Today's Objectives

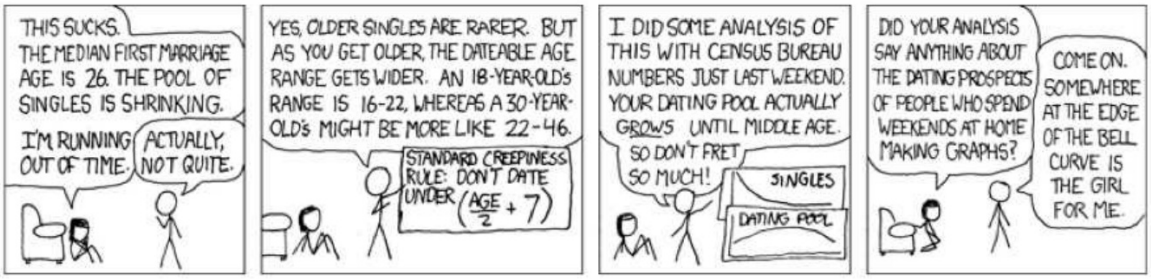
- Algebraically verify in writing **that two functions are inverses** and produce **inverse functions** using a step-by-step process and the algebraic definition of an inverse.
- Success Criteria:
  - Understand inverses in terms of dependency
  - Determine if a function is one-to-one
  - Identify graphical properties of inverses
- Vocabulary: inverse

Inverse Relation

The ordered pair (a,b) is in a relation if and only if the pair (b,a) is in the inverse relation.

An inverse relationship represents a change in dependency, meaning that we are changing our dependent and independent variable. This means that x and y change places.

- i.e. (3, -8) becomes (-8, 3)
- Real world example



- Let x be the age of the older person and let y represent the age of the younger person.

- The equation would be

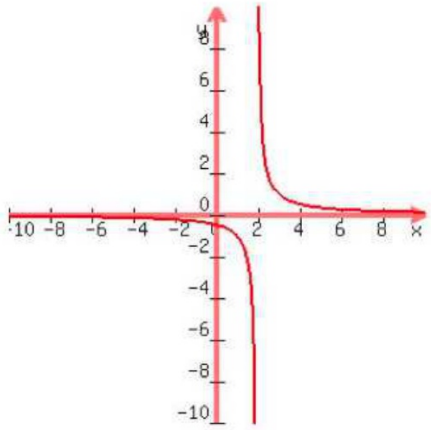
$$y = \frac{x}{2} + 7$$

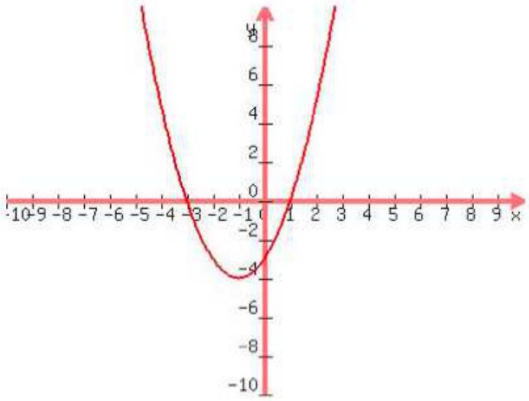
- What if you're the younger person? How could you modify the equation to be more helpful for you?

Horizontal Line Test

The inverse of a relation is a function if and only if each horizontal line intersects the graph of the original relation in at most one point.

Do these functions pass?



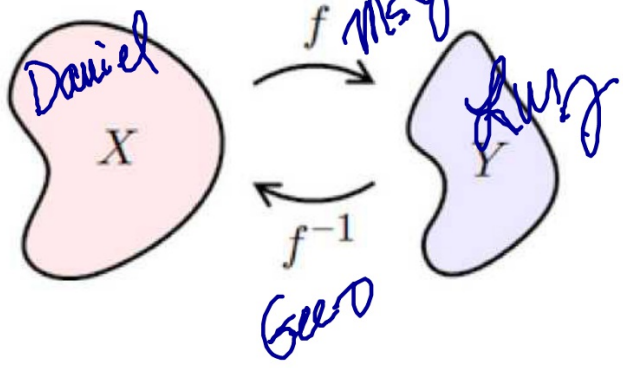


Inverse Function

If f is a one-to-one function with domain D and range R, then the **inverse function of f**, denoted f^{-1}, is the function with domain R and range D defined by $f^{-1}(b) = a$ if and only if $f(a) = b$.

More about Inverses

- We write inverse functions as f^{-1}
- The domain of the original function is the range of the inverse
- The range of the original function is the domain of the inverse



When can I have an inverse?

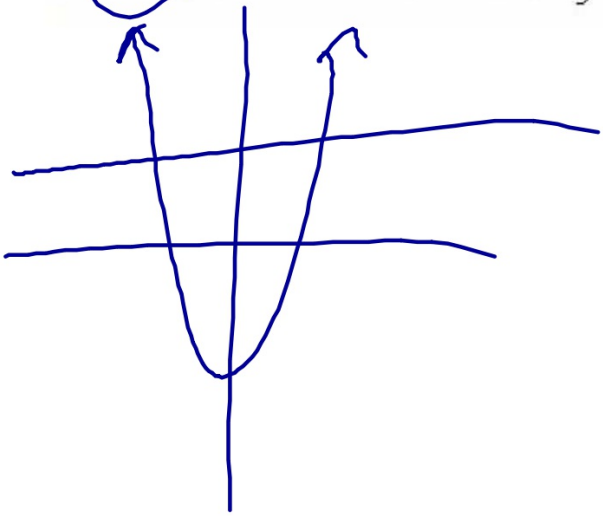
- There can only be an inverse when functions are one-to-one.
- One-to-one functions pass the vertical AND horizontal line test

- In relationships, a relationship is a one to one function when both people are only seeing one person.

AM: Determine if functions are one-to-one

1. Which of the following is *not* a one-to-one function?

[A] $f(x) = x^2 - 2$ [B] $f(x) = \frac{1}{5}(x-2)$ [C] $f(x) = x - 2$ [D] $f(x) = 2x$



AM: Determine if functions are one-to-one

2. Which of the following is a one-to-one function?

[A] {(9, –4), (8, –7), (5, 5), (8, 6)}

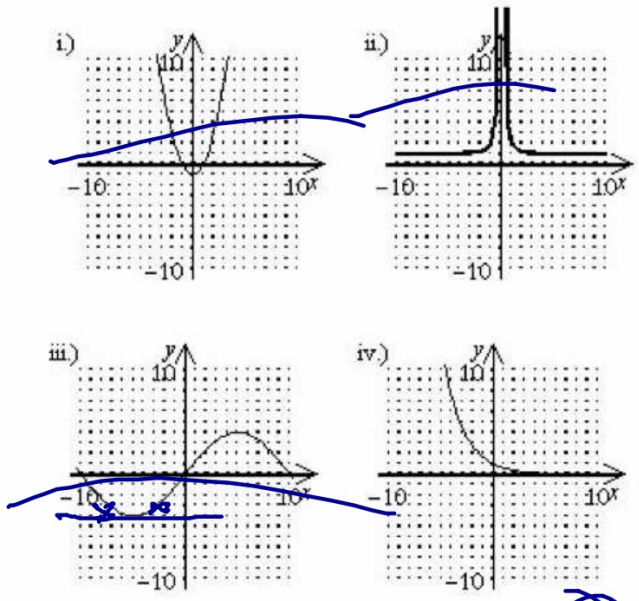
[B] {(9, –4), (8, 5), (5, 8), (1, 1)}

[C] {(9, –4), (8, –7), (9, –2), (–7, 8)}

[D] {(9, –4), (8, –7), (5, –2), (1, –4)}

AM: Determine if functions are one-to-one

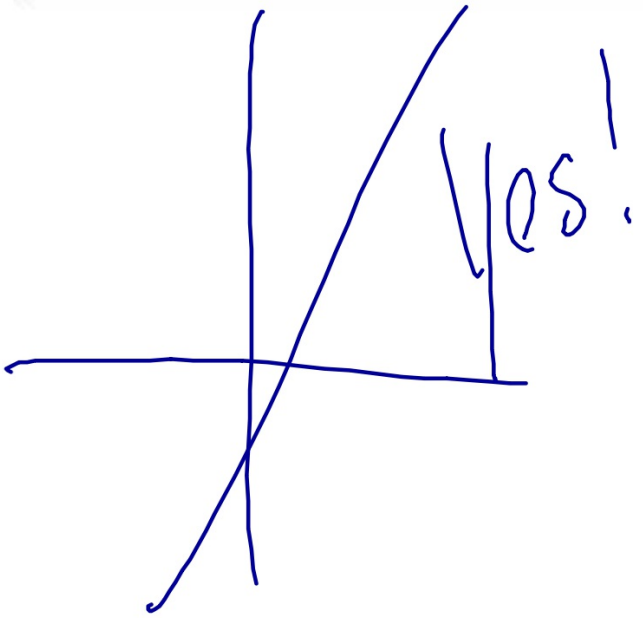
3. Determine which of the following are one-to-one functions:



[A] ii and iv only [B] i and iv only [C] iv only [D] i, ii, and iv only

AM: Determine if functions are one-to-one

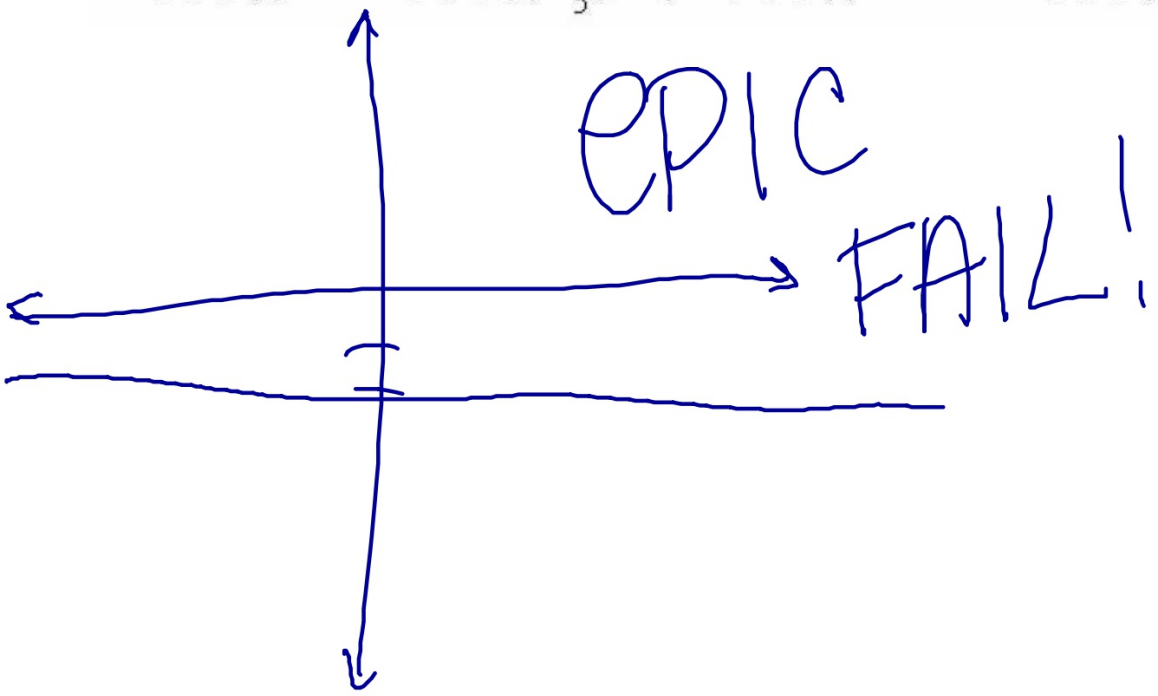
4. Is $f(x) = 3x - 4$ a one-to-one function?



AM: Determine if functions are one-to-one

1. Which of the following is *not* a one-to-one function?

[A] $f(x)=-2$ [B] $f(x)=\frac{1}{5}(x+2)$ [C] $f(x)=x+2$ [D] $f(x)=-2x$



The Inverse Reflection Principle:
use to graphically "confirm" that functions are inverses

The points (a,b) and (b,a) in the coordinate plane are symmetric with respect to the line y=x. The points (a,b) and (b,a) are reflections of each other across the line y=x.