Algebra 1 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

Construct and compare linear and exponential models and solve problems.

Task

A small town has a teenage population of 2,500 high schoolers that is increasing by 10% per year. In their district's budget, the Town Council can only afford to build one new, moderately sized high school every 3 to 5 years that will house 1,200 to 1,800 students. The larger the school is, the more time it will take to raise the funding necessary to build it. The town currently has two high schools that are over capacity and can only house 1,000 students each. What are your short- and long-term recommendations for the Town Council? Use mathematical representations to fully justify your recommendations.

Facilitate

Prompt students to use multiple representations in their justifications to the Town Council and to possibly include numerical, graphical, and symbolic representations. Students should explain their reasoning for and connections between representations.

Make the Math Visible

Ask students to pitch their recommendations in a presentation to the Town Council by sharing their representations with the class or to a class visitor. Select students to critique presentations by questioning peer representations and the connections between them. Sequence student solutions to build conceptual understanding from repeated reasoning.

Notes

rich tasks mathematics *Rich Mathematical Tasks, Algebra 1*, created by Megan Gitterman.
Copyright © 2019 by Corwin. All rights reserved.

CORWIN
A SAGE Publishing Company

2

Topic

Solve systems of linear equations exactly and approximately.

Task

Tonya is purchasing a new cell phone plan, and she wants to research all of her options. One company offers unlimited data, but costs $90 per month for a single phone line and a free upgrade. They also offer a discounted plan that provides 3 GB data and only costs $50 per month for a phone line, but Tonya would have to spend $200 on an upgraded phone. An alternate company offers a plan that costs $35 per month for talk and text and an additional $10 per month for every GB of data you want to add to the plan. This plan requires a $75 upgrade to Tonya's phone. Compare and contrast the merits of each plan. Which plan would you recommend Tonya purchase and why?

Facilitate

Encourage students to consider the reasonability of each data option, based on their predicted usage, and consider having them research teen data usage as necessary. Remind students that there is no right or wrong decision, as long as their justification is based on this reasonability and supported with appropriate representations.

Make the Math Visible

Monitor the decisions made and the representations they use to justify those decisions. Consider selecting groups that have made the same decision to join together and strengthen their combined argument by comparing representations and making connections between them. Sequence larger groups, based on the decisions they have made, to share their recommendations with Tonya. As a class, discuss how the rationales for each plan are different and how they are the same.

3

Topic

Interpret quadratic functions that arise from applications in terms of a context.

Task

A local star quarterback who is 6 feet and 6 inches tall releases the football at a height of about 8.4 feet. At practice, he works on making his long passes predictable. Each long pass he throws has a maximum height of 10 feet. The ball begins to descend 20 yards from the quarterback and hits the ground about 70 yards in front of him every time. Create a model to represent where a receiver who is around 6 feet tall could easily catch one of this quarterback's long passes.

Facilitate

Consider showing a video clip of a quarterback passing to a receiver to help contextualize the problem for students unfamiliar with football. Give students an aerial picture or diagram of a football field and action figures or other objects to act as the quarterback, ball, and receiver. Allow students to work in groups, and encourage them to use pictorial or graphical representations to make sense of the problem.

Make the Math Visible

Monitor student methods to select a variety of techniques to be explained to the class. Sequence these explanations in an order that will allow students to build conceptual understanding. Ask remaining students to share which explanation most closely resembles their own, which explanation most differs from their own, and which explanation they find most interesting.

Rich Mathematical Tasks, Algebra 1, created by Megan Gitterman.
Copyright © 2019 by Corwin. All rights reserved.

CORWIN
A SAGE Publishing Company

4

Topic

Build a quadratic function that models a relationship between two quantities.

Task

The Student Government Association (SGA) at your school wants to determine how to price their Spring Fling tickets this year, as they have been losing money on the event in recent years. Two years ago, when the tickets were $45 each, they were able to sell 200 tickets. Last year, when the tickets were $65 each, they were able to sell only 150 tickets. For what price should the SGA sell their tickets to maximize their revenue (amount of money coming in from the ticket sales)?

Facilitate

Consider removing the question from the problem and discussing the modified prompt as a class first to help students make sense of the scenario. Prompt students to be precise in their definition of variables in order to make sense of the patterns they notice or functions they create. Encourage students to consider using a variety of representations, strategies, and technology in order to arrive at their answer.

Make the Math Visible

Select students who have used a variety of strategies to share their solution with the class. Sequence these students in a way that builds connections between pictorial, numerical, and symbolic representations.

Notes

rich tasks mathematics *Rich Mathematical Tasks, Algebra 1*, created by Megan Gitterman.
Copyright © 2019 by Corwin. All rights reserved.

CORWIN A SAGE Publishing Company

5

Topic

Use functions fitted to data to solve problems in the context of the data.

Task

A small village in a developing nation has a population that has grown over the past decade, and access to clean water is a concern. The World Health Organization estimates that a minimum of 7.5 liters per person per day is necessary for survival, but that 20 to 50 liters per person per day is necessary for basic hygiene purposes. Ideally, people should have access to an average of 100 liters of water per day. The table below shows the population of the village over the past 10 years, in thousands of people.

Year	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Population (in thousands)	4.8	5.4	6.0	6.7	7.6	8.5	9.6	10.8	12.0	13.6

The closest source of fresh water is a 20-minute walk from the village and is not guaranteed to be sanitary. You work for a charity organization that intends to build a water treatment plant near the village. Use a model to create a proposal for your organization that will communicate the estimated water treatment plant usage over the next decade.

Facilitate

Contextualize the problem by having students do research, by showing a video clip about the world water crisis, or by linking this activity to World Water Day activities in other content areas. Prompt students to attend to the modeling cycle throughout the problem, verifying their choice of functions using residuals. Encourage students to think about the reasonability of the possible funding of their proposal, and caution them about the risks of using a model to extrapolate too far outside the data set.

Make the Math Visible

Have students use the modeling cycle to organize and present their work to the class or to a classroom visitor.

Rich Mathematical Tasks, Algebra 1, created by Megan Gitterman.
Copyright © 2019 by Corwin. All rights reserved.

CORWIN
A SAGE Publishing Company

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

rich tasks mathematics

Rich Mathematical Tasks, Adapt-a-Mathematical TASK Tool, created by Beth McCord Kobett, Greta W. Richard, and Megan Gitterman.
Copyright © 2019 by Corwin. All rights reserved.

CORWIN
A SAGE Publishing Company