



Center for Algebraic Thinking

MODULE

Analysis of Change: Axes

BACKGROUND

Students struggle to understand the dynamic between the axes in a graph and the relationship between x and y .

1) **SET: Engage with a problem or problems that help teachers consider students' algebraic thinking (teachers' prior knowledge)**

Three dimensional graph. (Apple Grapher)

How do we know which is which axis?

What one equation might help me see what each axis represents?

2) **STUDENTS: Watch video clips of students describing their thinking as they engage with problems**

What do you learn from what you are hearing or seeing regarding students' thinking?

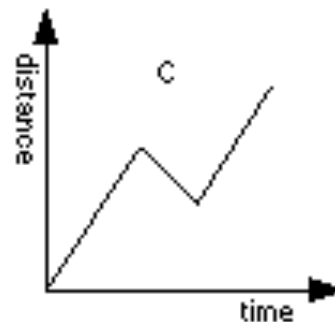
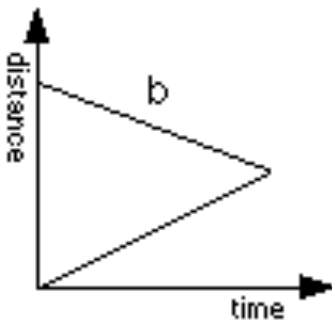
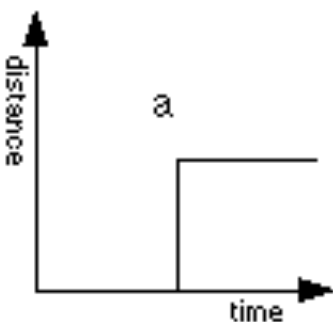
Video of formative assessments below.

3) **RESEARCH: Examine/discuss research (encyclopedia entries)**

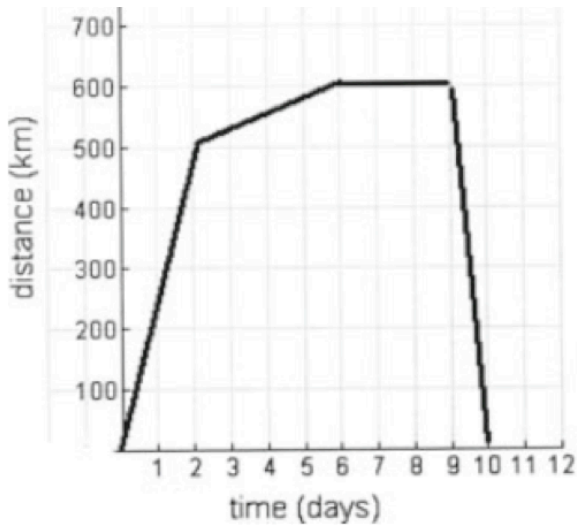
Students' understanding of the interaction between axes.

4) **ASSESSMENT: Consider assessments (formative assessment database)**

1. Which of the graphs below represent journeys? Describe what happens in each case. Why do you think that?



The Ramirez family's whole holiday is shown on the graph. The vertical axis shows the distance in kilometers away from home. The horizontal axis shows the time in days since the start of their trip.



- During which days did the Ramirez family travel fastest?
- They stayed with friends for a few days. Which days were these?
- On average, how fast did the Ramirez family travel to get to their destination?

5) **SUGGESTIONS FOR TEACHING: Consider strategies based on research (including apps)**

Graphs without numbers (Shell Centre)

<https://files.pbworks.com/download/BBFYWq9bjJ/fwiatrowskimbhs/12422919/Graphing%20Skill%20and%20Practice%20Sheets.pdf>

http://erinschumacher.com/09/files/physics/mofo/motiongraphs_nonumbers.pdf

Incline app

<http://www2.edc.org/edc-research/curriki/ROLE/lc/sessions/session6/bike.htm>

6) **Did the preservice teachers understand? How do you know? Evidence**

REFERENCES:

Herbert, S., & Pierce, R. (2008). An 'Emergent Model' for Rate of Change. *International Journal of Computers for Mathematical Learning*, 13(3), 231-249.

Kerslake, D. (1981). *Graphs Children's understanding of mathematics: 11-16* (pp. 120-136). London: John Murray.