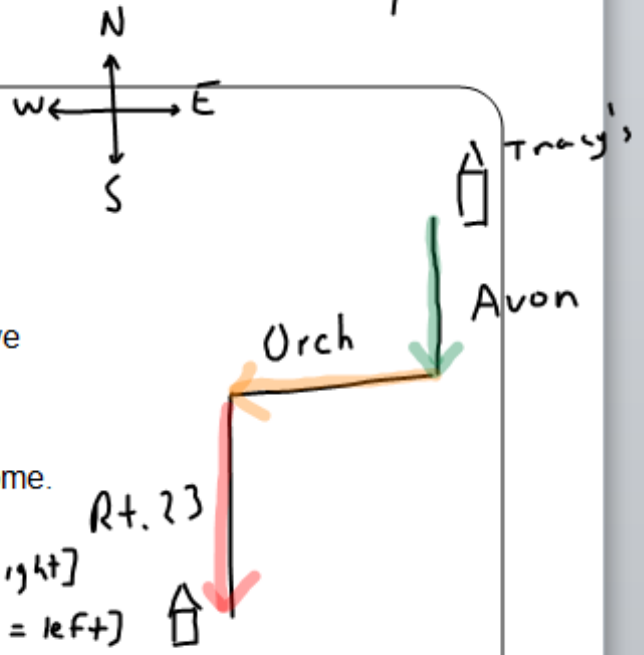
7.8. Advanced Algebra DATE: 9/13

Introduction to Inverses

Suppose you are given the following directions:

- From home, go north on Rt 23 for 5 miles
- Turn east (right) onto Orchard Street
- Go to the 3rd traffic light and turn north (left) onto Avon Drive
- Tracy's house is the 5th house on the right.



If you start from Tracy's house, write down the directions to get home.

- Head south on Avon until you hit Orchard.
- Turn west on Orch until you hit Rt 23. [west = right]
- Turn south on Rt. 23 and head for 5 miles [south = left]

1. How did you come up with the directions to get home from Tracy's?

I drew a pic and went backwards, "undoing" original directions

Now suppose you are given the following algorithm:

- Starting with a number, add 5 to it
- Divide the result by 3

Now suppose you are given the following algorithm:

- Starting with a number, add 5 to it
- Divide the result by 3
- Subtract 4 from that quantity
- Double your result

2. The final result is 10. Working backwards knowing this result, find the original number. Show your work.

Go backward: $\frac{10}{2} = 5$; $5 + 4 = 9$; $9 \times 3 = 27$; $27 - 5 = \boxed{22}$

3. Write a function $f(x)$, which when given a number x (the original number) will model the operations given above.

$$f(x) = 2\left(\frac{x+5}{3} - 4\right)$$

CHECK: $f(22) = 2\left(\frac{22+5}{3} - 4\right)$ "Follow algorithm" $= 2\left(\frac{27}{3} - 4\right) = 2(9-4) = 2(5) = 10$ ✓

4. Write a function $g(x)$, which when given a number x (the final result), will model the backward algorithm that you came up with above.

Inverse of $f(x)$ → $g(x) = 3\left(\frac{x}{2} + 4\right) - 5$

CHECK: $g(10) = 3\left(\frac{10}{2} + 4\right) - 5$

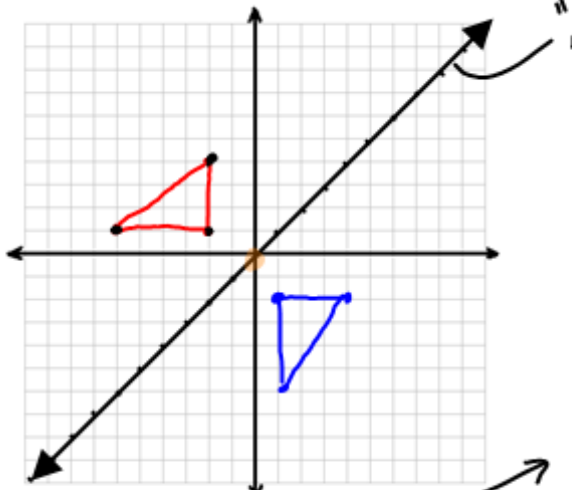
$= 3(5+4) - 5 = 3(9) - 5 = 27 - 5 = 22$ ✓

Follow algorithm backward

Follow these directions:

1. Using the coordinate plane below, graph relation A = {(-2,1), (-2,4), (-6,1)}. These points should form a right triangle.

2.



"mirror line" or "reflection line"

3. On the coordinate plane in #2, graph y = x.

$y = \frac{1}{1}x + 0$

slope : $\frac{1}{1}$ ↑ → y-intercept : 0

4. Explanation: "*An inverse is when the x-value and y-value are switched for each point within a relation.*" Using this explanation of inverse, write the inverse of A, which is written as A^{-1}. A^{-1} = {(1 , -2), (4 , -2), (1 , -6)}.

-1 means inverse. So A^{-1} is read as "A inverse"

5. Graph A^{-1} on the coordinate plane in #2.

6. Describe how the graph of A compares to the graph of its inverse, A^{-1}. Use the line y = x to help you with your description.

A^{-1} (blue Δ) and A (red Δ) are reflections of eachother over the mirror line.