Plugging in Potholes while Building New Roads

Audrey Federman
Giselle George-Gilkes
East Side Community High School
New York, NY

Question to Address:

How can developmental mathematics move students through content that must be relearned while simultaneously gaining momentum on more advanced mathematics?

A Tale of 2 Kids

- Student #1
  - "Abby"
  - Graduated from East Side
  - Took Calculus
  - 540 on math SAT

- Student #2
  - "Felipe"
  - Also graduated from East Side
  - Took Calculus
  - 550 on math SAT

Math at East Side

- 6 – 12 school
- Kids come to us with many ***math potholes***
- Our approach: build new roads – while filling in the potholes.
- Teach new content while spiraling old content.
- Social Justice issue: expose Title 1 kids to advanced, engaging and rich content.

Math Biography Middle School

- Both students took 8^{th} grade math.
- Both students used projects and struggle problems to bridge potholes in old content.
- Both students got 4's on the Middle School Math Test
  - Top rating on the test.
  - 1 is the lowest rating

Composition of Transformation

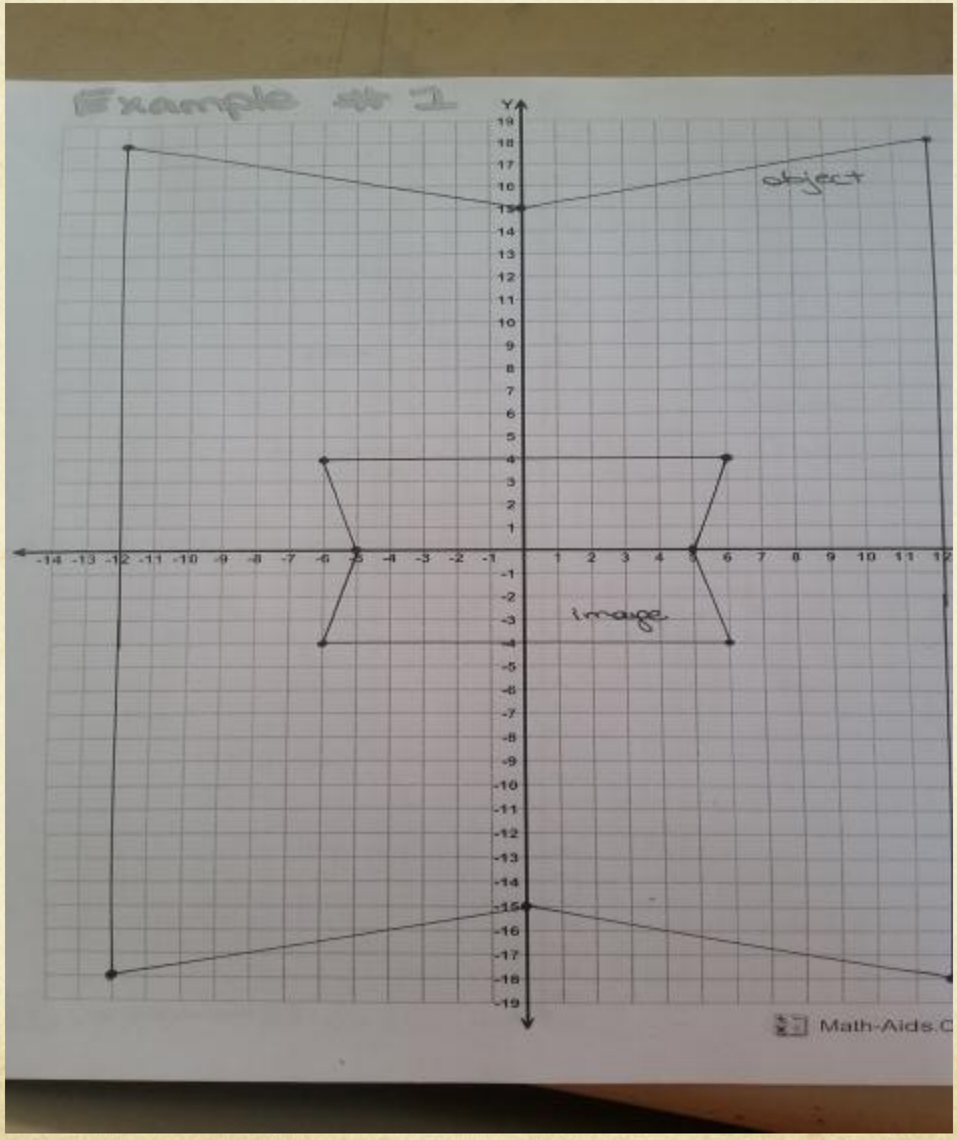
- Potholes addressed
  - Fractions
  - Coordinate Plane
  - Integers
- New Roads Built
  - Transformations
  - Compositions
  - Identifying Congruent and Similar Figures

8th Grade Common Core Standards

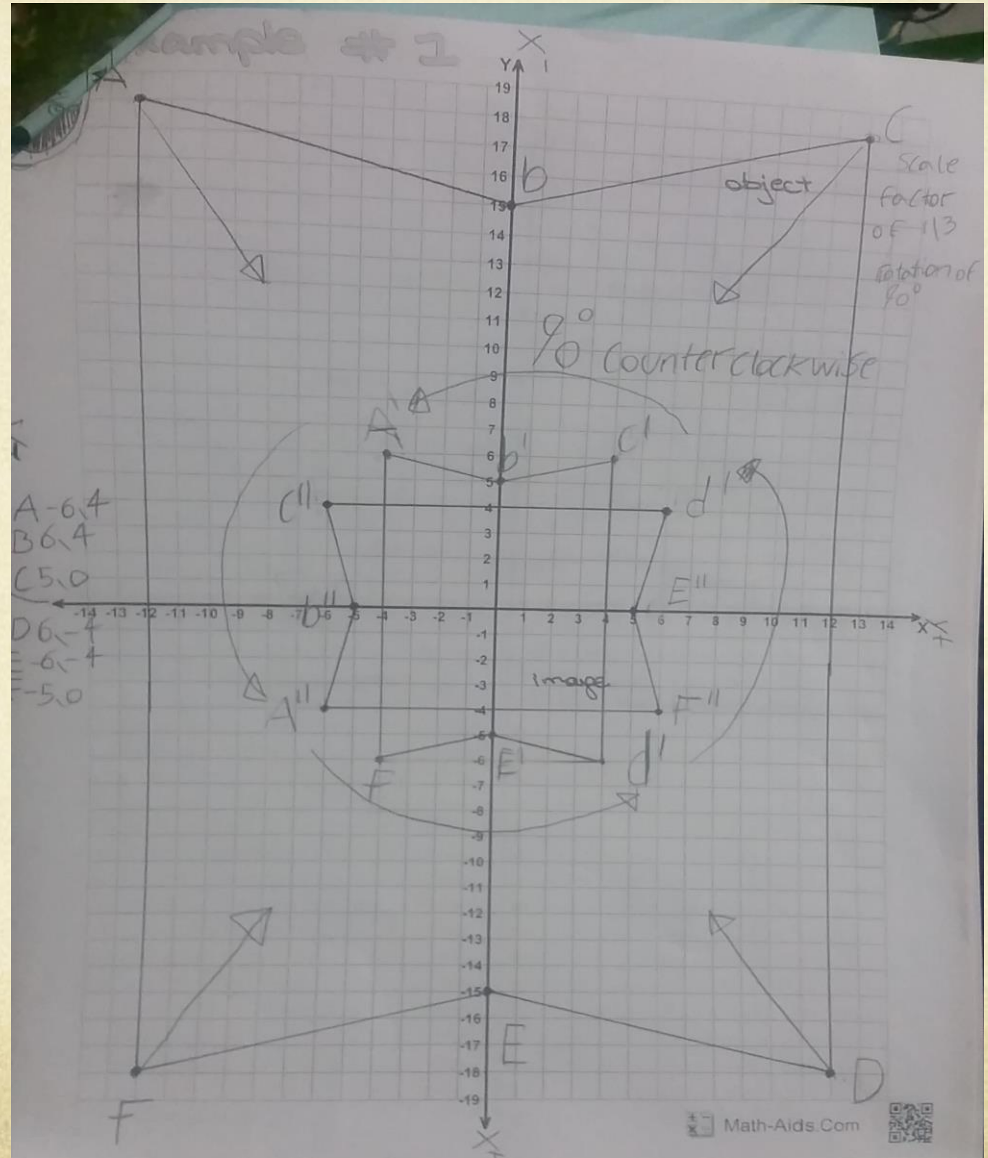
- Understand that a two-dimensional figure is ***congruent*** to another, if the second can be obtained from the first, by a ***sequence of rotations, reflections and translations***; given two congruent figures describe a sequence that exhibits the congruence between them.

- Understand that a two-dimensional figure is ***similar*** to another, if the second can be obtained from the first, by a ***sequence of rotations, reflections, translations and dilations***; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them.

Original Problem

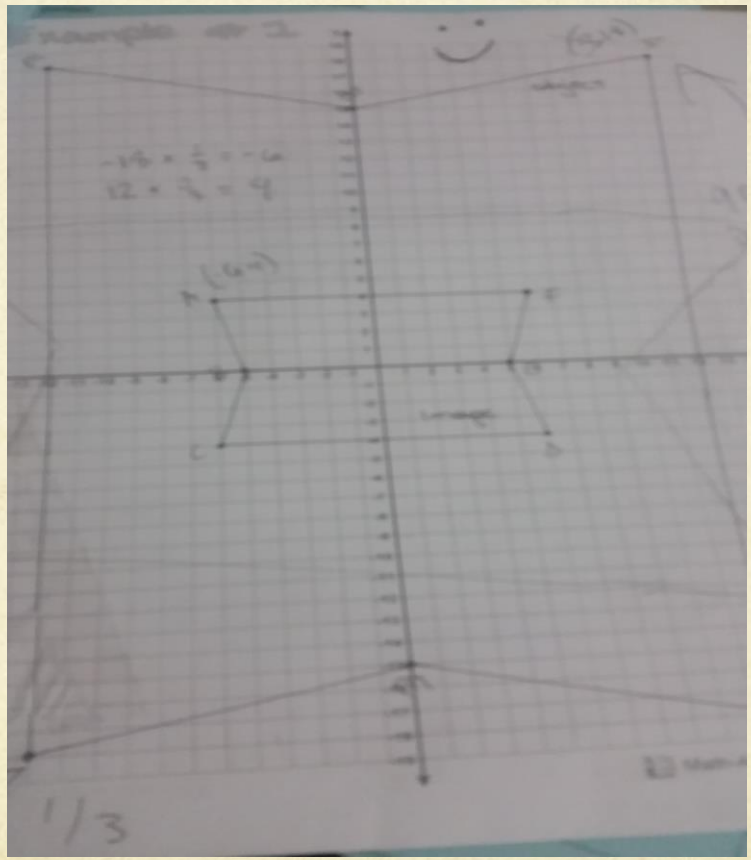


Student Work

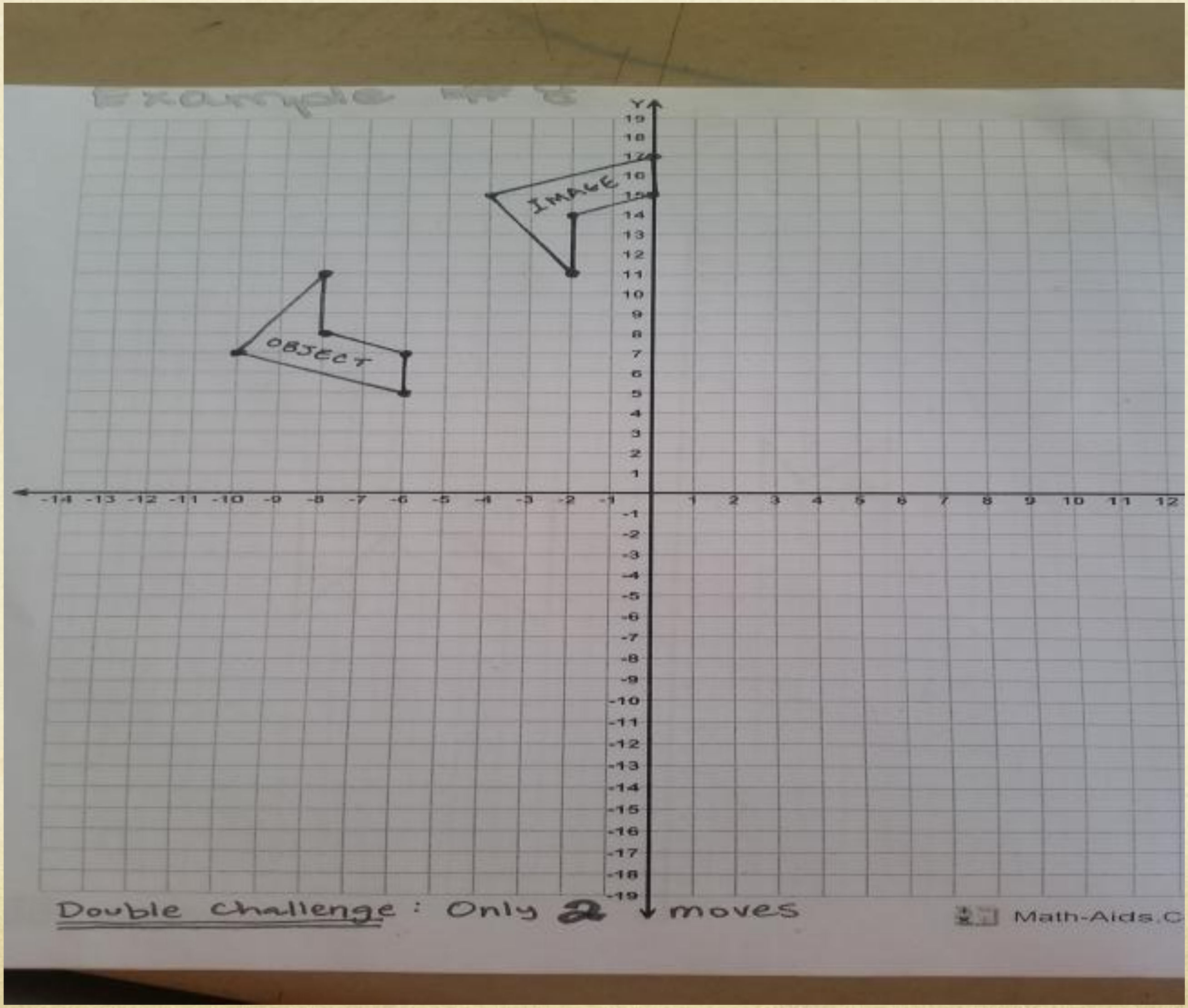


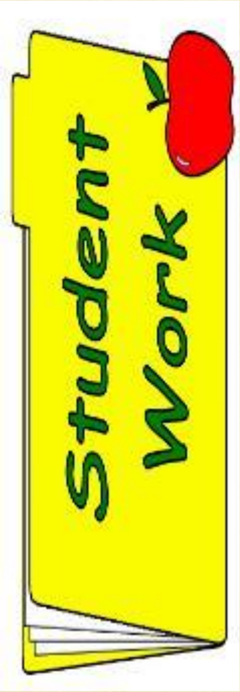
Series of transformations to be performed. Details.	Congruent or Similar. Why?
There is a dilation first, with a scale factor of $\frac{1}{3}$. Then, there is a 90° rotation around the origin, and it doesnt matter if it's clockwise or counter clockwise	Similar, because the size changed

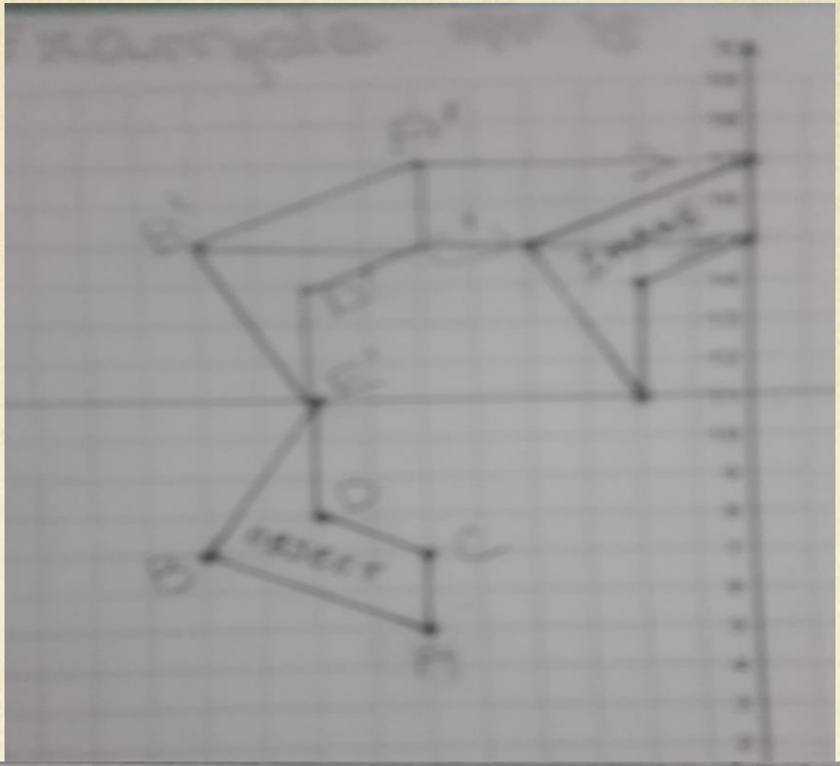
Student Work



Original Problem







① Reflect object of over line
Y = 11

② Translate the object 6 units
to the right

They are
congruent
because same
size and same
shape


Student
Work

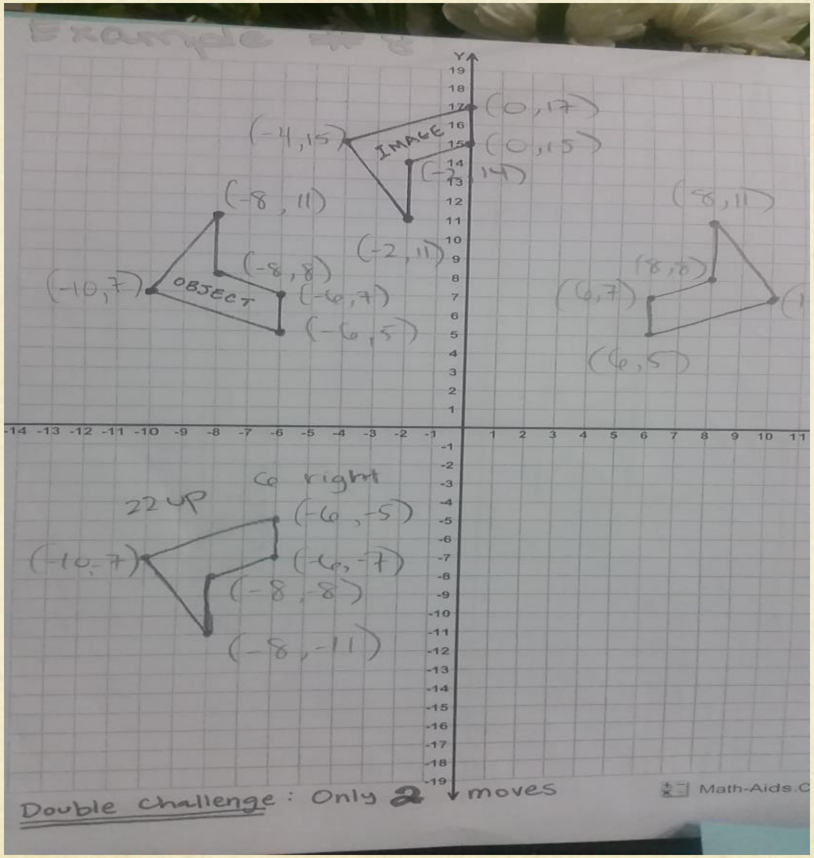


IMAGE
(0,17)
(0,15)
(-4,15)
(-2,14)
(-8,11)
(-2,11)
(-8,8)
(-10,7)
OBJECT
(-6,7)
(-6,5)
(8,11)
(8,8)
(6,7)
(6,5)
6 right
22 UP
(-6,-5)
(-10,-7)
(-6,-7)
(-8,-8)
(-8,-11)
Double challenge : Only 2 moves
Math-Aids.C

Math Biography
High School

- 12th Grade: All students who have passed math take either Calculus or Pre-Calculus. (Those who failed take Algebra 2 again).

- Both classes are project based with a focus on understanding the theory behind the content

- Both classes provide opportunities to fill in past potholes (piecewise functions review graphing, integers are reviewed during exponent rules, etc.)

Limit Exhibition

- Potholes Addressed:
  - Rate has a fractional slope
  - Range and Domain
  - Review of Graphing

- New Content
  - Definition of a limit
  - Piecewise functions
  - Step Discontinuities

Babysitting the Little Limits

You have a fantastic career as a babysitter. Rich people all over the Upper West Side want YOU to babysit their children.

Here is your rate.

It costs 5 bucks for you to show up. This includes the first hour. After that your rate is 9 dollars for every two hours (prorated—this means that if you are only there for part of an hour, you only charge for part of an hour). unless you are there for longer than 8 hours, in which case your rate goes up to 6 dollars an hour (NOT PRORATED) Also, if you cook a meal for the children, that costs an extra 7 dollars.

PART I

1)Please graph the following situation. Your x axis is time and your y axis is total money earned.

You arrive at noon to babysit the Little Limit family, the children are a boy named efofex, a girl named Continuitina. Perhaps someday the limits will have another child, but for now, that baby Doesn't Exist (ba dum bum ching!) Anyway, you hang out with the kids until 6 pm. At exactly 6 pm, you cook them dinner. Then you stay until 10 pm.

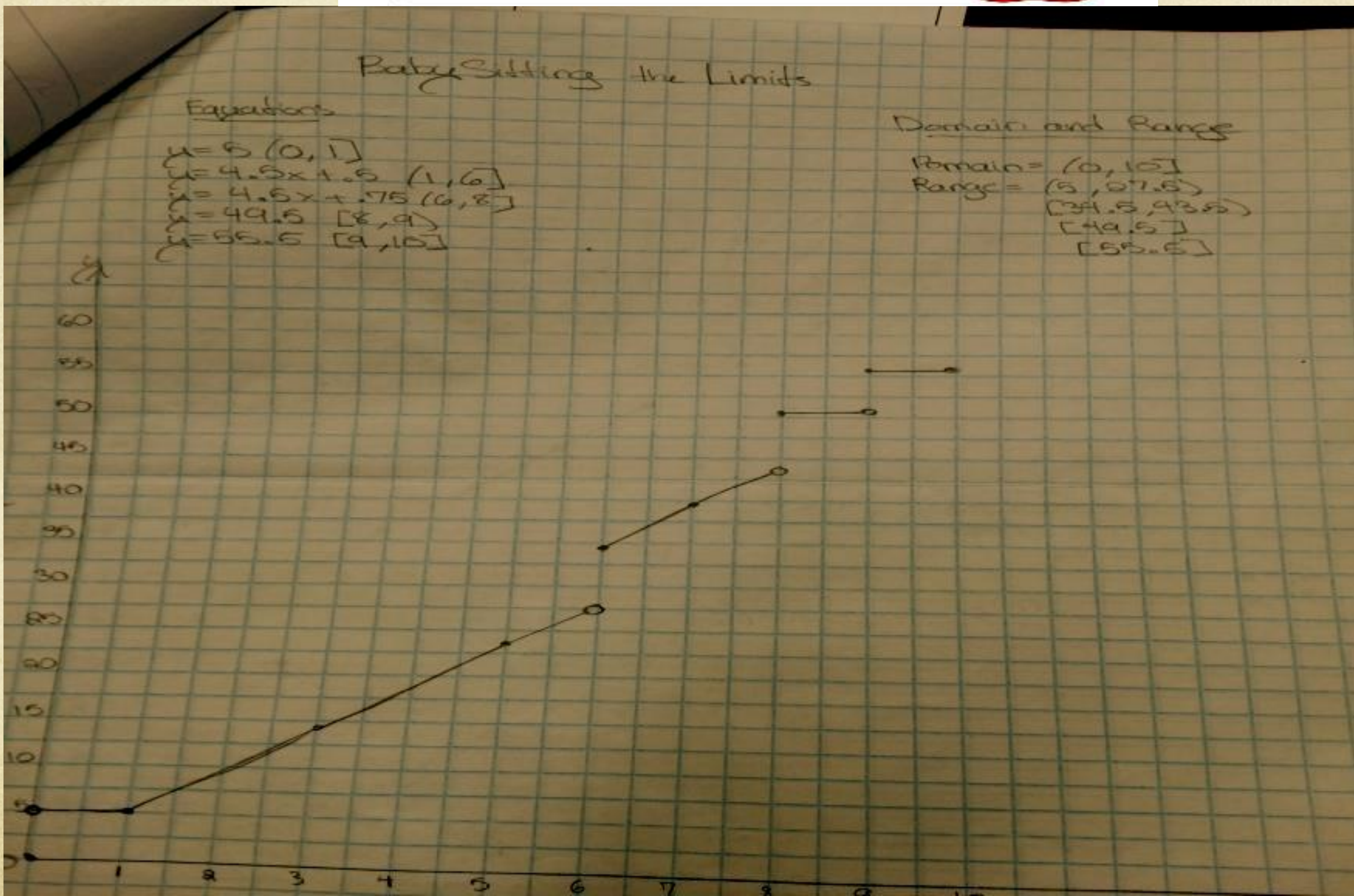
2) Find the equation of the piecewise function that represents your time with the little limit babies.

3) What is the range and domain of this function?

4) Answer the following questions thoughtfully about your graph. You must provide an explanation for EVERY answer.

a) Find the right, left, and overall limit at $c=0$. Find $f(0)$. Explain the reason for

Student Work



for a part of an hour, the sitter will get paid as if he/she was there for the full hour. Visually on raph it looks like it jumps. That's why on 9pm there is a step discontinuity, because at 9pm the will no longer earn 49.5 (open circle) but 55.5 (closed).

The limit for the right at c=0 is 5 because as the x value gets infinitesimally smaller to he y value is getting closer to 5. The limit for the left at c= 0 does not exist because the baby sitt have a negative cost. Moreover the overall limit for c= 0 is 5. When f(0) the answer does not ex ise it is an open circle at 0. The limit for the right when c= 1 is. The limit for the left at c= 1 is 5 ise as the x value gets closer to 5 the y value also approaches 5. The overall limit when c= 1 is 5 ise the left and right side approaches 5. When C(1) the y value is also 5 because it is a closed

sitter's payment is prorated meaning even if she worked half an hour then she

l still get a full hour pay.

By looking at the graph, as the limit for c=0 on the right is 5 because as the x gets infinitesimally closer to 0, the y value is getting closer to 5. The limit for c: e left does not exist because the graph is starting at zero. When f(0) the functic not exist because there is an open circle meaning the function gets infinitesima to zero but never touching. The overall limit when c= 1 is 5 because the left an side approaches 5. When c=(1), the y value is also 5 because the point is being

Final Outcomes for the Students

- Abby – Small Prestigious Private College
  - No placement exam, Abby enrolled in Freshman Calculus where she got a 92.
- Felipe –Business-Focused 4-year CUNY
  - Due to Compass exam, Felipe had to take remedial math and could not enroll immediately in college.

Are my students college ready?