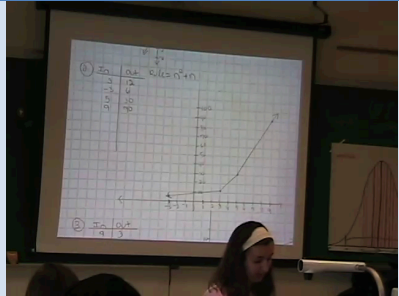

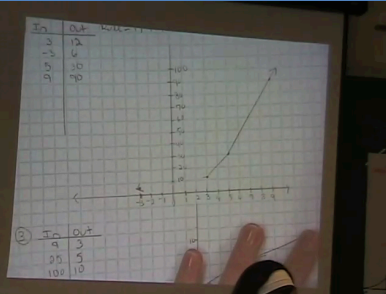
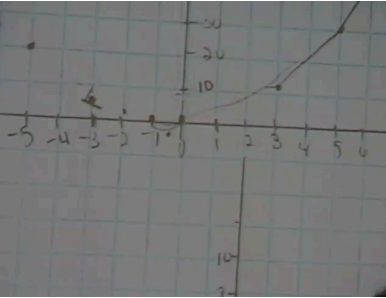
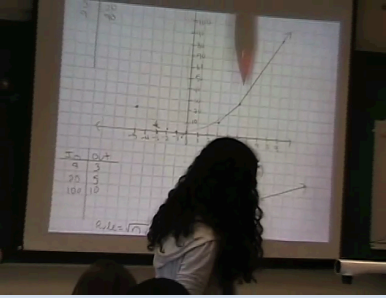


Graphing Quadratics — Video Analysis Guide

Segment Focus	Approximate time in video	Line numbers in transcript	Visual Cues	Narrative Summary	Salient quotes
Shape of the graph	0:00- 1:24	1-24		Chrissy presents her initial graph and says that it does not look parabolic. Students begin to discuss the shape of the graph.	Chrissy: “I think it was supposed to be a parabola but I didn’t exactly know how to make it a parabola.”
Bounce at zero	1:25-2:50	25-49		Students discuss the location of the “bounce” (vertex) of the graph.	Alessandra: “But -3 and 3 aren't the same. It's supposed to balance out.”

Plotting points	2:51-4:23	50-74		Chrissy plots additional points to get a better picture of the shape of the graph.	Chrissy: And then, I don't know, I was going to do it with -3. So like -3 squared is 9. Plus 3 is 12.
Finding the vertex	4:24-6:01	75-98		Monique comes to the overhead and explains how to find the vertex.	Monique: Where like it bounces, would be between like well zero and negative 1...
Sketching the graph	6:02-7:00	99-115		Monique sketches the graph.	Monique: [I]t's a really small number, where it bounces. So this half would be symmetrical to that half.

Graphing Quadratics

Video Analysis Guide

1. Chrissy's Question: Is the graph a parabola?

Central Issues:

What concern does Chrissy raise about her graph?

She believes the graph is supposed to be a parabola, however her graph does not look parabolic.

Chrissy claims that the equation describes a quadratic function, yet she connects the points with linear segments. What issues is she struggling with as she tries to connect the equation to the graph?

She knows what a parabola looks like and the points she sketched do keep increasing from left to right. It is possible that she thinks the vertex is somewhere to the left of the points she plotted, yet maybe she realizes that the graph goes up if she plugs in more negative values.

How do other students respond to Chrissy's graph?

Katherine points out that Chrissy connected her points with line segments and commented that there should be points lower than the line segments on the graph.

Alessandra points out the fact that the values of the function for 3 and -3 are not the same. She argues that if you cut a parabola in half (at the line of symmetry), the two sides would match up, so the parabola is not symmetric with respect to the y-axis.

Relevant quotes include:

Lines 1-2

Chrissy: And then this was my graph. And I don't know, I think it was supposed to be a parabola, but I didn't exactly know how to make it a parabola.

Lines 7-9

Chrissy: I don't know why. 'Cause usually when there is like a parabola, it like goes on this side and then like you can do the same thing on the other side. But it doesn't really match up. You know. Maybe you have to move it over more.

Line 11, Line 13

Katherine: Um, well, I think that it's cause like, you connected them, like the one from 3 to -3.

Katherine: Yeah, it would usually go down to like zero.

Line 42, 43

Alessandra: Like, the whole thing, if you cut it in half and you flip it over it would look the same.

What does Chrissy mean by, “Maybe you have to move it over more?”

Additional Issues:

What procedures did Chrissy likely use to sketch her graph?

What ideas about parabolas are others most likely drawing upon when they reason about the graph?

2. Reasoning About the Vertex of a Parabola

Central Issues:

How do students reason about where the vertex of the parabola (or “the bounce”) should be located on the graph?

Some students think that because $(0,0)$ is on the graph, the vertex needs to be that point. For example, in line 39, a student asks, “Wouldn't it [bounce] at zero, because zero squared plus zero is zero?”

Some students reason about the bounce using symmetry. For example, Alessandra argues that because the x -values, 3 and -3 have different y -values, the vertex wouldn't be at $x=0$.

In lines 79-80 Monique uses the x -intercepts to argue that the vertex would be somewhere between $x=0$ and $x=-1$ and below the x -axis.

Relevant quotes include:

Line 39

Student: “Wouldn't it [bounce] at zero, because zero squared plus zero is zero?”

Line 40

Alessandra: Yeah, but, that's true but -3 and 3 aren't the same. It's supposed to balance out.

Lines 79-80

Monique: Well because, since it crosses the x -axis at both negative 1 and 0, that means the dip is somewhere in between there, below zero on the y -axis.

Additional Issues:

Which properties of parabolas are Alessandra and Monique likely using to reason about where the vertex should be located?

3. Symmetry of a Parabola

Central Issues:

How does thinking about the symmetry of a parabola affect students' thinking about the graph?

In lines 40 and 42-43, Alessandra uses symmetry to argue that the vertex would not be at the origin (0, 0).

Chrissy seems to initially think that the symmetry is along the y-axis. However, she notices that the points she plotted are not symmetric around the y-axis. In lines 7-9 she argues "it doesn't really match up," and she isn't quite sure where to go from there.

At the end of the video, Chrissy realizes that the symmetry can be "moved over" and doesn't have to be with respect to the y-axis.

In lines 47-49, Nico talks about the y-coordinates being the same on the "negative side" of the parabola and the "positive side" of the parabola. Since 3 and -3 aren't the same, he reasons that the bounce has to be lower on the x-axis than 0.

Relevant quotes include:

Lines 47-49

Nico: Um, so it's a parabola so that means, um, on both sides, on the negative side and the positive side, the, the y coordinate numbers should be the same for reverse, like, negative 3 and 3 should both be 12, but since -3 is 6 that means it doesn't balance, so it bounces lower.

Lines 106-107

Chrissy: So you're saying that's why they're not symmetrical is because it's not exactly at zero?

Line 109

Student: Well it is symmetrical just not from zero.

Line 112:

Chrissy: Not at zero, just over.

What does Nico mean when he says, "it doesn't balance, so it bounces lower?"

Additional Issues:

Where does knowledge of symmetry help students reason about the shape of the graph?

Where does knowledge of symmetry help students find where the vertex should be located?

Which properties of quadratics seem to be the most salient to students when reasoning about the graph?