

Use this 3-Act Math task any time after Lesson 3-5.

3-ACT MATH PREVIEW

Page 80 This page gives students a preview of the 3-Act Math task for Topic 3. Read the robot's speech bubble with students.

Generate Interest Ask students what they know about trains. Say: *Have you or has anyone you know ever ridden on a train?* Have them share stories about their experiences with trains.

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 3, students draw on their conceptual understanding of factors and multiples. They make use of representations and tools such as

- partial products,
- arrays, and
- area models.

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'd 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
3-2	Estimating products
3-4	Multiplying two-digit numbers
3-5	Multiplying two- and three-digit numbers

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

3-ACT MATH PREVIEW
Math Modeling
Morning Commute

Before watching the video, think:

Train conductors don't wear this kind of hat anymore. Even paper tickets are less common now that some train lines use an app to purchase tickets. What are some other ways we have updated transportation as part of our modern society? All aboard!

I can ...

model with math to solve a problem that involves computing with whole numbers.

80
Topic 3 | 3-Act Math Preview



Video



Activity

ACT 1: THE HOOK



BRAINSTORM

PLAY THE VIDEO **WHOLE CLASS**

The first screen shows a video of a passenger train driving by. The train moves too fast to count the number of cars. 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

How many seats are on the train?

MAKE PREDICTIONS **INDIVIDUAL**

Item 2 Point out that the prediction is only an estimate for the number of seats on the train. Do not give students time to make calculations.

SURVEY PREDICTIONS **WHOLE CLASS**

Construct Arguments You can survey the class for a range of predictions. Point out that, without any information, you expect a wide range of predictions. Ask *Why do you think your prediction is the answer to the Main Question? Who has a similar prediction? How many of you agree with that prediction? Who has a different prediction?*

Make sure students understand it is equally important to think about unreasonable predictions to the Main Question. Ask *What is a number too small to be the number of seats? What number is too many seats?*

3-ACT MATH RECORDING SHEET

Name _____



Teaching Tool
31

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3-ACT MATH Recording Sheet

ACT 1

1. What questions do you have?



Students may say: What kind of train is that? Where is the train going? How long is the train? What's on the train?

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

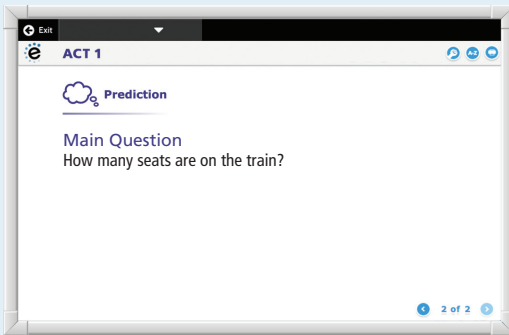


Students will predict a range of numbers. Check students' explanations.

3-Act Math Recording Sheet 1 of 3

Use any time after Lesson 3-5.

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.

- Train car seating chart showing 14 rows of 4 seats
- Image of train showing 11 passenger cars

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. [How can you describe the relationship between the number of seats and the number of passenger cars on the train?](#) [The total number of seats will be the number of seats in 1 car times the number of passenger cars on the train.] [What assumption do you need to make to use a math model?](#) [All the passenger cars have the same number of seats.]

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 can also 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
31

ACT 2

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

Info

Students may say: the number of seats in 1 passenger car; the number of passenger cars on the train

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

Annie's Work

$$\begin{array}{l}
 1 \text{ car} = 8 + 8 + 8 \times 4 \\
 16 + 8 \times 4 \\
 16 + 32 \\
 48 \text{ seats} \\
 11 \text{ cars} = 48 \\
 \begin{array}{r}
 \times 11 \\
 48 \\
 48 \\
 \hline
 528
 \end{array} \\
 528 \text{ seats on train}
 \end{array}$$

Jayden's Work

$$\begin{array}{l}
 1 \text{ train car:} \\
 14 \text{ rows} \\
 4 \text{ seats} \\
 4 \times 14 = 56 \\
 11 \text{ cars on train:} \\
 56 \times 11 = 616 \\
 616 \text{ seats on train}
 \end{array}$$

Annie says she counted the seats in one car and multiplied to find the total number of seats. How did Annie count the seats? [Annie counted two groups of 8 seats with tables and 8 rows of 4 seats in between the tables. She didn't count the 2 rows of 4 seats outside the table groups, so she missed 8 seats. Her answer is low by 11×8 , or 88, seats.]

Jayden says he counted the rows of seats and multiplied twice. Why did Jayden multiply twice? Does his answer make sense? [Jayden multiplied once to find the number of seats in 1 train car and then multiplied again to find the number of seats in 11 cars. Yes, his answer makes sense.]



Video



Activity

ACT 3: THE SOLUTION

ANSWER

REVEAL AN ANSWER WHOLE CLASS

Item 5 The Act 3 video shows a counter updating the number of seats on the train as it goes by, for a total of 616 seats. 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? Why are some predictions closer to the answer in the video than others?*

MAIN QUESTION ANSWER

There are 616 seats on the train.

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. *If the train had two more passenger cars, how many more seats would it have?* [112 more seats]

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?

Look for and Express Regularity in Repeated Reasoning

Explain how multiplication and addition are related. How did that relationship help you answer the Main Question?

REVISIT BRAINSTORMING WHOLE CLASS

Item 1 To acknowledge that students have important ideas, use remaining class time to return to their 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
31

ACT 3

5. What is the answer shown in the video?
616 seats

Answer

6. Does your answer match the Act 3 video? If not, what is one reason that could explain the difference?
Students may say: No, I miscounted the number of seats in 1 car, so my total didn't match the total in the video.

Reflect

SEQUEL

7. Show how you would answer the Sequel.
Students may say: I subtracted 56 seats from 616 seats, to find the number of seats in 10 cars. Since that number (560) was still over 500, I subtracted 56 again, to find the number of seats in 9 cars. That number, 504, is over 500 but means that if 500 passengers ride the train, they will all have seats. Check students' work. Look for student answers of 9 cars. Students who answer 504 have found the number of seats but need to perform one more operation to find the number of cars.

3-Act Math Recording Sheet 3 of 3

SEQUEL

POSE THE SEQUEL INDIVIDUAL

Item 7 You can assign this similar problem situation involving multiplication of multi-digit whole numbers for early finishers or as homework.

Exit

SEQUEL

Between 400 and 500 passengers ride a particular train every day. How many cars does the train need to make sure every person has a seat?

1 of 1

Sequel Answer 9 cars; students who answer 504 have found the number of seats but need to perform one more operation to find the number of cars.