A Unit on Conic Sections

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Education 352
Professor Schilling
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**NAME OF COURSE/GRADE LEVEL:** Algebra 2/Eleventh Grade

**DESCRIPTION OF COURSE:** This course is designed to build upon topics learned in Algebra I and to prepare students for college. Students learn more about functions and relations.

**NAME OF CHAPTER/UNIT:** Advanced Functions and Relations

**DESCRIPTION OF CHAPTER/UNIT:** This chapter looks at advanced functions in Algebra 2 which include parabolas, circles, ellipses, hyperbolas, solving quadratic equations, rational expressions, classes of functions, exponential functions, and logarithmic functions.

**TITLE OF TEXTBOOK:** Algebra 2

**NAME(S) OF AUTHOR(S)/EDITOR(S):** Berchie Holliday, Gilbert J. Cuevas, Beatrice Moore-Harris, John A. Carter, Daniel Marks, Ruth M. Casey, Roger Day, and Linda M. Hayek

**NAME OF PUBLISHING COMPANY:** McGraw-Hill Companies

**COPYRIGHT DATE:** 2003

**READING LEVEL OF TEXTBOOK:** This textbook is designed for a junior level mathematics class and assumes that students understand and know many of the regular mathematics concepts.
PHILOSOPHY OF READING IN THE CONTENT

STANDARDS
A2.4 – Students write equations of conic sections and draw their graphs.

IMPORTANCE
Students study conic sections in Algebra 2 in order to understand applications of mathematics in the world. Applications of conic sections include: astronomy, architecture, interior design, communication, manufacturing, physics, photography, and meteorology.

PHILOSOPHY
Students are generally not taught how to read and understand mathematics books. They generally have always been taught by a teacher how to solve various problems and every once in a while are expected to learn how to do something else through reading. Students are able to get by without ever picking up and reading their math book, but in college, professors do not have the time to teach every small detail of solving problems; therefore, at the high school level students should learn how to read a mathematics book and understand proper techniques. I believe that this is important as entering college and advancing in my math career became more of a challenge with the expectation to be able to read for further information within the textbook and gain understanding from the reading.

In order to help my students understand what they are reading, we will practice in class to gain better understanding. The more practice and better understanding students receive, the more likely they will be able to use the techniques on their own as well as in college.
Sample Passage 1:
Intravenous or IV fluid must be given at a specific rate, neither too fast nor too slow. A nurse setting up an IV must control the flow rate $F$, in drops per minute. They use the formula $F = \frac{V \times d}{t}$, where $V$ is the volume of the solution in milliliters, $d$ is the drop factor in drops per milliliter, and $t$ is the time in minutes. Suppose a doctor orders 1500 milliliters of IV saline to be given over 12 hours, or $12 \times 60$ minutes. Using a drop factor of 15 drops per milliliter, the

Sentences: 4.370
Syllables: 151

Sample Passage 2:
Recall that point $M$ is the midpoint of segment $PQ$ if $M$ is between $P$ and $Q$ and $PM = MQ$. There is a formula for the coordinates of the midpoint of a segment in terms of the coordinates of the endpoints.

Find a Midpoint

LANDSCAPING A landscape design includes two square flower beds and a sprinkler halfway between them. Find the coordinates of the sprinkler if the origin is at the lower left corner of the grid.

The centers of the flower beds are at $(4, 5)$ and $(14, 13)$. The sprinkler will be at the midpoint of the segment joining

Sentences: 7.846
Syllables: 144

Sample Passage 3:
Solve Trigonometric Equations You have seen that trigonometric identities are true for all values of the variable for which the equation is defined. However, most trigonometric equations, like some algebraic equations, are true for some but not all values of the variable.

Solve Equations for a Given Interval
Find all solutions of each equation for the given interval.
a. $\cos^2\theta = 1; 0^\circ \leq \theta < 360^\circ$
   $\cos^2\theta = 1 \quad \text{Original equation}$
   $\cos^2\theta - 1 = 0 \quad \text{Solve for } \theta$
   $(\cos\theta + 1)(\cos\theta - 1) = 0 \quad \text{Factor}$
Now use the Zero Product Property.
$\cos\theta$+
I was surprised to find that the Fry Readability test was fairly accurate with the Algebra II textbook that the classroom uses. Many students take Algebra II their sophomore or junior year which is between the ages of fifteen and sixteen. I do not believe that the test is very accurate for mathematics books because many of them require more words than what is written within the text. Often you can consider each equation to be a sentence but when you divide, you say divided by or when you multiply two different statements together such as \((x+2)(x-2)\), we often say the quantity of \(x\) plus two times the quantity of \(x\) minus two which can easily skew the test results.
TRADE BOOKS

ANNOTATED LIST OF TRADE BOOKS FOR MATHEMATICS


After discovering a shared love of art, two sixth grade students are challenged when a thief, who has stolen a Vermeer painting, places clues in the newspaper. From pentominoes to puzzling clues, the two must solve the mystery before the painting is destroyed. Twists and turns occur as their teacher begins to act suspiciously in class and has them working on assignments that fall in line with the clues the thief is leaving.

*Chasing Vermeer* is a logical thinking book that can be used to show that mathematics is not always about numbers and equations. While reading the novel students can work to solve the provided puzzles and see who can solve the mystery first. While reading the novel the class will be able to look at how mathematicians solve their problems and have daily discussions as to what we have learned so far from the puzzles in the book. As the teacher I will monitor discussions and make sure no one speculates what is going to happen unless that is the discussion we are having and that no one tells who it was before it is time for the class to know. After finishing the novel students will create their own puzzle to then share with the class.


Many of today’s adults in the United States of America loathe mathematics. This book looks at beliefs about mathematics from the public and educators’ positions. Focusing on why math has such a bad reputation, the reason why it should be important to us, and how to stop future generations from having such negative attitudes toward the subject.

I would use this book at the beginning of the year to help students realize the importance of math in their lives. While reading the novel we will critically look at the statistics and information provided and determine what our stance is about math. Students will be required to write a short paper about the novel to
decide how they believe the system can be reformed and how they will use the information to look at math more positively.


Ravi, a 14 year old math genius, helps solve cases for the local police department in this collection of short stories. Each story has a mathematical problem at the center and then explains how to solve the problem. Readers can apply high school math and physics to solve the mysteries in this book.

This book can be used in Pre-Calculus, Algebra 2, and physics courses to help students better understand various concepts. I will use this book in my classroom to aid students in learning the material and add to their understanding of applications in mathematics. The book is said to contain trigonometry which is used in Pre-Calculus and combinatorics and probability which is taught in Algebra II. After reading part of the short story students will get into groups and work to solve the mystery before reading about how it was solved.


This novel tells the story of a boy who finds a mysterious tollbooth in his bedroom. Upon taking his toy car through the tollbooth and paying the toll, he finds himself transferred to a fantasy world. He travels through worlds of words, numbers, and more on a quest to bring back the princesses Rhyme and Reason.

This book can be used to teach students the importance of wit and reasoning. Mathematics relies heavily on logic and students should be able to think logically. Reading a short chapter booked can help students learn to think in a more logical way and while reading the story as a class we can discuss how mathematics depends more on logic than what you believe to be true. If you can prove in some way that something is true then mathematicians are more likely to believe it. One important idea that could be used when reading this book is to have students practice writing proofs to connect what is happening in the story.

*The Sundae Scoop* looks at combinations. The school is hosting a picnic with six different ingredients from which to choose. How many possible combinations of sundaes are there to make from these ingredients?

I will use this in my classroom to have students look at the importance of combinations within the probability and statistics section of Algebra 2. I will read the book aloud to the class and have students make notes about the different ingredients they have to choose. Then before finishing the book, students will determine the amount of choices people have to choose from. After finishing the book, I will begin the lesson on combinations and have them mathematically determine the number they should have discovered.
MANCHESTER COLLEGE
Department of Education

LESSON PLAN by Kelli Jordan

Lesson: Kick-Off to Conic Sections (1)  Length 50 min  Age or Grade Intended Alg. 2

Academic Standard(s):

A2.10.1: Use a variety of problem-solving strategies, such as drawing a diagram, guess-and-check, solving a simpler problem, writing an equation, and working backwards.

Performance Objectives:

- Given the formula, students in Algebra 2 will write an equation to find the midpoint of a given line 4 out of 5 times correctly.
- Using the yarn, students in Algebra 2 will measure the length of the string to guess and check the distance between them and their partner.
- Given the formula, students in Algebra 2 will write an equation to find the distance of a given line 4 out of 5 times correctly.

Assessment: Students will turn in their work from the in-class activity and it will be checked for accuracy on solving the problems for distance and midpoint. The homework assignment will then be graded to check for correct calculations.

Advanced Preparation by Teacher:

1. Using masking tape, create a graph on the floor with every coordinate 1 foot apart
2. Purchase yarn or string
3. Find/gather yard sticks for the activity
4. Print off pairs of numbers to partner students up at random (i.e. 2-1’s, 2-2’s, etc)
5. Get a basket for numbers
6. Find a pair of scissors
7. Before class write the distance formula and midpoint formula on the board
8. Print out worksheets for students
9. Move desks out of the way

Procedure:

Introduction/Motivation:

“Today you are going to play the role of a point on a graph to determine the midpoint and distance between yourself and a partner. You will determine your partner by drawing numbers from a basket.”

Step-by-Step Plan:

1. Classroom Activity (Gardner: Bodily Kinesthetic, Visual/Spatial, Interpersonal, and Mathematical/Logical)
   a. Have students pick a place to stand on the graph system, make sure they have a piece of paper and pen/pencil with them (each student will be required to turn in their own work)
   b. Have students write down the coordinates of their location
   c. Go around and have each student draw a number from the basket
d. Find one person from group 1 and give them one end of the string, then go to the other person and cut off the string so that the length is the distance between them.
e. Repeat step d for all of the groups.
f. Have the pairs take their piece of string and measure it with a yard stick.
   i. What would you estimate the length of your string to be? (Bloom: Analysis)
   ii. What is the length of your string? (Bloom: Knowledge)
   iii. What is the midpoint of your string? (Bloom: Knowledge)
g. Have students use the formulas they were given to find the distance and midpoint from the points they wrote down.
   i. Set-up and evaluate an equation for the midpoint. (Bloom: Synthesis)
   ii. Set-up and evaluate an equation for the distance. (Bloom: Synthesis)
h. Have students evaluate the situation. All of the information should go on the provided hand-out with questions included.
   i. What is the difference between the measurements you found and your calculations? (Bloom: Knowledge)
   ii. Which way do you believe is easier? Support your answer. (Bloom: Evaluation)
   iii. Explain why you believe mathematicians use formulas to evaluate the distance and midpoint rather than measuring. (Bloom: Evaluation) (Gardner: Verbal/Linguistic)
i. Have the class discuss the importance of formulas for mathematicians and why mathematicians developed formulas. (Bloom: Synthesis) (Gardner: Verbal/Linguistic, Logical/Mathematical)
j. Assign homework problems from the textbook.
   i. Pp 414-415, # 12, 15, 16,18, 20, 26, 29, 30, 35, 36
k. Allow students additional time to work on the homework.
l. Make sure to leave the last 5 minutes for closure and clean up.

Closure: “Tomorrow we will begin to discuss conic sections which are formed when a plane intersects a cone. I will show you an online representation of how these sections are formed and we will begin with parabolas. We will not look at them as we have in the past but look at the focus which relates to what we have done today, directrix, and axis of symmetry.”

Adaptations/Enrichment: There are no adaptations or enrichments for this lesson.

Self-Reflection:
- Was the goal for the students too ambitious?
- Was the time allotted enough?
- Was the discussion deep and thoughtful?
- What changes should be made for next time?
HUMAN GRAPH WORKSHEET

Directions: Working as a group, answer the following questions. Make sure to show all of your work. Each person will be required to turn in their own worksheet.

1. What was your coordinate? _________
   What was your partner’s coordinate?_________

2. What is your estimate for the length of your string (in feet)?

3. What is the length of the string (in feet)?

4. What is the midpoint of your string (in feet)?

5. Using the coordinates, set-up and evaluate an equation for the distance between your points.
6. Using the coordinates, set-up and evaluate an equation for the midpoint between your points.

7. What is the difference between the measurements you found and your calculations?

8. Which way do you believe is easier? Support your answer.

9. Explain why you believe mathematicians use formulas to evaluate the distance and midpoint rather than measuring.
MANCHESTER COLLEGE
Department of Education

LESSON PLAN by Kelli Jordan

Lesson: Conic Vocabulary (2)  Length 50 min. Age or Grade Intended Alg. 2

Academic Standard(s):

A2.4.1-Write the equations of conic sections (circle, ellipse, parabola, and hyperbola).

Performance Objectives:

- Using their Math Self-Awareness Check table, students will identify the type of conic section from a given equation 3 out of 4 times correctly.

Assessment:

The teacher will go around the room and individually ask the students to identify the type of conic section from the equations listed on the Identifying Conic Sections handout, answers are located on the back. If there is not enough time to speak to each students or a there is a substitute, students should be given the Identifying Conic Sections handout to complete as homework.

Advanced Preparation by Teacher:

10. Print off copies of the Math Self-Awareness Check Table (at least enough for 2 per student)
11. Prepare Identifying Conic Sections handout copies for the students in case there is not enough time to ask each of them 4 questions or a substitute is teaching.
12. Prepare computer for showing students the website
13. Write reflection question on the board or have pages copied with the question located at the top for students to use as the assignment.

Procedure:

Introduction/Motivation:

“Yesterday you learned how to find the distance and midpoint between two points, today you are going to learn how the distance and midpoint are used in conic sections. Conic sections are formed when a double cone, two cones on top of each other, have a plane intersecting them. There are four types of conic sections that can be formed: parabola, circle, ellipse, and hyperbola.”

Step-by-Step Plan:

1. Show students the images of how conic sections are formed from: http://mathworld.wolfram.com/ConicSection.html (Gardner: Visual/Spatial)
2. “You will all be developing your own charts for the vocabulary terms in sections 2-5 today from your textbook. You will determine what items you feel are important to write on the chart and then compare them to the list of items I thought you should include.”
3. Hand out the Math Self-Awareness Check Tables to each student, place additional copies on the front table in case additional copies are needed.
4. “We will start with the first term together and then you will have time to work in groups to write down definitions in your own words and complete the charts. When there are fifteen
minutes left I will begin walking around the classroom to ask each of you to identify the type of conic section based upon the equation I show you.”

5. Definition 1: Parabola (use the definition about the focus and directrix) Ask the class, “In your own words, how would you state the definition of parabola taking into account both of the definitions the book uses on page 419.” (Bloom: Comprehension)

6. “Classify your level of understanding by marking the box where you believe your level of awareness falls: a plus is very confident in understanding, a check is you think you understand, and minus is you do not understand very well.” (Bloom: Analysis)

7. Equation: \( y = a(x-h)^2 + k \)

8. Have the students find an example in the book to demonstrate the equation of the parabola

9. Have the students break-off into groups of 2-3 to continue working on the Self-Awareness Check (Gardner: Interpersonal, verbal/linguistic)

10. When there are 15 minutes left begin walking around the classroom to ask students 4 questions individually. (If there does not seem to be enough time to have each student answer, have students complete the Identifying Conic Sections handout, but do not provide the second page of answers to them). (Bloom: Knowledge)

11. For homework have students answer the following: “Reflect upon filling out the Self-Awareness charts in a minimum of one paragraph. Did you feel this was a helpful tool in learning new math terms?” (Bloom: Evaluation) (Gardner: Intrapersonal)

**NOTES:** Students should have the following definitions: parabola, focus, directrix, latus rectum, axis of symmetry, circle, center, radius, tangent, ellipse, foci, major axis, minor axis, center, hyperbola, foci, center, asymptotes, vertex, transverse axis, conjugate axis, rectangular hyperbola, and nonrectangular hyperbola. Duplicate definitions listed will be different based upon the conic section with which they are located.

**Closure:**

“Tomorrow we will begin looking at parabolas and work on solving equations to find the directrix, focus, axis of symmetry, and vertex. The chart you created today will provide you with helpful tools in the coming sections.”

**Adaptations/Enrichment:** No adaptations or enrichments for this lesson.

**Self-Reflection:**

- Did the students have enough time to get through a majority of the vocabulary words within the chapter?
- Was there enough time for me to go around and ask each student four questions?
- What changes should be made for next time?
- How were the student responses to the reflective writing?
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Identifying Conic Sections

1. \((x)^2 + (y)^2 = 25\)
2. \(y = (x - 6)^2 + 4/5\)
3. \(x^2/5 + (y-13)^2/4 = 1\)
4. \((x-3)^2 + (y+25)^2 = 9\)
5. \(\frac{(x-3/5)^2}{15} - \frac{(y-6)^2}{4} = 1\)
6. \((x+2)^2 + (y)^2 = 15\)
7. \(\frac{(x+5)^2}{4} - \frac{(y-2)^2}{5} = 1\)
8. \(y = \frac{1}{4} * (x + 8)^2 - 5\)
9. \(\frac{(x-15)^2}{10} + \frac{(y-8)^2}{12} = 1\)
10. \(y = 5x^2 + 4\)
11. \((x+8)^2 + (y-45)^2 = 100\)
12. \(\frac{(x-9)^2}{14} - \frac{(y-11)^2}{81} = 1\)
13. \(\frac{(x+13)^2}{13} + \frac{(y-5)^2}{169} = 1\)
14. \(\frac{(x-1)^2}{121} - \frac{(y-5)^2}{225} = 1\)
15. \((x-5)^2 + (y+4)^2 = 36\)
ANSWERS
1. Circle
2. Parabola
3. Ellipse
4. Hyperbola
5. Circle
6. Hyperbola
7. Circle
8. Parabola
9. Ellipse
10. Parabola
11. Circle
12. Hyperbola
13. Ellipse
14. Hyperbola
15. circle
LESSON PLAN by Kelli Jordan

Lesson: Parabolas (3) ___________________ Length 50 min. Age or Grade Intended Alg. 2

Academic Standard(s):

A2.4.1-Write the equations of conic sections (circle, ellipse, parabola, and hyperbola).

A2.4.2-Graph conic sections

Performance Objectives:

• Using their notes and book, Algebra 2 students will graph a parabola (type of conic section) with an axis of symmetry, latus rectum, focus, and directrix all present on the graph, 3 out of 4 times correctly.
• Using their notes and book, students in Algebra 2 will re-write the equation of a parabola from non-standard form to standard form 2 out of 2 times correctly.
• Using their notes and book, students will create the equation of a parabola with a given vertex and focus or directrix correctly.
• Given a word problem, students will create a parabolic equation for the problem correctly.

Assessment:

The assigned homework has been set-up to assess the objectives in graphing parabolas, creating equations for parabolic functions, and changing the form of an equation. The teacher will look over all of the problems in the homework and re-teach anything that students do not seem to understand very well.

Advanced Preparation by Teacher:
14. Prepare notes for lecture
15. Practice reading from Crimes and Mathdemeanors.

Procedure:

Introduction/Motivation:
“Yesterday you worked on making a Math Self-Awareness Check Table of the vocabulary for our current chapter. I hope you find this helpful in learning equations and understanding new concepts. Last night you were to write a short reflection on your experience creating the chart. I would like for you to please pass those to the front now, so I may collect them,” (also collect “Identifying Conic Sections” if necessary). “Today we will read a short excerpt from Crimes and Mathdemeanors and then we will discuss parabolic functions with more information than previously learned before.”

Step-by-Step Plan:
12. We will start with Crimes and Mathdemeanors. While I am reading, you should pay attention to the clues and mathematical terms put into the story. Please keep notes, as we will continue the story at another time. (Gardener: Verbal Linguistic)
a. Note that this will be separate from the second part of the lesson.
b. Read part of a short story from the book.
c. Ask students questions covering the reading such as:
   i. “What are some of the mathematical terms you remember from the text?”
      (Bloom: Knowledge)
   ii. “Who do the clues suggest are behind the crime?” (Bloom: Synthesis)
d. *You should not spend more than 10-15 minutes on this Read Aloud.
e. After you have finished, give the students a few minutes to get out a piece of paper for notes and prepare for today’s lesson. Also, have them get out their Self-Awareness Checks for you to look over when they are working independently.

13. Now you have all previously seen graphs in the form of y=ax^2. This type of equation forms a graph known as a parabola. Can anyone demonstrate what a parabola looks like only using your body? (Bloom: Comprehension) (Gardener: Bodily/Kinesthetic) *Provide feedback to the students, it should look somewhat like a U.

14. “Our chapter considers the standard form of a parabola to be y=a(x-h)^2+k or x=a(y-k)^2+h with the vertex at (h,k) and the axis of symmetry at x=h for an equation with x^2 or y=k for an equation with y^2. Would someone be able to explain what they believe the axis of symmetry is?” (Bloom: Comprehension)
a. If no one answers ask them the following series of questions:
   i. What is meant by symmetry? (Bloom: Knowledge)
   ii. How would that fit into the meaning of an axis of symmetry when we are graphing something? (Bloom: Application)

15. “I would like for you all try graphing the following two equations. Please make sure to label your axis of symmetry and begin by graphing the vertex.” (Gardener: Intrapersonal)
a. Equations: y=(x-3)^2-4 and x=2(y+7)^2+3
   i. Walk around the classroom to check on students. This should only take 2-3 minutes. Begin checking the Self-Awareness Check Tables while they are working.
   ii. After they have finished, graph the function yourself on the board and have them check their work (Please see notes for the graph) (Gardener: Visual/Spatial)
      1. Have the students tell you the vertex, axis of symmetry, and which way the graph opens for each graph. Show them how they can use the “slope” to graph the equations

16. “Generally we would stop here with regular parabolas; however, with conic sections, mathematicians also like to look at what is known as the focus and directrix.”

17. “The focus and directrix define a parabola is geometric terms rather than algebraic terms. (Geometric terms are considered to be lines and points and shapes). Using the geometric definition of a parabola we say that a parabola is the locus of points or points connected by some type of line that are equidistant from the focus a point and directrix line. Can anyone explain what equidistant means?” (Bloom: Comprehension)
a. Students or teacher should explain that equidistant means the distances are equal

18. “If we were to use the distance formula we discussed the other day in class, from a point along our parabola to the focus and directrix, we would get the same answer. To find the focus, we will use the equation (h, k+1/(4a)) if we have a parabola with x as the squared term (x^2) and (h+1/(4a), k) if y is the squared term (y^2). The directrix can then be found by using the equation y=k-1/(4a) if we have x^2 and x=h-1/(4a) if we have y^2.”

19. “The last piece to add to our graphs is known as the latus rectum which is the line that goes horizontally or vertically through the focus and has a length of the absolute value of 1/a units.”

20. “Now using the previous equations, find the focus, directrix, and length of latus rectum. Be sure to add them to your graphs as well.” (Bloom: Application)
a. Allow the students a few minutes to work, walking around to assist in any way that you can. Give them a maximum of 5 minutes to complete this activity. (Gardener: Intrapersonal)
   i. While they are working, continue checking their Self-Awareness Check Tables
b. Add the pieces to your graphs that you have on the board.
c. Ask the students to assist you by asking them what the point was for their focus, the equation of the line for their directrix and the length of the latus rectum.

21. Cover two more examples with the class. (See the notes)
22. Ask the students if they would like to go through another example of any type (standard form, non-standard form, creating an equation), if some of them do then break into groups to allow the students who feel like they understand the material to go ahead and begin on the homework assignment. They may work with a partner. (Gardner: Interpersonal/Intrapersonal)
23. Assign: pp. 424-25 #12,13,18,21,25,39,44

Closure:
“Your assignment will be due at the beginning of class tomorrow. We will look at the second type of conic sections: circles. In order to work with this lesson in a more hands-on way I would like you each to bring in a small object that has a circular shape tomorrow. We will use the objects to find the equation of a circle based upon where you decide to graph the object on a piece of graph paper.”

Adaptations/Enrichment for Students with ADD/ADHD:
1. Have student collect the papers for you and place them on your desk and erase the board from the previous class if needed.
2. While taking notes for the story allow the student to doodle pictures that may help them remember things. If you see anything that you think would help the entire class, ask if they would share it (make sure you do not ask them in front of the class).
3. Instead of asking the students and drawing the pieces yourself, have students come up to the board or computer to draw the graph, axis of symmetry, directrix, focus, and latus rectum.
4. When students can begin working in groups, have a student that will help the student with ADD/ADHD remain on task and keep focused.

Self-Reflection:
- Were the students engaged in the lesson?
- Did my adaptations help engage my student(s) with ADD/ADHD?
- Do I need to shorten or lengthen the lesson?
- How did the students do on the homework?
- Is there another way I could explain parabolic functions to help the students understand more information?
Lesson Plan by Kelli Jordan

Lesson: Circles (4)  Length 50 min  Age or Grade Intended Alg. 2

Academic Standard(s):

A2.4.1-Write the equations of conic sections (circle, ellipse, parabola, and hyperbola).

A2.4.2-Graph conic sections

Performance Objectives:

Given a circle students will develop an equation for the particular circle 100% correctly.

Assessment:

The students will have a circular object that they will trace onto graph paper. They will then develop an x and y axis on the paper that will be used to develop an equation for a circle. In order to do so students will choose the coordinate closest to the circle’s edge that will accurately determine the radius and diameter of the circle. If the arc comes between two lines then they will either choose the line they wish or they will use a half at the end (for example: if it is between 1 and 2 on the x-axis they could use either 1 or 2, or say the x-coordinate is 1.5). In their write-up of the equation they must state what points they chose to use.

Advanced Preparation by Teacher:

16. Gather extra circular objects for students to use, be sure to write initials or name on them and to have a variety.
17. Prepare PowerPoint
18. Prepare notes
19. Have graph paper out and available

Procedure:

Introduction/Motivation:

"Yesterday you looked at parabolas and were to complete a homework assignment over them. Will someone please go to the board and do problem 18 from the homework last night?" Allow the student to work on the problem with the help of the class. Make sure no one feels put on the spot or that anyone laughs at him/her for the work he/she does on the board. "Would you please pass the assignments forward now? Today we will look at another type of conic section that occurs when a plane goes through a cone parallel to the top and bottom. This is known as a circle."

Step-by-Step Plan:

1. Have students take out a sheet of paper for notes.
2. Go through the “Circles” PowerPoint with the class. (Gardener: Visual/Spatial and Verbal/Linguistic)
   a. Any bold blue words should be deleted for the student handout and students should fill these words into their own handouts. Before sharing with them the correct answer,
have them try to guess what the blanks should be. The PowerPoint will allow each one to come up individually. (Bloom: Knowledge)
b. Questions for each slide
   i. Slide 1
      1. “Start by graphing the center. Then use the radius to count four above, to the left, below, and to the right of the center.”
      2. Graph the circle while going through these steps.
      3. “What do you believe the equation for this circle should be?” (Bloom: Comprehension)
      4. The equation should be: \((x+2)^2+(y-3)^2=16\)
   ii. Slide 2
      1. “How would you go about finding the center and radius of this circle?” (Bloom: Application)
      2. “Start by finding the midpoint. This will give us the what?” Answer: center
      3. See Teacher Notes of PowerPoint for the work on this problem.
      4. “Now we find the radius using the distance formula.”
      5. “Will someone please come up and graph this equation for me?”
   iii. Slide 3
      1. “Given the information, how would you find the radius of the circle?”
         Answer: distance formula
      2. “Using the distance formula what is the radius of the circle?”
      3. “What is the equation of this particular circle?”
   iv. Slide 4
      1. “What is the radius of this equation?”
      2. “Will someone please come up and graph this equation for me?”
   v. Slide 5
      1. “What is the center and radius of this equation?”
      2. If a student answers that problem correctly ask them how they arrived at their answer. If no one answers the question ask them: “How would we change the equation to the standard form of a circle so that we would be able to find the center and radius?” Answer: Completing the Square
      3. “Would someone please come to the board and show the work for completing the square?”
      3. “Please get out your circular objects now. If you do not have one I would like for you to go and grab one off of the (wherever objects are located) or share one with a neighbor.”
      4. “On a sheet of graph paper I would like you to label the x and y axis. Then lay your circle down onto the graph paper. Do not center the object at the origin. Trace your object onto the graph paper and choose two of the closest points to the line to then determine the center and radius using the distance and midpoint formulas. After you have finished this I would like you to write an equation for your graph.” (Gardener: Intrapersonal and Logical/Mathematical and possibly Naturalist depending on what students chose to bring in) (Bloom: Application and Synthesis)
      5. After completing the assignment have students answer the following question: “How would you explain to someone the steps you went through to complete the assignment?” (Bloom: Evaluation)
Closure:

“Today we learned how to graph circles in the coordinate plane. Tomorrow we will look at ellipses which have more of an oval shape. We will also begin looking at foci, directrix, major axes, and minor axes.”

Adaptations/Enrichment for Students with Learning Disorders:

- I will place students with learning disabilities closer to the front and near students who will be able to help them focus their attention.
- I will make sure these students receive a copy of my notes that are neatly organized after the lesson although they will be expected to keep some notes during the lesson.
- I believe that the constant questioning of my students in the lesson will already engage the students. I will also call on students with LD as well as others to help rephrase information in a way that may help another student better understand. A student with an LD may also be called upon to do the work on the PowerPoint or on the board.
- The review at the beginning of the period of the homework problem will help the students review the material we learned the day before. This is good for students with LD because they get a reminder and continue to improve upon previous topics.

Self-Reflection:

- Were the students engaged in the lesson?
- Did my adaptations help engage my student(s) with gifts and talents in math?
- Do I need to shorten or lengthen the lesson?
- How did the students do on the homework?
- How did the in class activity work out for the students?
Lesson: Ellipses (5) Length 50 min. Age or Grade Intended Alg. 2

Academic Standard(s):
A2.4.1-Write the equations of conic sections (circle, ellipse, parabola, and hyperbola).
A2.4.2-Graph conic sections

Performance Objectives:
- Using prior knowledge and the Math Self-Awareness charts, students will correctly graph an ellipse and identify the foci, semi-major axis, semi-minor axis, and center correctly.
- Given an exit slip, students will use prior knowledge and what they learned today to develop an equation for an ellipse with the center, and 2 points marked on the ellipse correctly.

Assessment:
Students will be given an exit slip of an equation that represents an ellipse which they are to graph and determine the foci, semi-major axis, semi-minor axis, and center. Another problem on the same slip will have a graph that has already been drawn with a point marked on the x and y axes along with the center. The students will then need to develop an equation for the ellipse.

Advanced Preparation by Teacher:
20. Purchase funnel cups
21. Prepare lecture notes
22. Prepare pictures of ellipses in the real world

Procedure:
Introduction/Motivation:
“Yesterday we talked about circles. I would like you all to take out a piece of paper and graph the following function: $x^2+y^2=25$.”
Write the function on the board for students to refer back to it. Have them then exchange papers and check each other. The graph should be a circle centered at the origin going through the points (5, 0), (0, 5), (-5, 0), (0,-5).
Today we are going to look at another type of conic section but we are going to do an activity first.
Step-by-Step Plan:
6. Begin with the activity (Gardener: Bodily Kinesthetic)
   a. Pass out funnel shaped cups to all of the students
   b. Allow them to go out and fill the cup up with water (the cups should not be filled to high)
   c. Have the students tip the cup slightly sideways and explain what they see (Bloom: Comprehension)
i. they should do this step and tilt the cup a variety of ways while being careful as to not spill any water
d. They should observe an oval type shape within the cup
7. “Today we are going to talk about the type of conic section that is formed when a plane is slightly skewed and only intersects one portion of the conic, known as an ellipse. Visually it looks like an oval as you saw in your cup. Can anyone else think of places you see ellipses in the real world?” (Bloom: Knowledge)
8. Show students pictures of ellipses from the PowerPoint Ellipses in Real Life (Gardener: Visual/Spatial)
   a. Again ask students “Where else can you see an ellipse?” (Bloom: Knowledge)
9. Lecture/Interaction (Notes also have most of the details) This should be done using a computer where you can write on a blank page or the chalkboard (Gardner: Verbal/Linguistic & Logical/Mathematical)
   a. Equation 1: \( \frac{x^2}{9} + \frac{y^2}{16} = 1 \)
      i. Ask students where the center should be
         1. center is at (0,0)
      ii. Ask students if they can find a few points for this graph
      iii. Graph the function using \( x=0 \) and \( y=0 \) to find 4 points
      iv. Ask them to pull-out their Math Self-Awareness Check Tables
      v. “What is the semi-major and semi-minor axis?”
      vi. semi-major axis is 4 (should be vertically oblong)
      vii. semi-minor axis is 3 (horizontal distance from center to point on the axis)
      viii. “Our ‘a’ will always be the larger or semi-major axis for our equations and ‘b’ is always equal to the semi minor axis. We know that the focus is a distance ‘c’ from the center. We also know that the distance from b to c is a. Thus we have a triangle with these 3 sides.”
      ix. What is the value of a? (Bloom: Knowledge) Answer: 4
      x. What is the value of b? (Bloom: Knowledge) Answer: 3
      xi. How can we find c, using what we have drawn and know? Answer: Pythagorean Theorem
      xii. \( c^2 = a^2 - b^2 \) or \( c^2 = 16 - 9 = 7 \) or \( c = \pm \sqrt{7} \)
      xiii. Do you think we can use this same formula in all cases? (Bloom: Analysis)
b. “Let’s try another problem.”
c. Equation 2: \( \frac{x^2}{25} + \frac{y^2}{9} = 1 \)
   i. “What is the center?” Answer: (0,0) or origin
   ii. What is the semi-major axis? Answer: 5
   iii. What is the semi-minor axis? Answer: 3
   iv. Try to graph the ellipse with only these 3 items.
   v. Graph the function for the class
   vi. “We know the focus is c units from the center therefore we can choose a random point that we think might be our c. Do we get the same diagram as we did last time?” Should say yes except it is flipped so that c is along the x-axis
   vii. “Can we use the same method we did last time?” (Pythagorean Theorem: yes)
   viii. \( c^2 = a^2 - b^2 \) or \( c^2 = 25 - 9 = 16 \) or \( c = \pm 4 \)
d. “Do you think this will hold for all ellipses? Why?” (Bloom: Analysis)
e. “Although we do not have a formal proof we do consider this to hold for all ellipses thus to find the foci you take \( c^2 = a^2 - b^2 \) where a is always greater than b.”
f. Equation 3: \( 4(x-5)^2 + 9(y-3)^2 = 36 \)
   i. “What should we do first?” (Bloom: Evaluation) Answer: Divide both sides by 36 to put the equation in standard form
ii. “Using your prior knowledge from circles, where is the center of the ellipse?” (Bloom: Application)
   1. Ask students for varying answers. You want a variety of answers if possible. Once you have 3 to 4 different answers with one being (5, 3) tell the students one of the answers is correct. If possible eliminate one or two so that 2 to 3 are left. Have students then vote on which one they believe is the correct answer. Make sure everyone votes!

iii. Do the same for the semi-major axis, semi-minor axis, and distance of foci from the center of the ellipse.

iv. Answers: semi-major – 3, semi-minor – 2, foci distance - ±√5 on x-axis

   g. “Here’s an equation not in standard form.”
   h. Equation 4: 2x^2+4x+y^2+6y=12 *This equation will not be graphed
      i. “How would re-write this equation to put it into standard form?” Answer: Completing the Square
      ii. see notes for the work
      iii. final equation should be 2(x+1)^2/23+(y+3)^2/23=1
      iv. “What is the center, distance of the foci to the center, semi-major axis, and semi-minor axis?”
      v. Answer: center – (-2, 3), foci distance along y-axis - ±√(23/2), semi-major axis - √23, semi-minor axis - √(23/2)

i. Start with a graph with 3 distinct, clearly marked points at (2,-2); (0,-2); (2,5)
   i. The center should be at (2,-2)
   ii. Have students develop an equation from these 3 points and find the foci distance
   iii. Equation: (x-2)^2/4+(y+2)^2/49=1
   iv. foci distance ±√45

10. Have students do the following problems as practice if time allows: pg 438-9 #17 &29 (answers are in the back of the textbook)

11. Have students take the short end of period quiz/exit slip

12. Assign problems on pg 438-9 #16,19,24,26,33,35,37
   a. If there is extra time and everyone has finished the exit slip students may work in small groups of 2-3 on the homework assignment (Bloom: Interpersonal)

Closure:

“Today we looked at conic sections that apply to architectures, jewelers, and landscapers, and astronomers to name a few. Tomorrow we will look at our last conic section which applies to low frequency radio transmitters, terrestrial navigation system, and radar tracking stations. There will be an interactive online activity as well tomorrow.”

Adaptations/Enrichment for Students with Gifts and Talents in Math:

Students with gifts and talents in math will be given a self instructed assignment that discusses conic sections in a different type of coordinate system known as the polar coordinate system. They will look at the same types of conic sections just in a different way, learning how to graph them and find the eccentricity, focus, and directrix. They will also have to determine what type of conic section is given by an equation. At some point in the year they will have already learned about polar coordinates and parametric equations.

If needed, however, a lesson can be included at this point in time that covers those as well. Before students will be allowed to work in the polar coordinate system they will pass the test that will be
given to the rest of the class at the end of the chapter with an 85% or higher. Included with this lesson are two attached sections that could potentially be given to students about conic sections in polar coordinates. These students will receive help from the teacher when the class has free time and before or after school.

**Self-Reflection:**

- Were the students engaged in the lesson?
- Did my adaptations help engage my student(s)?
- Do I need to shorten or lengthen the lesson?
- How did the students do on the homework?
- How did the in class activity work out for the students?
- Should the activity be taken out?
- How did the students do on the exit slip?
- Do I need to spend more time on this section?
EXIT SLIP

1. Equation: \( \frac{(x+11)^2}{144} + \frac{(y-3)^2}{25} = 1 \)
   Center:
   Semi-Major Axis:
   Semi-Minor Axis:
   Foci Distance:
   Points of Foci:

2. Develop an equation from the following graph
   Center:
   Semi-Major Axis:
   Semi-Minor Axis:
   Foci Distance:
   Points of Foci:
   Final Equation:
MANCHESTER COLLEGE  
Department of Education

LESSON PLAN by Kelli Jordan

Lesson: Hyperbolas (6) Length 100 min. Age or Grade Intended Alg. 2

Academic Standard(s):

A2.4.1-Write the equations of conic sections (circle, ellipse, parabola, and hyperbola).

A2.4.2-Graph conic sections

Performance Objectives:

• Given 6 homework problems, students will find the foci, length of transverse axis, length of conjugate axis, asymptotes, and vertices and graph the equation 5 out of 6 times correctly.
• Given 4 homework problems students will construct a hyperbolic equation 3 out of 4 times correctly.

Assessment:
The homework assigned at the end of day 2 will be the assessment for the two days. The assignment contains 6 problems having to do with the graphing, 4 problems having to do with writing equations, and 2 story problems.

Advanced Preparation by Teacher:
23. Review the website and make sure an account is available
24. Create copies of the instructions if necessary
25. Write the RAFT information on the board
26. Prepare notes for day 2
27. Prepare answer key for day 2

Procedure:

Introduction/Motivation:
“To begin today’s class I would like for you to all take out a piece of paper and answer the following writing prompt: Choose one of the following types of conic sections: parabola, circle, or ellipse and write out the explanation you would give to a middle school student on how the particular conic section you set-up is used in graphing. The information using RAFT is written on the board for you to look at. For those of you who have not used RAFT before it stands for Role, Audience, Format, Topic. Your role in this paragraph is an Algebra II student who is writing to middle school students in 1 to 2 paragraphs about a certain type of conic section. You may use your Math Self-Awareness Check to help you if necessary. These will be worth 10 points.”
On the board should be RAFT written vertically with Role: Algebra II student, Audience: middle school students, Format: 1-2 paragraphs, Topic: explanation of a type of conic section for how to graph and identify.
Step-by-Step Plan:
DAY 1: ***Note: There must be an account on the Explore eLearning website before this lesson can be done.

1. Writing to learn activity – approximately 10-15 minutes (Gardener: Verbal/Linguistic) (Bloom: Application)
2. “I will review your prompts and get them back to you within the next couple of days.”
3. “Now, please grab a pencil or pen and a piece of paper. Put everything else underneath your desk.” Wait for students to finish the task. “We are going to now go down to the lab and begin working with our last type of conic sections, hyperbolas. You will have approximately 20-25 minutes to work. We will then come back to the classroom and discuss what you found.”
4. Have students log onto the network and open the web browser. They should then proceed to the following 2 links:
   a. Instructions
   b. Gizmo
5. “On the second web site, the site with the Gizmo, please log in using the link in the very top-right corner of the page that says ‘Login’”
6. “Once you have clicked that button, select the option that says ‘I am a student, and I have a class code, Enroll in a Class’”
   a. Class Code: XXXXX (whatever the code is)
7. [Check to make sure everyone has found both sites and are logged in]
8. “Now that everybody is logged in and ready to go, take out a sheet of paper and answer all of the questions that are asked of you. Answer them as best as you can and as completely as you can. Take the next 20 minutes or so to do this. When everybody is done, we will discuss answers as a class.” (Bloom: Knowledge, Comprehension) (Gardener: Bodily/Kinesthetic, Visual/Spatial, Logical/Mathematical)
9. After 20-25 minutes, have the students log off of the computers and return to the classroom. There should be 10 minutes at least for a short class discussion.
10. “Let’s go ahead and discuss each of the questions”
   a. Go through questions one at a time, encouraging participation from all students
   b. Be sure to make sure all relevant themes are pointed out
11. When there are about 5 minutes left in class ask the students, “Did you feel that this activity was engaging and enjoyable? Why or why not?” (Bloom: Evaluation)

DAY 2: *This will not be used on a day with a substitute. Another lesson will be provided if necessary.

1. “Yesterday you looked at hyperbolas on the computer. Can anyone remind the rest of the class what we talked about and saw?” Have a few students answer this question.
2. “Let’s now make a know/need to know chart of what you guys still need to learn about hyperbolas in order to get a better understanding of what you feel like we need to cover today.” (Bloom: Evaluation)
3. Cover those items students still feel like they need to understand.
4. Go over two problems with the class.
   a. Equation 1: \( \frac{x^2}{16} - \frac{y^2}{9} = 1 \)
   b. Find the foci, vertices, direction of transverse axis, length of transverse and conjugate axis, and equations of asymptotes
      i. Foci: (5, 0) and (-5,0)
      ii. Vertices: (-4,0) and (4,0)
iii. Direction of transverse axis: horizontal
iv. Length of transverse axis: 8 units
v. Length of conjugate axis: 6 units
vi. Equations of asymptotes: \( y = \pm \frac{3}{4}x \)
c. Graph the equation using the above information
d. Equation 2: \( 2x^2 - y^2 - 8x + 6y = 12 \)
   i. See notes for work on the problem
   ii. Foci: \( (2, 3 - \sqrt{33}/2) \) & \( (2, 3 + \sqrt{33}/2) \)
   iii. Vertices: \( (2,3 - \sqrt{11}) \) and \( (2,3 + \sqrt{11}) \)
   iv. Direction of transverse axis: vertical
   v. Length of transverse axis: \( 2\sqrt{11} \) units
   vi. Length of conjugate axis: \( 2\sqrt{11/2} \) units
   vii. Equations of asymptotes: \( y - 3 = \pm \sqrt{2}(x - 2) \)

5. Students will then be given time in class to work on the homework assignment that is due the following day. They may work in groups of 2-3 but if anyone is off task they will be asked to work alone. Students may work alone if preferred. (Gardener: Interpersonal/Intrapersonal)

6. Assignment: pp. 445-7 #6, 9, 11, 12, 17, 19, 23, 26, 31, 34, 37, 39

7. During work time walk around the room to check on students to see how they are doing on the homework and answer questions when necessary.

Closure:

“What were we able to mark off of your need to know list today? Do you believe you understand enough that you can complete your homework with only minor errors? Is there anything else we should cover tomorrow that you are not completely sure about?” (Bloom: Analysis)

“Today we looked at our last type of conic section and tomorrow we will begin looking at equations were they look similar to one another. We will learn how to look at an equation and determine what type of conic section it is as well.”

Adaptations/Enrichment for Students with Behavior Disorders:

- If there is a student with a behavior disorder in my classroom I will pre-arrange signals for the student to let me know when he/she needs to leave the room and help the rest of the class understand behavior disorders.
- If necessary, during the group work time allow a student with an emotional disorder to work in a corner away from students on his/her own.
- If necessary I will shorten the assignment for the student with ED to only 3 of the first set of problems and 4 of the second while leaving the 2 story problems.
- The activity for day 1 involves technology which is said to be a good resource for students with ED, thus I have already implemented one strategy for the classroom.
- While teaching and asking students questions. Be positive in my comments to the students. Do not just tell the student they are wrong.

Self-Reflection:

- Were the students engaged in the lesson?
- Did my adaptations help engage my student(s) with ED?
- Do I need to shorten or lengthen the lesson?
- How did the students do on the homework?
- How did the in class activity work out for the students?
- How did the students do on the writing to learn activity?
MANCHESTER COLLEGE
Department of Education

LESSON PLAN by Kelli Jordan

Lesson: Conic Sections (7) Length 50 min. Age or Grade Intended Alg. 2

Academic Standard(s):

A2.4.1-Write the equations of conic sections (circle, ellipse, parabola, and hyperbola).

A2.4.2-Graph conic sections

Performance Objectives:

- Given five equations written in standard form, students will identify the type of conic section 4 out of 5 times correctly.
- Given five equations written in standard form, students will rewrite the equation to match the correct conic 4 out of 5 times correctly.
- Given five equations written in standard form, students will rewrite the equation to graph the conics 4 out of 5 times correctly.

Assessment:

Students will work on their own to determine the type of conic section from five equations written in standard form and then re-write the equations to graph them in the xy-plane.

Advanced Preparation by Teacher:

28. Notes for lecture
29. Write-out assessment
30. Complete the key for the assessment
31. Make copies of assessment

Procedure:

Introduction/Motivation:

“Yesterday you learned the last type of conic section. What was the name of the conic? What are the other three conic sections called? Please take a moment to write down the standard form of the equation for each type of conic section. Remember that some of two forms of the equation. Please do not use your books or notes for this activity. When you are finished, I will call on someone to tell me the equation for each one.” Write each of the equations on the board as students say them and ask the class to raise their hands if they agree with the equations once they have been written. “Can anyone think of some places where you might see these shapes in the real world?” (Bloom: Knowledge & Evaluation) *Note: equations are provided on the notes sheet.

“This today we are going to look at equations that are in standard form of a conic. This can be confusing because we consider the equations we have written on the board as standard form of a certain conic. What mathematicians to consider to be the standard form of a conic section is \(Ax^2+Bxy+Cy^2+Dx+Ey+F=0\). In order for this equation to be accurate for a conic section A, B, or C cannot be 0, one or two of the three may equal zero but never should all three equal 0.”

Step-by-Step Plan:
1. Lecture (Gardener: Logical/Mathematical and Verbal/Linguistic)
   a. “We can use our standard form to rewrite the equations in a form that will allow us to have the standard form of a particular conic.”
   b. “Let’s start with the following equation: \(x^2+2y^2+4x+8y-7=0\). Now, how do you believe we would go about solving this particular problem?” (Bloom: Comprehension) Answer: completing the square (CTS) two times
   c. Work through the steps to complete each square with the class. Ask students what they believe should be done first, second, and so forth until the equation is in the form of a particular conic section. Once it is in the form of a particular conic section ask the class what type of conic section they believe it is? (Bloom: Comprehension) Do these same steps with the next three equations as well, be sure to have various students answer the questions, take polls on which is correct and have students raise their hands if they agree. Let the students try the third equation on their own.
   *Note: the work for each equation is provided on the notes paper
   i. Equations
      1. \(x^2+y^2-6x-12y-4=0\)
      2. \(y^2+x^2+2y-13=0\)
      3. \(y^2-3x^2+2y+12x-20=0\)
   d. Following each equation also ask the students the following questions
      i. \(x^2+2y^2+4x+8y-7=0\)
         1. “What type of conic section does this equation form?”
         2. “What is the coordinate of the center?”
         3. “What is the direction of the major axis?”
         4. “What are the points of the foci?”
         5. “What is the length of the semi-major axis?”
         6. “What is the length of the semi-minor axis?”
      ii. \(x^2+y^2-6x-12y-4=0\)
         1. “What type of conic section does this equation form?”
         2. “What is the coordinate of the center?”
         3. “What is the radius?”
         4. “What is one other point on the circle?”
      iii. \(y^2+x+2y-13=0\)
         1. “What type of conic section does this equation form?”
         2. “What is the coordinate of the vertex?”
         3. “What is the coordinate of the focus?”
         4. “What is the equation for the directrix?”
         5. “What is the equation for the axis of symmetry?”
         6. “Which way does the parabola open?”
      iv. \(y^2-3x^2+2y+12x-20=0\)
         1. “What type of conic section does this equation form?”
         2. “What is the coordinate of the center?”
         3. “What are the points of the vertices?”
         4. “What is the direction of the transverse axis?”
         5. “What are the coordinates of the foci?”
         6. “What is the length of the transverse axis? Conjugate axis?”
         7. “What are the equations for the asymptotes?”
   e. “From these three equations can anyone notice a quick to determine the type of conic section from a standard equation?” (Bloom: Analysis)
      i. Parabola will have \(A\) or \(C\) equal to zero
      ii. Circle will have \(A=C\)
      iii. \(A\) and \(C\) have the same sign and \(A\neq C\)
iv. Hyperbola A and C have opposite signs

f. Practice (Gardener: Interpersonal)
   i. *If students were able to mostly do the fourth problem on their own you may only do one of these; otherwise, you may want to do two or three.
   ii. “You will now have a chance to practice a few problems in pairs. You will need to identify the conic section first and then rewrite the equation into the standard form of the particular conic and graph the equation. Quickly pair up now. Are there any questions before we begin?” *See notes for solutions
   iii. “Here is your first equation.” Choose one from the list below. “Let’s decide what type of conic section it is before you rewrite the equation.”

   iv. \[ x^2+6x+y^2-6y+9=0 \]
      1. Circle
   v. \[ 9x^2-36x+36=4y^2+24y+72 \]
      1. Hyperbola
   vi. \[ 9x^2-18x+16y^2+160y=-265 \]
      1. Ellipse

   g. Assessment (Gardener: Intrapersonal)
   i. “Alright now you will each be given five equations to complete the same task. State the type of conic section and how you know it is that type then rewrite the equation so that you will be able to graph the conic.”
   ii. Pass out the assessment sheet to the students. They should be working individually on the assignment.

Closure:
“Today we looked at conic sections in standard form. What type of conic do we have given the equation \[ 4x^2-y^2=4? \]” Answer: Hyperbola. “Tomorrow we will look at solving quadratic solutions where given a conic and a line we check to see if they cross at any points.”

Adaptations/Enrichment for Students with Autism:
- On the section with notes, I would provide a student with autism a set of neat organized notes that would help them understand the concepts. Although during note taking I would expect them to pay attention and take a few notes of their own.
- I would seat any students with autism away from peers who may have a tendency of irritating them or causing outbursts and next to students who would be able to help.
- I will have patience with these students as they may not understand the material the first time. I would provide extra hours of study before and after school that I would ask these students to attend for additional help and explanation.
- I would work to keep posters at the back and sides of the room and try to keep the noise level of the other students down as this will help with minimizing sensory overload.
- If necessary, I would also change the directions of the assessment so that students with autism understood the directions more clearly and had less to complete.

Self-Reflection:
- Were the students engaged in the lesson?
- Did my adaptations help engage my student(s) with autism?
- Do I need to shorten or lengthen the lesson?
- How did the students do on the assessment?
- How did the practice work out for the students?
Conic Sections

Directions: For each standard equation identify the type of conic and state how you know this. Then rewrite the conic section in the appropriate form and graph it on the attached piece of graph paper labeling each problem separately. Be sure to include where the center, vertex, focus/foci, and directrix are located when necessary. State the radius, semi-major axis, semi-minor axis, length of conjugate axis, length of transverse axis, and equation of asymptotes in the correct circumstances.

1. \( x^2 + 4x + 2y^2 + 16y + 32 = 0 \)

Type of Conic ________________

2. \( x^2 + 10x + 5 = 4y^2 + 16y \)

Type of Conic ________________
3. \( x^2 + 4x + y^2 - 8y = 2 \)

Type of Conic__________________

4. \( 3x^2 + y = 12x - 17 \)

Type of Conic__________________

5. \( \frac{(y-5)^2}{4} - (x+1)^2 = 4 \)

Type of Conic__________________
Lesson Plan by Kelli Jordan

Lesson: Solving Quadratic Systems (8)  
Length 50 min  
Age or Grade Intended: Alg. 2

Academic Standard(s):

A2.3.7-Solve pairs of equations, one quadratic and one linear, or both quadratic.

Performance Objectives:

- Given 11 problems, students will find solutions for the systems 9 out of 11 times correctly.

Assessment:

The homework assignment assigned to the students will assess their ability to find solutions to systems of quadratic equations. There are two problems where there are inequalities and nine problems with two equations where they must solve the system using substitution or elimination.

Advanced Preparation by Teacher:

32. Lecture notes  
33. Reserving computer lab  
34. Answer key to the homework problems  
35. Write the questions for the exit slip/journal on the board for the students to easily see and refer to

Procedure:

Introduction/Motivation:

“Yesterday we looked at conic sections in standard form. What type of conic section is formed by the equation $x^2+y^2=10x+2y+23$?” (Bloom: Analysis) Answer: Circle “Today we will look at solving quadratic systems. This means that we will be given two different equations and be asked to find if the equations have solutions, how many solutions, and what the solutions are.”

Step-by-Step Plan:

1. “Please grab a pencil and piece of paper so that we may move to the computer lab.”
   a. Make sure students travel together and no one is lagging behind or very far in the front.
2. Once in the computer lab begin the self-study session with the students.
3. “Please pair up with the person next to you and go to the following website: http://www.mathwarehouse.com/system-of-equations/how-to-solve-linear-quadratic-system.php. I would like you to use the website to learn about solving a system of equations with a linear and quadratic function. I encourage you to try to solve the systems on your own.” (Gardener: Visual/Spatial & Interpersonal)
4. Students should be given approximately 20 minutes to complete this portion of today’s lesson.
5. “Please log off of the computers. We will now return to the classroom.”
6. “How many solutions are possible when we have a system with a parabola and a line?” (Bloom: Comprehension)
7. “The same methods you used in solving a system of linear equations can be applied to solving systems of quadratic equations. What method was used for the parabola-linear system you saw on the computer?” Answer: Substitution (Bloom: Evaluation)
8. Lecture (Gardener: Verbal/Linguistic)
   a. “We will now go through another example together of a quadratic-quadratic system.”
   b. System: $x^2+y^2=13$ and $x^2-y^2=5$ *See notes for solution
      i. “What method would you use for solving this system of equations?” (Bloom: Analysis)
      ii. “Use elimination now to solve this system. What are your solutions?” (Bloom: Application)
   c. “The last example is one that you have seen before. We are going to graph conic sections as systems of inequalities. The system I would like you to graph is: $x^2/25+y^2/16\leq1$ and $y\leq x-2$. I will give you this time to do this on your own.”
   d. “Which equation would you like to graph first?” Graph the equation on the board See notes for picture.
      i. When graphing $x^2/25+y^2/16\leq1$ ask the students the following questions:
         1. What type of conic section is given? (Bloom: Analysis) Answer: Ellipse
         2. Where is the center? How do we know this is the center? (Bloom: Knowledge & Evaluation) Answer: (0,0) because there is no h or k value
         3. How do we proceed to graph this conic? (Bloom: Comprehension)
         4. Is the line dotted or solid? (Bloom: Comprehension) Answer: Solid
         5. Where do we shade for this graph? (Bloom: Comprehension) Answer: Inside the ellipse
      ii. The students should not need any prompting for the second equation but ask
         1. What is the slope? (Bloom: Knowledge) Answer: 1
         2. What is the y-intercept? (Bloom: Knowledge) Answer: (0, -2)
         3. Is the line dotted or solid? (Bloom: Comprehension) Answer: Solid
         4. Where do we shade for this line? (Bloom: Comprehension) Answer: Below
      iii. “Where do the conic sections have a solution?” (Bloom: Analysis) Answer below the line and inside the ellipse

9. “For homework tonight I would like you to do the following problems on pages 458-59 12-27 multiples of 3, 33, 35, 52, 59, 64.”

10. Writing to Learn Strategy-Exit Slip/Journal (Bloom: Intrapersonal)
    a. “For our final activity today I would like you to take 5 minutes to respond to the following questions:
       i. How comfortable do you feel with the graphing conic equations and finding the various parts associated with each type of conic? Why? (Bloom: Evaluation)
       ii. Discuss the level of comfort you have with equations in standard form and determining what type of conic section it is without rewriting the equation. (Bloom: Synthesis)
       iii. How did you feel about the activities we did throughout this chapter? Provide examples and details. (Bloom: Evaluation)
       iv. Is there anything you believe could be improved? How and why? (Bloom: Evaluation)
       v. What are ideas you have to make this section more appealing? (Bloom: Synthesis)
    b. “Try to provide detail and use complete sentences in your writing.”
Closure:

“Today we discussed our last section in our unit: systems of quadratic equations. What are the numbers of solutions you could have in a system?” None, One, Two, Three, Four, Infinitely many
“Tomorrow we will review for the exam over our chapter. You will be provided with a graphic organizer and a review guide for assistance.”

Adaptations/Enrichment for Students with Mental Retardation:

- Students with a mental disability would be required to work with a partner during the computer activity to gain more experience with social interactions and interpersonal relationships. At the same time, however, I would ensure the student was working with someone that would not be rude to him/her.
- I would create a diagram representing with multiple pictures that would represent what the student would be doing that particular day.
- After the group activity I would have the student with mental disabilities go to www.coolmath4kids.com and play the lemonade stand game. This game will teach the student about economics and learning how to satisfy customers while still trying to make a prophet.
- If necessary I would have the student move to the resource room or to a quieter part of the room to work on his/her assignment for the day. When students had free time I would be sure to work one-on-one with this student.

Self-Reflection:

- Were the students engaged in the lesson?
- Did my adaptations help engage my student(s) with ED?
- Do I need to shorten or lengthen the lesson?
- How did the students do on the homework?
- How did the in class activity work out for the students?
- How did the students do on the writing to learn activity?
Lemonade Stand

Directions: Go to http://www.coolmath-games.com/lemonade/index.html and play the game. While playing the game answer the following questions.

1. What was your method for selling lemonade? How much did you charge? How many lemons did you use? How much sugar? How many ice cubes?

______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________

2. How did the weather impact the amount of customers you had each day?

______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________

3. What did you like about the activity? What did you not like?

______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________
MANCHESTER COLLEGE
Department of Education

LESSON PLAN by Kelli Jordan

Lesson: Review Session (9)  Length 50 min.  Age or Grade Intended Alg. 2

Academic Standard(s):

A2.4.1-Write the equations of conic sections (circle, ellipse, parabola, and hyperbola).

A2.4.2-Graph conic sections

Performance Objectives:

• Given a chapter assessment, students will obtain a score of at least 80%.

Assessment:

The assessment will be given the following day. It will have 2 multiple choice questions, 3 true or false, and 7 short answer problems. The multiple choice problems and true false are each worth 2 points apiece with the short answer being worth 5 to 10 points each. The exam is then worth a total of 70 points and covers all of the material that was discussed within the chapter.

Advanced Preparation by Teacher:

36. Create graphic organizer

Procedure:

Introduction/Motivation:

“Yesterday we went over our last section in this chapter. If you would please get out your homework assignment I would like for you to compare your answers with a partner right now.” (Gardener: Interpersonal and Mathematical/Logical) After students have had time to go over problems have each pair group with another pair. The students should again compare problems. “Are there any problems that you would like to see worked out?” If there are problems have one of the students go to the board and work on the problem. Have students help each other through the problems until the correct solution has been found.

Step-by-Step Plan:

8. “Tomorrow we will have a test over the chapter. There will be two multiple choice questions, three true or false where you must correct the statement if it is false, and 7 problems for you to work out. All of the problems are like ones you have done before. You will have to identify conics, graph them and find the various points and lines that correspond to the conics. You will also need to know how to write an equation for the conics given a point or other information. Finally, you will need to be able to solve systems of quadratic equations.”

9. “For your first task today, you will get into four different groups. You may choose your groups just make sure that they are even. I will assign each group a conic section and you will need to
develop a song that focuses on the important pieces to the conic. For example, with the parabola you would want to include something about the vertex, focus, and directrix. You could also include other pieces as well. You will have 6 minutes to develop your song and I will walk around to see how everyone is doing. Everyone will participate in the activity in front of the class.” (Gardener: Musical)

10. After each group presents their songs to the class pass out the graphic organizer. “You will now work on making a graphic organizer to help you remember each conic section. Each circle in the concept map should have a different topic. What do you believe would go in the first set of circles that I have provided to you?” (Bloom: Comprehension) Answer: Each type of conic section. “I would also like you to include a description of how we define conic sections geometrically. I will now give you time to individually work on this assignment. Be sure to include what you feel is important for each conic section, that may be a description for them or formulas.” (Gardener: Intrapersonal and Visual/Spatial) (Bloom: Analysis and Synthesis)

*This fits both analysis and synthesis of Bloom because students must analyze the information they have been given to determine what they feel is most important. Then they have to put everything together on the concept map. Students should have 15 minutes to work on this part of the assignment.

11. “We will now draw a concept map on the board. I would like each one of you to go to the board and write one thing on the concept map. After everyone has written something once we will go over what has been written and see if there is anything else you feel that should be added.”

12. After you have finished going over the concept map with the class and adding any additional pieces have students get out their Math Self-Awareness Check sheet.

13. “I would like for you all to get out your Math Self-Awareness Check sheets that we created at the beginning of our unit. Please re-evaluate your knowledge over each vocabulary term you have written down.” (Bloom: Evaluation) (Gardener: Verbal/Linguistic)

**Closure:**

“Today we have spent some time reviewing the major concepts with conic sections. Is there any particular type of problem you would like to go over?” If students say yes review a problem similar from the book. “To review for your test tomorrow look over homework assignments and notes from this chapter as well as activities and worksheets we have done. There is a review at the end of the chapter in your book. As I have mentioned you will need to be able to identify conic sections, write equations, recognize which equations belong with which conic sections, recognize the forms if it is in a standard equation format, that is \( Ax^2+Bxy+Cy^2+Dx+Ey+F=0 \), and be able to solve systems of quadratic equations. I will be available after school today and before school tomorrow to answer any questions you may have.”

**Adaptations/Enrichment for Students with Visual or Hearing Impairment:**

- For a student with a visual impairment, I would provide them with a larger concept map or a piece of paper for each type of conic section so that he or she can make things as large as they need.
- For a student with a hearing impairment I will make sure I face him or her when I am speaking so that he or she is able to see my lips moving when I speak.
For a student with a hearing impairment I would also include written instructions for each part of the lesson. These can easily be copied and pasted from the lesson plan into another document.

For a student with a visual impairment I will be sure to say what has been written on the board when we work on the concept map as a class.

Self-Reflection:

- Were the students engaged in the lesson?
- Did my adaptations help engage my student(s) with ED?
- Do I need to shorten or lengthen the lesson?
- How did the students do on the homework?
- How did the in class activity work out for the students?
- How did the students do on the writing to learn activity?
Conic Sections
CONIC SECTION ASSESSMENT

Directions: Please put your name at the top of each page this is worth 2 points. Answer each question to the best of your abilities and follow the directions provided with each problem or set of problems. Note that the point values are indicated in parentheses.

Multiple Choice (2 pts each): For problems 1-2 choose the best answer.

_______1. Choose the best answer: Which of the following denotes the formula for the midpoint?
   a. \( \left( \frac{x_1+x_2}{2}, \frac{y_1+y_2}{2} \right) \)
   b. \( \sqrt{\left( (x_2 - x_1)^2 + (y_2 - y_1)^2 \right)} \)
   c. \( \left( \frac{x_1-x_2}{2}, \frac{y_1-y_2}{2} \right) \)
   d. \( \sqrt{\left( (x_2 + x_1)^2 + (y_2 + y_1)^2 \right)} \)

_______2. What is the maximum number of solutions you could have with a system of quadratic equations?
   a. 3
   b. 4
   c. 5
   d. 6

True or False (2 pts each): For problems 2-3 determine whether the statement is true or false. If the answer is false state what would make it correct.

_______3. True or false: The equation form of a parabola that opens up/down is: \( x=a(y-k)^2+h \).

_______4. True or false: In the equation \( Ax^2+Bxy+Cy^2+Dx+Ey+F=0 \), if \( A = C \) the conic formed is an ellipse.

_______5. True or false: In the equation \( Ax^2+Bxy+Cy^2+Dx+Ey+F=0 \), if \( A \) is negative and \( C \) is positive the conic formed is a hyperbola.
Short Answer
For each standard equation identify the type of conic and state how you know this. Then rewrite the conic section in the appropriate form and graph it on the attached piece of graph paper labeling each problem separately. Be sure to include where the center, vertex, focus/foci, and directrix are located when necessary. State the radius, semi-major axis, semi-minor axis, length of conjugate axis, length of transverse axis, and equation of asymptotes in the correct circumstances. (10 pts each)

6. $x^2+4x+2y^2+16y=0$

Type of Conic___________________

7. $x^2+10x+20=4y^2+16y$

Type of Conic___________________
8. \(x^2 + 6x + y^2 - 18y = 31\)

Type of Conic ____________________

9. \(3y^2 + x = 12y - 17\)

Type of Conic ____________________
10. (8) Given the following information, write an equation for the following conic sections:

a. Ellipse with endpoints of major axis at (2,2) and (2, -10) and endpoints of minor axis at (0,-4) and (4, -4).

b. Parabola with vertex at (5,-1) and focus at (3,-1).

c. Circle with center at (3, -7) and tangent to the y axis.

d. Hyperbola with vertices (-5, 0) and (5, 0) and conjugate axis of length 12 units.
Solve the following system of quadratic equations, algebraically. (5 points each)

11. \(3x^2 - 20y^2 - 12x + 80y - 96 = 0\)
   \(3x^2 + 20y^2 = 80y + 48\)

12. \(x^2 + y^2 = 36\)
   \(y = x + 2\)
MODIFIED CONIC SECTION ASSESSMENT

Directions: Please put your name at the top of each page this is worth 2 points. Answer each question to the best of your abilities and follow the directions provided with each problem or set of problems. Note that the point values are indicated in parentheses.

Multiple Choice (2 pts each): For problems 1-2 choose the best answer.

_______6. Choose the best answer: Which of the following denotes the formula for the midpoint?
   a. \( \left( \frac{x_1+x_2}{2}, \frac{y_1+y_2}{2} \right) \)
   b. \( \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \)
   c. \( \left( \frac{x_1-x_2}{2}, \frac{y_1-y_2}{2} \right) \)
   d. \( \sqrt{(x_2 + x_1)^2 + (y_2 + y_1)^2} \)

_______7. What is the maximum number of solutions you could have with a system of quadratic equations?
   a. 3
   b. 4
   c. 5
   d. 6

True or False (2 pts each): For problems 2-3 determine whether the statement is true or false.

_______8. True or false: The equation form of a parabola that opens up/down is: \( x=a(y-k)^2+h \).

_______9. True or false: In the equation \( Ax^2+Bxy+Cy^2+Dx+Ey+F=0 \), if \( A = C \) the conic formed is an ellipse.

_______10. True or false: In the equation \( Ax^2+Bxy+Cy^2+Dx+Ey+F=0 \), if \( A \) is negative and \( C \) is positive the conic formed is a hyperbola.
Short Answer
For each standard equation identify the type of conic and state how you know this. Use completing the square to rewrite the conic section in the appropriate form and graph it on the attached piece of graph paper labeling each problem separately. If the equation is an ellipse include the semi-major axis, semi-minor axis, center, and foci. If the equation is a circle include the center and radius. If the equation is a parabola include the vertex, focus, directrix, direction of opening. If the equation is a hyperbola include the center, vertex, length of transverse axis, length of conjugate axis, foci, and equations of asymptotes.

6. \( x^2 + 4x + 2y^2 + 16y = 0 \)

Type of Conic________________________

7. \( x^2 + 10x + 20 = 4y^2 + 16y \)

Type of Conic________________________
8. $x^2 + 6x + y^2 - 18y = 31$

Type of Conic

9. $3y^2 + x = 12y - 17$

Type of Conic
10. (8) Given the following information, write an equation for the following conic sections:
   
a. Ellipse with endpoints of major axis at (2,2) and (2, -10) and endpoints of minor axis at (0,-4) and (4, -4).

b. Parabola with vertex at (5,-1) and focus at (3,-1).

c. Circle with center at (3, -7) and tangent to the y axis.

d. Hyperbola with vertices (-5, 0) and (5, 0) and conjugate axis of length 12 units.
Solve the following system of quadratic equations, algebraically. (5 points each)

11. \[3x^2 - 20y^2 - 12x + 80y - 96 = 0\]
   \[3x^2 + 20y^2 = 80y + 48\]

12. \[x^2 + y^2 = 36\]
   \[y = x + 2\]
Equation Sheet for Modified Test

Midpoint formula: \((\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2})\)

Distance formula: \(\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}\)

Parabola:
Standard form of equation: \(y = a(x - h)^2 + k\) or \(x = a(y - k)^2 + h\)
Vertex: \((h,k)\)
Axis of symmetry: \(x = h\) or \(y = k\)
Focus: \(\left(h, k + \frac{1}{4a}\right)\) or \(\left(h + \frac{1}{4a}, k\right)\)
Directrix: \(y = k - \frac{1}{4a}\) or \(x = h - \frac{1}{4a}\)

Circle:
Standard form of equation: \((x - h)^2 + (y - k)^2 = r^2\)
Center: \((h,k)\)

Ellipse:
Standard form of equation: \(\frac{(x-h)^2}{a^2} + \frac{(y-k)^2}{b^2} = 1\) or \(\frac{(x-h)^2}{b^2} + \frac{(y-k)^2}{a^2} = 1\)
Center: \((h,k)\)
Foci: \((h \pm c, k)\) or \((h, k \pm c)\)
Length of Semi-Major Axis: \(a\) units
Length of Semi-Minor Axis: \(b\) units
where \(a > b\)
\(c^2 = a^2 - b^2\)

Hyperbola:
Standard form of equation: \(\frac{(x-h)^2}{a^2} - \frac{(y-k)^2}{b^2} = 1\) or \(\frac{(y-k)^2}{a^2} - \frac{(x-h)^2}{b^2} = 1\)
Center: \((h,k)\)
Foci: \((h \pm c, k)\) or \((h, k \pm c)\)
Length of Transverse Axis: \(2a\) units
Length of Conjugate Axis: \(2b\) units
Equations of asymptotes: \(y - k = \pm \frac{b}{a}(x - h)\) or \(y - k = \pm \frac{a}{b}(x - h)\)
Vertices: \((h \pm a, k)\) or \((h, k \pm a)\)
where \(a\) always comes before the negative sign
\(c^2 = a^2 + b^2\)
EXPLANATION OF MODIFIED UNIT ASSESSMENT

The assessment has been modified with minor adjustments. Students with a learning disability will be given more time to work on the assignment as well as a guide to the standard form of the equation for each type of conic section. This will also include formulas for finding various parts of a conic section. For a student with a learning disability it is hard to memorize facts and concepts. I will not need to create a different answer key as they have all of the same information on their test. The differences come in specifying precisely what needs to be included when a particular conic section is given and in not having them correct the statements that are false. After the students have finished the first page of the test, it will be taken away and they will be given the various formulas they need to complete the assignment. The rest of the class may receive the standard form for each type of conic section but the rest of the material they should have learned on their own.
As a student I enjoyed reading. That rarely included what was required in class but there were times I would read outside of class for pleasure. As I have gotten older, I still enjoy reading. I typically do not have as much time to do so and cannot find as many books that capture my attention like I used to; however, reading in math was another story. I very rarely read my math book as it was never required. The only times I would read from my math book were when I missed a class and needed to learn the new material. Often, the book did not make much sense to me and I would ask my peers for assistance on the homework. They would help me and I would not need to understand what the book was saying. Once I entered college, the routine was different. Professors would not always take the time to teach all of the material they wanted us to learn. In those cases we were expected to learn how to read the material and interpret it. This was not an easy skill for me and has taken up to this year to truly understand what the book is trying to explain to me.

Until this semester, I had not thought about the difference between math books and most other books. Fisher and Frey pointed out one difference that I should have noticed many years ago. With novels you can read the material and even if you don’t necessarily understand one word you can interpret its meaning based on context clues. With math, however, there are many symbols and words that have specific meaning related only to math. If a student does not understand one small concept, they may become lost in the entire material (2008).

Along with understanding why reading in math is so different than most other content areas, Fisher and Frey taught me about various tools that I can take into my classroom. To encourage understanding of math and reading in math to my students, I will use vocabulary self-
awareness charts, Role-Audience-Format-Topic (RAFT), journals, concept maps, and compare and contrast charts (2008). These are feasible within the content as students will be required to read through the chapter and find important vocabulary terms for their self-awareness charts. They will then evaluate their understanding of an idea based upon their current knowledge. This aids me in determining where students may have difficulties in the chapter and what ideas I may need to spend less time on in class. RAFT and journals can be used during the chapter to assess the knowledge of my students over various ideas. If multiple students are having a difficult time with the same concept then that tells me I may need to go back and find a new way to teach it. Finally, at the end of a chapter, I will have students re-evaluate their knowledge on the vocabulary terms they wrote down and have them fill out a concept map or a compare and contrast chart that covers the concepts from the chapter. After students have had time to fill out these charts on their own, we can discuss them as a class and find ideas students may have felt were unimportant or forgot and discuss why they should or should not be included.

All of these ideas as well as my teaching style will work to promote the learning of all of my students whether they fall into special education or general education. Those students who may have difficulties with material can receive one on one time with me or peer tutoring from a classmate. Other options are for students to come in before or after school to work with me. I do believe that all of my students can learn the concepts taught in math courses. The main skill they should all learn from these courses is that of problem solving and critical thinking. They may not use conic sections in their everyday life but they learned about how to solve problems with conic sections and could one day help their children.
References


Columbus, Ohio: Prentice Hall.