Algebra I Professional Development

Quadratics

Module 1

Outcome

- Participants will experience a rigorous Algebra I concept task

"Bend it Like Beckham"

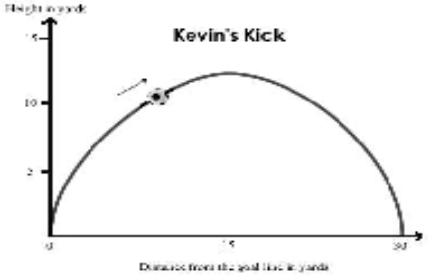
Bend it like Beckham

Andre, Juana, Kevin and Emiko go to a soccer day at the L.A. Galaxy's training field at the Home Depot Center. The coach has a computer and video system that can track the height and distance of their kicks. All four soccer players are practicing up-field kicks, away from the goal.

Andre goes first and takes a kick starting 12 yards out from goal. His kick reaches a maximum height of 17 yards and lands 48 yards from the goal.

Juana goes next and the computer gives the equation of the path of her kick as $y = -x^2 + 14x - 24$, where y is the height of the ball in yards and x is the horizontal distance of the ball from the goal line in yards.

After Kevin takes his kick, the coach gives him a printout of the path of the ball:



Finally Emiko takes her kick but the computer has a problem and can only give her a partial table of data points of the ball's trajectory.

Emiko's table

Distance from the goal line in yards	10	11	12	13	14	15	16	17	18	19	20
Height in yards	0	4.7	8.75	12.2	15	17.2	18.75	19.7	20	19.7	18.75

The computer is still not working but Andre, Juana, Kevin and Emiko want to know who made the best kick.

Help them decide by using what you know to find: (a) Whose kick went the highest? (b) Whose kick went the longest? Be prepared to explain your answer and support your reasoning.

CA Algebra 1 Standard 23.0 Students apply quadratic equations to physical problems, such as the motion of an object under the force of gravity.
Prepared by the LAUSD Secondary Math Unit; Adapted from "Water-Balloon Contest" CPM Algebra 1, Vol. 2, Dietiker, Kysh, Sallee & Hoey

“Bend it Like Beckham”

Share, Discuss, and Analyze:

- Whose kick went the highest?
- Whose kick went the longest?
- Be prepared to share your solution with the group

“Bend it Like Beckham”

Group discussion:

How do we make the mathematics accessible to all students?

How can the four access strategies:

- graphic organizers
- cooperative groups
- academic language development
- instructional conversations

be more explicitly embedded in the lesson?

Module 2

Outcome

- Participants will work with the Thinking Through a Lesson Protocol (TTLP) to plan the implementation of the task in the classroom

Thinking Through a Lesson Protocol

Thinking Through a Lesson Protocol

The main purpose of the *Thinking Through a Lesson Protocol* is to prompt you in thinking deeply about a specific lesson that you will be teaching that is based on a cognitively challenging mathematical task.

SET-UP
Selecting and setting up a mathematical task

- What are your mathematical goals for the lesson (i.e., what is it that you want students to know and understand about mathematics as a result of this lesson)?
- In what ways does the task build on students' previous knowledge? What definitions, concepts, or ideas do students need to know in order to begin to work on the task?
- What are all the ways the task can be solved?
  - Which of these methods do you think your students will use?
  - What misconceptions might students have?
  - What errors might students make?
- What are your expectations for students as they work on and complete this task?
  - What resources or tools will students have to use in their work?
  - How will the students work – independently, in small groups, or in pairs – to explore this task?
  - How long will they work individually or in small groups/pairs? Will students be partnered in a specific way? If so, in what way?
  - How will students record and report their work?
- How will you introduce students to the activity so as not to reduce the demands of the task?
- What will you hear that lets you know students understand the task?

EXPLORE
Supporting students' exploration of the task

- As students are working independently or in small groups:
  - What questions will you ask to focus their thinking?
  - What will you see or hear that lets you know how students are thinking about the mathematical ideas?
  - What questions will you ask to assess students' understanding of key mathematical ideas, problem solving strategies, or the representations?
  - What questions will you ask to advance students' understanding of the mathematical ideas?
  - What questions will you ask to encourage students to share their thinking with others or to assess their understanding of their peer's ideas?
- How will you ensure that students remain engaged in the task?
  - What will you do if a student does not know how to begin to solve the task?
  - What will you do if a student finishes the task almost immediately and becomes bored or disruptive?
  - What will you do if students focus on non-mathematical aspects of the activity (e.g., spend most of their time making beautiful poster of their work)?

SHARE, DISCUSS, AND ANALYZE
Sharing and discussing the task

- How will you orchestrate the class discussion so that you accomplish your mathematical goals? Specifically:
  - Which solution paths do you want to have shared during the class discussion? In what order will the solutions be presented? Why?
  - In what ways will the order in which solutions are presented help develop students' understanding of the mathematical ideas that are the focus of your lesson?
  - What specific questions will you ask so that students will:
    - make sense of the mathematical ideas that you want them to learn?
    - expand on, debate, and question the solutions being shared?
    - make connections between the different strategies that are presented?
    - look for patterns?
    - begin to form generalizations?
- What will you see or hear that lets you know that students in the class understand the mathematical ideas that you intended for them to learn?
- What will you do tomorrow that will build on this lesson?

Thinking Through a Lesson Protocol

- How will we *set up* the lesson?
- How will the students *explore* the concept?
- How will the students *share, discuss, and analyze* their solutions?

Planning for Implementation: Thinking Through a Lesson Protocol

- Read through the lesson and discuss how the TTLP was used to design it.

- What instructional strategies could be added to the lesson that would contribute to increased access for all learners?
  - EL
  - SEL
  - Gifted
  - SWD

Module 3

Outcome

- Participants will learn about explicit strategies that foster the development of academic language

Compare and Contrast

Using the Language of Comparison and Contrast

Compare and Contrast T-CHART

List the things that are similar or the same for $(2x+1)(x+4)$ and $2x^2+9x+4$ on one side of the T- Chart and things that are different on other side.

Compare	Contrast

Compare and Contrast

How will this activity support the academic language development for your students?

What questions can you ask to engage students with this activity?

Using the Language of Compare and Contrast

Using the Language of Comparison and Contrast

Listening & Speaking

On Your Own

1. Think about how $(2x+1)(x+4)$ and $2x^2+9x+4$ compare.
2. Fill in the blanks for both the *Comparison Questions*.

Comparison Questions

Initiator: How are _____ and _____ **similar**?

Responder: _____ and _____ are **similar** because both _____.

Initiator: What do _____ and _____ have **in common**?

Responder: Both _____ and _____ have/are _____.

Initiator: How is _____ **like** _____?

Responder: **Like** _____, _____ is/has _____.

Initiator: What is a significant **similarity** between _____ and _____?

Responder: A significant **similarity** between _____ and _____ is _____.

Initiator: What is another important **comparison** between _____ and _____?

Responder: Another important **comparison** between _____ and _____ is _____ because _____.

With Your Partner: *practice speaking and listening to the language of comparison.*

1. First *Partner 1* one reads the **Initiator** questions and *Partner 2* answers as the **Responder**.
2. Then switch roles: *Partner 2* is the **Initiator** and *Partner 1* is the **Responder**.

Using the Language of Compare and Contrast

Using the Language of Comparison and Contrast

Listening & Speaking

On Your Own

1. Think about how $(2x+1)(x+4)$ and $2x^2+9x+4$ contrast.
2. Fill in the blanks for both the *Contrast Questions*.

Contrast Questions

Initiator: How are _____ and _____ **different**?

Responder: _____ and _____ are **different** because they have/are

_____.

Initiator: What makes _____ **unlike** _____?

Responder: _____ and _____ are **dissimilar** because _____

_____.

Initiator: How else do_____ and _____ **differ**?

Responder: **Unlike** _____, _____ is/has _____

_____.

Initiator: What is a major **difference** between _____ and _____?

Responder: A major **difference** between _____ and _____ is

_____.

Initiator: What is another significant **difference** between _____ and _____?

Responder: Another important **difference** between _____ and _____ is

_____ because _____.

***With Your Partner**: practice speaking and listening to the language of contrast.*

1. First *Partner 1* one reads the **Initiator** questions and *Partner 2* answers as the **Responder**.
2. Then switch roles: *Partner 2* is the **Initiator** and *Partner 1* is the **Responder**.

Using the Language of Compare and Contrast

Using the Language of Comparison and Contrast

Writing & Reading

On Your Own: Fill in the blanks of the Comparison/Contrast Paragraph Frame.

Comparison/Contrast Paragraph Frame

_____ and _____ are similar. Each (is/has) _____ _____. Like _____, _____ also has _____. A significant similarity between the two is _____ _____. Although they share many similarities, _____ differs from _____ because _____. An important difference between the two is _____. Perhaps the most significant difference is _____.

On Your Own: Write your paragraph.

With Your Partner: Reading the language of comparison and contrast.

1. First *Partner 1* one reads her/his paragraph to *Partner 2*.
2. Then *Partner 2* one reads her/his paragraph to *Partner 1*.

Using the Language of Compare and Contrast

How will you use this with your students?

What do you need to modify or add?

Why is this activity important?

When else can you use this activity with future lessons?

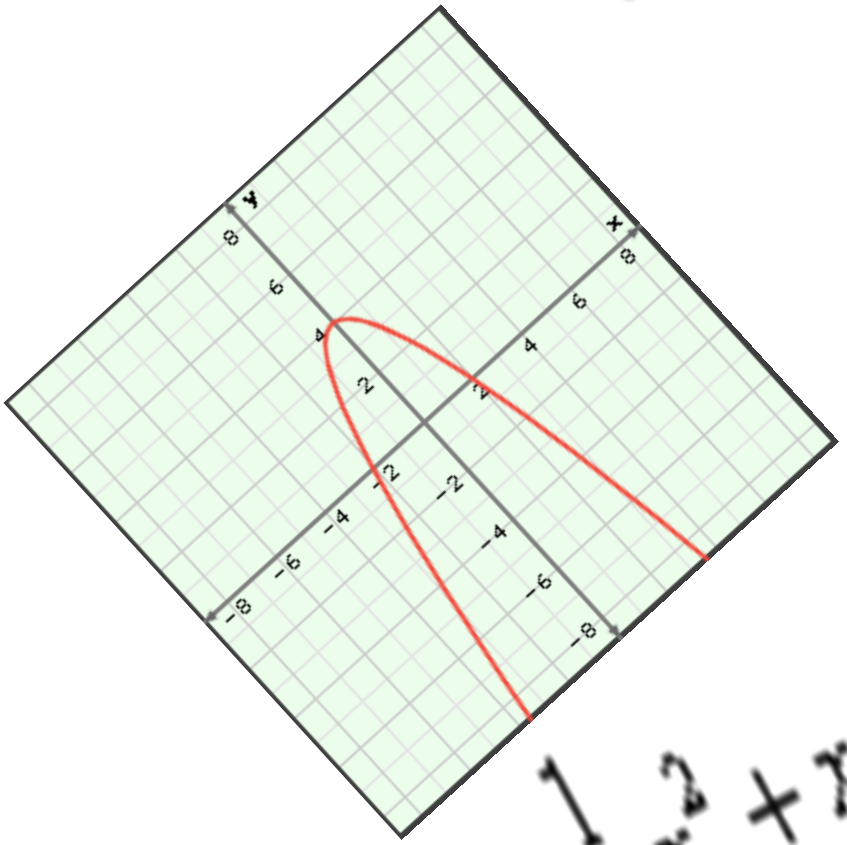
Module 4

Outcome

- Participants will gain an increased understanding of strategies that increase students' access to core mathematics content

Analyzing Quadratic Graphs

y is always x squared



x	y
4	16
2	5
0	2
−2	3
−4	5
−8	16

$$y = -\frac{1}{2}x^2 + x + 2$$

Analyzing Quadratic Graphs

Take the cards out of your envelope and spread them out on your table.

Match together the verbal descriptions, tabular representations, graphs, and symbolic representation.

Analyzing Quadratic Graphs

In a small group, discuss what helped you to identify the members of each set?

Each group will then share one set of four representations and explain how they identified the members of that set.

Analyzing Quadratic Graphs

How does this activity enrich the students' understanding of different quadratic representations?

How might you use a similar type activity in a different unit of study?

Analyzing Quadratic Graphs

COMPARING GRAPHS 1

Tables

Set 1

$y = x^2$

$y = 2x^2$

$y = 3x^2$

$y = 4x^2$

$y = 5x^2$

x	y

$y = x^2$

x	y

$y = 2x^2$

x	y

$y = 3x^2$

x	y

$y = 4x^2$

x	y

$y = 5x^2$

Analyzing Quadratic Graphs

Each group will receive one of the comparing graphs sheet.

Each member of the group will be receiving a blank transparency, a different colored marker, and a piece of graph paper.

Each person in the group will graph one of the equations on a transparency—your group will have a total of five different graphs.

Analyzing Quadratic Graphs

Now that your group has graphed each equation, layer your transparencies.

What do you notice?

What is causing this to happen?

Generate two more equations which illustrate that you know what is causing the changes to occur.

Module 5

Outcome

- Participants will learn explicit instructional conversations strategy that foster the development of academic language that increase students' access to core mathematics content

The Quadratic Formula

The Quadratic Formula

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Problem 1 – Write in standard form and solve using the quadratic formula	Problem 2 – Write in standard form and solve using the quadratic formula
$2x^2 = 4x + 30$	$2q^2 - 6 = -4q$

Academic Language Development

Strategy:

- *Instructional Conversation (Listening/Speaking)*

Mathematically Speaking!

Write your name and your partner's name.

Person #1 explains how to solve the first problem to person #2. Person #2 should mark a tally mark on the chart each time a vocabulary word is used. Encourage your partner to keep on talking until he or she has used all the target words. Then person #2 should explain how to solve the second problem while #1 marks on the chart.

Mathematics Vocabulary	#1_____	#2_____
coefficient		
discriminant		
formula		
identify		
opposite		
quadratic		
radical		
roots		
second degree polynomial		

"Mathematically Speaking…"

- Instructional Conversation
  - The instructional conversation activity is used for *review or guided practice*. Student pairs are formed. Target vocabulary words are written on the IC chart in the left column. The 2 students write their names across the top. One student explains half of the completed task or a given problem to the other student as he or she tallies on the chart each time a target word is used in the explanation. Students keep talking until all target words have been used. The other student then takes a turn doing the same.

Academic Language Development

- How can this strategy modeled be used with other concepts in this unit?
- What changes do you foresee in your students' understanding after utilizing these strategies?
- How can this strategy specifically address EL needs?
- How will you make time in your day-to-day lessons to incorporate these strategies?

Module 6

Outcome

- Participants will become familiar with the Comprehensive Assessment Program for Mathematics

Periodic Assessments

- There are Periodic Assessments for grades Kinder through Geometry.
- Blueprints available for PA's on the math website under Instructional Guide
- Elementary:
  - There are 3 PA's – each PA assesses the standards in the Instructional Blocks found in the Mathematics Instructional Guide
- Secondary:
  - There are 3 PA's – each PA assesses the standards in the first three units of the Mathematics Instructional Guide

Progress Monitoring Assessments

- There are PMA's for each of the grades and/or courses that have Periodic Assessments.

- There are two types of PMA's:
  - Ready-Made Assessments – assess 1 or 2 standards with 4 to 10 questions
  - Create your own assessment
  - There are answer sheets available to get your assessment scores on CORE K12

Diagnostic Assessments

- Grade 5 Diagnostic
  - All grade 5 students will take this assessment at the end of the year.
  - Data from this assessment will be used to decide the intervention students will need in grade 6 if any.
- Grade 8 Diagnostic
  - All students enrolled in Algebra Readiness in the Spring semester will take this assessment.
  - Data from this assessment will be used to decide the intervention students will need in grade 9 if any.

End-of-Course Examinations

Algebra 1

- The Algebra 1 *End-of-Course Examination will be cumulative.*
- *Items may test a* student's knowledge on any of the 25 California Algebra 1 Standards (See the Mathematics Framework for California Public Schools, 2007).
- These include standards that would be taught during Algebra 1A and Algebra 1B.
- The assessment will consist of 40 multiple choice items and four constructed response items. Students will answer *two of the four constructed response items.*

Geometry

- The Algebra 1 *End-of-Course Examination will be cumulative.*
- *Items may test a* student's knowledge on any of the 25 California Algebra 1 Standards (See the Mathematics Framework for California Public Schools, 2007).
- These include standards that would be taught during Geometry 1A and Geometry 1B.
- The assessment will consist of 30 multiple choice items and four constructed response items. Students will answer *two of the four constructed response items.*

Assessment Information and Data

- www.lausd.com/math
- www.lausd.net
  - Offices
    - Periodic Assessment Program Office
- CORE K12
  - https://lausd.corek12.com
- MyData
- DSS