INSTRUCTIONAL UNIT

Title of Lesson: “Parabolas in the Real World”

Lesson description: Learners will find a real world quadratic and write the equation of this function using appropriate technology, solve their individual equation using at least two different methods, and research quadratic functions and their usefulness in everyday life. During the research process, learners will construct a research question, complete academic research using reliable internet sources and academic texts, and synthesize their research to create a product using the Makerspace tools that illustrates the usefulness and real world application of quadratic functions.

Note: This unit was developed using the Guided Inquiry Design model. The inquiry process for this unit was not linear. The complex nature of the mathematical concepts covered required a more circular inquiry process. For example, learners moved from Immerse into Explore, then back to Immerse and then on to Explore again. For the purposes of this lesson template, the “activities and procedures for completion” are listed in a linear format.

Grade level/subject: 9-12, Algebra 2

Collaborative Planning Steps:
- Classroom educator expresses interest in collaborating with the librarian on a research unit with a maker product
- Librarian and teacher meet together to discuss the focus of the unit (the concept) and the content standards to be addressed (both Algebra 2 and Library)
- Librarian and teacher invite the instructional technology coach to the next collaboration meeting
- At the collaboration meeting, the librarian, teacher, and instructional coach work together to design the unit within the Guided Inquiry Design (GID) framework. Standards and objectives are reviewed, and then the team plans the main activities and lessons that fit within each phase of the GID process.
- Dates are put on the calendar, roles are decided upon for each team member.
- Librarian, teacher, and instructional coach create rubric for assessment of final product.
- Team makes plans to meet at the conclusion of the unit to reflect and discuss changes to be made in future units.

Instructional Roles for School Librarian:
- Co-plan and design unit
- Facilitate exploration of Makerspace
- Facilitate questioning activities
- Conference with learners regarding research questions and making proposals
- Direct instruction on library resources and databases for Gather phase
- Direct instruction on MLA style/citation guide
- Facilitate use of technology tools in Makerspace
Instructional Roles for Teacher:
- Facilitate the development of curiosity and interest in parabolas
- Facilitate the gathering of credible sources
- Conference with learners regarding research questions and making proposals
- Direct, whole-group instruction on the mathematical components - graphing and solving quadratic equations
- Conference with learners regarding the mathematical components of the project
- Facilitate use of time and resources to complete projects

Subject Area Standards Met:
Oklahoma Academic Standards for Mathematics - Algebra 2
A2.A.1.1 - Represent real-world or mathematical problems using quadratic equations and solve using various methods (including graphing calculator or other appropriate technology), factoring, completing the square, and the quadratic formula. Find non-real roots when they exist.
A2.A.2.3 - Recognize that a quadratic function has different equivalent representations
\[ f(x) = ax^2 + bx + c, f(x) = a(x-h)^2 + k, \text{ and } f(x) = (x-h)(x-k) \]. Identify and use the representation that is most appropriate to solve real-world and mathematical problems.
A2.F.1.2 - Recognize the graphs of exponential, radical (square root and cube root only), quadratic, and logarithmic functions. Predict the effects of transformations
\[ f(x+c), f(x) + c, f(cx), \text{ and } cf(x), \text{ where } c \text{ is a positive or negative real-valued constant} \]
algebraically and graphically, using various methods and tools that may include graphing calculators or other appropriate technology.
A2.F.1.3 Graph a quadratic function. Identify the \( x- \) and \( y- \)intercepts, maximum or minimum value, axis of symmetry, and vertex using various methods and tools that may include a graphing calculator or appropriate technology.
A2.A.2.1 Factor polynomial expressions including but not limited to trinomials, differences of squares, sum and difference of cubes, and factoring by grouping using a variety of tools and strategies.

AASL/State standards for Learners met:
I. Inquire: Build new knowledge by inquiring, thinking critically, identifying problems, and developing strategies for problem solving.
   A. Think - Learners display curiosity and initiative by:
      1. Formulating questions about a personal interest or a curricular topic.
   B. Create - Learners engage with new knowledge by following a process that includes:
      1. Using evidence to investigate questions.
      2. Devising and implementing a plan to fill knowledge gaps.
      3. Generating products that illustrate meaning.
   C. Share - Learners adapt, communicate, and exchange learning products with others in a cycle that includes:
      1. Interacting with content presented by others.
D. Grow - Learners participate in an ongoing inquiry-based process by:
   1. Continually seeking knowledge.
   2. Engaging in sustained inquiry.
   3. Enacting new understanding through real-world connections.
   4. Using reflection to guide informed decisions.

II. Include: Demonstrate an understanding of commitment to inclusiveness and respect for diversity in the learning community.
   A. Think - Learners contribute a balanced perspective when participating in a learning community by:
      1. Articulating an awareness of the contributions of a range of learners.
      2. Adopting a discerning stance toward points of view and opinions expressed in information resources and learning products.
   B. Create - Learners adjust their awareness of the global learning community by:
      1. Interacting with learners who reflect a range of perspectives.
      2. Evaluating a variety of perspectives during learning activities.
      3. Representing diverse perspectives during learning activities.
   C. Share - Learners exhibit empathy with tolerance for diverse ideas by:
      1. Engaging in informed conversation and active debate.
      2. Contributing to discussion in which multiple viewpoints on a topic are expressed.
   D. Grow - Learners demonstrate empathy and equity in knowledge building within the global learning community by:
      1. Seeking interactions with a range of learners.
      2. Demonstrating interest in other perspectives during learning activities.
      3. Reflecting on their own place within the global learning community.

III. Collaborate: Work effectively with others to broaden perspectives and work toward common goals.
   A. Think - Learners identify collaborative opportunities by:
      1. Demonstrating their desire to broaden and deepen understandings.
      2. Developing new understandings through engagement in a learning group.
   C. Share - Learners work productively with others to solve problems by:
      2. Involving diverse perspectives in their own inquiry process.
   D. Grow - Learners actively participate with others in learning by:
      1. Actively contributing to group discussions.
      2. Recognizing learning as a social responsibility.

IV. Curate: Make meaning for oneself and others by collecting, organizing, and sharing resources of personal relevance.
   A. Think - Learners act on an information need by:
      1. Determining the need to gather information.
      2. Identifying possible sources of information.
      3. Making critical choices about information sources to use.
   B. Create - Learners gather information appropriate to the task by:
      1. Seeking a variety of sources.
      2. Collecting information representing diverse perspectives.
3. Systematically questioning and assessing the validity and accuracy of information.

D. Grow - Learners select and organize information for a variety of audiences by:
   1. Performing ongoing analysis of and reflection on the quality, usefulness, and accuracy of curated resources.

V. Explore: Discover and innovate in a growth mindset developed through experience and reflection.

A. Think - Learners develop and satisfy personal curiosity by:
   1. Reflecting and questioning assumptions and possible misconceptions.
   2. Engaging in inquiry-based processes for personal growth.

B. Create - Learners construct new knowledge by:
   1. Problem solving through cycles of design, implementation, and reflection.
   2. Persisting through self-directed pursuits by tinkering and making.

C. Share - Learners engage with the learning community by:
   1. Expressing curiosity about a topic of personal interest or curricular relevance.
   2. Co-constructing innovative means of investigation.
   3. Collaboratively identifying innovative solutions to a challenge or problem.

D. Grow - Learners develop through experience and reflection by:
   1. Iteratively responding to challenges.
   2. Recognizing capabilities and skills that can be developed, improved, and expanded.
   3. Open-mindedly accepting feedback for positive and constructive growth.

VI. Engage: Demonstrate safe, legal, and ethical creating and sharing of knowledge products independently while engaging in a community of practice and an interconnected world.

A. Think - Learners follow ethical and legal guidelines for gathering and using information by:
   1. Responsibly applying information, technology, and media to learning.
   2. Understanding the ethical use of information, technology, and media.
   3. Evaluating information for accuracy, validity, social, and cultural context, and appropriateness for need.

B. Create - Learners use valid information and reasoned conclusions to make ethical decisions in the creation of knowledge by:
   1. Ethically using and reproducing others’ work.

C. Share - Learners responsibly, ethically, and legally share new information with a global community by:
   1. Disseminating new knowledge through means appropriate for the intended audience.

D. Grow - Learners engage with information to extend personal learning by:
   1. Personalizing their use of information and information technologies.
   2. Reflecting on the process of ethical generation of knowledge.
   3. Inspiring others to engage in safe, responsible, ethical, and legal
information behaviors.

Activities and Procedures for completion:

- **Open** (2 days, meet in Library Classroom) - Invitation to inquiry, open minds, stimulate curiosity
  - Day 1: Learners participate in six stations that use parabolas in some way:
    - bean bag toss, Mario Brothers video game, Angry Birds video game, water squinters, badminton, catapult
    - Stations set up in Library classrooms and outdoor courtyard.
  - Day 2: Game Day Debrief
    - Classes watched slow motion videos taken during the activities on day one.
    - Inquiry Journal Prompts:
      - What do you notice from these videos? How are they similar? How are they different? Thoughts about this?
      - Whole class discussion of prompts
      - Vocabulary activity
      - Close with additional inquiry journal prompt:
        - After the class discussion, what additional things did you notice? What questions do you have?

- **Immerse** (9 days, meet in regular classroom) - Build background knowledge, connect to content, discover interesting ideas
  - Classroom educators used the Immerse phase to build on students’ knowledge of parabolas, scaffolding from Algebra 1. Topics covered include graphing (standard and vertex form), characteristics, factoring, solving using multiple methods, and writing equations.
  - Inquiry journal prompts used throughout Immerse to check in with content. Example prompts:
    - Discuss the differences and similarities between the two forms of quadratic graphs. Which one do you like better?
    - When solving a quadratic equation (either by factoring or using square roots), what do the answers represent graphically?
    - What prior experience do you have with factoring?

- **Explore** (3 days, meet in Library Classroom) - Explore interesting ideas, look around, dip in
  - Day 1: Learners find 2-3 examples of quadratics in the real world and locate an article, graphic, or video about each example. Digital Inquiry Journals are used to allow students to track the interesting ideas found and link to articles, graphics, and/or videos. At the end of the class period, learners meet in inquiry circles to share interesting ideas found on day one and respond to the prompt: What patterns do you notice among the resources you have looked at over the last two days?
  - Day 2: Mini-lesson with librarian on evaluating sources (the CRAAP test) and ethical use of information. After mini-lesson, learners continue to explore and locate 2-3 additional examples of quadratics in the real world. Interesting
articles, graphics, and videos are logged in the digital Inquiry Journals.

- **Day 3:** Explore the library Makerspace. Librarian and Instructional Technology Coach introduces the concept of Making and the various tools available via a Google slideshow, showing examples of products created by students in other units and disciplines. During the presentation, learners are asked to stop and answer prompts in their Inquiry Journals. Afterwards, learners are able to explore the Makerspace and ask any questions.
  - How do you define making?
  - Explain how having choices in the way you show your learning could make school more meaningful to you.
  - After today’s activities, what tools are you most interested in using? Why?

- **Identify** (2 days, meet in Library Classroom) - Pause and ponder, identify inquiry question, decide direction
  - Day 1: Librarian led mini-lesson on questioning using the “Question Formulation Technique.” Learners are shown 3 images (all showing parabolas) and asked to select one, then brainstorm a list of questions about the chosen image. Learners are instructed that any question is acceptable and that the goal is to come up with as many questions as possible in the allotted time. Class discussion follows, with librarian asking learners to share their questions aloud with the class. This leads into a discussion of open and closed questions and various levels of questions. Learners are shown a video on the “3 Levels of Questioning.” At the conclusion of the mini-lesson, learners are instructed to go back to their inquiry journals and read over everything they’ve done up to that point. They can underline or highlight questions that are interesting to them. Learners are then asked to turn to a shoulder partner and respond to this prompt:
    - What patterns do you notice among the resources you have looked at over the last few days?
    - What questions do you still have? What is most interesting to you?
  - Day 2: Learners write initial inquiry questions, then conference with two peers, the classroom educator, and the librarian about their questions. Learners make any changes to their inquiry questions and then submit via a Google form.

- **Gather** (3 days, meet in Library Classroom) - Gather important information, go broad, go deep
  - Day 1: Librarian led mini-lesson on use of library databases and citations. Learners gather print and digital information to help answer their inquiry questions. Relevant sources and facts are added to the digital Inquiry Logs. At the end of class, learners are asked to respond to the following prompt in their Inquiry Journals:
    - Scale your feelings about the research process so far:
      - 4- I’m feeling good. No complaints! I am confident in my topic and the resources I am finding.
      - 3- I’m okay. I understand the assignment, I am just nervous about it all coming together.
      - 2- I’m overwhelmed and I’m not sure I am moving in the right
direction. I need to conference with you.

- 1- I’m really stressing out. Where do I even begin? Help me! Help me!

○ Day 2: After reviewing Inquiry Logs and Journals, librarian and classroom teacher identified struggling learners and conferenced with each one to coach and guide through this challenging part of the inquiry process. Learners continued gathering information and adding sources and facts to Inquiry Logs.

○ Day 3: Learners continue gathering information. Learners are asked to submit one page written response that answers their inquiry question, as well as the Project Proposal Google form indicating plans and materials needed for the Create phase of the process.

- **Create** (7 days, meet in Library Classroom) - Reflect on learning, go beyond facts to make meaning, create to communicate

  ○ Day 1: Independent work time. Learners submit one page written response that answers their inquiry question, as well as the Project Proposal Google form indicating plans and materials needed for the Create phase of the process.

  ○ Day 2: Independent work time, with support from librarian and teacher.

  ○ Day 3: Independent work time, with support from librarian and teacher.

  ○ Day 4: Independent work time, with support from librarian and teacher. Learners are asked to submit Prototype Check In Google form, answering the following questions:

    ■ What is your inquiry question?
    ■ How does the project connect to your research question?
    ■ What was your initial proposal?
    ■ How has your project evolved/changed since you started?
    ■ What have been the challenges of your project so far?
    ■ What has gone well?
    ■ What is a question you have? What would you specifically like feedback on?
    ■ How can Mrs. R (classroom teacher) help you with the Math Component of the project?
    ■ What do you need to accomplish next week to complete your project (identify final steps toward completion)?
    ■ Copy and paste the link to your project OR attach images of your work-in-progress

  ○ Day 5: Independent work time

    ■ Librarian uses Prototype Check In submissions to identify learners who need additional support in the maker component and/or research component. Classroom educator supports learners as they work through the mathematical component.

  ○ Day 6: Independent work time, with support from librarian and teacher.

  ○ Day 7: Independent work time, with support from librarian and teacher.

- **Share** (3 days, meet in Library Classroom) - Learn from each other, share learning, tell your story

  ○ Days 1-3: The class is split into three groups. Each day, one group shares while
the other two groups are the audience. Audience members must ask questions of each presenter and answer reflection questions after visiting each station. During Share, classroom teacher and teacher librarian are using rubric to evaluate.

- **Evaluate** (1 day, meet in regular classroom) - Evaluate achievement of learning goals, reflect on content, reflect on process
  - Day 1: Class discussions centered around learner products. Learners complete “GID + Making Research Reflection” document to self-assess both product and process.

**Resources: (please designate all books, videos, online resources, websites, etc. by title/name)**

- Norman High School Library Website
  https://sites.google.com/norman.k12.ok.us/nhs-library/home
- Desmos https://www.desmos.com/
- Gale Virtual Reference Library
- EBSCO

**Evaluation methods used:**

- **For evaluating students’ comprehension:**
  Learners utilized https://www.desmos.com/ to better understand the graph of a quadratic function, as well as a tool for self checking their work. The Inquiry Journal and Inquiry Log also provided opportunities for formative assessments. With the inquiry journals in Google Docs, they become a vehicle for two way communication between learners and teachers and allow teachers to know where and when learners need extra support. Classroom educators use learner Inquiry Journals to check in with content. For example, learners are asked to describe the ways to solve a quadratic. Learners are also given formative assessments throughout the unit to check in with the content (goal quizzes, daily assignments, tests, etc.). Librarians and classroom educators conference with learners throughout the inquiry process, specifically during the Identify, Gather, and Create phases to assess comprehension, progress toward goal, etc.

Classroom teachers and librarians worked together to create a 60 point rubric assessing the math component, the research component and the maker component. Learners were given the rubric at the beginning of the Create phase. Both classroom teacher and librarian evaluate learner process and product through the rubric.

Learners complete self-evaluation by answering the following questions:

- What did you learn in this unit that you didn’t know before, and why do you think it is important?
- What skills did you learn in this unit?
- If you could talk to next year’s Algebra 2 students, what would you tell them about this unit?
What do you want to tell your teachers about this unit (be honest!)?

For evaluating the unit:
The instructional team met at the conclusion of the unit to evaluate the unit as a whole. Each phase of the GID process was discussed and the librarian took notes on the successes and challenges on a shared Google doc. The team reviewed learners’ responses to the “GID + Making Research Reflection” document in which learners self-assessed both the product and the process and discussed supports and scaffolds that could be put into place to help all learners be successful.

For evaluating contributions by learning team members:
At the reflection meeting, the team discussed the instructional roles of each team member and suggestions were made for adjustments to responsibilities for future units. For example, it was discussed that, next time, during the create phase, that the instructional technology coach be in the Makerspace and be available to provide assistance to students.

Reflection on any changes needed in unit or modification after unit was first taught:

How were goals met?
- Content and library standards/goals were met through the intentional design of the Guided Inquiry unit. Each activity, structure, and support was critical to the goals being met. Students were taught information about quadratics through immerse, then showed their understanding through their project via mathematical component. At the conclusion of the unit, the classroom teacher gave the regular unit test and looked for gaps in knowledge. She then re-taught or “mopped up” those skills. Librarian and classroom teacher used the digital Inquiry Journal and Google form responses to formatively assess standards/goals throughout the unit.

How were goals modified?
- Because this was an inquiry and Making unit, students were asked to complete three components - the math component, the research component, and the maker component. Many students successfully completed all three components, but a number of students only completed two components. Librarian and classroom teacher discussed supports to put in place for future units to ensure students were able to complete all three components. Goals were modified depending on the student and as needed to best support their learning. For example, one student who was absent a lot during the unit created a project, but the mathematical component was simplified into a basic quadratic equation.

How did goals exceed?
- Some student projects exceeded the expectations. Outcomes were positive overall, and many students who are not typically engaged in Algebra 2 were engaged in this unit.

Follow-Up- an extension for future research, inquiry:
This project opened up the Makerspace to students, so future projects (like this one) were more of a possibility since students were now familiar with the Makerspace and available tools. This project helps students in Pre-Calculus when they study functions again and look for the real world examples. For example, Pre-Calculus classes studied logarithms and exponential graphs in the real world. Students researched and then uploaded photos/graphs to desmos.com to create the equation for their real world example.

**Student Work**
Please submit no more than two examples of student work from this unit. Please remove last names prior or to scanning or provide a link to view the examples.

**Student Work Sample #1 - Amara (see attached document)**
Inquiry question: How does changing the parabolic shape of a telescope lens effect how well and far you can see?

**Student Work Sample #2 - Joscelyn (see attached document)**
Inquiry question: How do developers program gravity using parabolas in video games?
## Math Component (20 points)

<table>
<thead>
<tr>
<th>Equation</th>
<th>Write the equation of the real world parabola in standard form (y = ax^2 + bx + c)</th>
<th>5 points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Graph</td>
<td>Graph your quadratic on graph paper using appropriate scale (must be labeled and clear for reader!)</td>
<td>5 points</td>
</tr>
</tbody>
</table>
| Characteristics | Vertex  
y-intercept  
Axis of symmetry  
Domain  
Range | 5 points |
| x-Intercepts | How many times does it cross?  
Solve your quadratic equation using two methods  
What do you notice about your answers?  
How does it relate to the graph? | 5 points |

## Research Component (20 points)

<table>
<thead>
<tr>
<th>Inquiry Question</th>
<th>State your inquiry question</th>
<th>2 points</th>
</tr>
</thead>
</table>
| Your Final Answer | In at least two paragraphs, answer your question based on your research  
(Acceptable formats: essay, detailed on multiple slides, etc...) | 10 points |
| Conclusion | In a conclusion paragraph, what is the main take away of your real world quadratic?  
(i.e. how are quadratics related to you?) | 5 points |
| Resources | Citations  
(can be in any organized form) | 3 points |

## Maker Component (20 points)

<table>
<thead>
<tr>
<th>Presentation of Project</th>
<th>Project put together in a visually appealing way</th>
<th>5 points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iteration</td>
<td>Completing the project, having improved the design and/or aesthetics over time.</td>
<td>5 points</td>
</tr>
<tr>
<td>Initiative</td>
<td>Student encounters complications with a positive attitude &amp; perseveres to problem-solve.</td>
<td>5 points</td>
</tr>
<tr>
<td>Required Information</td>
<td>Maker Component represents both Math and Research Components</td>
<td>5 points</td>
</tr>
</tbody>
</table>

PROJECT TOTAL: _____/60 = ________%
Quadratics Inquiry Journal - Joscelyn
7th hour Algebra 2

**Explore:**

<table>
<thead>
<tr>
<th>Resource 1 Title</th>
<th>What is sticking with you from this resource? What did you find most interesting?</th>
</tr>
</thead>
<tbody>
<tr>
<td><a href="https://www.youtube.com/watch?v=IdUN6lR8dpw">https://www.youtube.com/watch?v=IdUN6lR8dpw</a></td>
<td>What sticks with me is that I played this game before knowing what parabolas were. Now that I know what parabolas are, the game makes a lot more sense.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Resource 2 Title</th>
<th>What is sticking with you from this resource? What did you find most interesting?</th>
</tr>
</thead>
<tbody>
<tr>
<td><a href="https://www.youtube.com/watch?v=E_0AHlaK48A">https://www.youtube.com/watch?v=E_0AHlaK48A</a></td>
<td>I didn’t realize that when someone designed this game they had to give mario’s jump height a calculated parabola</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Resource 3 Title</th>
<th>What is sticking with you from this resource? What did you find most interesting?</th>
</tr>
</thead>
<tbody>
<tr>
<td><a href="https://www.youtube.com/watch?v=c4b9lCfSDQM">https://www.youtube.com/watch?v=c4b9lCfSDQM</a></td>
<td></td>
</tr>
</tbody>
</table>

**Quick Write:** List questions (any level) that you are wondering about from everything you’ve learned up to this point:

1. Who discovered parabolas?
2. Why haven’t we discussed sideways parabolas?
3. Are equations for horizontal parabolas different?
Explore the Makerspace:

Journal: What is making?

Making is taking different parts and putting them together or taking them apart in a way to make something new.

Journal: Explain how having choices in the way you show your learning could make school more meaningful to you.

If I had choices, school would be more meaningful because I would really retain the knowledge I learn since I am interested.

Identify:

Quick Write: Look over your question lists from Explore Day 2. What do you want to know more about? Why are you interested in that question or topic?

I want to know more about how gravity is programmed in video games using parabolas. I want to know more about this since I play video games a lot but I don’t even know how they are made. The gravity mechanic in games is weird to me since the developers can make pixels on a screen look like a falling or floating object.

My initial inquiry question:

How is gravity programmed in video games?

My revised inquiry question:

How do developers program gravity using parabolas in video games?

Approved by: Pangburn

My final inquiry question:

How do developers program gravity using parabolas in video games?
Share Day 1:

Quick Write: What did you see today that stood out to you or made you see something differently? What similarities and differences does your work have to that of your peers?

Today was my presentation day, but I did get good feedback about my video.

Share Day 2:

Quick Write: What did you see today that stood out to you or made you see something differently? What similarities and differences does your work have to that of your peers?

I thought the suspension bridge was cool since it was a real accurate model.

Evaluate:

Quick Write: answer each of the following questions in 3-5 sentences:

1. What did you learn in this unit that you didn’t know before, and and why do you think it is important?

I learned a lot about video game design that I didn’t know before. Now I have a better understanding of the games I play everyday.

2. What skills did you learn in this unit?

I learned the quadratic formula and video editing skills.
3. If you could talk to next year’s Algebra 2 students, what would you tell them about this unit?

Be sure to pick a topic that matches well with a real world model or would make for an interesting video/presentation.

4. What do you want to tell your teachers about this unit (be honest!)?

This unit was pretty fun, it would be cool for other subjects like English since we could create visual book reports. It makes the lessons a lot more interesting than the normal way of doing things.

Joselyn’s video - https://tinyurl.com/uf5wvq3
\[(0, 2.55) \quad (1.77, 1.21)\]

\[y = a(x-h)^2 + k\]
\[y = a(x-0)^2 + 2.55\]

\[
1.21 = a(1.77 - 0)^2 + 2.55 \\
1.21 = a(1.77)^2 + 2.55 \\
1.21 = a(3.132) + 2.55 \\
-2.55 = -2.55 \\
-1.34 = a(3.132) \\
\frac{1.32}{3.132} \quad \frac{3.132}{3.132} \\
\boxed{-0.428 = a}\]

\[y = -0.428(x-0)^2 + 2.55\]
**Explore:**

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<td><a href="http://astronomy.swin.edu.au/cosmos/P/Parabola">http://astronomy.swin.edu.au/cosmos/P/Parabola</a></td>
<td>This website is about parabolas in telescopes. It gives me the formula and what it looks like on a graph.</td>
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<td>The website tells more details of why parabolas are used in telescopes and how it works; along with formulas as well.</td>
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<td><a href="http://astronomy.swin.edu.au/cosmos/P/Parabola">http://astronomy.swin.edu.au/cosmos/P/Parabola</a></td>
<td>This website elaborates more on how a telescope has a parabola and the formula to solve it. This also talks about the origin of a parabola, like where it got its name.</td>
</tr>
</tbody>
</table>

**Quick Write:** List questions (any level) that you are wondering about from everything you’ve learned up to this point:

1. Does the change of parabola of a telescope change the
distance you can see?
2. Does changing the parabola of a telescope effect how clearly you can see?
3. How does an eye lens effect how much light your eye can collect?
4. When you change the parabola of the eye lens, does it change how well you can see?
5. Is there a way to change your parabolic lens and still see the same way?

Explore the Makerspace:

*Journal: How would you define making?*

I would define making as creating.

*Journal: Explain how having choices in the way you show your learning could make school more meaningful to you.*

It would allow me to stay more interested in what I’m actually learning and it would help me understand, grasp the concept quicker.

Identify:

*Quick Write: Look over your question lists from Explore Day 2. What do you want to know more about? Why are you interested in that question or topic?*

How does your vision change when the parabola of your lens changes? Or does it stay the same?

My initial inquiry question:

How does your vision change when you completely change the parabola of your eye lens? Or does your vision stay the same?
My revised inquiry question:

Why does changing the parabolic shape of an eye affect your vision? Also telescopes?

What is the impact of parabolas on different types of vision?

Approved by: Pangburn

My final inquiry question:

How does changing the parabolic shape of a telescope lens affect how well and far you can see?

Create:

Journal: What will you be working on during class for the next 4 days? And what will you be working on at home?

I will be working on the math and research part of my project in class and since I don’t think I will be able to gather the wood for my telescope at school I will work on constructing my project at home. (Unless I can figure out how to work on it at school)

Share Day 1:

Quick Write: What did you see today that stood out to you or made you see something differently? What similarities and differences does your work have to that of your peers?

I saw parabolas in many different ways and I did not realize how many things have parabolas in them. My work like some of my peers was time consuming and took a while to figure out. Some people had a hard time with their projects coming to life just like me.
Share Day 2:

Quick Write: What did you see today that stood out to you or made you see something differently? What similarities and differences does your work have to that of your peers?

I didn’t know what made your nails grow. I learned that when making a longer bridge it is better to use the parabolic shape. Some people had an easier idea unlike me. Some did not have everything completed like me.

Share Day 3:

Quick Write: What did you see today that stood out to you or made you see something differently? What similarities and differences does your work have to that of your peers?

I presented.

Evaluate:

Quick Write: answer each of the following questions in 3-5 sentences:

1. What did you learn in this unit that you didn’t know before, and why do you think it is important?

I learned that parabolas are a big part of the real world. I think this is important because it allows me to be able to see that the things I learn in class is actually important and relates to the real world. I also learned that a hands on learning experience was a better learning environment for me.

2. What skills did you learn in this unit?

I improved my comprehension skills and bringing an idea to life. I was also more
engaged in what I was doing and it became more serious than everyday work. I also had to work on my time management skills to help me achieve my goal.

3. If you could talk to next year’s Algebra 2 students, what would you tell them about this unit?

This is going to be a little hard at first but it is a very fun way to learn math. You will also be able to see a parabola in every little thing you see and sometimes you find one without realizing it. Prepare for a lot of independent work, it will be a struggle.

4. What do you want to tell your teachers about this unit (be honest!)?

I loved doing this guided inquiry maker project. It was a lot of fun even though it was stressful. I would have liked a little more time to work on the project though because maybe then I could have improved my project better. I have also caught myself finding parabolas when I look out the car window driving places. This project has opened my eyes more to what I was actually learning by relating it to something that I was interested in. I would have liked to have learned how to use other tools but I didn’t know how to use them. It was also nice not being stuck in the classroom having knowledge shoved in my brain.