Grade 8
rich tasks
mathematics

Instructional mathematics tasks are accessible to all learners because they invite students to wrestle with a problem. Students share their ideas, ask questions of one another, use and apply multiple representations, and collaborate to develop various solution pathways. Then, teachers use students' solutions to make the math visible, connect prior learning, and forecast new mathematical learning.

Directions: Launch the tasks in a whole group to provide opportunities for students to discuss their understanding of the task and suggest strategies to solve. Organize the students in pairs or groups of four to encourage participation. Provide manipulatives, chart paper, and markers.

1

Topic

The Number System: Use rational approximations of irrational numbers to locate them approximately on a number line diagram and estimate the value of expressions.

Task

Isaiah wants to build a square sandbox for his niece. He bought enough sand to cover an area of 200 square feet. To determine the dimensions of the sandbox, Isaiah found $\sqrt{200}$.

　　A. Is $\sqrt{200}$ rational or irrational?

　　B. Where is $\sqrt{200}$ located on a number line?

　　C. How long should Isaiah make each side of the sandbox?

Facilitate

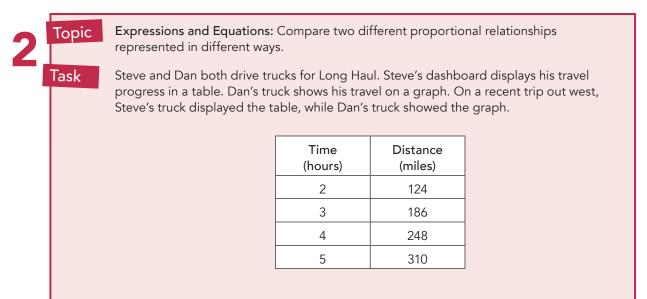Reveal Part A of the problem. Prompt students to describe the difference between rational and irrational numbers. Ask students to think of other ways $\sqrt{200}$ can be expressed. Make available a number line for students to access for Part B. Encourage students to revisit the scenario and respond to Part C in the context of the problem.

Make the Math Visible

Ask students to share their responses and reasoning for Part A. Allow time for students to construct an argument and critique the reasoning of others. Provide a large classroom number line and invite all students to place their answer to Part B on it. Prompt the class to discuss and identify the most accurate location on the number line. Elicit students to describe the meaning of this value in the context of the problem.

Notes

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2

Expressions and Equations: Compare two different proportional relationships represented in different ways.

Task

Steve and Dan both drive trucks for Long Haul. Steve's dashboard displays his travel progress in a table. Dan's truck shows his travel on a graph. On a recent trip out west, Steve's truck displayed the table, while Dan's truck showed the graph.

Time (hours)	Distance (miles)
2	124
3	186
4	248
5	310

Which Long Haul driver was traveling at the faster rate? Use multiple representations to support your answer.

Facilitate

Elicit from students what it means to be "faster" in terms of miles per hour. Make available multiple representations organizers that include tables, graphs, equations, and space for other models. Encourage students to use several different representations to reach a conclusion and support their thinking.

Make the Math Visible

Select and sequence students to share their solutions and strategies, beginning with a concrete representation, such as a table, and progressing toward slope and an equation. Ask students what they notice. Highlight the relationships between all of the various representations. Extend thinking by asking students to describe a driver that travels faster than both Steve and Dan.

3

Topic

Functions: Understand that a function is a rule that assigns each input exactly one output.

Task

Lexi's mom keeps track of how long she is on her phone at school and how many messages she sends. In 1 week, her mom collected the following data:

Number of Minutes	22	20	21	22	20
Number of Messages	17	14	15	21	15

Does the relationship between minutes and messages represent a function? Use a graph to support your reasoning.

Facilitate

Provide students with graph paper. Encourage students to discuss what a function is. Elicit students to identify the independent and dependent variables in the scenario.

Make the Math Visible

Discuss the definition of a function. Ask students to share their graphs and answers. Encourage students to describe what they see in the graphs. Prompt students to draw conclusions and make generalizations beyond the context of this situation.

4

Topic

Geometry: Verify experimentally the properties of rotations, reflections, and translations.

Task

Marcus claims that when a figure in Quadrant II is reflected over the *y*-axis and then rotated 90° clockwise, it produces the same result as when the original figure is reflected over the *x*-axis and then rotated 90° counterclockwise. Determine whether Marcus's claim is *always/sometimes/never* true. Explain your reasoning.

Facilitate

Make available graph paper/coordinate planes, patty paper, rulers, and other geometric tools for student use. Prompt students to model the situation. Encourage students to attempt to develop several examples and nonexamples to help them draw valid conclusions.

Make the Math Visible

Ask students to share their approach to investigating Marcus's claim. Invite students to post examples and nonexamples for the class to review. Prompt the class to analyze whether the examples and nonexamples are accurate models. Discuss students' final conclusions.

Topic Statistics and Probability: Understand that patterns of association can be seen in bivariate categorical data by displaying frequencies in a two-way table.

Task For homework, Sophia had to ask students on the bus whether or not they have a phone and record her findings in a two-way table. Unfortunately, just after Sophia got home from school, her nonna spilled tomato sauce onto her table. Use your knowledge of patterns of association to restore Sophia's table and save her homework.

	Grade 6	Grade 7	Grade 8	TOTAL
Yes, I have a phone.	🟥	8	14	27
No, I do not.	13	🟥	2	🟥
TOTAL	18	🟥	🟥	48

Facilitate Prompt students to describe how data are organized in a two-way table. Ask students to identify what operations can be used to relate the values in two-way tables. Encourage students to use sense-making skills to complete the table and review their answers.

Make the Math Visible Prompt students to share their solutions. Allow time for students to discuss strategies they used to determine the missing values in the table. Address any misconceptions. Advance student thinking by asking students to analyze the data in the table with questions such as, "What percent of eighth graders have a phone?"

Adapt-a-Mathematical TASK Tool

Do you have a task that is not quite right? Use this guide to adapt the task to meet your needs!

How does the task meet your STUDENTS' needs?

ACCESS and EQUITY: Ensure that the task is "responsive to students' backgrounds, experiences, cultural perspectives, traditions, and knowledge" (NCTM, 2014, para. 1, https://www.nctm.org/uploadedFiles/Standards_and_Positions/Position_Statements/Access_and_Equity.pdf). Consider students' language readiness, including access to mathematical vocabulary.

- How can you differentiate the context of the task to support the students' backgrounds, experiences, and cultural needs?
- How can you group students to engage the students' socio-emotional and developmental needs?
- How can you "open up" the task to encourage access to the task for all learners?
- How can you connect the task to the mathematics the students have learned and students' interests?

Notes

How do you PLAN for students to learn from the task?

MATHEMATICAL GOAL: The task should provide students opportunities to access new mathematical knowledge and to solidify, consolidate, or extend knowledge. Tasks can be changed to highlight multiple learning needs and content standards. Ensure that you strategically connect the learning goal to the task.

- What do your students know how to do right now?
- What do you expect your students to understand as a result of this task?
- What do you anticipate students will do? What changes might you make as a result of your anticipation?

FACILITATE: Task facilitation is critical to student success. Consider how you will organize students and **design** purposeful questions to help them discover and connect mathematics concepts and procedures.

- What **questions** are you going to ask? What tools will you provide? How will students be grouped?
- How and when will you provide opportunities for student **discourse**?

Notes

How do you move learning FORWARD?

FORMATIVE ASSESSMENT: Collecting information about student understanding will help you adjust instruction as you conduct the task.

- How will you listen, observe, and identify students' strategies?
- How will you respond to students' understanding?
- How will you provide feedback to students?
- How will you provide opportunities for students to provide feedback to one another?
- How will you provide opportunities for students to persevere and productively struggle through problems?
- How will you make the mathematics visible for your students?

Notes