the risk by allowing students to quickly rearrange solution attempts. Also, the tactile experience of manipulatives is naturally engaging for students.

Good for SMPs 7, 8

Card sets could be anything that incurs connections. Common usages:

- Multiple representations (i.e. function, graph, written scenario, table)
- Equations and solutions
- Definitions and applications

Dominoes is a variation of matching in which the correct solution makes a complete, closed circle. In this case, the cards connect side-by-side, which yields an immediate check for correctness.



Do now: Start by creating a card sort using multiple representations. Come up with scenarios to match certain functions.

Extend: Create a domino set using material from your content area.

Would You Rather?

Would you rather...

Take a shuttle to and from the airport...

Or drive yourself?

Pose problems in the format "would you rather," which provides students two competing scenarios. Students identify the best selection using mathematics, given information, and assumptions.

WHY: Posing "either/or" situations foster immediate engagement. Students get to argue about their selection, using math to justify.

Good for SMPs 1, 2, 3, 4

Example:

Would you rather have....

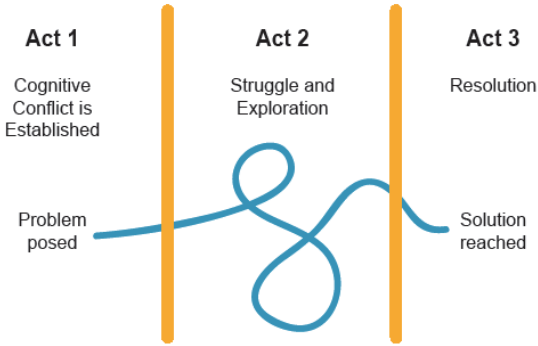
your weight in pennies your height in quarters

Supporting resources:
Wyrmath.com

Do now: Solve the task above. Before you begin, make a prediction as to which you'd rather have: your weight in pennies or your height in quarters. Then solve on your own using the dimensions of a penny and quarter. You might have to do a bit of research!

Extend: Create your own "would you rather" math task or scan through wyrmath.com.

Three-Act Math



Mirroring the narrative arc of a three-act movie or play, a three-act math task is a problem or scenario that achieves the following:

Act 1 - Establish cognitive conflict
Act 2 - Struggle and exploration
Act 3 - Resolution

WHY: Three-act math promotes persistent problem solving by creating an engaging hook in Act 1. The teacher may reveal necessary information to help students solve the problem as needed. The third act reveals the end of the scenario, which makes the work real to students.

Good for SMPs 1, 2, 3, 4

Act 1 - Present students an unresolved scenario. The scenario could be a picture, a video, or a word problem. Solicit open questions students have about the scenario, necessary but missing information, and additional need-to-knows.

Act 2 - Present additional information (if applicable). Students work through the task, answering questions you and they have co-developed.

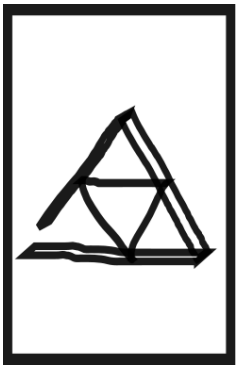
Act 3 - When students arrive at a solution, reveal the conclusion or resolution, to see if their solution matches up.

Supporting resources:
Dan Meyer (blog.mymeyer.com)
Graham Fletcher (gfletchy.com)
Dane Ehlert (whenmathhappens.com)

Do now: Explore the three-act tasks in the "supporting resources" section of this card.

Extend: Create your own three-act task from a video or picture you find compelling.

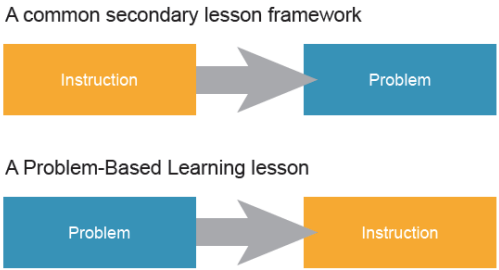
Problem-Based Learning



Give students a complex task in which additional learning must occur to arrive at a solution.

WHY: Students retain content better when given the opportunity to struggle with a task before the teacher demonstrates methods by which to find a solution (Schwartz and Bransford 1998).

Good for SMPs 1, 4



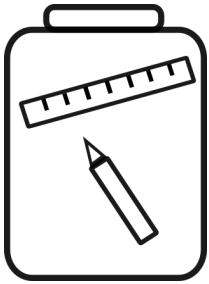
Step 1: Pose the problem via text or a picture.
Step 2: Identify notices and wonderings or knows and need-to-knows.
Step 3: Let students begin the problem.
Step 4: When (and if) necessary, give students instruction or prompting on how to progress through the problem.
Step 5: Students arrive at solutions accompanied by share-out.

Supporting resources:
Geoff Krall's PrBL Curriculum Maps (www.emergentmath.com)

Do now: Explore Geoff's PrBL Curriculum Maps (www.emergentmath.com)

Extend: Give a problem to students before demonstrating precisely how to solve it.

Project-Based Learning



Give students a real-world scenario in which to apply mathematical content. Over the course of weeks, students use and learn content and non-content skills to solve an authentic problem, potentially addressing a community need.

WHY?

Project-Based Learning (PBL) allows students to practice skills beyond merely mathematical content knowledge. Students also utilize and learn skills about communication, collaboration, and other essential know-how that will yield postsecondary success. Also, an authentic project can engender excitement and engagement as well as more permanent learning.

Good for SMPs 1, 2,4, 5

Example - Are we ADA compliant?

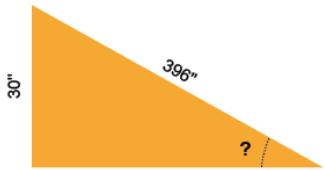
Dear Ridgeland Students,

As you know, our school buildings were reconstructed and remodeled five years ago. As the principal of Ridgeland High School, I strive to ensure that our school buildings are healthy, safe, and secure physical environments for learning. The administrative team does this by continuously creating effective learning spaces and improving the function of our school.

As I plan for retirement, I hope to ensure that all students can access the wonderful opportunities our school provides. In my effort to improve our space and make it functional for all students, I am conducting research into the wheelchair accessibility at Ridgeland. And I need your help!

In pairs, please research any legislation with which we may need to comply when supporting disabled students. Based on your research, then determine if our school's wheelchair ramps are appropriate and compliant. Please individually prepare a formal report organizing your findings for review by Ms. Christine and our administrative team. Your work will help us inform how we use our funds to best maintain and further update the Ridgeland High School buildings.

Sincerely,
Principal Donna, Ridgeland High School



Do now: Identify mathematical content that potentially pairs well with PBL.

Extend: Seek out opportunities to work with organizations outside of school that utilize math to advance their work.