TOPIC
Mathematical Connections and Problem Solving

KEY QUESTION
How do you select the cheapest long distance phone plan to best meet a family’s needs?

LEARNING GOALS
Students will:
• Use numeric and written data to create a procedure for selecting the most economical phone plan
• Understand how to make efficient use of money.
• Make decisions about whether or not a solution meets the needs of a client
• Communicate the solution clearly to the client

GUIDING DOCUMENTS
This activity has the potential to address many mathematics and science standards, as well as address engineering principles. Please see pages 4-6 for a complete list of mathematics and science standards.

RECOMMENDED SUPPLIES FOR ALL MODEL-ELICITING ACTIVITIES
It is recommended to have all of these supplies in a central location in the room. It is recommended to let the students know that they are available, but not to encourage them to use anything in particular.

• Overhead transparencies and transparency markers/pens or whiteboards and markers, posterboards, or other presentation tools such as a document camera.
• Calculators
• Rulers, scissors, tape
• Markers, colored pencils, pencils
• Construction paper, graph paper, lined paper
• Paper towels or tissues (for cleaning transparencies)
• Manila folders or paper clips for collecting the students’ work
• Optional: Computers with programs such as Microsoft Word and Excel

WHAT ARE MODEL-ELICITING ACTIVITIES (MEAs)?
Model-Eliciting Activities are problem activities explicitly designed to help students develop conceptual foundations for deeper and higher order ideas in mathematics, science, engineering, and other disciplines. Each task asks students to mathematically interpret a complex real-world situation and requires the formation of a mathematical description, procedure, or method for the purpose of making a decision for a realistic client. Because teams of students are producing a description, procedure, or method (instead of a one-word or one-number answer), students’ solutions to the task reveal explicitly how they are thinking about the given situation.

THE Phone Plans MEA CONSISTS OF FOUR COMPONENTS:
1) Newspaper article: Students individually read the newspaper article to become familiar with the context of the problem. This handout is on pages 7-8.
2) Readiness questions: Students individually answer these reading comprehension questions about the newspaper article to become even more familiar with the context and beginning thinking about the problem. This handout is on page 9.
3) Problem statement: In teams of three or four, students work on the problem statement for 45 – 90 minutes. This time range depends on the amount of self-reflection and revision you want the students to do. It can be shorter if you are looking for students’ first thoughts, and can be longer if you expect a polished solution and well-written letter. The handouts are on pages 10-12.
4) Process of sharing solutions: Each team writes their solution in a letter or memo to the client. Then, each team presents their solution
to the class. Whole class discussion is intermingled with these presentations to discuss the different solutions, the mathematics involved, and the effectiveness of the different solutions in meeting the needs of the client.

In totality, each MEA takes approximately 2-3 class periods to implement, but can be shortened by having students do the individual work during out-of-class time. The Presentation Form can be useful and is explained on page 4 and found on page 14.

**RECOMMENDED PROGRESSION OF THE Trash Trouble MEA**

While other implementation options are possible for MEAs, it is recommended that the MEA be implemented in a cooperative learning format. Numerous research studies have proven cooperative learning to be effective at improving student achievement, understanding, and problem solving skills. In this method students will complete work individually (Newspaper article and readiness questions; as well as initial thoughts on the problem statement) and then work together as a group. This is important because brainstorming works best when students have individual time to think before working as a group. Students can be graded on both their individual and group contributions. Social skills’ discussion at the beginning of the MEA and reflection questions at the end of the MEA are also essential aspects of cooperative learning.

**Social Skills** (3 - 5 minutes)

Students must be taught how to communicate and work well in groups. Several social skills that are essential to group work are decision-making, asking questions, and communicating and listening. The teacher can show part of a YouTube video and discuss aspects of these skills before beginning the MEA.

(http://www.youtube.com/user/flowmathematics)

**Newspaper Article and Readiness Questions:**

The purpose of the newspaper article and the readiness questions is to introduce the students to the context of the problem.

(10 minutes): Give the article and the questions to the students the day before for homework. Then, in the next class, discuss as a class the answers to the readiness questions before beginning to discuss the problem statement.

**Problem Statement:**

You may want to read the problem statement to the students and then identify as a class: a) the client that the students are working for and b) the product that the students are being asked to produce. Once you have addressed the points above, allow the students to work on the problem statement. Let the students know that they will be sharing their solution to the rest of the class. Tell students that they need to make sure that everyone understands their group’s solution so they need to be sure to work together well. The group member who will present can be picked by assigning each group member a number.

**Working on the Problem Statement** (35-50 minutes): Place the students in teams of three or four. Students should begin to work by sharing their initial ideas for solving the problem. If you already use teams in your classroom, it is best if you continue with these same teams since results for MEAs are better when the students have already developed a working relationship with their team members. If you do not use teams in your classroom and classroom management is an issue, the teacher may form the teams. If classroom management is not an issue, the students may form their own teams. You may want to have the students choose a name for their team to promote unity.

**Teachers’ role:** As they work, your role should be one of a facilitator and observer. Avoid questions or comments that steer the students toward a particular solution. Try
to answer their questions with questions so that the student teams figure out their own issues. Also during this time, try to get a sense of how the students are solving the problem so that you can ask them questions about their solutions during their presentations.

Presentations of Solutions (15-30 minutes): The teams present their solutions to the class. There are several options of how you do this. Doing this electronically or assigning students to give feedback as out-of-class work can lessen the time spent on presentations. If you choose to do this in class, which offers the chance for the richest discussions, the following are recommendations for implementation. Each presentation typically takes 3 – 5 minutes. You may want to limit the number of presentations to five or six or limit the number of presentations to the number of original (or significantly different) solutions to the MEA.

Before beginning the presentations, encourage the other students to not only listen to the other teams’ presentations but also to a) **try to understand the other teams’ solutions** and b) **consider how well these other solutions meet the needs of the client**. You may want to offer points to students that ask ‘good’ questions of the other teams, or you may want students to complete a reflection page (explanation – page 4, form – page 15) in which they explain how they would revise their solution after hearing about the other solutions. As students offer their presentations and ask questions, whole class discussions should be intermixed with the presentations in order to address conflicts or differences in solutions. When the presentations are over, collect the student teams’ memos/letters, presentation overheads, and any other work you would like to look over or assess.

ASSESSMENT OF STUDENTS’ WORK
You can decide if you wish to evaluate the students’ work. If you decide to do so, you may find the following Assessment Guide Rubric helpful:

**Performance Level Effectiveness:** Does the solution meet the client’s needs?

**Requires redirection:** The product is on the wrong track. Working longer or harder with this approach will not work. The students may need additional feedback from the teacher.

**Requires major extensions or refinements:** The product is a good start toward meeting the client’s needs, but a lot more work is needed to respond to all of the issues.

**Requires editing and revisions:** The product is on a good track to be used. It still needs modifications, additions or refinements.

**Useful for this specific data given, but not shareable and reusable OR Almost shareable and reusable but requires minor revisions:** No changes will be needed to meet the immediate needs of the client for this set of data, but not generalized OR Small changes needed to meet the generalized needs of the client.

**Share-able or re-usable:** The tool not only works for the immediate solution, but it would be easy for others to modify and use in similar situations. OR The solution goes above and beyond meeting the immediate needs of the client.
IMPLEMENTING AN MEA WITH STUDENTS FOR THE FIRST TIME
You may want to let students know the following about MEAs:

- MEAs are longer problems; there are no immediate answers. Instead, students should expect to work on the problem and gradually revise their solution over a period of 45 minutes to an hour.
- MEAs often have more than one solution or one way of thinking about the problem.
- Let the students know ahead of time that they will be presenting their solutions to the class. Tell them to prepare for a 3-5 minute presentation, and that they may use overhead transparencies or other visuals during their presentation.
- Let the students know that you won’t be answering questions such as “Is this the right way to do it?” or “Are we done yet?” You can tell them that you will answer clarification questions, but that you will not guide them through the MEA.
- Remind students to make sure that they have returned to the problem statement to verify that they have fully answered the question.
- If students struggle with writing the letter, encourage them to read the letter out loud to each other. This usually helps them identify omissions and errors.

OBSERVING STUDENTS AS THEY WORK ON THE Phone Plans MEA
You may find the Observation Form (page 13) useful for making notes about one or more of your teams of students as they work on the MEA. We have found that the form could be filled out “real-time” as you observe the students working or sometime shortly after you observe the students. The form can be used to record observations about what concepts the students are using, how they are interacting as a team, how they are organizing the data, what tools they use, what revisions to their solutions they may make, and any other miscellaneous comments.

PRESENTATION FORM (Optional)
As the teams of students present their solutions to the class, you may find it helpful to have each student complete the presentation form on page 14. This form asks students to evaluate and provide feedback about the solutions of at least two teams. It also asks students to consider how they would revise their own solution to the Paper Airplane MEA after hearing of the other teams’ solutions.

STUDENT REFLECTION FORM
You may find the Student Reflection Form (page 15) useful for concluding the MEA with the students. The form is a debriefing tool, and it asks students to consider the concepts that they used in solving the MEA and to consider how they would revise their previous solution after hearing of all the different solutions presented by the various teams. Students typically fill out this form after the team presentations.

STANDARDS ADDRESSED
NCTM MATHEMATICS STANDARDS

Numbers and Operations:
- Work flexibly with fractions, decimals, and percents to solve problems
- Understand and use ratios and proportions to represent quantitative relationships
- Judge the reasonableness of numerical computations and their results

Algebra
- Represent, analyze, and generalize a variety of patterns with tables, graphs, words, and, when possible, symbolic rules
- Relate and compare different forms of representation for a relationship
- Model and solve contextualized problems using various representations, such as graphs, tables, and equations
- Use symbolic algebra to represent and explain mathematical relationships
- Identify essential quantitative relationships in a situation and determine the class or classes of functions that might model the relationships
- Draw reasonable conclusions about a situation being modeled

Data Analysis and Probability
• Find, use, and interpret measures of center and spread, including mean and interquartile range

**Problem Solving**
• Build new mathematical knowledge through problem solving
• Solve problems that arise in mathematics and in other contexts
• Apply and adapt a variety of appropriate strategies to solve problems
• Monitor and reflect on the process of mathematical problem solving

**Reasoning and Proof**
• Develop and evaluate mathematical arguments and proofs

**Communication**
• Communicate their mathematical thinking coherently and clearly to peers, teachers, and others
• Analyze and evaluate the mathematical thinking and strategies of others

**Connections**
• Recognize and use connections among mathematical ideas
• Understand how mathematical ideas interconnect and build on one another to produce a coherent whole
• Recognize and apply mathematics in contexts outside of mathematics

**Representation**
• Use representations to model and interpret physical, social, and mathematical phenomena

**NRC Science Standards**

**Inquiry**
• Use appropriate tools and techniques to gather, analyze and interpret data
• Develop descriptions, explanations, predictions, and models using evidence
• Think critically and logically to make the relationships between evidence and explanations
• Recognize and analyze alternative explanations and predictions
• Communicate scientific procedures and explanations
• Use mathematics in all aspects of scientific inquiry

**Common Core State Standards**
• 5 MD-2: represent and interpret data
• A-CE-D-2: Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.

• F-IF-6: Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.
• F-LE: Construct and compare linear, quadratic, and exponential models and solve problems
  1. Distinguish between situations that can be modeled with linear functions and with exponential functions.
     a. Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals.
     b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.
     c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.
  2. Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).
  3. Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.
  4. For exponential models, express as a logarithm the solution to ab^ct = d where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology.
• F_LE: Interpret expressions for functions in terms of the situation they model
  5. Interpret the parameters in a linear or exponential function in terms of a context.
• S-ID 6: Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.
  a) Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear, quadratic, and exponential models.
  b) Informally assess the fit of a function by plotting and analyzing residuals.
  c) Fit a linear function for a scatter plot that suggests a linear association.
• S-ID 7: Interpret linear models. Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.
• S-IC 1: Understand statistics as a process for making inferences about population parameters based on a
random sample from that population.

- S-IC 2: Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation. For example, a model says a spinning coin falls heads up with probability 0.5. Would a result of 5 tails in a row cause you to question the model?

### Standards for Mathematical Practices integration with MEAs

<table>
<thead>
<tr>
<th>Mathematical Practice</th>
<th>How it occurs in MEAs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Make sense of problems and persevere in solving them.</td>
<td>As participants work through iterations of their models they continue to gain new insights into ways to use mathematics to develop their models. The structure of MEAs allows for participants to stay engaged and to have sustained problem solving experiences.</td>
</tr>
<tr>
<td>2. Reason abstractly and quantitatively</td>
<td>MEAs allow participants to both contextualize, by focusing on the real world context of the situation, and decontextualize by representing a situation symbolically.</td>
</tr>
<tr>
<td>3. Construct viable arguments and critique the reasoning of others.</td>
<td>Throughout MEAs while groups are working and presenting their models.</td>
</tr>
<tr>
<td>4. Model with mathematics.</td>
<td>This is the essential focus of MEAs; for participants to apply the mathematics that they know to solve problems in everyday life, society, or the workplace. This is done through iterative cycles of model construction, evaluation, and revision.</td>
</tr>
<tr>
<td>5. Use appropriate tools strategically.</td>
<td>Materials are made available for groups as they work on MEAs.</td>
</tr>
<tr>
<td>6. Attend to precision.</td>
<td>Precise communication is essential in MEAs and participants develop the ability to communicate their mathematical understanding through different representations including written, verbal, symbolic, graphical, pictorial, concrete, and realistic.</td>
</tr>
<tr>
<td>7. Look for and make use of structure.</td>
<td>Participants in MEAs can use their knowledge of mathematical properties and algebraic expressions to develop their solutions.</td>
</tr>
<tr>
<td>8. Look for and express regularity in repeated reasoning.</td>
<td>As participants develop their models the patterns they notice can assist in their model development.</td>
</tr>
</tbody>
</table>
One Family's Dilemma: Getting Slammed

Brenda Olsen knows how expensive things can be for a large family! She lives with her Mom and Dad, two sisters, and twin brothers. Brenda’s first sister, Shelley is the oldest at 16 years of age. Brenda is the next oldest child at 12 years old. Her other sister, Melinda is 11 years old, and the twin boys are 8 years old.

With five children, Brenda’s Mom and Dad have plenty of food and clothing expenses. As a result, the Olsen’s are cautious with their money and try to save money when possible. For example, some of the younger siblings will wear the clothes that no longer fit their older siblings. Also, Brenda’s parents use coupons whenever they can at the grocery store.

Thus, when Mrs. Olsen discovered that the family’s phone bill was higher than usual, she was concerned. After sharing this discovery with Mr. Olsen, Mr. and Mrs. Olsen decided to have a family meeting with the older children, Shelley, Brenda, and Melinda. They wanted to ask the girls if they had made any unusual long distance calls during the previous month. They thought that might explain the added expense.

At the meeting Mr. Olsen asked them, “Have any of you made some unusual long distance calls this month?”

After hearing that no one had made any unusual calls, Mr. and Mrs. Olsen returned to examining the phone bill.

“Well, it does look like one of our typical phone bills,” said Mrs. Olsen. “I’m not sure exactly what is going on, but I notice a charge here for $5.95 that we don’t usually receive. Did we by any chance get slammed?”

“What’s slammed mean?” asked Melinda.

“That’s when a phone company changes your long-distance calling plan without asking for your permission,” explained Mr. Olsen.

“But how can they do that?” asked Brenda. “Isn’t that illegal?”

“Yes, it is,” replied her father. “I’ll have to call the phone company to straighten this out and to tell them that our long-distance calling plan is not to be changed. I understand that if you tell them that you should not get slammed again.”

“Yes, slamming would explain our added expense,” interjected Mrs. Olsen. “Midwest switched us from our First Talk One Rate plan to their plan. With First Talk One Rate, we only paid five cents a minute whereas with Midwest Plan 1000, we have to pay ten cents a minute for calls before 7 p.m.”

“Thanks for meeting with us girls. Your Mom and I will get this straightened out now,” said Mr. Olsen.

SLAMMED! The Olsen’s were slammed and had their long distance calling plan switched from First Talk to Midwest.

<table>
<thead>
<tr>
<th>Name of Plan</th>
<th>Time of Call</th>
<th>Cost per minute of Call</th>
<th>Monthly Fee</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Talk One Rate</td>
<td>All Day, Everyday</td>
<td>$0.05</td>
<td>$8.95</td>
</tr>
<tr>
<td>Midwest Plan 1000</td>
<td>7 p.m. to 7 a.m.</td>
<td>First 1000 minutes free</td>
<td>$20</td>
</tr>
<tr>
<td></td>
<td></td>
<td>After first 1000 minutes: $0.07</td>
<td></td>
</tr>
<tr>
<td></td>
<td>7 a.m. to 7 p.m.</td>
<td>$0.10</td>
<td></td>
</tr>
</tbody>
</table>
Readiness Questions

1. Why are the Olsen’s cautious about their money?

2. What are some ways the Olsen family saves money?

3. Why did Mr. and Mrs. Olsen call a family meeting with Shelley, Brenda, and Melinda?

4. Why is the Olsen’s phone bill higher this month?

5. What is the monthly fee for the Olsen’s old calling plan, First Talk One Rate?

6. What cost per minute do the Olsen’s pay for a call made at 10 a.m. with the Midwest Plan 1000?

7. Why might the cost for one call made at 8 p.m. under the Midwest Plan 1000 plan be free when another call at 8 p.m. cost $1.68?
The Phone Plans Problem

**Information:** The Olsen family just discovered that they were *slammed* and thus, had received a higher phone bill. Instead of simply switching back to their old plan, they decided to look into the various long-distance calling plans that are available to see if another plan would save them even more money. Included in the following pages are a list of the current long-distance calling plans available and a list of the long distance calls that the Olsen family made in June.

Furthermore, Mr. and Mrs. Olsen realized that the long-distance plans that are available often change over time. So, to take advantage of any new calling plans that might become available, they decided it would be a good idea to review their long-distance calls and their long-distance calling plan once a year to determine if a different plan might save them more money.

**The Problem:** The Olsen family needs your help in selecting the cheapest long-distance calling plan for their family. Write a letter to them that describes your method for finding the cheapest phone plan. The Olsen Family will also be using your method to re-evaluate their phone plan next year. Therefore, be sure to include enough details about your method that the Olsen Family can use it next year when new phone plans will likely be available.
## Long-Distance Calling Plans

<table>
<thead>
<tr>
<th>Name of Plan</th>
<th>Time of Call</th>
<th>Cost per Minute</th>
<th>Monthly Fee</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Talk One Rate</td>
<td>All Day, Everyday</td>
<td>$0.05</td>
<td>$8.95</td>
</tr>
<tr>
<td>Midwest Nights</td>
<td>7 p.m. to 7 a.m.</td>
<td>$0.05</td>
<td>$5.95</td>
</tr>
<tr>
<td></td>
<td>7 a.m. to 7 p.m.</td>
<td>$0.10</td>
<td></td>
</tr>
<tr>
<td>Midwest Plan 1000</td>
<td>7 p.m. to 7 a.m.</td>
<td>First 1000 minutes free After first 1000 minutes: $0.07</td>
<td>$20</td>
</tr>
<tr>
<td></td>
<td>7 a.m. to 7 p.m.</td>
<td>$0.10</td>
<td></td>
</tr>
<tr>
<td>Midwest Sense Any Time</td>
<td>All Day, Everyday</td>
<td>$0.10</td>
<td>$4.95 (Waived if Long Distance spending is more than $25 for the month.)</td>
</tr>
<tr>
<td>Horizon Nation Wide Saver Plan</td>
<td>All Day, Everyday Calls under 20 minutes</td>
<td>$0.08</td>
<td>$4.95</td>
</tr>
<tr>
<td></td>
<td>All Day, Everyday Calls 20 minutes and over</td>
<td>$0.05</td>
<td></td>
</tr>
</tbody>
</table>
## The Olsen’s Long-Distance Calls

<table>
<thead>
<tr>
<th>Call Number</th>
<th>Date</th>
<th>Time</th>
<th>Place Called</th>
<th>Number Called</th>
<th>Minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>June 1</td>
<td>9:18 pm</td>
<td>Monroe, MI</td>
<td>735 289-2293</td>
<td>19.0</td>
</tr>
<tr>
<td>2</td>
<td>June 3</td>
<td>7:40 am</td>
<td>Monroe, MI</td>
<td>735 289-2293</td>
<td>8.0</td>
</tr>
<tr>
<td>3</td>
<td>June 3</td>
<td>8:55 pm</td>
<td>Cleveland, OH</td>
<td>216 371-4092</td>
<td>23.0</td>
</tr>
<tr>
<td>4</td>
<td>June 3</td>
<td>9:18 pm</td>
<td>Arlington, VA</td>
<td>703 979-2902</td>
<td>1.0</td>
</tr>
<tr>
<td>5</td>
<td>June 4</td>
<td>8:43 pm</td>
<td>Crescentville, OH</td>
<td>513 942-6531</td>
<td>27.0</td>
</tr>
<tr>
<td>6</td>
<td>June 6</td>
<td>7:15 pm</td>
<td>Monroe, MI</td>
<td>735 289-2293</td>
<td>10.0</td>
</tr>
<tr>
<td>7</td>
<td>June 6</td>
<td>7:24 pm</td>
<td>Monroe, MI</td>
<td>735 289-2293</td>
<td>17.0</td>
</tr>
<tr>
<td>8</td>
<td>June 7</td>
<td>11:55 am</td>
<td>Monticello, IN</td>
<td>219 583-7690</td>
<td>1.0</td>
</tr>
<tr>
<td>9</td>
<td>June 7</td>
<td>11:57 am</td>
<td>Logansport, IN</td>
<td>219 722-1039</td>
<td>1.0</td>
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<tr>
<td>10</td>
<td>June 9</td>
<td>6:25 pm</td>
<td>Monroe, MI</td>
<td>735 289-2293</td>
<td>20.0</td>
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<tr>
<td>11</td>
<td>June 10</td>
<td>9:26 pm</td>
<td>Yuma, CO</td>
<td>970 876-3270</td>
<td>33.0</td>
</tr>
<tr>
<td>12</td>
<td>June 15</td>
<td>9:14 am</td>
<td>Monroe, MI</td>
<td>735 289-2293</td>
<td>2.0</td>
</tr>
<tr>
<td>13</td>
<td>June 15</td>
<td>8:32 pm</td>
<td>Ft. Collins, CO</td>
<td>970 493-2876</td>
<td>1.0</td>
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<tr>
<td>14</td>
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<td>7:58 pm</td>
<td>Ft. Collins, CO</td>
<td>970 493-2876</td>
<td>2.0</td>
</tr>
<tr>
<td>15</td>
<td>June 16</td>
<td>7:29 pm</td>
<td>Ft. Collins, CO</td>
<td>970 493-2876</td>
<td>16.0</td>
</tr>
<tr>
<td>16</td>
<td>June 16</td>
<td>7:59 pm</td>
<td>Monroe, MI</td>
<td>734 289-2345</td>
<td>3.0</td>
</tr>
<tr>
<td>17</td>
<td>June 20</td>
<td>9:01 am</td>
<td>Toledo, OH</td>
<td>419 474-3546</td>
<td>1.0</td>
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<tr>
<td>18</td>
<td>June 21</td>
<td>9:03 pm</td>
<td>Belleville, MI</td>
<td>734 289-2897</td>
<td>1.0</td>
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<tr>
<td>19</td>
<td>June 22</td>
<td>9:15 am</td>
<td>Toledo, OH</td>
<td>419 474-3546</td>
<td>29.0</td>
</tr>
<tr>
<td>20</td>
<td>June 22</td>
<td>7:09 pm</td>
<td>Monroe, MI</td>
<td>735 289-2293</td>
<td>7.0</td>
</tr>
<tr>
<td>21</td>
<td>June 23</td>
<td>10:17 am</td>
<td>Yuma, CO</td>
<td>970 876-3270</td>
<td>33.0</td>
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<tr>
<td>22</td>
<td>June 25</td>
<td>2:05 pm</td>
<td>Trenton, MI</td>
<td>734 675-1152</td>
<td>2.0</td>
</tr>
<tr>
<td>23</td>
<td>June 28</td>
<td>3:24 pm</td>
<td>Monroe, MI</td>
<td>735 289-2293</td>
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OBSERVATION FORM FOR TEACHER - Phone Plans MEA

Team: ____________________________

Math Concepts Used:
What mathematical concepts and skills did the students use to solve the problem?

Team Interactions:
How did the students interact within their team or share insights with each other?

Data Organization & Problem Perspective:
How did the students organize the problem data? How did the students interpret the task? What perspective did they take?

Tools:
What tools did the students use? How did they use these tools?

Miscellaneous Comments about the team functionality or the problem:

Cycles of Assessment & Justification:
How did the students question their problem-solving processes and their results? How did they justify their assumptions and results? What cycles did they go through?
PRESENTATION FORM – Phone Plans MEA

Name____________________________________

While the presentations are happening, choose TWO teams to evaluate. Look for things that you like about their solution and/or things that you would change in their solution. You are not evaluating their style of presenting. For example, don’t write, “They should have organized their presentation better.” Evaluate their solution only.

Team _____________________________

What I liked about their solution:

What I didn’t like about their solution:

Team _____________________________

What I liked about their solution:

What I didn’t like about their solution:

After seeing the other presentations, how would you change your solution? If you would not change your solution, give reasons why your solution does not need changes.
STUDENT REFLECTION FORM – Phone Plans MEA

Name __________________________ Date________________________

1. What mathematical or scientific concepts and skills (e.g. ratios, proportions, forces, etc.) did you use to solve this problem?

2. How well did you understand the concepts you used?

Not at all  A little bit  Some  Most of it  All of it

Explain your choice:

3. How well did your team work together? How could you improve your teamwork?

4. Did this activity change how you think about mathematics?