Grade 3

enVision® Mathematics

3-ACT MATH

Mathematical Modeling in 3 Acts

Take and Teach

SAVVAS

enVision™ K-12

In Typical Textbook Problems...

Students are given a problem to solve.
The problem is already defined for students.

21. The principal at Concord High School's graduation reads names off a list at an average rate of eight names per minute. There are 288 students in the graduating class. **How long will the ceremony last?**

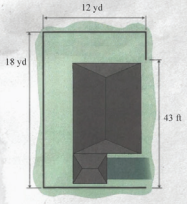
Students are given all the information required to solve the problem. Students are rarely required to determine all the information necessary to solve the problem because all the data needed to solve the problem is already provided for them.

21. The principal at Concord High School's graduation reads names off a list at an average rate of **eight names per minute**. There are **288 students** in the graduating class. How long will the ceremony last?

Students flip to the back of the book to see if they got the right answer. If students don't get the correct answer, they ask for the formula to use (or where they went wrong with the formula) to solve the problem.

19. 15 Inches
21. 36 Minutes
23. 47.5 Feet

Students move onto another word problem that's just like the word problem they just solved.



Kiri needs to replace the wooden fence that surrounds her yard. She measured her property, and it was 18 yards wide and 12 yards deep. There is no fence in front of her house, and the gap in the fence at the front of the property is 42 feet, as shown in the diagram. Kiri plans to replace the existing fence pickets with 5-foot long cedar boards placed vertically. The boards are 5 1/2 inches wide and will be spaced 1/4 inch apart. She placed an order for 275 boards. Did she order enough?

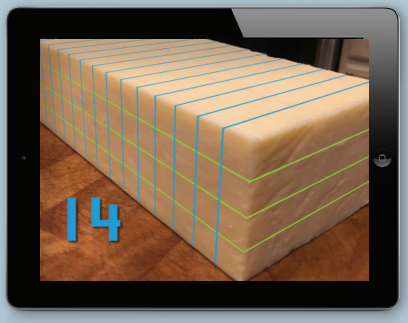
Typical math textbook word problems from Dan Meyer's 2012 MISA talk

In Mathematical Modeling in 3 Acts...

Grade 3 Act 1 Video

The Hook:

Students watch a video that prompts them to ask questions—in this case, "How many cheese sticks are being sliced?" Rather than being given all information up front, students actively define the word problem they are going to solve. **Act One** provides an entry point for every student, no matter their level of mathematical proficiency.



Grade 3 Act 2 Video

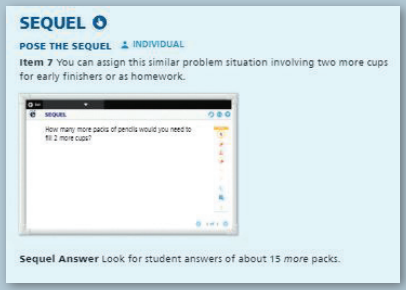
Modeling with Math:

Students model with mathematics. Here, students figure out how many cheese sticks there will be. Students apply the mathematical concepts learned in the chapter and select the appropriate tools to solve the problem they defined in **Act One**. This is closer to the work of STEM professionals—it's more challenging, and more fun.

Grade 3 Act 3 video

The Solution:

Students watch a video where the answer to the problem is revealed. In **Act Three**, students root for their conjectures and analyze their results. This act of analyzing and justifying solutions embodies the spirit of the Standards for Mathematical Practice.



Grade 3 Sequel Problem

Sequel:

Students can extend their learning with a **Sequel** problem. The **Sequel** is a reimagined word problem related to the original problem, which requires students to model with mathematics.

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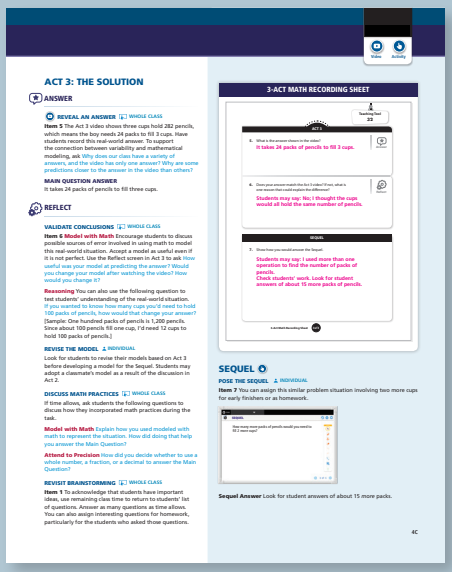
Mathematical Modeling in 3 Acts

Mathematical Modeling in 3 Acts is accessed through Savvas' learning platform, Savvas Realize. Access the teacher and student support pieces in print or online at SavvasRealize.com. Parallel print and digital support is available.



Sample of Teacher Support

Components

- **Engaging Multimedia**
  Mathematical Modeling in 3 Acts Video for every enVision 3 Act Math problem
- **Robust Teacher Support**
  Teacher support for every Mathematical Modeling in 3 Acts Task
- **Student Support**
  Accompanying student support for every Mathematical Modeling in 3 Acts Task is available to aid students with solution planning, analyzing conjectures, and justifying results.

An overarching goal of including 3-ACT MATH Tasks in classrooms is to engage students in being both problem posers and problem solvers as they determine solutions to authentic questions.

– Zak Champagne
enVision K-5 Author

Bottom line: We are privileged ambassadors of a message that math models your world. We're in a privileged position, and we've got to make good on it.

– Dan Meyer, 2012
"Why Students Hate Word Problems" MISA talk

Try this sample lesson!

Visit **Savvas.com/3am** to download additional lesson resources and videos.

Name _____

Teaching Tool
32

3-ACT MATH Recording Sheet

ACT 1

1. What questions do you have?

2. Predict a reasonable answer to the Main Question. Explain your prediction.

ACT 2

3. What information do you need to answer the Main Question?

4. Show how you can find the answer to the Main Question.

ACT 3

5. What is the answer shown in the video?

Answer

6. Does your answer match the Act 3 video? If not, what is one reason that could explain the difference?

Reflect

SEQUEL

7. Show how you would answer the Sequel.

3-ACT MATH

Fun Raiser

Use this 3-Act Math task any time after Lesson 9-3.

3-ACT MATH PREVIEW

Page 336 This page gives students a preview of the 3-Act Math task for Topic 9. Read the robot's speech bubble with students.

Generate Interest Ask students what they know about fundraisers. Say: Has anyone you know participated in a fundraiser? What sorts of fundraisers have you seen? Have them share ideas and stories about fundraising.

TASK OVERVIEW

Essential Understanding Many real-world problems can be represented with a mathematical model, but that model may not represent a real-world situation exactly.

Students use the 3-Act Math task to practice mathematical modeling. They:

- identify an important problem,
- identify the important information,
- develop a model that represents that situation,
- use the model to propose a solution, and
- test the appropriateness of that math model.

In the 3-Act Math for Topic 9, students draw on their conceptual understanding of addition and subtraction. They make use of representations and tools such as

- bar diagrams,
- number lines, and
- partial sums.

TASK PLANNING

The following pages contain specific support for using this task with your class.

Before introducing the 3-Act Math task, consider when you would prefer students to record their answers on their Recording Sheets and when they should share their answers verbally.

TASK CONTENT

In every task, students apply a variety of concepts and skills.

Lesson	Concept/Skill
7-3	Using information from graphs
8-5	Estimating sums
9-2	Adding three or more numbers

They also combine conceptual understanding with math practices and processes in every step of the task.

Video Activity

ACT 1: THE HOOK

BRAINSTORM

PLAY THE VIDEO WHOLE CLASS

The first screen shows a video of students counting money raised during Week 6 of a six-week fundraiser. You cannot see the amount of money the students count, nor whether they have reached their fundraising goal. Take advantage of your students' initial reactions to watching the video. Ask What do you notice about the video? What do you wonder?

BRAINSTORM QUESTIONS WHOLE CLASS

Item 1 **Make Sense** Encourage students to share their questions in a class discussion. Record their questions and store them for later. Listen for interesting mathematical and *non*-mathematical questions.

To help students work on posing interesting, mathematical problems, ask Which question do you find most interesting? Which questions could we use mathematics to answer?

PREDICTION

POSE THE MAIN QUESTION WHOLE CLASS

Use the Main Question screen in Act 1 to pose the problem situation students will be tasked with modeling and solving.

MAIN QUESTION

Has the third grade reached its goal?

MAKE PREDICTIONS INDIVIDUAL

Item 2 Point out that the prediction is based on an estimate of the amount of money students raised. Do not give students time to make calculations.

SURVEY PREDICTIONS WHOLE CLASS

Construct Arguments You can survey the class for predictions. Point out that, without any information, you expect a variety of predictions. Ask Why do you think your prediction is the answer to the Main Question? Who has the same prediction? Who has a different prediction?

3-ACT MATH RECORDING SHEET

Name _____

Teaching Tool 32

3-ACT MATH Recording Sheet

ACT 1

1. What questions do you have?

Brainstorm

Students may say: Why do they have so much money? What are they doing with all that money? How much money do they have?

2. Predict a reasonable answer to the Main Question. Explain your prediction.

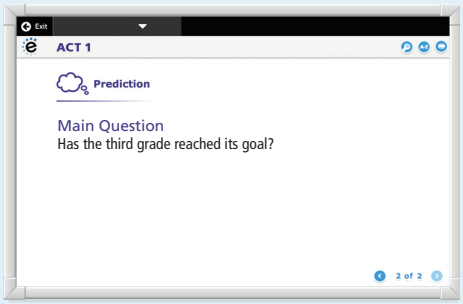
Prediction

Students will say either yes or no. Check students' explanations.

3-Act Math Recording Sheet 1 of 3

Use any time after Lesson 9-3.

CONSIDER THE MAIN QUESTION



Have students consider what they know about the scenario so far. Encourage students to think about how that information can help them make a prediction to the Main Question.

ACT 2: THE MODEL

INFO

IDENTIFY IMPORTANT INFORMATION WHOLE CLASS

Item 3 Before showing any information, use the Information screen in Act 2 to give students time to think about what quantities are relevant to the problem situation. Ask What information do you need to answer the Main Question? I will only give you the information you ask for.

Use Appropriate Tools After discussing what information would be useful, ask How could you get that information? How would you use it once you have it? You can also have students complete the sentence frame "If I knew ____, then I could figure out ____."

REVEAL THE INFORMATION WHOLE CLASS

Use the Image Gallery screen in Act 2 to reveal each piece of information. Record information as students identify it and keep the information where students can refer to it. Have students discuss whether this information matches their expectations.

- The amount of money raised during each of the first 5 weeks
- The amount of money each of the three classes raised during the 6th week

MODEL

DEVELOP A MODEL SMALL GROUP PARTNERS

Item 4 Model with Math To support productive struggle, observe. If needed, ask guiding questions that elicit thinking. Can you use the amount collected during Week 5 to predict the amount collected during Week 6? [No; each week's fundraising amount is separate.] What assumption do you need to make to use a math model? [You can assume the amount raised each week is approximately the same and use that to estimate the 6-week total.]

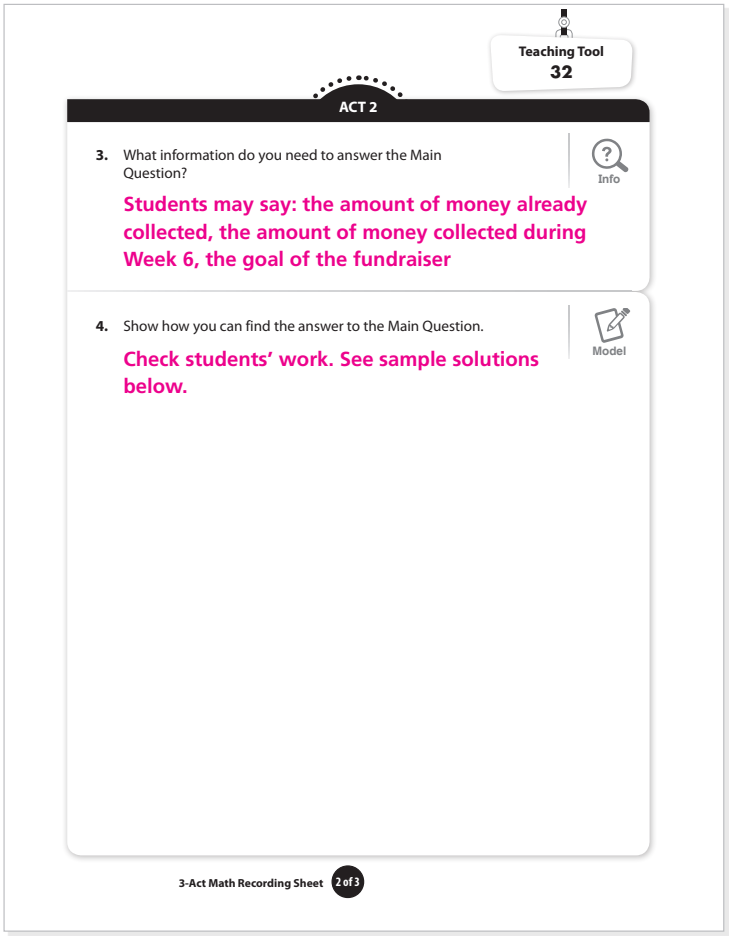
EXTEND THE TASK INDIVIDUAL

Item 7 For early finishers, use the SEQUEL button on the Image Gallery screen to reveal the Sequel, shown on the next page. You also can assign the Sequel after Act 3 or as homework.

SHARE SOLUTION STRATEGIES WHOLE CLASS

Critique Reasoning Have students share their solution methods. If needed, use the Analyze Student Work screen in Act 2, also shown at the right.

3-ACT MATH RECORDING SHEET



Teaching Tool 32

ACT 2

3. What information do you need to answer the Main Question? Info

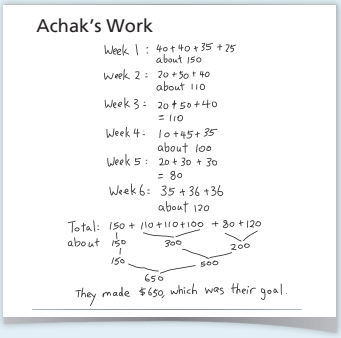
Students may say: the amount of money already collected, the amount of money collected during Week 6, the goal of the fundraiser

4. Show how you can find the answer to the Main Question. Model

Check students' work. See sample solutions below.

3-Act Math Recording Sheet 2 of 3

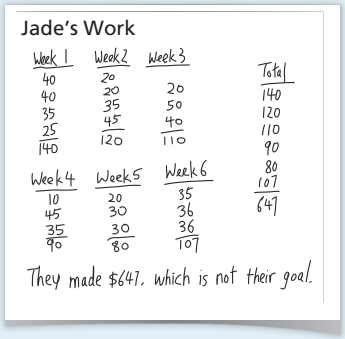
ANALYZE STUDENT WORK



Achak's Work

Week 1 : 40 + 40 + 35 + 25 about 150
Week 2 : 20 + 50 + 40 about 110
Week 3 : 20 + 50 + 40 = 110
Week 4 : 10 + 45 + 35 about 100
Week 5 : 20 + 30 + 30 = 80
Week 6 : 35 + 36 + 36 about 120
Total: about 150 + 110 + 100 + 80 + 120 → 300, 200, 500, 650
They made $650, which was their goal.

Achak says he estimated to find the total raised by the third grade. How did Achak estimate? Is his answer valid? [Achak rounded each amount. Since he rounded twice, his estimate is less accurate. His answer is close, but not exact.]



Jade's Work

Week 1	Week 2	Week 3	Total
40	20	20	140
40	20	50	120
35	35	40	110
25	45	110	90
140	120		80
			107
			647

Week 4	Week 5	Week 6
10	20	35
45	30	36
35	30	36
90	80	107

They made $647, which is not their goal.

Jade says she added to find the total raised by the third grade. How did Jade use addition? Is her answer valid? [Jade added the amounts raised each week and then totaled the weeks' amounts. Her answer is valid.]

Video Activity

ACT 3: THE SOLUTION

ANSWER

REVEAL AN ANSWER WHOLE CLASS

Item 5 The Act 3 video shows the total amount raised during the fundraiser. Have students record this real-world answer. To support the connection between variability and mathematical modeling, ask Why does our class have a variety of answers, and the video has only one answer?

MAIN QUESTION ANSWER
Yes, the third grade reached its goal, thanks to a final donation.

REFLECT

VALIDATE CONCLUSIONS WHOLE CLASS

Item 6 **Model with Math** Encourage students to discuss possible sources of error involved in using math to model this real-world situation. Accept a model as useful even if it is not perfect. Use the Reflect screen in Act 3 to ask How useful was your model at predicting the answer? Would you change your model after watching the video? How would you change it?

Reasoning You can also use the following question to test students' understanding of the real-world situation. What might influence the amounts of money students raise during a fundraiser? Why do you think the amount raised during Week 6 was more than the amount raised during Week 5? [During the first couple of weeks, people are eager to donate. During the final week of a fundraiser, people may donate a little more because it's the final week.]

REVISE THE MODEL INDIVIDUAL

Look for students to revise their models based on Act 3 before developing a model for the Sequel. Students may adopt a classmate's model as a result of the discussion in Act 2.

DISCUSS MATH PRACTICES WHOLE CLASS

If time allows, ask students the following questions to discuss how they incorporated math practices during the task.

Model with Math Explain how you modeled with math to represent the situation. How did doing that help you answer the Main Question?

Attend to Precision Explain how estimation and precision helped or didn't help you represent the situation and answer the Main Question.

REVISIT BRAINSTORMING WHOLE CLASS

Item 1 To acknowledge that students have important ideas, use remaining class time to return to students' list of questions. Answer as many as time allows. You can also assign interesting questions for homework, particularly for the students who asked those questions.

3-ACT MATH RECORDING SHEET

Teaching Tool 32

ACT 3

5. What is the answer shown in the video? Answer

Yes, the third grade reached its goal, thanks to the final donation by a student.

6. Does your answer match the Act 3 video? If not, what is one reason that could explain the difference? Reflect

Students may say: I added incorrectly. I estimated, and since the amount was close I said "yes," which was correct, but maybe for the wrong reason.

SEQUEL

7. Show how you would answer the Sequel.

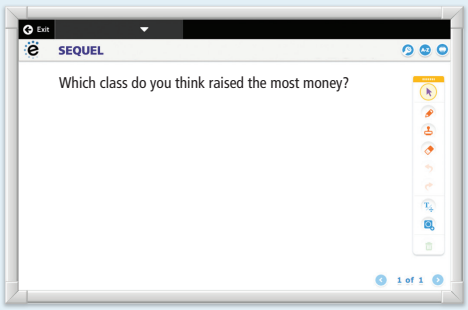
Students may say: I used the colors in the thermometer to estimate.
Check students' work. Look for student answers showing that Classes A and B raised about the same amount and Class C raised a little less.

3-Act Math Recording Sheet 3 of 3

SEQUEL

POSE THE SEQUEL INDIVIDUAL

Item 7 You can assign this similar problem situation involving adding three or more numbers for early finishers or as homework.



Sequel Answer Look for student answers showing that Classes A and B raised about the same amount and Class C raised a little less.

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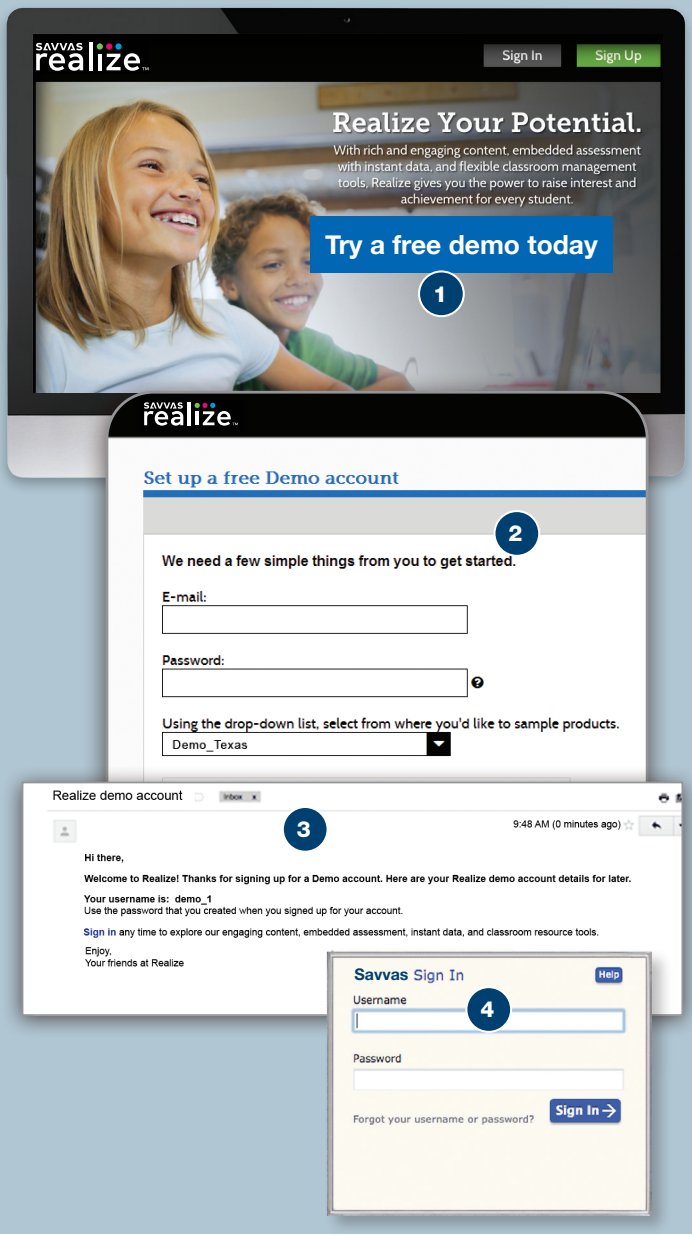

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