Kaitlyn Frasier

Spring 2015
Microteaching 2
(Practice edTPA)
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</tbody>
</table>
Task 1 Part A: Secondary Mathematics Context for Learning Information

About the School Where You Are Teaching

1. In what type of school do you teach?
   Middle school: ______
   High school: __X__
   Other (please describe): ______
   Urban: ______
   Suburban: ______
   Rural: __X__

2. List any special features of your school or classroom setting (e.g., charter, co-teaching, themed magnet, remedial course, honors course) that will affect your teaching in this learning segment.
   My classes are all strategic intervention, or “applied” classes designed to meet the needs of students who have previously not succeeded in traditional mathematics courses.

3. Describe any district, school, or cooperating teacher requirements or expectations that might affect your planning or delivery of instruction, such as required curricula, pacing plan, use of specific instructional strategies, or standardized tests.
   The school uses the complex instruction model for cooperative learning, and my cooperating mentor teacher has requirements for this strategic intervention class that include clear and direct instructions for tasks, extra time for learning, slower pace than the traditional Algebra II class, tasks broken into small manageable pieces, and more scaffolding for learning tasks.

About the Class Featured in This Assessment

1. What is the name of this course?
   Applied Algebra II

2. What is the length of the course?
   One semester: ______
   One year: __X__
   Other (please describe): ______

3. What is the class schedule (e.g., 50 minutes every day, 90 minutes every other day)?
   About 50 minutes a day on average

4. Is there any ability grouping or tracking in mathematics? If so, please describe how it affects your class.
   Students who have previously not succeeded in mathematics have been tracked into this course for their third or fourth year mathematics course. This means that these students may have mental math blocks that affect their motivation to learn and willingness to participate in mathematical group work and discussions. Because of this tracking, the class has been set up in a way to accommodate student needs in the following ways: extra time is provided for students on tests, any tests can be re-taken, concrete examples are provided for work whenever requested, help generalizing concrete mathematical concepts is provided, procedures are clearly defined and repeated, assignments are broken down into small manageable bits, students receive individual attention, and mathematical language is clearly defined.
5. Identify any textbook or instructional program you primarily use for mathematics instruction. If a textbook, please provide the title, publisher, and date of publication.
Algebra 2 Learning in Context, CORD Communications 2008

6. List other resources (e.g., electronic white board, graphing calculators, online resources) you use for mathematics instruction in this class.
Graphing calculators, smart board

About the Students in the Class Featured in This Assessment

1. Grade-level composition (e.g., all seventh grade; 2 sophomores and 30 juniors):
All juniors

2. Number of:
students in the class: __16__
males: __7__ females: __9__

3. Complete the chart below to summarize required or needed supports, accommodations, or modifications for your students that will affect your instruction in this learning segment. As needed, consult with your cooperating teacher to complete the chart.

<table>
<thead>
<tr>
<th>IEP/504 Plans: Classifications/Needs</th>
<th>Number of Students</th>
<th>Supports, Accommodations, Modifications, Pertinent IEP Goals</th>
</tr>
</thead>
<tbody>
<tr>
<td>504: ADHD</td>
<td>1</td>
<td>Step-by-step instructions Extra time Preferential seating</td>
</tr>
<tr>
<td>504: Severe ADHD</td>
<td>1</td>
<td>Step-by-step instructions Extra time Preferential seating Headphones</td>
</tr>
<tr>
<td>504: Migranes</td>
<td>1</td>
<td>Extra time Preferential seating Breaks</td>
</tr>
<tr>
<td>Other Learning Needs</td>
<td>Number of Students</td>
<td>Supports, Accommodations, Modifications</td>
</tr>
<tr>
<td>Underperforming students</td>
<td>16</td>
<td>Extra time Bridges concrete to abstract concepts/Help to generalize Procedural clarity Breaking down tasks into small manageable bits Individual attention Clearly defined language</td>
</tr>
</tbody>
</table>
Lesson 1

<table>
<thead>
<tr>
<th>Launch 10 minutes</th>
<th>Discuss group norms and roles (about 5 minutes)</th>
</tr>
</thead>
</table>
| **I Say:** So I’ve been here for a while now and I noticed how you all work within your groups pretty well, but I want to challenge you to use each other as your first resources, and brainstorm with each other more before asking me or Mrs. Fowler a question. Does this sound ok with you? I’ll still be here as a resource, and I will happily answer any questions that your group as a whole can’t find any answers to, but I will tell you I’m more likely to ask you another question than give you an answer. I also noticed how you have group roles on your desks that you use when presenting your group work for the day, and I like that, but I also want to challenge you to read your role cards and see what you can do to follow that as closely as possible this week. So Team Captains raise your hands. What are your responsibilities? What about my Facilitators? Resource Managers? Product Monitors? I’m going to have you make posters today, and I want you to make them like you would professionally, making sure that your information is neat, and that everyone in your group agrees on that information ok? Ok, so just one more thing about group work, I will be keeping an eye on you all working with your groups and I want to make sure everyone participates and is paying attention to their team, so I may come over and interrupt if it seems like not everyone is getting their say, and I might just ask a random team member to give me a quick summary of what’s happening, so always make sure that everyone knows what they are supposed to be doing, and that any questions one person has, the whole group has tried to answer, and everyone knows the questions before I come over.

**Launch (about 5 minutes)**

- **I Say:** Ok, so enough about group norms because we will both, you all, and me, be learning more about how that will work throughout the period today. There is one more logistical thing though. I am going to show you the rubric I will be using to assess your understanding throughout the week. I will look at your posters to see these things, and this will be how I grade the test. [projecting the rubric]. Meeting standard is the goal for the test and would give you a solid C grade.

- **I Say:** So what have you all been working on for the past, let’s see, three weeks or so? Solving quadratic equations?
  - What does solving a quadratic equation mean?
  - What are the “solutions?” [students may say the zeros or intercepts, or not be sure] Right, so they are the places where the equation’s y value is 0, so the x-intercepts. What do they mean though? What is that a solution to?
  - How could we use these solutions in real life? Well, that’s something we will find out today through some exploration of creating and interpreting equations.
  - What does it mean to create an equation?
  - How do you find the maximum/minimum/vertex of a quadratic equation?

- **I Say:** Each of your groups will get a task card like you usually get for group work, but I’m not going to do an example like usual because you all have a lot of experience working with quadratics already, and there are going to be two group work problems instead of a different one for each group. What I’m going to do is tell you what I expect as your final product, then I want
| Instructions/Structured Practice & Application | At this point Team Captains should be reading one of the two task cards [attached instructional materials] aloud to their group and the groups might start struggling to figure out what to do first. I will hold back for at least five minutes, making sure every group has read their task card before I wander around the room to listen in on the groups. Resource Monitors might jump up to get their group a poster paper and pens, and groups may start having questions. If groups are struggling to begin I will ask scaffolding questions:

**Odd Group Number Task:**
- Could you draw a picture?
- What is the total area of the garden and the walkway together?
- What is the length/width of the garden and the walkway together?
- How could you write an equation to help you solve this?
- What are some ways you can represent area?
- Extension: The designer has decided that he wants to put specially designed stones in the corners of the garden that will be perfect squares. What will the area of the walkway without the special stones be? How do you know?

**Even Group Number Task:**
- What does t stand for?
- What does h(t) stand for?
- Where does the 6 come from?
- How do you find maximum height?
- How can you find the time when the ball is at its maximum height?
- Extension: What does the \(-16t^2\) stand for? What about the 80t?

As I walk around and the time passes I will note strategies that I hear being used to interpret the word problem, write an equation, and solve the problem. I will continue this monitoring into the next day’s lesson to help me select and sequence groups for presentation. I will write down anything that may lead toward misconceptions and make sure to address them in the discussion in the next lesson.

| Closure | At five minutes to bell the groups should all be working on their posters and I will wrap up by saying: Ok everyone, time to put resources away, we will have some time tomorrow, maybe instead of entry task, to work on your product, and make sure everything is all good before I will have groups present tomorrow. Please make sure any calculators and markers or colored pencils are put away and please stack your posters with your group names, number, period and the date, on table group 8 for me so I can keep them nice for tomorrow.

| Planned Supports | Whole Class:
- Students have the option of extending their work with the extension

**Individual students with 504 Plans:**
- I will keep an eye on, and make eye contact with, my students who have ADHD, giving Team Captains a list of the following questions to make sure they ask to keep them focused:
  - What is our first step?
<p>| | |</p>
<table>
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</thead>
</table>
|   | Could we draw a picture or in some way model this problem?  
|   | Where are we now?  
|   | What is our next step?  
|   | What can we write down now?  
|   | Who hasn’t shared their ideas yet?  
|   | Do we need anything in order to move forward?  

**Strategies for responding to common errors and misunderstandings:**

- Asking a probing question related to the question they asked in order to get at what they already know

The common errors are:

- Students believe that to find the height after time t they use the velocity in trajectory problems
  - Groups will deconstruct the equation in trajectory problems and name how we find time and height at time t  
  - I will ask probing questions about finding output values from equations
- Students believe that t represents velocity and h(t) represents h times t
  - We will deconstruct the equation given in the trajectory problems  
  - The groups with the trajectory problem will explain the deconstruction

**What Ifs**

- Students may not know how to start the group work on their own
  - I will ask scaffolding questions and try to lead them toward starting with drawing a picture or identifying variables
- Students may insist that I give an example before starting their group work
  - I will ask scaffolding questions and try to lead them toward their own work rather than working on a problem for them
- I may be asking too much to change the schedule from their normal example then group work then worksheet
  - I will try to make it clear why I am changing the schedule, but if it is required I will provide one of the group work tasks as an example and the groups will all do the other, then the discussion in lesson two will be centered around the problem they did together with some of my input on the problem I did as an example. I will then ask them what the similarities and differences there are between the problems.

**Materials**

**Teacher Materials**

- Task cards (4 copies of each)  
- Clipboard with paper divided into Cornell Note columns to monitor

**Student Materials**

- Poster boards  
- Pens  
- Colored pencils
**Lesson 2**

**Launch**

<table>
<thead>
<tr>
<th>20 minutes</th>
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<tbody>
<tr>
<td>• In lieu of an entry task today we will work on our group work from yesterday for 10 minutes and ready what we would say in the presentation</td>
</tr>
<tr>
<td>• I will hand out the group work rubric I will use to assess understanding for myself, and talk about how I am looking for what students understand and hoping that they fall in the 2 or 3 category for today, then we can move into 3 and 4 on Thursday in lesson 3.</td>
</tr>
<tr>
<td>• Talk about discussion norms</td>
</tr>
<tr>
<td>- So I’m going to have 2 or 3 or 4 groups present their posters because I saw common strategies happening and I want everyone to hear these ideas. When groups are presenting their ideas I want everyone to be respectful and raise their hand if they have any questions. I will raise my hand too. After each group is done presenting I want to have a conversation about the strategies we saw today for solving problems like these.</td>
</tr>
<tr>
<td>• Sequence the groups as selected from yesterday and this morning during the 10 minute work session.</td>
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**Instruction**

<table>
<thead>
<tr>
<th>25 minutes</th>
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<tbody>
<tr>
<td>• I will ask questions as follows to scaffold the discussion:</td>
</tr>
<tr>
<td>- What sorts of strategies did we see to deconstruct the meaning of the word problems? Talk with an elbow partner (team captain with facilitator and resource manager with recorder/reporter) for a minute to construct a thought.</td>
</tr>
<tr>
<td>- What strategies did we see to solve quadratic equations?</td>
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<tr>
<td>- How were the problems you saw today the same?</td>
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<tr>
<td>- How were these problems different?</td>
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<tr>
<td>- What is something new you learned from working with these problems? Share with your elbow partner.</td>
</tr>
<tr>
<td>• In the discussion if the following points come up I will emphasize them, but if not I will point them out</td>
</tr>
<tr>
<td>- Careful reading of the problem</td>
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<tr>
<td>- When negative answers do and do not make sense</td>
</tr>
<tr>
<td>- Where each piece of the equation comes from</td>
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</tbody>
</table>

**Closure**

<table>
<thead>
<tr>
<th>15 minutes</th>
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<tbody>
<tr>
<td>In closing I will summarize the main points that the class makes and re-emphasize the points above.</td>
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<tr>
<td>In the last 10 minutes of class I will hand out the exit ticket [attached] reflection for students to fill out.</td>
</tr>
<tr>
<td>In the last 5 minutes of class I will ask for exit tickets and posters.</td>
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</tbody>
</table>

**Planned Supports**

**Students with IEP’s or 504 plans:**

- I will ask students with 504 plans for ADHD focused questions to keep their discussions on the math.

**Strategies for responding to common errors and misunderstandings, developmental approximations, misconceptions, partial understandings, and/or misunderstandings:**

- Asking a probing question related to the question they asked in order to get at what they already know

**The common errors are:**

- Students believe that to find the height after time t they use the velocity in trajectory problems
  - Groups will deconstruct the equation given in trajectory problems and name how we find time and height at time t
I will ask probing questions about finding output values from equations
- Students believe that t represents velocity and h(t) represents h times t
- We will deconstruct the equation given in the trajectory problems
- The groups with the trajectory problem will explain the deconstruction

**Student Interactions**
After having groups present their posters I will ask pairs to brainstorm a question to ask the presenters.
Students will have the chance to talk to their elbow partners often to share ideas about questions I ask in the class discussion.

**What Ifs**
Seeing how the class has never had a big structured mathematical discussion as I would define it I could see this discussion going a couple of ways out of hand. I could either lose control of students’ side discussions because I do not yet have the trust of the class, in which case I hope to implement a learner centered model where students ask each other questions and make sense of the math, where I lead only by asking math questions. Or, students may not have much to say to the class as a whole, and then I will have to probe, giving wait time and watching what I say carefully as to not alienate conversation.

**Materials**

**Teacher Materials:**
- Student reflection pages

**Student Materials:**
- Previous day’s posters
- Pens
- Colored pencils
Lesson 3

| Launch | 12 minutes | So all week what have we been working on? Right, quadratic word problems, that is, figuring out how we can use quadratic equations to solve real world problems, and last time you left me questions that I have collected and organized into some common piles and I’d like to share them with you and see if anyone can answer, or if I can give some answers for you. [On Wednesday I will sort the questions and figure out answers. If the following are not addressed in the questions I will re-emphasize: negative answers and when they make sense, defining each piece of the equations, careful reading of the problem, and picking the best answer]. So now that we have some answers, are there any more questions we can work out together? Ok, so today we will be doing a review worksheet with problems like we did in group work, and the test tomorrow will be a lot like the worksheet. I’d like you to work in your groups like you did on Monday, so make sure to pay attention to your role cards. I know that usually you don’t have a discussion after worksheets, but I would like to reserve the last ten or so minutes of class to discuss any questions or concerns we have about the test tomorrow. That being said, Resource Managers you’ll need one copy of the worksheet for each of your team members. |
|---|

| Instruction/Structured Practice and Application | 20 minutes | Students will be working in their groups on the worksheet and I will hang back for five minutes to let them get into the swing of things. I will only intervene for group behavior issues unless a group calls me over, in which case I will ask scaffolding questions like:

- What could you do first?
- Does anyone at your group think they could help?
- Could you draw a picture?
- How do you know?
- Why is that true?

As students start finishing up their worksheets I will go around asking them to check their answers by putting the numbers back into the equation and seeing if the results are reasonable, then I will let students see the answer key to check their solutions again and I will make sure their strategies are logical, giving them a stamp for their daily work. After monitoring to see how students are doing on their worksheet I will pull the class back together. |

| Closure | 8 minutes | So today we did some practice on word problems, does anyone have any questions now? I’d like to make sure everyone understands how their test will be graded because Mrs. Fowler and I will be collaborating on this one. I’ll hand out a rubric for you all to see, you can take one home if you want to keep it, and I want to be clear on what I am looking for. Some things I expect for answers on your test are for your answers to have units and be rounded to the nearest 100th if in decimal form. I also would prefer full sentence answers, but you would still get credit for boxed numerical answers. So I know everyone is going to do great on the test tomorrow, have a lovely day. |

<table>
<thead>
<tr>
<th>Planned Supports</th>
<th>Individual students:</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>- I will be looking for students to be working on their worksheets in their groups, but they tend to work independently so I will answer questions that individual students have after I see if anyone in the group has tried to answer.</td>
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<tr>
<td>Strategies for responding to common errors and misunderstandings, developmental approximations, misconceptions, partial understandings, and/or misunderstandings:</td>
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<tr>
<td>- Asking a probing question related to the question they asked in order to get at what they already know</td>
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<tr>
<td>The common errors are:</td>
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<tr>
<td>- Students believe that to find the height after time t they use the velocity in trajectory problems</td>
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<tr>
<td>- Groups will deconstruct the equation given in trajectory problems and name how we find time and height at time t</td>
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<tr>
<td>- I will ask probing questions about finding output values from equations</td>
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<tr>
<td>- Students believe that t represents velocity and h(t) represents h times t</td>
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<tr>
<td>- We will deconstruct the equation given in the trajectory problems</td>
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<tr>
<td>- The groups with the trajectory problem will explain the deconstruction</td>
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</tbody>
</table>

| Student Interactions | Students will be encouraged to work in their groups from lessons 1 and 2, using each other as resources before they call me over with questions. |

<table>
<thead>
<tr>
<th>Materials</th>
<th>Teacher Materials:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- Quadratic word problems worksheet</td>
</tr>
<tr>
<td></td>
<td>- Key to worksheet</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>All Three Lessons’ Academic Language Demands:</th>
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<tbody>
<tr>
<td><strong>Language Functions</strong></td>
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<tr>
<td><strong>Vocabulary</strong></td>
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<tr>
<td><strong>Language Uses</strong></td>
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<tr>
<td><strong>Supports</strong></td>
</tr>
</tbody>
</table>
Overall Assessments:

<table>
<thead>
<tr>
<th>Type of assessment</th>
<th>Description of assessment</th>
<th>Modifications</th>
<th>Evaluation Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-Assessment</td>
<td>Two quadratic word problems, one to be solve by factoring with little scaffolding to see how students create an equation and one to be solved by the quadratic formula with scaffolding questions to establish how students are interpreting the equation given.</td>
<td>No modification to the assessment itself, but students can have extra time if they need it.</td>
<td>This is to gather what prior knowledge students have about interpreting quadratic word problems.</td>
</tr>
<tr>
<td>Formative Assessment</td>
<td>I will collect posters and exit tickets from lesson 2 and record common errors or misconceptions that arose as well as questions that students asked in their exit ticket.</td>
<td>No modifications to the exit tickets, but students will be given ample time to complete them for my information.</td>
<td>This provides me with information on where students are in the learning of quadratic word problems, allowing me to see what questions I can answer in lesson 3.</td>
</tr>
<tr>
<td>Post-Assessment</td>
<td>Three quadratic word problems, two just like the pre-assessment, and a third harder problem like the group work garden problem.</td>
<td>Students will be allowed extra time to complete the test.</td>
<td>This will show me how much students have learned since the pre-assessment and how they can apply the skills they have learned throughout the week.</td>
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</table>
## Applied Algebra II Grading Rubric

<table>
<thead>
<tr>
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<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
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</thead>
<tbody>
<tr>
<td><strong>Conceptual</strong></td>
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<td></td>
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<tr>
<td>Understanding</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
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<tr>
<td>No work shown</td>
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<tr>
<td>Work shown demonstrates that you have some idea of what the problem is asking, but the connection between the work shown and the problem is unclear and leads to an incorrect answer</td>
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<tr>
<td>Work shown demonstrates that you have an idea of what the problem is asking, but the connection between the work shown is unclear or leads to an incorrect answer</td>
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<tr>
<td>Work shown demonstrates that you have an idea of what the problem is asking and there is a clear connection to the work shown, but it may lead to an incorrect answer</td>
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<tr>
<td>Work shown demonstrates that you have a good idea of what the problem is asking and a clear connection to the work shown with a correct answer</td>
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<td><strong>Procedural</strong></td>
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<tr>
<td>Fluency</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
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<tr>
<td>No work shown</td>
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<tr>
<td>Incorrect use of the strategy used to solve the quadratic equation, but obvious effort shown</td>
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<tr>
<td>Almost correct use of the strategy used to solve the quadratic equation</td>
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<td>Correct use of the strategy used to solve the quadratic equation, but the answer may not be correct</td>
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<td>Correct use of the strategy used to solve the quadratic equation and a correct best answer chosen</td>
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<td><strong>Problem</strong></td>
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<tr>
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<td>1</td>
<td>2</td>
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<td>4</td>
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<tr>
<td>No work shown</td>
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<td>Some work is shown, but is not obviously connected to the answer, and the answer is incomplete or incorrect</td>
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<td>Some work is shown and connects to the answer given, but the answer is incomplete or incorrect —Or—</td>
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<td>Ample work is shown and connects to the answer given, but the answer may not be complete or correct —Or—</td>
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<td>A complete and correct answer is given with little work shown</td>
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<td>All necessary work is shown and clearly connects to the complete and correct answer</td>
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<td><strong>Reasoning</strong></td>
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<td>No work shown</td>
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<td>Steps in the work shown are difficult to follow and lead to an incorrect answer —Or—</td>
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<td>Steps in the work shown can be followed with a close eye but do not lead to a correct answer —Or—</td>
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<td>Steps in the work shown follow from one to the next, but may not lead to a correct answer</td>
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<tr>
<td>Steps in the work shown clearly follow from one to the next and lead to a correct answer</td>
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Lesson 1 Materials

**Odd Group Number Task Card**

**Your Task:**
A designer is planning to lay a walkway around a community garden. The garden is a rectangle with the dimensions of 12 meters in width by 16 meters in length. The budget for the walkway allows for a maximum walkway area of 128 square meters. The designer wants your help to find out: what is the width of the walkway?

**What your group will prepare:**
A poster with all of your group member’s names, the period, and the date that clearly addresses the following:

- A picture/model representing the garden with labels on the length and width of the garden and the width of the walkway
- An equation that will help determine the width of the walkway
- Two strategies to solve the equation with your answer checked thoroughly
- A sentence saying what the width of the walkway is, making sure to use units
- Justification for why your group’s answer is right

**Even Group Number Task Card**

**Your Task:**
A ball is thrown upward from a height of 6 feet with a velocity of 80 feet per second which can be modeled by the equation $h(t) = -16t^2 + 80t + 6$.

⇒ What is the maximum height of the ball, and at what time will the ball reach that height?
⇒ At what time will the ball hit the ground?

**What your group will produce:**
A poster with all of your group member’s names, the period, and the date that clearly addresses the following:

- What does $t$ stand for? What about $h(t)$? Where does the +6 come from?
- The maximum height of the ball
- Two equations, one representing how to find the time the ball will reach the maximum height, and the other representing how to find the time the ball will hit the ground
- Two sentences saying the time the ball will reach the maximum height, and the time it will hit the ground making sure to use units
- Clear written justifications for your solutions that include symbols and color to make connections
Lesson 2 Materials

Applied Algebra 2 Reflection

Name: __________________________
Date: ________________ Period: __

What have we been learning about this week? Why is it important to know?

How will I [Ms. Frasier] make sure you know the math we have been working on?

What is one thing you would have changed about this class for the past two days?

What are some questions you still have about quadratic word problems? (Please write at least one question, even if you think you could answer it, someone else may still be foggy too)
1. Joe has a rectangular garden that is 6 meters long by 4 meters wide, so it has an area of 24 square meters. He wants to double the area of his garden by increasing its length and width by the same amount, x meters.
   
   A. Draw a picture with labels to model this situation.

   B. Find x, the number of meters the length and width must be increased by.

2. A designer is planning to lay a walkway around a community garden. The garden is a rectangle with the dimensions of 12 meters in width by 16 meters in length. The budget for the walkway allows for a maximum walkway area of 128 square meters.

   A. What is the total area of the garden and the walkway together?

   B. Draw a picture to model this problem, labelling the width of the walkway with an x.

   C. What is the length of the walkway and the garden together?

   D. Write an equation that you could use to find the width (x) of the walkway.

   E. What is the width (x) of the walkway?
3. Two bedrooms in my house are each perfect squares with the same dimensions (x by x) and a combined area of 162 square feet.

   A. Draw a picture with labels to model this situation.

   B. What are the dimensions of my bedrooms?

4. At the beginning of a basketball game the referee tosses a jump ball. The referee holds the ball 4 feet above the floor and tosses the ball upward at a velocity of 26 feet per second. The acceleration of the ball is affected by gravity, which is approximately 32 feet per second squared. This situation can be modeled by the equation $h(t) = -16t^2 + 26t + 4$.

   A. What does t stand for? What about h(t)?

   B. Where does the 4 come from? How do you know?

   C. At what time will the ball reach its maximum height?

   D. What is the ball’s maximum height?
1. The length of a rectangle is 2 meters less than the width, and the area of the rectangle is 35 square meters. Find the length and width of the rectangle.

2. A ball is thrown upward from a height of 6 feet with a velocity of 80 feet per second which can be modeled by the equation \( h(t) = -16t^2 + 80t + 6 \).
   - A. What does \( t \) stand for? What about \( h(t) \)?
   - B. Where does the +6 come from?
   - C. If the ball has been in the air for 2 seconds, how far above the ground is it?
   - D. At what time does the ball reach its maximum height?
   - E. What is the ball’s maximum height?
   - F. At what time will the ball hit the ground?
1. The length of a rectangle is 3 meters less than the width, and the area of the rectangle is 180 square meters. Find the length and width of the rectangle in meters.

2. At the beginning of a basketball game the referee tosses a jump ball. The referee holds the ball 4 feet above the floor and tosses the ball upward at a velocity of 26 feet per second. The acceleration of the ball is affected by gravity, which is approximately 32 feet per second squared. This situation can be modeled by the equation \( h(t) = -16t^2 + 26t + 4 \).

   A. What does \( t \) stand for? What about \( h(t) \)?

   B. Where does the 4 come from? How do you know?

   C. At what time will the ball reach its maximum height?

   D. What is the ball’s maximum height?
3. A designer is planning to lay a walkway around a community garden. The garden is a rectangle with the dimensions of 12 meters in width by 16 meters in length. The budget for the walkway allows for a maximum walkway area of 128 square meters.

   A. What is the total area of the garden and the walkway together?

   B. Draw a picture to model this problem, labelling the width of the walkway with an x.

   C. What is the length of the walkway and the garden together?

   D. Write an equation that you could use to find the width (x) of the walkway.

   E. What is the width (x) of the walkway?
Task 1 Part E:
Secondary Mathematics Planning Commentary

1. Central Focus

   a. Describe the central focus and purpose for the content you will teach in the learning segment.

   The central focus of my sub-unit is quadratic word problems, that is, creating equations in order to solve real world problems utilizing quadratic equations. The purpose for this content is to learn applications for quadratic equations, how to decode word problems, as well as building equations. The standards I have honed in on are N-Q: Reason quantitatively and use units to solve problems- 1. Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. And A-CED: Create equations that describe numbers or relationships- 1. Create equations and inequalities in one variable and use them to solve problems; and 3. Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. The learning targets I have pulled from these standards are as follows (Knowledge-K, Skill-S, Reasoning-R, Product-P):

   - Use units as a way to understand problems (S)
   - Choose and interpret units consistently in formulas (R)
   - Create equations in one variable (S)
   - Use these equations to solve problems (R)
   - Interpret solutions to these equations as viable or nonviable options in a modeling context (R)

   b. Given the central focus, describe how the standards and learning targets within your learning segment address

   - Conceptual understanding
     The standards and learning targets within my learning segment address conceptual understanding through asking students to draw on their prior knowledge of equality and equations in order to create equations from a word problem context. In turn, students will be using units from the problem context in order to understand and consistently create equations that will lead to viable results.

   - Procedural fluency
     The standards and learning targets within my learning segment address procedural fluency through having students find the maxima/minima of quadratic equations because this is a procedure that students have learned in their past algebra experience. With quadratic equations, students will also be drawing on their prior knowledge of solving for x with factoring, completing the square, and the quadratic formula. The learning targets also ask students to draw upon prior knowledge of simplifying equations, which is also procedural in nature.

   - Mathematical reasoning and/or problem-solving skills
     The standards and learning targets within my learning segment address mathematical reasoning through asking students to translate word problems into equations and interpret solutions to these equations as viable or non-viable options
in the context of the problem. The standards and learning targets within my learning segment address problem-solving skills through asking students to use units as a way to understand problems or guide them to solutions.

c. Explain how your plans build on each other to help students make connections between facts, concepts, and procedures, and to develop their mathematical reasoning and/or problem-solving skills to deepen their learning of mathematics.

In lesson 1 I ask students to take what they already know about quadratics and interpreting word problems and see how they can apply that prior knowledge to solve problems. In this lesson students are asked to reason what it means for something to be called a solution, then apply that understanding to finding the best answer to a contextualized quadratic problem. Students are then asked in lesson 2 to present this information to the class and have a discussion about the strategies they can use to deconstruct word problems, as well as again addressing what it means for something to be a solution, and how to find the best answer. This builds on lesson 1 by asking students to discuss in general what it means to deconstruct a word problem and create an equation. By lesson 3 students should be well versed in what is and is not a solution to a real world problem and have a chance to practice this conceptual understanding through solving more real world problems, and thus developing a procedural fluency for solving quadratic word problems. Having students continue to work with similar word problems to the ones they did in their group work and then presented allows them to apply their generalized reasoning skills to concrete problems that will help them see explicit connections. Lesson 3 builds on the first two lessons by asking students to try a variety of problems in a worksheet form rather than grappling with one problem as a group.

d. How and when will you give students opportunities to express their understanding of the learning targets and why they are important to learn?

In lesson 1 I have structure in a time where students in the role of Team Captain in their groups will tell me what their immediate goal is in their group, which is to read aloud the task card and get their groups off to a good start. In lesson 2 I will have students reflect on a provided reflection page [see Lesson 2 Instructional Materials], which explicitly asks what students have been learning the past two days why they are important to learn. From this reflection I will have a chance to see what sorts of questions students still have about quadratic equations in context, giving students a chance to see where they stand with their understanding of word problems.

2. Knowledge of Students to Inform Teaching

a. Prior academic learning and prerequisite skills related to the central focus—Cite evidence of what students know, what they can do, and what they are still learning to do.

Students have been learning how to solve quadratic equations for the past 6 weeks and have four methods of solving quadratic equations for roots in their tool kit: factoring (including special cases like difference of squares), graphing, completing the square, and the quadratic formula. All students have been tested on these strategies, finding that many students have made progress with factoring, but make minor mistakes with the completing the square and quadratic formula algorithms. I believe this is because they are trying to memorize the algorithm rather than having a deeper understanding of the process because the mistakes I am seeing are mostly about misplacing the a, b or c in the quadratic formula, or forgetting to square in completing the square. Students also have extensive experience simplifying algebraic expressions as seen with their algebra basic
skills monitors, which they perform the first week of every month as a way to track their skill building. Also, students have experience with finding output values given input values, although on their pre-assessments they either did not answer, or gave incorrect answers for the question pertaining to this skill, although I would attribute this to lack of experience with quadratic word problems. Students have experience with word problems about systems of linear equations, but not with quadratic equations, and so they will be practicing how to interpret these problems and draw pictures to represent real world scenarios. On the individual level there are two students I am most concerned about with their learning of quadratic equations because one does not do her work in class, and the other tends to copy her answers from her group members during worksheet time.

b. Personal/cultural/community assets related to the central focus—What do you know about your students’ everyday experiences, cultural backgrounds and practices, and interests?

I know that many of my students have interests in sports, so it was natural to include a problem about trajectories of a basketball. I also know at least two students who are interested in some sort of graphic or video game design which connects with the idea of creating a perimeter fence around a garden as they work with in groups, or finding measurements of rooms on the lesson 3 worksheet because graphic design has a lot to do with finding perimeter measurements for areas given by the customer, then figuring out what will best work in that area. Around the school there are also walkways and paths that are worn, and students could draw connections from what they are learning in class to the school community and consider the implications for their real lives. If given more time and permission to walk the school grounds with the class I would take this problem into the field and have students measuring the path around the math building and figuring out how they could better their school for the least cost.

c. Mathematical dispositions—What do you know about the extent to which your students

- **Perceive mathematics as “sensible, useful, and worthwhile”**
  Because my students have not succeeded in traditional mathematics classrooms they tend to have an overall mindset that math is not useful and they are only learning it so they can graduate. Some students more than other see how the math they learned in lower grades is useful, but believe they will never use the math they are learning in Applied Algebra II.

- **Persist in applying mathematics to solve problems**
  Many of my students persist in applying math to solving problems and work diligently on their classwork, but there are certainly four or five students who do not persist. I have one student who chooses to never do her classwork, another who works depending on the day, and a few who tend to give up when the problems get difficult in this class period.

- **Believe in their own ability to learn mathematics**
  The same students who tend to give up, and the student who chooses to not do her work in class all have an internal deficit mathematics mindset. When they get it they believe they can learn, but when it gets hard, they believe they are “dumb,” or “bad at math.” They certainly seem to be of a fixed mindset within the realm of mathematics. Otherwise my students have a similar mindset of not being typically “smart” in math, but they all have varying degrees of confidence in their ability to learn it, which
changes day-to-day. This is why I want to use their group roles and assign competence to students who believe they aren’t “smart” in math.

3. Supporting Students’ Mathematics Learning

a. Justify how your understanding of your students’ prior academic learning, personal/cultural/community assets, and mathematical dispositions guided your choice or adaptation of learning tasks and materials. Be explicit about the connections between the learning tasks and students’ prior academic learning, assets, mathematical dispositions, and research/theory.

Because my students have not been successful in traditional mathematics classrooms in the past I have tried to structure the lesson in a way that is routine to them, using group work in lesson 1 as a vehicle into their thinking processes. Group work in the complex instruction model is characterized by structured roles and responsibilities for each student in the group, and explicit classroom norms that the students have a hand in creating. Although in my classroom the norms and roles they have were not created by the students, the culture of the classroom still centers on the role cards taped to their desks. The roles are Team Captain, Facilitator, Resource Manager, and Recorder/Reporter. The team captain is responsible for making sure the group follows their roles, and fills in for missing roles; the facilitator gets the group off to a quick start and makes sure everyone is working together; the resource manager makes sure the group has the resources it needs and calls the teacher over for group questions; the recorder/reporter makes sure the whole group has their ideas represented and everyone can present the ideas shown. This structure of group work is shown to have a positive effect on the math self-image students have (NCTM, 2011), as well as increasing the likelihood that students will understand the material because it allows more of them access (Cohen & Lotan, 2014). I believe this is the best model for the students in my classroom because they have such deficit mindsets about their own mathematics learning, and they are used to the format of group work. Having the groups present their information as experts in front of the class in lesson 2 will both orient students to each other’s ideas as well as position the presenting students competently, high leverage teaching practices which are said to increase motivation and confidence in their mathematics efforts (NCTM, 2014). In terms of connecting the math to their prior knowledge, the lessons I’ve planned are mainly focused on using the quadratic equations solving strategies they have been building up for the past six weeks. The main focus of the lesson will really be how to read word problems because they struggled with them in their work with systems of linear equations, and often complain about the difficult nature of word problems. I believe this may be due to the fact that many students in the class have difficulty reading (some even having IEP plans for reading, while not qualifying in math), and thus the language demands they encounter are more difficult for them to process than some students. The structures I have in place to support students in their language interpretation are to ask scaffolding questions to lead students toward a mathematical and contextual understanding of the problem. All of the problems I pose are within a context that students understand, rather than something taken out of a context that will just cause more confusion.

b. Describe and justify why your instructional strategies and planned supports are appropriate for the whole class, individuals, and/or groups of students with specific learning needs.

In lesson 1, by giving Team Captains a list of facilitating questions they can ask the group to keep themselves on track I am providing the two students in the class who have 504 plans for ADHD (who are both Team Captains) a structured checklist-like sequence of
steps they can follow in order to participate in the group, which is a method supported by the 2002 PBS study on ADHD. I will also ask students to write down a new strategy they saw in lesson 2 from the classroom discussion, which will give students an activity to focus on during the discussion, as well as providing something to do with their hands. This is also based on the 504 plans for the two students with ADHD have, which ask teachers to give step-by-step instructions and break down tasks into small manageable bits. Two other strategies I will employ for these two students are asking them to repeat the directions I give within their groups in order to get them to remember and maintain an understanding of what they need to be doing, and miming what it means to do group work so that they have an example of what they need to be doing. The students who have 504 plans for ADHD and migraines also have signals for when they need to take a break which I have been informed of and I will allow them to rest if they signal me or my mentor teacher.

c. How will students identify resources to support their progress toward the learning targets?
In the structure of the lesson I have used the complex instruction model as outlined by the NCTM (2011) as well as Cohen and Lotan (2014) in their theory surrounding group work and group worthy tasks. In this model, students are oriented to each other’s thinking and are asked to first use their team members as resources, then if the group still has a question to call a teacher over. Also, on the schedule board as you enter my classroom there is an after school section that says when my mentor teacher and I will be in the classroom, which is usually at least two days a week to provide extra support. Therefore students can identify their resources by looking to their group members, or to the schedule whiteboard.

d. Describe common mathematical preconceptions, errors, or misunderstandings within your central focus and how you will address them.
The main mathematical misunderstandings I saw in reviewing the pre-assessment I gave were: students believed that to find the height after time t they use the velocity in trajectory problems; students believed that t represented velocity and h(t) represented h times t in trajectory problems; and a general confusion about how to deconstruct word problems. In order to address the first two misunderstandings I will monitor the groups who have even numbers in lesson 1 to see how they are approaching the trajectory problem and ask them what the t and the h(t) stand for, then if no group member can produce time or height in any capacity I will clarify. Then when groups present their posters I will make sure the groups that present the trajectory problem address what t and h(t) stand for. I will also make sure these groups understand what each piece of the equation stands for and can explain it to the class. To address the third confusion I will encourage groups to work together in deconstructing their word problems, and if the group as a whole struggles I will ask probing questions like I list in my lesson plan for lesson 2, then when groups present their posters I will have them explicitly explain their deconstruction of the word problem.

4. Supporting Mathematics Development Through Language

a. Language Function. Identify one language function essential for students to learn the mathematics within your central focus. Listed below are some sample language functions. You may choose one of these or another more appropriate for your learning segment.
Justify
b. Identify a key learning task from your plans that provides students with opportunities to practice using the language function identified above. Identify the lesson in which the learning task occurs. (Give lesson day/number.)

In lesson 1 students are asked to justify their conclusion from the group work problem they worked on.

c. Additional Language Demands. Given the language function and learning task identified above, describe the following associated language demands (written or oral) students need to understand and/or use:

- **Vocabulary and/or symbols (specifying units of measure, stating meaning of symbols), appropriate to your students’ mathematical and language development**
  Students will need to understand what the maxima/minima/vertices of a quadratic equation are as well as the several terms for roots/zeros/solutions of quadratic equations mean. They will also need to specify units of measure (feet, or meters) depending on the context of the problem.

- **Plus at least one of the following:**
  - **Syntax**
  - **Discourse**
  In terms of discourse I will expect students to share their mathematical thinking out loud with their groups in lessons 1 and 3, and with the class in lesson 2. I also want students to write their thinking out for the post-assessment. In terms of syntax, students will have to read the task card for lesson 1, the worksheet for lesson 3, and the post-assessment, which all demand that students interpret contextualized (word) problems.

d. Language Supports. Refer to your lesson plans and instructional materials as needed in your response to the prompt: Describe the instructional supports (during and/or prior to the learning task) that help students understand and successfully use the language function and additional language demands identified in prompts 4a–c.

In order to support students in their vocabulary I plan to launch lesson 1 with a discussion on the meaning of the solutions/zeros/roots/intercepts of quadratic equations, as well as ask the even numbered groups probing questions to have them access the their prior knowledge surrounding the vertex or maxima/minima of quadratic equations. To support students with their discourse I plan to ask groups probing questions to make sure each student is understanding what their group is concluding, and then their justification. The entire premise of the lesson is to support students in understanding the syntax of word problems in math and how to interpret them, first asking if they could draw a picture or interpret and equation, then continue to ask themselves what their next step is.

5. Monitoring Student Learning

a. Describe how your planned formal and informal assessments will provide direct evidence for you and your students to monitor their conceptual understanding, procedural fluency, AND mathematical reasoning and/or problem-solving skills throughout the learning segment.

As a formative assessment for lessons 1 and 2 I will collect group posters as well as exit tickets in the form of the Lesson 2 Instructional Materials (Reflection) which will allow me to see how students are understanding the concept of maxima/minima, and interpreting word
problems. On their group posters I will see how students are strategizing to solve the quadratic equations they create or deconstruct, which will show me how fluent students are with such procedures. This formative assessment will also allow me to see how students are problem-solving in time because I will watch how they work toward solutions in their groups, as well as how they justify this solution.

As a summative assessment I will provide the post-assessment. In this assessment I will see student understanding of the concept of maxima and minima of quadratic equations through problem 3. I will see student demonstration of procedural fluency of factoring in problem 1, and of the quadratic formula in problems 2 and 3. To see student reasoning I have asked for a justification of the deconstruction of the quadratic equation in problem 3, and I will expect students to provide reasoning for each solution. Every problem also requires students to problem-solve because they are context based (word) problems.

b. Explain how the design or adaptation of your planned assessments allows students with specific needs to demonstrate their learning.
The formative assessment itself has no modifications planned, but students will be allowed ample time to complete the written tasks. The summative assessment itself is structured in such a way that give step-by-step instructions and is broken down into small bits. Because the class is a tracked intervention class, all students have individual learning needs and so everyone will have the same test designed to meet a variety of needs rather than modifying the test for individuals. Students who need extra time will also be given time.

c. Describe when and where you will elicit student voice (oral or written) during instruction to raise awareness in both you and the students of where students are relative to the learning targets.
In lesson 2 I will have students reflect on the learning targets, explicitly asking them to name what they think we have been learning about and why it is important.

d. What tools and strategies will students use to monitor their own learning process during the learning segment?
In lesson 2 students will do the reflection, wherein they take stock of where they are in understanding the learning targets. In lesson 3 students have the opportunity to look at the rubric I will use to score the post-assessment, and can assess their worksheet based on their understanding, as well as check their work with the answer key.
Task 2 Part B: Instruction Commentary

1. Which lesson or lessons are shown in the video clip(s)? Identify the lesson(s) by lesson plan number.

I have chosen two videos from lesson 1 and one from lesson 2. (Stepping away from the edTPA practice for a moment, I have chosen three videos in this case because I felt two did not show enough of my variety of instruction, and there always seemed to be an interruption in the learning for more than six or so minutes of video. I realize that this would not be ok for the actual assessment, but I want to demonstrate my teaching growth to you as my faculty, so this is a decision I have made.)

2. Promoting a Positive Learning Environment

a. How did you demonstrate mutual respect for, rapport with, and responsiveness to students with varied needs and backgrounds, and challenge students to engage in learning?

At the beginning of my first video (0:00-0:18) a student responds to my intro to what we will be doing with "sleep," to which I banter back, making the joke that I could have just left them all outside, and two students laugh. I believe this sort of humor to ease the tension of a Monday morning was a demonstration of rapport with students, and a responsiveness to their needs because I realize that my first period class will be tired and believe that using humor will get them into the swing of things. Then, in between my introduction of the first and second problems (1:11) a student in the front asks about the tattoo on my arm, if the equation is solvable, and instead of ignoring the question, I chose to say it is, and that we may cover that nearer the end of the year. I believe this respect for her question encouraged her continued participation in class. Moving into creating a common language for the class to work with (2:22) we were talking about the solutions to real work problems, and I made the connection to the Hitchhiker's Guide to the Galaxy, to which three students animatedly responded, one of which whom was not paying attention the moment before. This demonstrates a response to her need for a hood to interest her in the conversation, and connected with her background. This conversation also challenged the class to participate in the discussion about what a solution to an equation meant, and it continued through our discussion on what it means to create an equation (3:40). In the middle of this common language creation though I recognized that the class was drifting into a higher level of background talking, and pointed out that I would only talk for five more minutes (3:30), which I believe demonstrates a respect for students, and a response to the needs of the class as a whole to participate in an activity rather than just hear me lecture. Then, when completing the launch of the group task I point out that the class may know where the resources are better than I do (5:35), to which a few students respond that they don’t so I point out the drawer. I believe this demonstrates rapport with students because I respond quickly, efficiently, and with ease. Overall, I believe this video of my launch of the group task in lesson demonstrates my mutual respect and rapport with students because the class mostly seems engaged in the discussion, and the communication between students and myself is harmonious, and relaxed.

In my second video (0:28) group 4 is talking about the trajectory problem (even group task from lesson 1) where two students are actively discussing with me what the pieces on the equation mean, and how to find the maximum height of the ball. Soon enough all but one group member is sharing ideas about what the maximum height could be. I believe this demonstrates a mutual respect between students, approaching rapport, but because not everyone in the group was actively involved in the discussion, I believe I still need to work toward creating a low-stress environment for all students to feel comfortable participating.
When I move into talking with group 1 who has the garden problem (even group task from lesson 1) I ask what they have so far and notice that one student has drawn a triangle (2:35). She claims she was just drawing, so I said no worries because I know she focuses better when she is actively doing something. This student has a 504 plan for severe ADHD, and in her plan it outlines methods of maintaining her attention, of which one is allowing her to have music, and another is giving her what many call a “fidget,” that is, something to keep her hands busy. By encouraging her to not erase her triangle, and actively allowing her to continue I responded to the needs of this student in particular, which gave her access to continuing with the group task. Shortly after this conversation I engaged group 1 in working with the math, asking them what the x stood for in their picture, and pushing them to re-think what they had drawn. I believe this demonstrates my challenging students to engage in learning because I push their constructed meaning toward the next step in solving the problem.

In my third video I am having students share the strategies they had just discussed in their groups about how to interpret word problems, and I believe this entire video demonstrates my mutual respect with students. First, a student in group 1 eagerly shares the strategies they collectively engaged as a group, and I write these on the board, showing them that I value their ideas and believe they are all important. I also ask groups one at a time in number order to share their strategies, making sure to ask at least once if they have any more strategies they want to share, then moving on to the next group when they are done sharing the strategies they as a group discussed. Also, by asking recorder/reporters share their groups ideas allowed the groups to feel as though no one was on the spot to share their individual strategy, but rather the strategies were for everyone to share. Then (2:30) I ask a student if it is ok for me to translate his language into a more common math form in order to make it shorter to write on the board, to which he responds he doesn’t care. I believe this is a situation where I could have demonstrated more tact, and could have been more harmonious in my communication, although I do believe it demonstrates rapport because I do ask his permission whether I can re-word his statement, and he grants me that permission.

3. Engaging Students in Learning

b. Explain how your instruction engaged students in developing
   - conceptual understanding
   - procedural fluency
   - mathematical reasoning and/or problem-solving skills

   In my first video (3:41) I ask the class what it means to create an equation to which a student responds with “taking the information from the problem and looking at the numbers,” then I ask a student to repeat what the first student said because it was a very important conceptual idea for interpreting word problems. The second student gets the ball rolling, but needs some support, so I have a few students call out more additions, ending up with an approximation of what the first student said, eliciting many voices in order to develop a mutual understanding of what it means to de-construct a word problem in order to create an equation. After this video ends the groups go on to work on the group task from lesson 1 and I help engage students in building conceptual understanding through further questioning, as seen in my lesson 1 scaffolding questions list. These questions help build students’ conceptual understanding because they build off of their prior knowledge and give them a base to take the next step in problem-solving. They also provide a basis for students to mathematically reason around the question. Many times my directed questioning would also lead students toward building procedural fluency in their use of the
quadratic formula, which sadly is not demonstrated in my videos, but can be seen in their post-assessments.

In my second video (0:25) I am working with group 4 and they are working on the even group task from lesson 1, demonstrating the building of problem-solving skills in talking about what the height of the ball will be. The male student speaking reasons that the height would be six, then the female student says that it starts out at six. They continue to reason about what the height of the ball couldn’t be because it doesn’t make sense. The male student says that it can’t be -16 because that would mean you are throwing the ball downward, demonstrating his building of mathematical reasoning skills, then I ask what the 80 means because they seemed to be looking at each piece of the equation. The female student speaking (0:51) says velocity, demonstrating a conceptual understanding of the problem itself. She shows me how she is understanding what the problem is saying to her, and how that understanding is changing as we discuss the context. Then (1:50) I ask how to find the vertex of a quadratic equation, to which the male student responds with it being $a+b+c$, and I ask if they remember what the special equation is for the vertex, giving them the algorithm, which I was unsure if they had learned, to which they respond with recognition, providing a glimmer of procedural fluency that I encourage them to build on as I go on to work with another group. Moving into working with group 1 (3:35) I ask the group about what their $x$'s mean, and work through how they are interpreting the problem through the picture on their whiteboard. They prove their conceptual understanding through adding to their picture an $x$ where the width of the walkway is (looking at the odd group task from lesson 1), and work on building problem-solving skills in moving forward with their drawing of the problem.

In my third video I am having groups share their strategies for deconstructing work problems and creating equations, wherein they provide evidence of conceptual understanding. Specifically (1:25) the recorder/reporter from group 2 shares that he would find the median in order to find the vertex of a parabola, providing evidence of his conceptual understanding of parabolic symmetry, beginning to build mathematical reasoning around finding the vertex, as well as procedural fluency with the algorithm for finding the $x$-coordinate of the vertex. Then (1:54) group 4 shares their strategy surrounding procedural fluency in the quadratic formula, which is to remember to put the $a$, $b$, $c$'s over the numbers that they represent, in order to correctly utilize the quadratic formula. Finally, group 5 (2:45) shares their strategy of finding $x$, which I ask what $x$ means, to which they respond the missing number. This demonstrates their conceptual understanding of what $x$ represents in a word problem, and gives me insight into their mathematical reasoning around how they will find the answer to the problem, through solving for $x$, the missing number, which they later build upon in their group work on the worksheet for the lesson. After the video ends the groups begin to work on the worksheet and I continue to ask students to refer to the strategy list on the whiteboard, where they build their problem-solving skills off of the strategies we share as a class. These strategies provide a base conceptual understanding of what it means to deconstruct word problems, then create equations from them, as well as some procedural fluency cues in the quadratic formula.

c. Describe how your instruction linked students' prior academic learning and personal, cultural, and community assets with new learning.

In my first video I give context behind the problems that we will be working with for the lesson (0:35), one of which is about a garden, which I claim is a space for my dog to go outside, but I don’t want to step in his “presents,” so I want to build a walkway, which provides for students a way of connecting with the problems. Also, I lead a discussion in
creating a common language with students surrounding solutions and creating equations. In order to connect solutions to real world problems (2:20) I ask the class what the solution to a world problem means, to which they respond with the answer, so I ask what the answer is. I ask what an example of a solution is, then provide the solution from the Hitchhiker’s Guide to the Galaxy, which connects to a couple of student's prior knowledge. Then we discuss what it means to create equations (3:42). A student responds with “taking the information from the problem and looking at the numbers,” which I ask someone to repeat because it is a great definition. Two students put it into their own words in order to provide another access point for the rest of the class. Outside of this video, students worked in their groups, providing resources for each other, working within their zones of proximal development, and pushing students to utilize the community assets within the room.

In my second video I begin working with group 4, where I am trying to get at what they already know, and the male student speaking gives his reasoning, where I respond with “it looks like we’re looking at the equation and trying to understand what each piece of the equation means.” After this I proceed to work through each piece of the equation. I then ask them how to find the vertex of a parabola, eliciting the strategy $\frac{-b}{2a}$, to which I respond with asking if they know the algorithms, and they respond with recognition. Moving into working with group 1 (2:48) I ask what the group know about the sides of the rectangle in their picture, recognizing that they had labeled the outer sides with $x$ because they were unknown, then posing that they might know more about that side than they originally thought, which builds on what they already brought into their group.

In my third video I ask students to share strategies they had shared with their groups, in order to provide the class with a collective community knowledge of strategies they could use for deconstructing word problems. I write all of this prior knowledge on the board, adding to it for the next two classes in order to build a community wealth of strategies for the test (post-assessment). Specifically (1:27) I point out a strategy that one student in group 2 says, about finding the median, which I build upon, saying that it is great for a specific type of problem, the trajectory problem from lesson 1.

4. Deepening Student Learning during Instruction

a. Explain how you elicited and built on student responses to promote thinking and develop conceptual understanding, procedural fluency, AND mathematical reasoning and/or problem-solving skills.

In my first video I ask students what the first problem I had just given context for was going to be about (1:50), eliciting the response that it was about my dog’s area, which was not what I was hoping for, but it did gauge the understanding in the room. From here we discuss what solutions mean in real world problems, which elicit student responses such as “the answer” and “the final number you would get” so I ask what these mean, and I make the connection to the Hitchhiker’s Guide to the Galaxy. Then one student asks if we would have the answer, and I build on this saying that we have to find the equation in order to find the answer, this building a common conceptual understanding for the class. From here (3:40) I ask what it means to create an equation, and the response I get is perfect, but quiet, so I ask the class to repeat it, and they build on the student’s response with what I summarize “pulling key points from the sentences.” This build again a conceptual understanding of what it means to create an equation from a real world context. Then I state that I won’t give examples, which elicits a student to say that examples really didn’t help, and I repeat what he says, that word problems are all really different so examples don’t really help. This mathematical reasoning builds on what they have been learning about understanding context in word problems, that it’s about picking out the important mathematical information, which will be different depending on context.
In my second video I begin by asking the question “so h(t) is height?” and the female student response with an affirmative, so I go on to ask what the maximum height is, eliciting the male student (0:38) to mathematically reason that it can’t be 16 because that would mean you’re throwing it into the ground. I build on this by recognizing that he is trying to pick apart the equation to see where the maximum height comes from. This building of conceptual understanding surrounding the equation prompts the female student to say the 80 means velocity, and so it is not the height. We then go through each piece of the equation and make sense of them. I then ask (1:40) how they found vertex before, and the male student says that it’s a, b, and c, and I build upon that procedural fluency by giving them the algorithm for the vertex of the parabola. This entire conversation captures the problem solving skills we were developing as a class together through the group work. By asking the students what each piece of the equation meant I got them thinking of ways they could search through the work problem and equation in order to understand the context and take out the important information, proving to be an important skill they could later use on future word problems. When I move into working with group 1 (2:40) I ask what the picture they are drawing means, to which they respond that they have labeled the dimensions of the garden, and labeled the walkway dimensions with x. I ask what this x means to them, then I pose that they extend the sides of the garden in their picture to help them see what information they have and what they need to find out, building their problem solving process. I ask if we can label a smaller chunk x, prompting the girl with black hair to write in x’s, providing their group with a basis to build further problem solving from. This exercise in mathematical questioning and reasoning response builds from answer to question in order to push students to see what in their picture can help them to take the next step in solving the problem.

In my third video I am conducing a strategy share about understanding the context within word problems. In order to elicit these strategies I first asked students to think about one strategy they had used in the past two days, or previously in word problems, then write it down, then I had the groups round robin share so everyone had a chance to share their strategy. In this video we see my asking the groups to share their strategies with the class, where the recorder/reporter in each group is sharing. The first group excitedly exclaims highlighting as their strategy and I ask what they are highlighting. This question prompts them to share that they were highlighting important information, which lends toward the conceptual understanding that there will be important and un-important information in the problem, which is later built upon by a student in third period who said one should organize the information into what is important and what is not. Another problem solving strategy that was shared (1:06) was putting the important information into the equation. Then this group shares (1:24) their strategy of finding the median, the conceptual understanding that underlies the algorithm for finding the vertex of a parabola. I add onto this strategy by claiming that it would be best used in trajectory problems that they see because they will be asking for maximum height, thereby adding a problem solving strategy they could use to their arsenal. When I move on to group 4 sharing (1:58) the recorder/reporter shares to remember to put the a, b, c’s over the numbers, which represents the procedure of the quadratic formula, and my writing this on the board lends to student understanding the importance of this procedure. Finally when talking to group 5 they share a strategy to find x, which I ask what x means, and they define it as the missing number. The building of conceptual understanding that happens in this exchange allows students to see the importance of what x means in the real world context of word problems.

b. Explain how you and the students used representations to support students’ understanding and use of mathematical concepts and procedures.
This entire lesson sequence was about going from the context representation of a math problem, to the picture, to the equation, then to the solution. In my second video we can see in the first group that they are working with the equation representation, trying to fit where the context of the problem fits each number in the equation. Moving into working with group 1 we see them drawing a picture to represent the context of the problem, representing the garden with an inner rectangle, and the walkway with an outer rectangle. Intermediate representations like pictures allow students to see the connections between the real world context and the equations they are creating from the pictures, which in this case involve area.

In my third video I ask students for strategies to interpret the context representation of real world problems, to which they respond with underlining important information, which allows them to see how this context fits into the equation representation. Surprisingly in this period, students did not mention to draw a picture, but in second period they did, which is another representation that connects context to equation.

5. Analyzing Teaching

a. What changes would you make to your instruction—for the whole class and/or for students who need greater support or challenge—to better support student learning of the central focus (e.g., missed opportunities)?

As I stated at the beginning of my first video I had students work on two different problems for the first two days. I would change this to having students work on one problem, then discussing it each day. I would have my students focus on what it means to take apart each type of problem, having everyone work on the same problem so they can use each other as resources outside of their groups. I would also have changed the problems to have more direction within the task itself. I would also have further scaffolded the discussion surrounding creating a common math language in my first video. In my first lesson I began with this introduction that appears in my first video, then having students work in their groups for the whole period. I ended up having to review the directions for each problem with each group, which I would have changed to introduce the problem to the whole group, as one problem for the whole class, leaving more time for students to work on the problem itself. I would have begun with the garden problem (the odd group task card from lesson 1) on day 1, then had a discussion and presentations of that problem, then on day 2 I would have continued this lesson and given the groups the trajectory problem (the even group task card from lesson 1) and followed the same procedure. In my second video the groups can be seen working on the two types of problems, and students with the trajectory problem find fewer access points in the problem, which is a missed opportunity for me. I would change this, so that all students had access to the problem, asking on the task card to draw a picture, write the equation with labels, and have the facilitator read the card out loud, which I forgot to ask the class to do in the launch.

In my second video at the beginning you can hear me ask when we get out of class, and there are five minutes left, which is something I would have changed too. I would have better timed my talking at the beginning, then giving ample time for groups to grapple with their problems. Also in this clip I am giving the group what each piece of the equation means, and then the algorithm for the vertex, which I would have changed. I would rather have asked more questions, having students dig into their prior knowledge instead of taking away the cognitive demand in the way I did by giving them the answer. When I work with group 1 in this clip I ask more questions, but again I would have liked to have them work more independently, oriented to each other’s ideas, to figure out what the picture means and how it connects to the problem on their own. Then at the end of this clip I tell the class how we will continue the work the next day, which I would have changed, so that the groups
would have a way to save the work they started, which I had taken a picture of group 2’s work, but not all groups had written work down.

Outside my videos I would have changed the scaffolding I had for my students with ADHD, having them play more of a direct role in the classroom discussion because in my third video they brought fantastic points, but in the whole class discussion in lesson 2 they did not speak outside of their presentation. Beyond these I would have liked to include a fourth lesson for students to work through problems together as a whole class in what I call a pass the pen game. Students would collectively work on the problems, everyone with a worksheet, and one student who thinks they know how to start would go to the board and start the problem, going as far as they can before having another student take over and go as far as they can in problem solving. After holding my second lesson I had considered doing this in my third lesson, but my timing did not allow for this activity.

b. Why do you think these changes would improve student learning? Support your explanation with evidence of student learning AND principles from theory and/or research.

I believe focusing in on one problem for the whole class each day to share would improve student learning because the whole class would have had a chance to see both problems in depth then discuss them, thereby improving engagement in the mathematical discussion that followed the problems. Alongside giving students more of a reason to participate in the discussion because they would all be on the same problem, this would also solve the issue of continuing the work from one day to the next, and trying to remember where students were with a problem on the second day because it would have them focus on one problem, and if just one group finished the problem they could present their findings to the whole class. This idea of having one problem for the whole group is supported by Watanabe in the book Heterogeneous Classrooms, where students are given single tasks as a whole class, then asked to share their findings, rather than having multiple tasks happening all at once. Further, math discussions are supported by Hufferd Ackles (2004) who give five practices to take the discussion one step further than show and tell. Orienting students to each other’s mathematical reasoning is presented in this text, which supports my change of wanting to have groups be more independent, relying on each other instead of when I lowered cognitive demand by giving the group who was working on the trajectory problem the analysis of the equation they were given.

As for my students with ADHD, in their 504 plans they list clear directions as one of the supports, as well as having checklists to follow, which I could have implemented more often, and required for the whole class to participate in the mathematical discussion, listing on a task card for everyone to ask each group at least one question. For the proposed fourth lesson I would also have had a task card for everyone to share at least once, and write down the steps of the problems in the pass the pen activity. This activity is not something I have read about in any research, although it was supported by several students wanting to do problems as a collective in order to solidify their understanding. This model of teaching where students first explore the math, then they do it as a collective, called “you, y’all, we” by some theorists is supported by Green (2014) who claims that the standard model of “I, we, you” in the traditional math classroom is one that is outdated and underestimates the students in the classroom. The traditional model is typically used in my practicum classroom, and I attempted to break this mold with the group task in lesson 1, but adding the pass the pen activity would lead toward the new model and into a more learner-centered (McCoombs, 1997) where students have more responsibility for their learning, and thus more motivation to work toward a common goal.
1. The length of a rectangle is 2 meters less than the width, and the area of the rectangle is 35 square meters. Find the length and width of the rectangle.

2. A ball is thrown upward from a height of 6 feet with a velocity of 80 feet per second which can be modeled by the equation \( h(t) = -16t^2 + 80t + 6 \).
   
   A. What does \( t \) stand for? What about \( h(t) \)?
   
   B. Where does the +6 come from?
   
   C. If the ball has been in the air for 2 seconds, how far above the ground is it?
   
   D. At what time does the ball reach its maximum height?
   
   E. What is the ball’s maximum height?
   
   F. At what time will the ball hit the ground?
5. The length of a rectangle is 3 meters less than the width, and the area of the rectangle is 180 square meters. Find the length and width of the rectangle in meters.

\[ A = 180 \]

2. At the beginning of a basketball game the referee tosses a jump ball. The referee holds the ball 4 feet above the floor and tosses the ball upward at a velocity of 26 feet per second. The acceleration of the ball is affected by gravity, which is approximately 32 feet per second squared. This situation can be modeled by the equation \( h(t) = -16t^2 + 26t + 4 \).

A. What does \( t \) stand for? What about \( h(t) \)?

\( t \) is height & time.

B. Where does the 4 come from? How do you know?

\( t \) is where the ball is starting off in the air when it’s being tossed.

C. At what time will the ball reach its maximum height?

\[ \frac{32}{2 \times 16} \]

\[ \frac{2}{2} \]

D. What is the ball’s maximum height?

\[ 2 \text{ feet} \]
3. A designer is planning to lay a walkway around a community garden. The garden is a rectangle with dimensions of 12 meters in width by 16 meters in length. The budget for the walkway allows for a maximum walkway area of 128 square meters.

A. What is the total area of the garden and the walkway together?

\[ 2(12x + 12 \cdot x + 110) \cdot x + 116x \]

B. Draw a picture to model this problem, labelling the width of the walkway with an x.

![Diagram of the garden and walkway](image)

C. What is the length of the walkway and the garden together?

D. Write an equation that you could use to find the width (x) of the walkway.

E. What is the width (x) of the walkway?
1. The length of a rectangle is 2 meters less than the width, and the area of the rectangle is 35 square meters. Find the length and width of the rectangle.

\[ l = w - 2 \]
\[ a = 35 \]

\[ l \]
\[ w \]

2. A ball is thrown upward from a height of 6 feet with a velocity of 80 feet per second which can be modeled by the equation \( h(t) = -16t^2 + 80t + 6 \).

A. What does \( t \) stand for? What about \( h(t) \)?

2. \( t \) is time.

B. Where does the +6 come from?

The +6 comes from the ball being thrown upward from the height of 6 feet.

C. If the ball has been in the air for 2 seconds, how far above the ground is it?

If the ball has been in the air for 2 sec, it will be 160ft above the ground.

D. At what time does the ball reach its maximum height?

1. At 3.2 sec.

\[ h(1) = -(16) + 80 + 6 \]

E. What is the ball’s maximum height?

F. At what time will the ball hit the ground?
1. The length of a rectangle is 3 meters less than the width, and the area of the rectangle is 180 square meters. Find the length and width of the rectangle in meters.

\[(3-w)(w) = 180\]

3\(w\)

2. At the beginning of a basketball game the referee tosses a jump ball. The referee holds the ball 4 feet above the floor and tosses the ball upward at a velocity of 26 feet per second. The acceleration of the ball is affected by gravity, which is approximately 32 feet per second squared. This situation can be modeled by the equation \(h(t) = -16t^2 + 26t + 4\).

A. What does \(t\) stand for? What about \(h(t)\)?

Time

\(x = \frac{-26 \pm \sqrt{932}}{-32}\)

B. Where does the 4 come from? How do you know?

The 4\(\text{th}\) above the ground

C. At what time will the ball reach its maximum height?

\(x = \frac{-26 + 30.53}{-32}\)

\(x = \frac{4.53}{-32}\)

\(y = 0.1415\)

D. What is the ball’s maximum height?

\(h(12.59) = -16(12.59)^2 + 26(12.59) + 4\)

\(h(12.59) = -2536.12 + 327.34 + 4\)

\(h(12.59) = -2536.12 + 331.34\)
3. A designer is planning to lay a walkway around a community garden. The garden is a rectangle with the dimensions of 12 meters in width by 16 meters in length. The budget for the walkway allows for a maximum walkway area of 128 square meters.

A. What is the total area of the garden and the walkway together?

\[ 192 + 128 = 320 \]

B. Draw a picture to model this problem, labelling the width of the walkway with an x.

\[
\begin{align*}
320 &= (2x+12)(2x+16) \\
320 &= 4x^2 + 32x + 24x + 192 \\
\frac{320}{4} &= \frac{4x^2 + 56x + 192}{4} \\
80 &= x^2 + 14x + 48 \\
-80 &= x^2 + 14x - 2 \times 2 \\
0 &= x^2 + 14x - 2 \times 2
\end{align*}
\]

C. What is the length of the walkway and the garden together?

\[ 2x + 16 \]

D. Write an equation that you could use to find the width (x) of the walkway.

\[ 320 = (2x+12)(2x+16) \]

E. What is the width (x) of the walkway?

\[ x = \frac{-14 \pm \sqrt{(14)^2 - 4(4)(-2)}}{2} \]

\[ x = \frac{-14 \pm \sqrt{196 + 32}}{2} \]

\[ x = \frac{-14 \pm \sqrt{228}}{2} \]

\[ x = \frac{-14 \pm 15.33}{2} \]

\[ x = -12.66 \quad \text{or} \quad x = -1.66 \]

\[ x = 10.92 \quad \text{or} \quad x = 24.92 \]
1. The length of a rectangle is 2 meters less than the width, and the area of the rectangle is 35 square meters. Find the length and width of the rectangle.

\[
\begin{align*}
\sqrt{35} &= \frac{x-2}{x} \\
2 &= \frac{35}{x} \\
17.5 &= 8.75 \\
x &= 19.75
\end{align*}
\]

2. A ball is thrown upward from a height of 6 feet with a velocity of 80 feet per second which can be modeled by the equation \( h(t) = -16t^2 + 80t + 6 \).

A. What does \( t \) stand for? What about \( h(t) \)?

B. Where does the +6 come from? \( \text{the boy's height} \)

C. If the ball has been in the air for 2 seconds, how far above the ground is it?

D. At what time does the ball reach its maximum height?

E. What is the ball’s maximum height?

F. At what time will the ball hit the ground?
1. The length of a rectangle is 3 meters less than the width, and the area of the rectangle is 180 square meters. Find the length and width of the rectangle in meters.

\[ L = W - 3 \]

\[ 180 \]

2. At the beginning of a basketball game the referee tosses a jump ball. The referee holds the ball 4 feet above the floor and tosses the ball upward at a velocity of 26 feet per second. The acceleration of the ball is affected by gravity, which is approximately 32 feet per second squared. This situation can be modeled by the equation

\[ h(t) = -16t^2 + 26t + 4. \]

A. What does \( t \) stand for? What about \( h(t) \)?

\( t \) stands for time and \( h(t) \) stands for height.

B. Where does the 4 come from? How do you know?

4 comes because the person is throwing it from 4 feet.

C. At what time will the ball reach its maximum height?

D. What is the ball's maximum height?
63. A designer is planning to lay a walkway around a community garden. The garden is a rectangle with the dimensions of 12 meters in width by 16 meters in length. The budget for the walkway allows for a maximum walkway area of 128 square meters.

A. What is the total area of the garden and the walkway together?

B. Draw a picture to model this problem, labelling the width of the walkway with an x.

C. What is the length of the walkway and the garden together?

D. Write an equation that you could use to find the width (x) of the walkway.

E. What is the width (x) of the walkway?
5. The length of a rectangle is 3 meters less than the width, and the area of the rectangle is 180 square meters. Find the length and width of the rectangle in meters.

20.1

\[ A = 180 \]

Your picture is a great start to understand what the problem is asking, so next how could you label it to help you see more?

2. At the beginning of a basketball game, the referee tosses a jump ball. The referee holds the ball 4 feet above the floor and tosses the ball upward at a velocity of 26 feet per second. The acceleration of the ball is affected by gravity, which is approximately 32 feet per second squared. This situation can be modeled by the equation

\[ h(t) = -16t^2 + 26t + 4. \]

A. What does \( t \) stand for? What about \( h(t) \)?

4. \( \text{height} \) & time.

B. Where does the 4 come from? How do you know?

4. It's where the ball is starting off in the air, when it's being tossed.

C. At what time will the ball reach its maximum height?

212

10.24 seconds?

This is a good use of units to solve the problem. I see how \( \frac{ft}{s^2} \div \frac{ft}{s} \) gets \( \frac{32}{20} \)

D. What is the ball's maximum height?

2010

24 \( \frac{2}{5} \) But I think it would be helpful if we talked about the strategy that the group with the trajectory problem used last Monday Tuesday.

I'm not sure where you got this, can you help me see?
3. A designer is planning to lay a walkway around a community garden. The garden is a rectangle with the dimensions of 12 meters in width by 16 meters in length. The budget for the walkway allows for a maximum walkway area of 128 square meters.

A. What is the total area of the garden and the walkway together?

B. Draw a picture to model this problem, labelling the width of the walkway with an x.

C. What is the length of the walkway and the garden together?

D. Write an equation that you could use to find the width (x) of the walkway.

E. What is the width (x) of the walkway?

On Tuesday last week you very animatedly labeled your picture and took many steps on your own toward answering each of these questions in your grasp. Do tests make you nervous or frustrate you? How can I help you show me you know this?
1. The length of a rectangle is 3 meters less than the width, and the area of the rectangle is rectangle is 180 square meters. Find the length and width of the rectangle in meters.

\[(3-w)(w) = 180\]

3. I see that you know what the problem is asking and have taken great steps toward finding \(w\), it just looks like you ran out of time. If you would like to finish up come in after class because you're on the right track with this problem!

2. At the beginning of a basketball game the referee tosses a jump ball. The referee holds the ball 4 feet above the floor and tosses the ball upward at a velocity of 26 feet per second. The acceleration of the ball is affected by gravity, which is approximately 32 feet per second squared. This situation can be modeled by the equation \(h(t) = -16t^2 + 26t + 4\).

A. What does \(t\) stand for? What about \(h(t)\)?

Time

B. Where does the 4 come from? How do you know?

The 4th above the ground

C. At what time will the ball reach its maximum height?

you have the right strategy, you just made a small calculation error in your second answer.

D. What is the ball’s maximum height?

\[\text{median} = 12.59\]

\[h(12.59) = -16(12.59)^2 + 26(12.59) + 4\]

\[h(12.59) = -2536.12 + 327.34 + 4\]

\[h(12.59) = -331.84 + 331.84\]

you also have the right strategy here, just the calculation error from part C plays a role, and it looks like you ran out of time.
3. A designer is planning to lay a walkway around a community garden. The garden is a rectangle with the dimensions of 12 meters in width by 16 meters in length. The budget for the walkway allows for a maximum walkway area of 128 square meters.

A. What is the total area of the garden and the walkway together?

\[ 192 + 128 = 320 \]

B. Draw a picture to model this problem, labelling the width of the walkway with an x.

\[ 320 = (2x + 12)(2x + 16) \]
\[ 320 = 4x^2 + 32x + 24x + 192 \]
\[ 320 = 4x^2 + 56x + 192 \]
\[ \frac{320}{4} = x^2 + 14x + 48 \]
\[ 320 = x^2 + 14x + 48 \]
\[ -320 = -320 \]
\[ 0 = x^2 + 14x + 48 \]
\[ x = \frac{-14 \pm \sqrt{(14)^2 - 4(1)(48)}}{2(1)} \]
\[ x = \frac{-14 \pm \sqrt{196 - 192}}{2} \]
\[ x = \frac{-14 \pm \sqrt{4}}{2} \]
\[ x = \frac{-14 \pm 2}{2} \]
\[ x = -7 \pm 1 \]
\[ x = -6, -8 \]

C. What is the length of the walkway and the garden together?

\[ 2x + 16 \]

D. Write an equation that you could use to find the width (x) of the walkway.

\[ 320 = (2x + 12)(2x + 16) \]

E. What is the width (x) of the walkway?

you have the right strategy again, but whatever you do to one side of the equals sign you have to do to the other!
1. The length of a rectangle is 3 meters less than the width, and the area of the rectangle is rectangle is 180 square meters. Find the length and width of the rectangle in meters.

It looks like you know what the problem is asking you through your picture. What do you know about area that could help you figure the next step?

2. At the beginning of a basketball game the referee tosses a jump ball. The referee holds the ball 4 feet above the floor and tosses the ball upward at a velocity of 26 feet per second. The acceleration of the ball is affected by gravity, which is approximately 32 feet per second squared. This situation can be modeled by the equation \( h(t) = -16t^2 + 26t + 4 \).

A. What does \( t \) stand for? What about \( h(t) \)?

- \( t \) stands for time and 
- \( h(t) \) stands for height

B. Where does the 4 come from? How do you know?

- It's +4 because the person is throwing it from 4 feet

C. At what time will the ball reach its maximum height?

D. What is the ball's maximum height?
A designer is planning to lay a walkway around a community garden. The garden is a rectangle with the dimensions of 12 meters in width by 16 meters in length. The budget for the walkway allows for a maximum walkway area of 128 square meters.

A. What is the total area of the garden and the walkway together?

B. Draw a picture to model this problem, labelling the width of the walkway with an $x$.

C. What is the length of the walkway and the garden together?

D. Write an equation that you could use to find the width ($x$) of the walkway.

E. What is the width ($x$) of the walkway?

Thank you for trying what you did on this test. I know you weren't feeling it Friday, but you have a great start to build off of for later if you choose to come in and take more time with it. 😊
Task 3 Part C: Assessment Commentary

1. Analyzing Student Learning

a. Identify the specific learning targets and standards measured by the assessment you chose for analysis.

The standard I have assessed is A-CED: Create equations that describe numbers or relationships- 1. Create equations and inequalities in one variable and use them to solve problems; and 3. Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. The learning targets that come from this standard are to that the student will be able to create equations in one variable, used these equations to solve problems, and interpret solutions to these equations as viable or nonviable options in a modeling context.

b. Provide a graphic (table or chart) or narrative that summarizes student learning for your whole class. Be sure to summarize student learning for all evaluation criteria submitted in Task 3, Part D.

<table>
<thead>
<tr>
<th>Pre-Assessment</th>
<th>Post-Assessment</th>
<th>Growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conceptual Understanding</td>
<td>Procedural Fluency</td>
<td>Problem Solving</td>
</tr>
<tr>
<td>Student 1</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Student 2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Student 3</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Student 4</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Student 5</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Student 6</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Student 7</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Student 8</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Student 9</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Student 10</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Student 11</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Student 12</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Student 13</td>
<td>Absent</td>
<td>Absent</td>
</tr>
<tr>
<td>Student 14</td>
<td>Absent</td>
<td>Absent</td>
</tr>
<tr>
<td>Student 15</td>
<td>Absent</td>
<td>Absent</td>
</tr>
<tr>
<td>Student 16</td>
<td>Absent</td>
<td>Absent</td>
</tr>
</tbody>
</table>

As can be seen in the provided student reflections, they knew that the learning target was quadratic equations with a link to word problems, although only Student 9 pointed out the importance of this material, which was that “we need it to go on to other math… Can use equations to figure out situations in daily life.” Also seen in these reflections students acknowledge that I will use their work in order to make sure they understand, as Student 9 says, or I will ask questions like Student 10 says, or by doing the work with the class and going over the steps as Student 2 says. As for student understanding of their own learning progress, I asked in the third and fourth questions of the reflection for students to share with me what they would change about the lesson and any questions they still have. Student 2 did not ask any questions and claimed that she wouldn’t change anything, not really telling me whether she knew where she was in the learning process. Student 9 said she would have liked to do the problems herself so she could have more practice, providing evidence
that she knew she needed extra practice in order to learn the material, and she asked if there would be any questions she hasn’t seen before on the test, which is telling me she was thinking about the next steps she would have to take in order to study for the test. Student 10 asked how to get from the word problem to the quadratic equation, and wished I had been more organized, which tells me she was thinking more externally than internally about her learning process, and that she needed more help with the conceptual understanding after lesson 2.

d. Use evidence found in the 3 student work samples and student self-reflections, and the whole class summary to analyze the patterns of learning for the whole class and differences for groups or individual learners relative to

- conceptual understanding,
- procedural fluency, AND
- mathematical reasoning and/or problem-solving skills.

I noticed in my summary chart which aligns with the 4 areas, the highest gains were made by Students 8 and 9 in problem solving, that is sticking with their initial understanding of what the problem was asking, writing something down or drawing a picture, then attempting to write an equation, and Student 7 in reasoning, which is justifying their answers or using a strategy that fit the problem. Overall, (8/16) students made gains in conceptual understanding of deconstructing word problems, but less so in reasoning how to create the equation through mathematical reasoning. The highest gains were made in procedural fluency, which in the context of the lesson on creating and using equations to solve problems it makes sense. Also in this summary chart I noticed that every student made gains in at least one section of the assessment criteria. For the whole class the pattern seems to be gains primarily in conceptual understanding of deconstructing word problems, and problem solving surrounding how to create the equation and use that equation to solve the problem, which is also evident in the student work for my focus students. We can see Student 2 go from not writing anything down on her pre-assessment, to showing an incorrect strategy for problem two, and drawing a picture for a problems one and three, which lends to a gain in problem solving skills. In Student 9’s work we see more gains in problem solving, going in her pre-assessment from an unknown strategy to using an averaging strategy and the quadratic formula in order to find the median time so she could find the maximum height of the ball. This also shows her making gains in reasoning, as well as conceptual understanding of using the given equation to solve the word problem. In Student 10’s work we can see her make a gain in conceptual understanding from her pre to post assessment in problem one, going from a division strategy to a step in the direction of a quadratic equation to find the measurements of the rectangle. In Student 10’s reflection, though, we see that she was still struggling with the idea of creating an equation, which can also be seen in her post-assessment because she starts the problem solving process, but does not write the equation for problems one or three. This also happened with Student 2, and the class as a whole developed strategies to start the problem, but tended to stop after they drew and labeled the picture. This has me thinking I need to point students toward connecting their pictures to their problem solving, to take the next step toward creating the equation.
2. Feedback to Guide Further Learning

a. In what form did you submit your evidence of feedback for the 3 focus students?
   - Written directly on work samples or in a separate document;
   - In audio files; or
   - In video clips from the Instruction task (provide a time-stamp reference) or in a separate video clip

My feedback was written directly on work samples, separately scanned.

b. Describe what you did to help each student understand his/her performance on the assessment.

To help each student understand their performance on the post-assessment I used a grading system they are used to, as seen in the four numbers on the left of each problem, then a total score out of 100 based on the addition of the sub scores, as well as extensive written feedback. In the written feedback I ask questions and point students toward the next step in the problem so they could come in and possibly take more time or re-take their test if they feel like they need to. For individual students I asked questions that built on what they had written, ranging anywhere from “how did you find this” when they did not show any work, to “I see where you’re going, but how can you use the picture to tell you what the equation is?” Asking these questions based on individual work allows students to see where they are in the process of understanding the learning target, and gives them an idea of what their next steps in learning could be.

c. Explain how feedback provided to the three focus students addresses their individual strengths and needs relative to the learning targets measured.

   On Student 2’s test you can see that I have built on what she started with in the first problem, having drawn a picture of the rectangle with the area labeled on the outside, and given her a tip to move forward. This addresses her strength in starting each problem, and her need for an idea of what to do next. On the second problem I guide her toward coming in to see me and talk about the strategy we discussed in class during lesson 2 to solve trajectory problems, as well as asking her to help me see how she was solving the final piece of that problem because I am really unsure what she was doing there, and I believe she may have misconceptions about what it means when the problem gives an equation to use, rather than creating one. On problem three, I again point her in the direction of creating an equation, so she could later come in and take more time with the problem. Finally at the end of her test, because she did not finish all of the problems, I point out what I noticed in her participation in class, and how she eagerly solved the problem, creating the equation, then using the quadratic formula, in her group’s presentation in lesson 2, but she seemed frustrated during the test. For this student I am encouraging her to come in and take more time with the test because her overall score was low, but I know that she understands the material in an environment that is less pressured.

   On Student 9’s test the feedback I gave built on what she gave me, which was a lot of movement in the right direction. I tried to make it clear that she was doing well, but she could take steps toward deeper understanding if she took her time. On this test she well demonstrated that she knows how to create equations and use them to solve word problems. This student was about fifteen minutes late the day of the exam, and so I have written on her first problem that she has the option of coming in and finishing her work because she was on the right track. Similarly in problem two I tell her she is on the right track because she is using the right strategy, but she made a minor calculation error. Finally in problem three I noticed that she was moving toward an answer again, but did not get to the last part, so I asked her what she could use to find the final answer. Even though
she has gotten a passing score on the test I ask her questions and offer her more time because all students deserve constructive feedback. On Student 10’s test the feedback I gave built on the ways this student started the problems. This student at first told me to not bother giving her a test because she was just going to re-take it another time, but I told her that anything she writes now will be something less she has to re-do later, and I left a test on her desk. For this reason I have asked her questions to lead her toward the next step in problems where she provided some work toward that answer. In problem one and three I ask how she can take what she has drawn in her picture to figure out what area is. At the end of her test I wrote an encouraging note because of what she expressed to me before the test started, hoping that she will take what she has and move forward with it when she comes in to finish or re-take it.

d. How will you support students to apply the feedback to guide improvement, either within the learning segment or at a later time?

To help support students collectively to apply the feedback directly to this learning segment I will go over the assessment in class and say what kinds of feedback I gave, which was similar for all students, building on what they had done, and asking questions to move them forward. Individually I will go around to the students who I noticed need more help or more time with the material, and offer them time and space to come in and seek the help they need. In applying the feedback to future lessons, after having students who needed more help come in, I will again go over the kinds of feedback I gave, explaining what I was looking for in the test explicitly, and going over what students can do next time in order to improve their scores. Mainly from this assessment I see that students did not try all of the problems, or made minor calculation errors, for which I will explain that persevering and trying anything on a problem is the best instinct you can have, it means that you can try something out, and learn from trying even if it doesn’t work. I will encourage students to try their hardest with every problem, and not leave any problem blank because everything they write down is a learning opportunity for me and for them. Everything they write down gives me an idea of what I need to help them with, and how I can help the whole class too. I will also encourage students to take their time with problems and not worry about running out of time because I can always provide extra time after class or at lunch. Taking your time and working through problems with precision is what helps combat calculation errors, and increases procedural fluency with practice.

3. Evidence of Language Understanding and Use

a. Explain and provide evidence for the extent to which your students were able to use or struggled to use language (selected function, vocabulary, and additional identified demands from Task 1) to develop content understandings.

In terms of the language function I selected to focus on in this unit, justification, I have a few examples of students logically arguing their point, but not enough in my videos or student work to claim that I successfully taught what it means to justify. In my third video from task 2 (0:28) the female student speaking justifies why the ball starts out at 6 feet saying “because they’re throwing it from their height.” The male student in the clip (0:35) claims that the maximum height cannot be -16, then justifying this claim by saying “because if it was negative sixteen, like you’re on the ground and throwing the ball to the ground.” In my student work samples I see Student 10 justify why the ball starts out at 4 feet in the post-assessment problem two “because the person is throwing it from 4 feet.” In Student 9’s reflection she justifies the reasoning for doing the math as “we need it to go on to other math like pre-calc, further algebra. Can use equations to figure out situations in daily life.” I believe these examples represent what students already know about providing logical
reasoning behind their answers, rather than something that I have provided instruction on. I do prompt students to say why they think something is true, but this doesn’t provide evidence of my teaching the language function.

In terms of vocabulary, the main new language was maxima/minima of quadratic equations, which can be seen in my second video. The male student in the video reasons about the maximum height (0:40) saying that it cannot be -16 because that would be throwing it down. Beyond this example I do not have any student work or video that exemplifies their understanding or use of the vocabulary because in their work they are using procedures that I taught to find maximum area rather than needing an understanding of the language itself. The main focus of this lesson was deconstructing the context of the problem anyway, and less focus on vocabulary was given.

In terms of syntax and discourse, students had to understand the context of the problems they worked on. In the student work this can be seen through the pictures all three focus students draw for problem one, more so in Student 9’s work because she labeled the sides of her rectangle and started writing an equation for area. It can also be seen in all three focus student’s definition for t and h(t) in problem two because they are using the context of the problem and what I am asking for in the sub questions to understand that time and height make sense.

4. Using Assessment to Inform Instruction

a. Based on your analysis of student learning presented in prompts 1b–d, describe next steps for instruction to impact student learning:

   - for the whole class
   - for the 3 focus students and other individuals/groups with specific needs

Because overall students made gains in their understanding of deconstructing the context of word problems, but not many students “passed” in the traditional sense, the post-assessment, I believe my next steps for instruction would be to have another unit focusing on word problems, but perhaps not quadratic word problems. In the interest of time, seeing how it is near the end of the year, and the majority of the class has passed the procedural exams prior to this one, surrounding quadratic problem solving, I believe it would be appropriate to move forward with the next math unit of exponential equations. I would be addressing creating equations using the context of real world problems with exponential equations then, but it would still have students deconstructing the context of the problem, and using units to make sense of the math. This would both accommodate those who did well with the material by not having them repeat something they already understand, as well as the students who I did not succeed in helping understanding the ways that equations can be used to solve problems in context.

For Student 2 I have asked her to come in after class for further instruction on the strategy we used for trajectory problems, and I believe this will help her see some of the context in using equations when they are given to solve the problem. I believe that she needed more time to complete her test, and so I am going to offer her that time too. Student 9 I believe has the conceptual understanding down, and some reasoning to work on, but is ready to move forward with the whole class. Student 10 expressed to me that she would be re-taking the test anyway, so I will supply her with this time, as well as a review of the material we covered during my instruction. After she feels she has sufficient comfort with that material she will complete her test and this will inform me on what my next steps for her will be.

I believe the reason that many students did not “pass” in the traditional sense was because they did not try every problem, which means in my continued
instruction I will have to set and maintain expectations so that students know it is of upmost importance that they write down anything, even their first idea, and persevere in problem solving because that is how you move forward. In my instruction of exponential equations moving forward I would focus on the context of the problem, and how each piece helps us determine what the equation will be, as well as orienting students to the multiple representations of the math.

b. Explain how these next steps follow from your analysis of student learning and student self-reflections. Support your explanation with principles from research and/or theory.

In my analysis of student work I noticed that the conceptual understanding of how to create equations from context based problems and using units to solve problems grew in all but 3 students who were present for the post-assessment, which encourages me to move forward with the mathematics they need to learn. This is a logical step because students need to maintain interest in the material they are learning, and repeating the same material would frustrate students, as I have learned from experience with these students. My mentor teacher also believes that the best step is to move forward with new math concepts and revisit creating equations, and I would get the opinion of my colleagues as well. I believe using the same concept of multiple representations would be of great use in the next unit with exponential equations because, as Kirwan (2014) says, it is vital to explore multiple representations in mathematics in order to connect the mathematics to the real world around them.

(Stepping outside of the edTPA again, at this time I am unsure of what the best next step would be for individual students who were absent for the majority of the lesson sequence. I still have questions about how to use student work to move forward, like how do I decide what to do when the majority of the class is not passing? I know it would be wrong to move on without due justification, which I do have here, but even with the justification it feels wrong to move forward with new math when they truly don’t understand how to create equations from context, which sounds like the whole basis of the class considering it is called Applied Algebra II. In my own classroom I would choose to do something different than what my mentor and I have chosen here, so how would I account for that in the edTPA? How does having a mentor teacher who has influence over our decisions play into how the edTPA is scored? Or in this prompt are we truly speaking theoretically, and don’t have to say what will actually happen, but what would happen in an ideal world for next steps?)
<table>
<thead>
<tr>
<th></th>
<th>0 Incomplete</th>
<th>1 Beginning</th>
<th>2 Approaching</th>
<th>3 Meeting</th>
<th>4 Exceeding</th>
</tr>
</thead>
</table>
| **Conceptual**

**Understanding**

No work shown

Work shown demonstrates that you have some idea of what the problem is asking, but the connection between the work shown and the problem is unclear *and* leads to an incorrect answer

Work shown demonstrates that you have an idea of what the problem is asking, but the connection between the work shown is unclear *or* leads to an incorrect answer

Work shown demonstrates that you have a good idea of what the problem is asking *and* there is a clear connection to the work shown, but it may lead to an incorrect answer

Work shown demonstrates that you have a good idea of what the problem is asking *and* a clear connection to the work shown with a correct answer

| **Procedural**

**Fluency**

No work shown

Incorrect use of the strategy used to solve the quadratic equation, but obvious effort shown

Almost correct use of the strategy used to solve the quadratic equation

Correct use of the strategy used to solve the quadratic equation, but the answer may not be correct

Correct use of the strategy used to solve the quadratic equation and a correct best answer chosen

| **Problem**

**Solving**

No work shown

Some work is shown, but is not obviously connected to the answer, *and* the answer is incomplete or incorrect

Some work is shown *and* connects to the answer given, but the answer is incomplete or incorrect

—Or—

An almost complete and correct answer is given with little work shown

Ample work is shown *and* connects to the answer given, but the answer may not be complete or correct

—Or—

A complete and correct answer is given with little work shown

All necessary work is shown *and* clearly connects to the complete and correct answer

| **Reasoning**

No work shown

Steps in the work shown are difficult to follow *and* lead to an incorrect answer

—Or—

There is no justification for the answer given

Steps in the work shown can be followed with a close eye but do not lead to a correct answer

—Or—

Steps in the work shown follow from one to the next, but may not lead to a correct answer

Steps in the work shown clearly follow from one to the next *and* lead to a correct answer |
What have we been learning about this week? Why is it important to know?

Quadratic equations.

Not sure

How will I [Ms. Frasier] make sure you know the math we have been working on?

By doing the work and going through the steps as a class.

What is one thing you would have changed about this class for the past two days?

Nothing.

What are some questions you still have about quadratic word problems? (Please write at least one question, even if you think you could answer it, someone else may still be foggy too)
What have we been learning about this week? Why is it important to know?

**Quadratic equation word problems.**
We need it to go on to other math like pre-cal, further algebra. Can use equations to figure out situations in daily life.

How will I [Ms. Frasier] make sure you know the math we have been working on?

**By our work.**

What is one thing you would have changed about this class for the past two days?

**Done each problem ourselves so we have done all of them.**

What are some questions you still have about quadratic word problems? (Please write at least one question, even if you think you could answer it, someone else may still be foggy too)

**Will there be any problems on the test we haven't done?**
Applied Algebra 2 Reflection

What have we been learning about this week? Why is it important to know?

Quadratic equations in word problems

How will I [Ms. Frasier] make sure you know the math we have been working on?

by asking us questions

What is one thing you would have changed about this class for the past two days?

More organized less crazy

What are some questions you still have about quadratic word problems? (Please write at least one question, even if you think you could answer it, someone else may still be foggy too)

how do you get things from the word problems to the quadratic equation
Works Cited


NCTM. (2014). *Principles to Actions: Ensuring Mathematical Success for All*. Reston, VA: NCTM.