

PARTITION AND ITERATION

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AMTNYS Annual Conference 2010

Saratoga Springs, NY

LINEARITY

Take a few moments and consider how you'd respond:

- What are the important ideas for understanding linear relationships?
- What are the fundamental notions behind linearity?
- What are the main assumptions of linear models?

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 - What are the main assumptions of linear models?
-
- What are common points of confusion for students?

BUCKET



If a basketball team scores 22 points in the first half, how many do they score in the second?

If one state gets 2 senators, how many do other states get?

If someone's salary is \$2,000 in January, how much is received in other months?

If a state with 1 million people has five congressmen, how many should a state with 2 million people have?

VOCABULARY

Slope

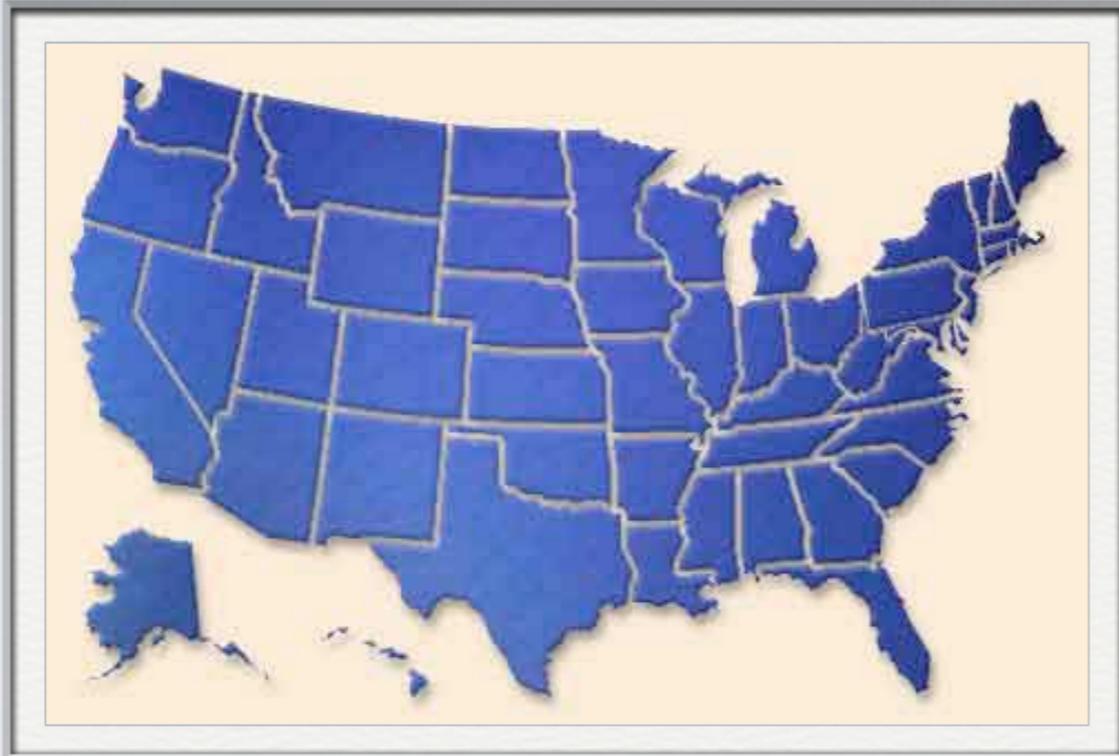
Rate of Change

How are these ideas intuitive for understanding linearity?
How are these helpful for relating to the numerical value?

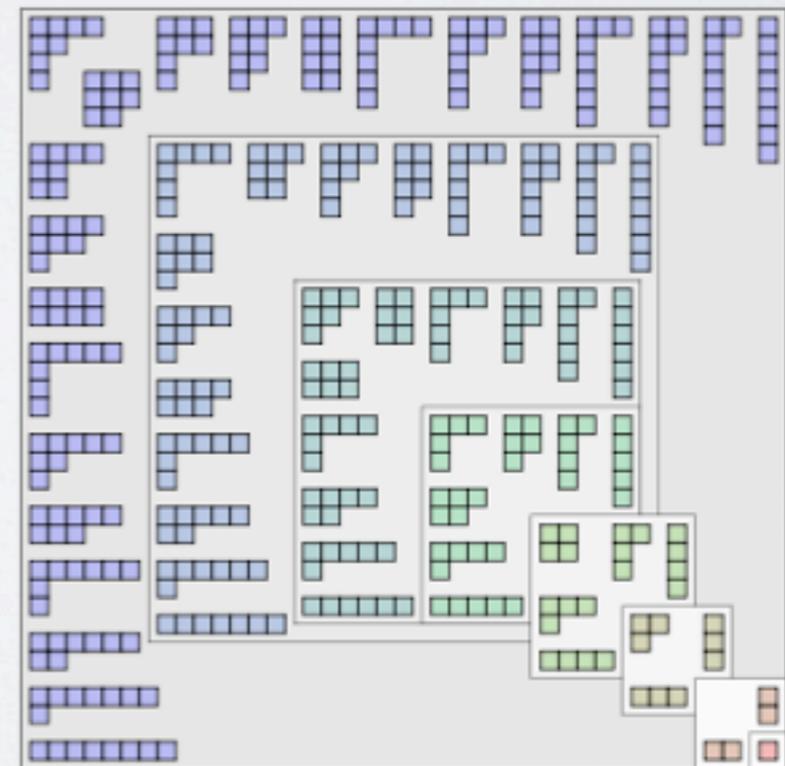
How could these words be confusing for students?

Teuscher and Reys (2010) give evidence that students misunderstand these two ideas, and have difficulties conceptualizing and connecting them.

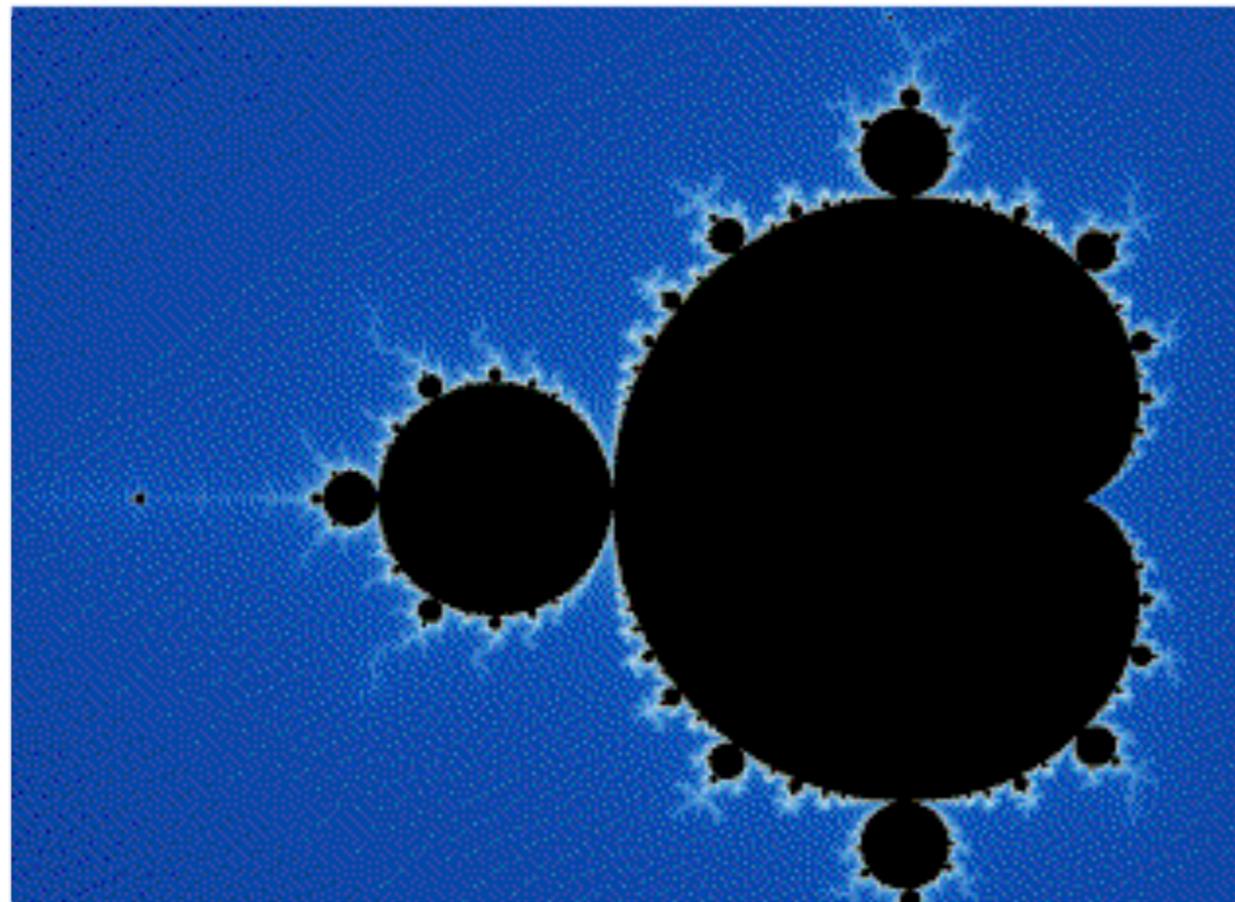
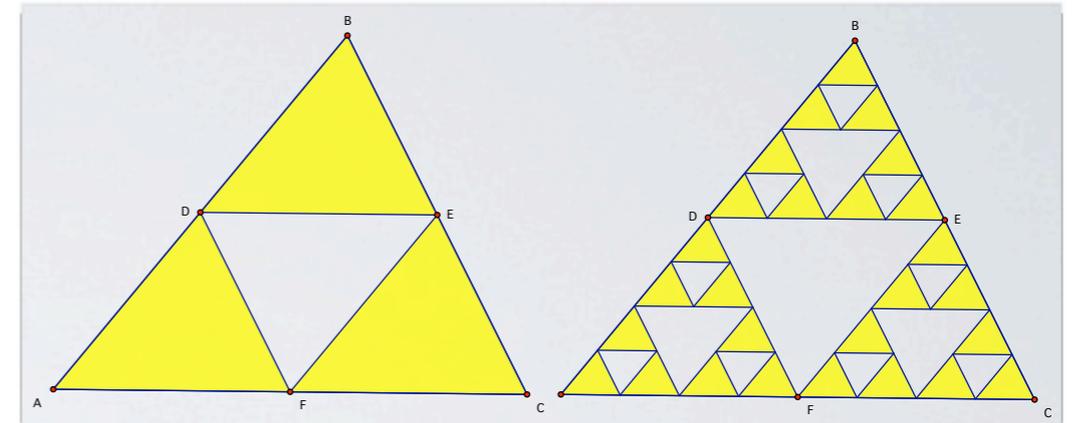
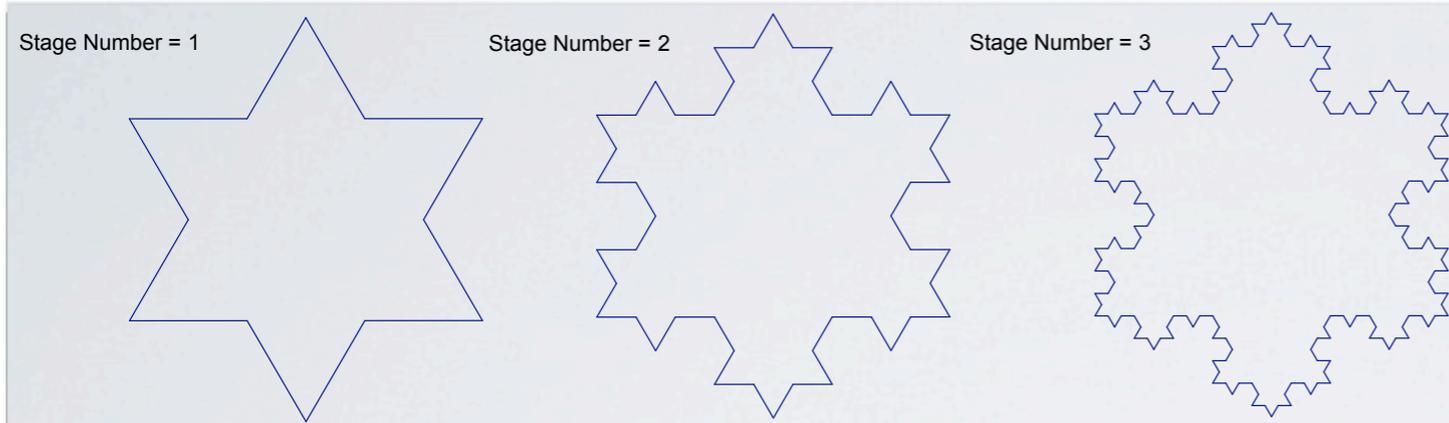
PARTITION



1									
1	1								
1	3	1							
1	7	6	1						
1	15	25	10	1					
1	31	90	65	15	1				
1	63	301	350	140	21	1			
1	127	966	1701	1050	266	28	1		
1	255	3025	7770	6951	2646	462	36	1	

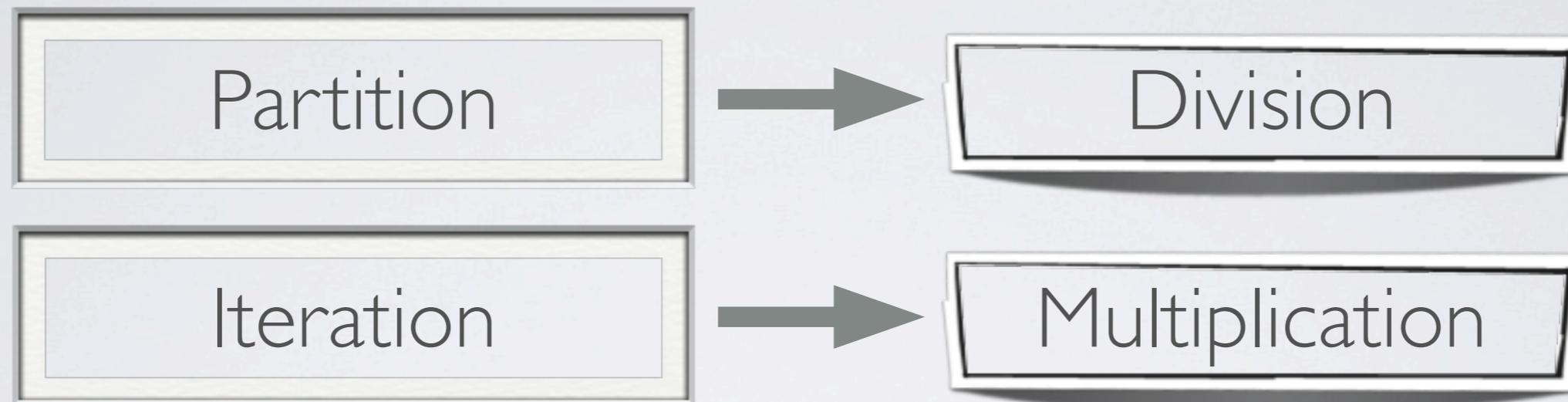


ITERATION



$$a_0, a_0 + \frac{1}{a_1}, a_0 + \frac{1}{a_1 + \frac{1}{a_2}}, a_0 + \frac{1}{a_1 + \frac{1}{a_2 + \frac{1}{a_3}}}, a_0 + \frac{1}{a_1 + \frac{1}{a_2 + \frac{1}{a_3 + \frac{1}{a_4}}}}$$

PARTITION AND ITERATION: MODELING LINEARITY



These basic ideas match the top broad categories behind understanding linear assumptions: namely, equal partitions and constant repetition (bucket analogy).

If these represent two fundamental concepts for linearity, we can intentionally point students to see these connections in linear relationships.

CONVERSION I

One Euro is equal to \$1.47 in U.S. dollars. How much are 2, 3, 4, 5, 6, 10, or 50 Euros worth in U.S. dollars?

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€	\$
1	
2	
3	
4	
5	
6	

CONVERSION I

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€	\$
1	$a_1 = 1.47$
2	$a_2 = 1.47 + 1.47$
3	$a_3 = 1.47 + 1.47 + 1.47$
4	$a_n = 1.47 + 1.47 + 1.47 + 1.47 + \dots + 1.47$
5	
6	

CONVERSION 2

A package weighs 6 kilograms, or 13.2 lbs. What does a one-kilogram package weigh in lbs?

kgs	lbs
0	0
1	
2	
3	
4	
5	
6	13.2

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1	
2	
3	
4	
5	
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kgs	lbs
0	0
1	2.2
2	4.4
3	6.6
4	8.8
5	11.0
6	13.2

DRIVING TO NYC

After driving four hours a car is 251 miles away from NYC and after driving seven hours it is 35 miles away from NYC. Assuming a constant speed, how far away did the car begin its trip?

<u>time</u>	<u>distance</u>
0	
1	
2	
3	
4	251
5	
6	
7	35

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2	
3	
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partition

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iteration

partition

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time	distance
0	
1	
2	
3	
4	251
5	
6	
7	35

iteration

partition

time	distance
0	539
1	467
2	395
3	323
4	251
5	179
6	107
7	35

A BABY'S WEIGHT

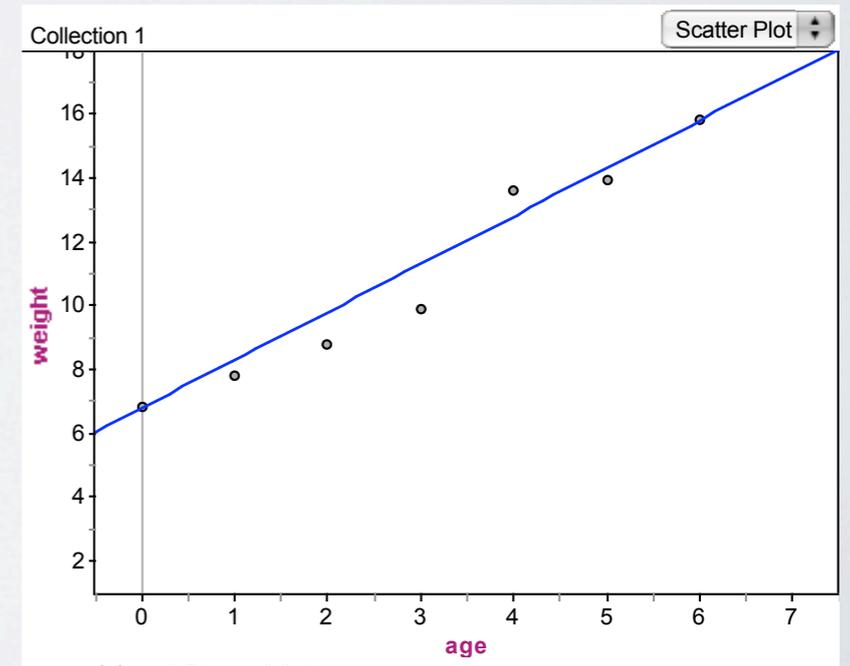
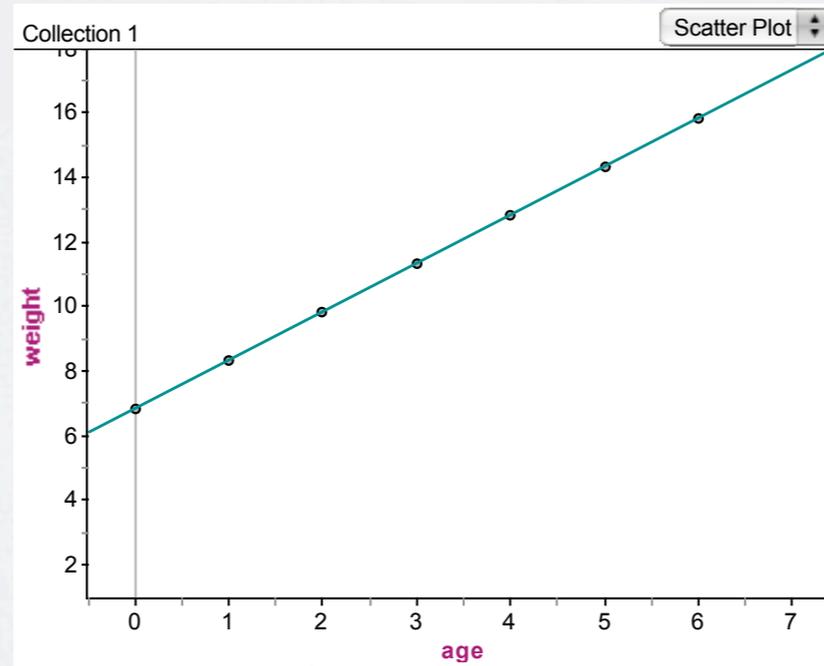
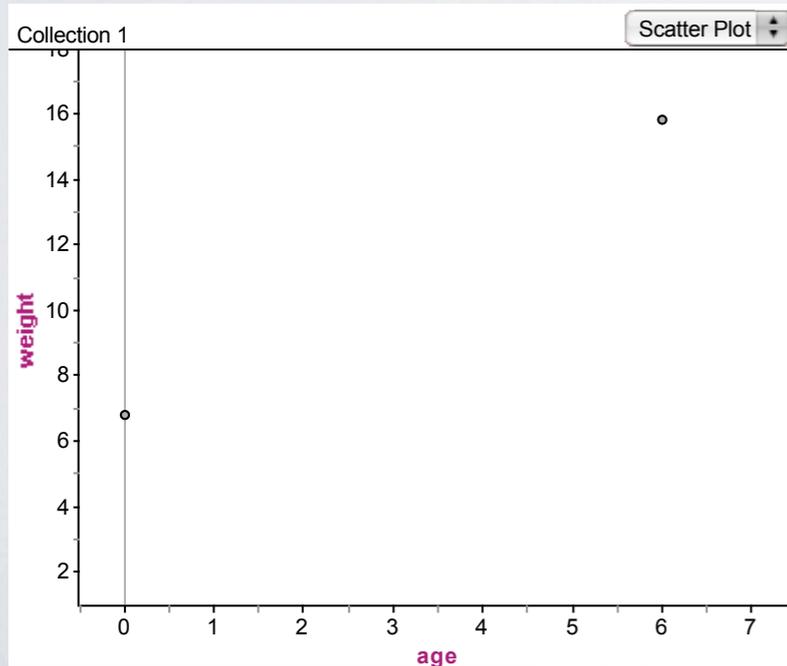
A baby weighs 6.8 lbs at birth and at 6 months the baby weighs 15.8 lbs. How much does the baby weigh at 1, 2, 3, 4 and 5 months? How much will the baby weigh at 2 years?

Discuss how the notions of Partition and Iteration might model students thought processes.

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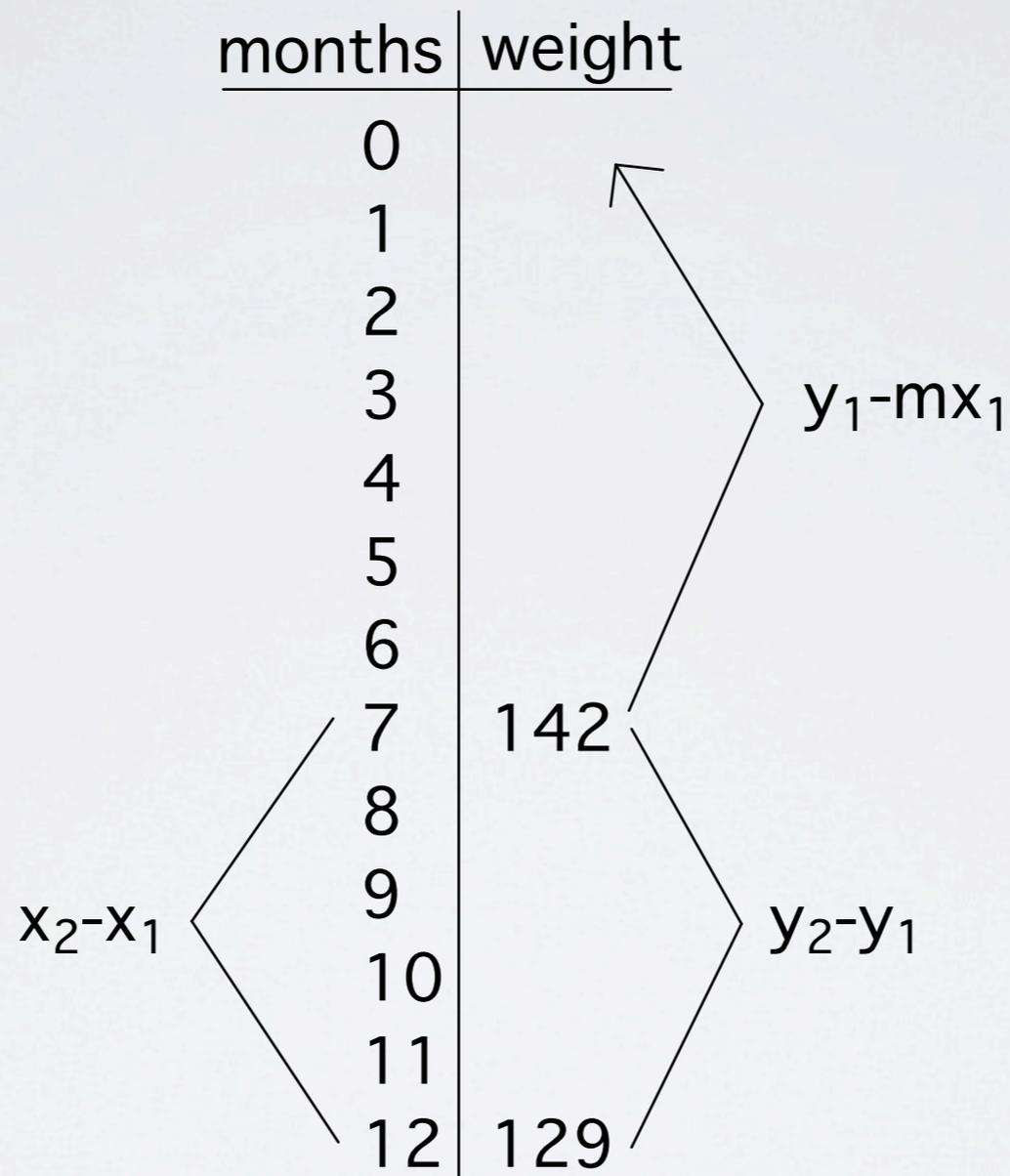
LOSING WEIGHT

Betty has been on a weight loss program for the last 12 months. Seven months after starting the program her weight was 142 lbs, and today (at 12 months) she weighs 129 lbs. Assuming a constant rate of change, model and describe her weight over the past year.

Discuss how the notions of Partition and Iteration might model students thought processes.

Write a linear equation that tracks her weight over time.

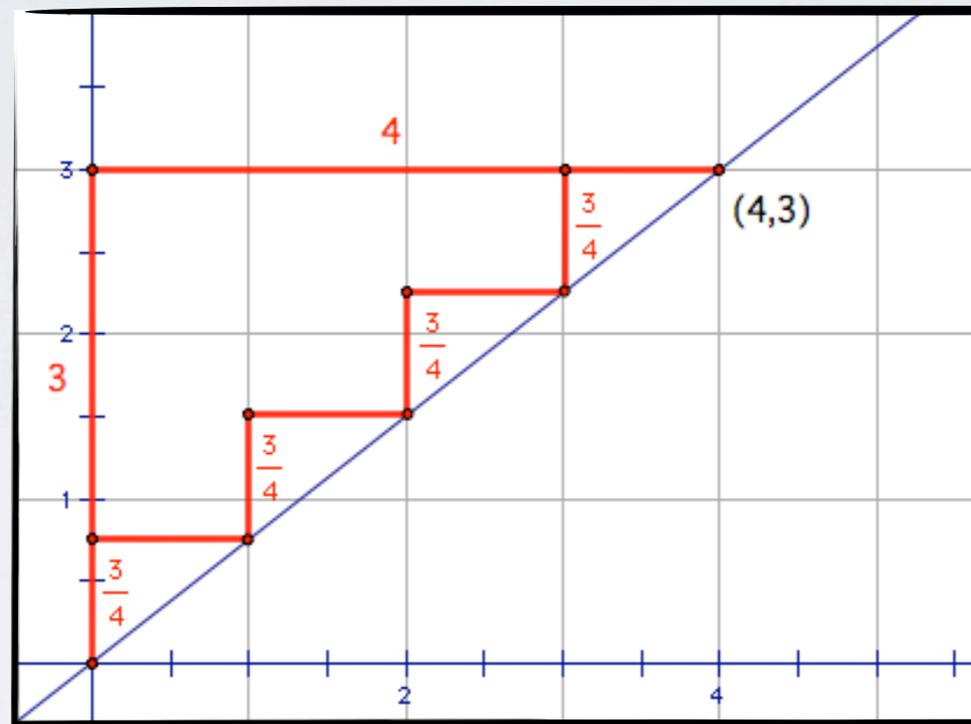
GENERALIZING



$$y = (y_1 - mx_1) + mx$$

CONCLUSIONS

A frequent disconnect



What does a slope of $\frac{3}{4}$ mean?
Rise of 3, Run of 4?