

COT 3100

1/10/23

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HMK - Financial Aid Assignment<sup>11</sup>

Diagnostic Quiz - 0%

Time Limit: 60 min (one sitting)

M.C. 20 Q.

My Course Goals:

1) Showing you beauty + creativity in mathematics!

2) Anyone can get good at math via properly directed effort!

"Growth Mindset" - Carol Dweck

"Outliers" - Malcolm Gladwell

3) Yes there's LOTS OF Creativity

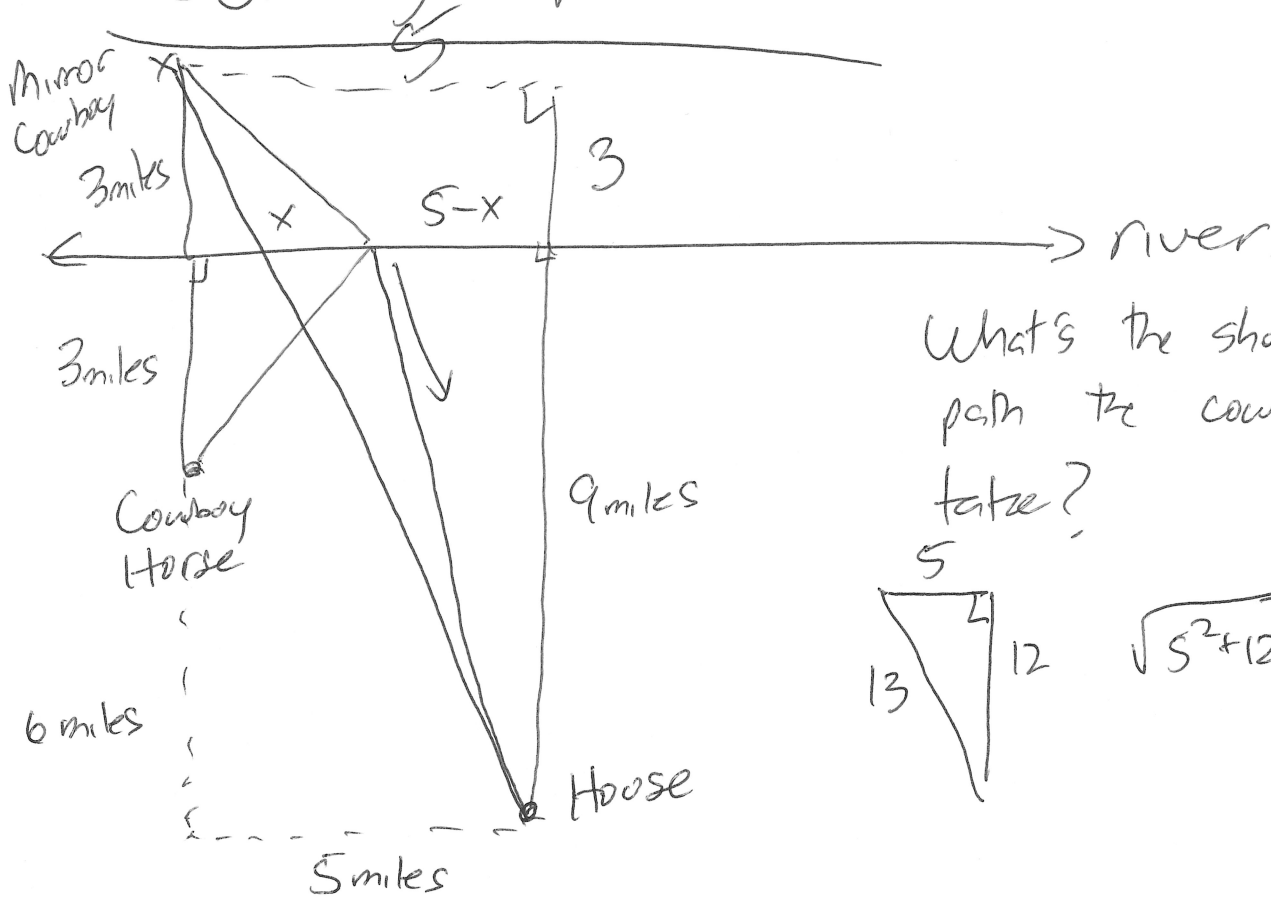
But structure of (a) Direct Proof

(b) Proof by Contradiction

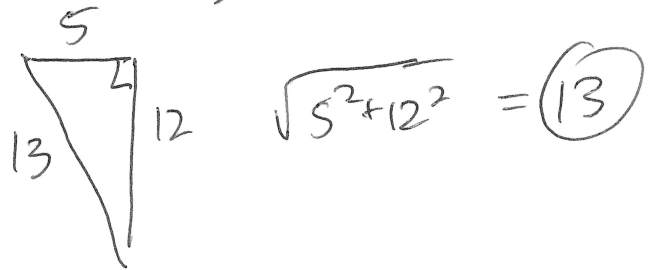
(c) Mathematical Induction

are fairly consistent + reliable.

# Cowboy Problem



What's the shortest length path the cowboy can take?

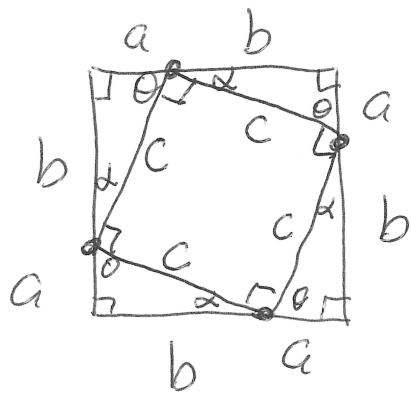


Usual: get distance traveled as function of  $x$ ,  
 $x$  = miles east of init position on river get under.  
 $f'(x) = 0$  get val  $x$  that minimizes  $f(x)$  (a/k/a).

Answer: Same as answer to: How far did mirror cowboy walk?

PROBLEM REDUCTION: Express your problem as a different but equivalent problem that you know how to solve!

# Pythagorean Thm Proof



$$\text{Area Lrg Sq} = (a+b)^2$$

$\theta + \alpha = 90^\circ$ , so angle inside  
small quad =  $180^\circ - 90^\circ = 90^\circ$

$$\text{Area Lrg Sq} = 4(\text{triangle}) + \text{Sm Sq}$$

$$= 4\left(\frac{ab}{2}\right) + c^2$$

$$= 2ab + c^2$$

$$(a+b)^2 = 2ab + c^2$$

$$a^2 + \cancel{2ab} + b^2 = \cancel{2ab} + c^2$$

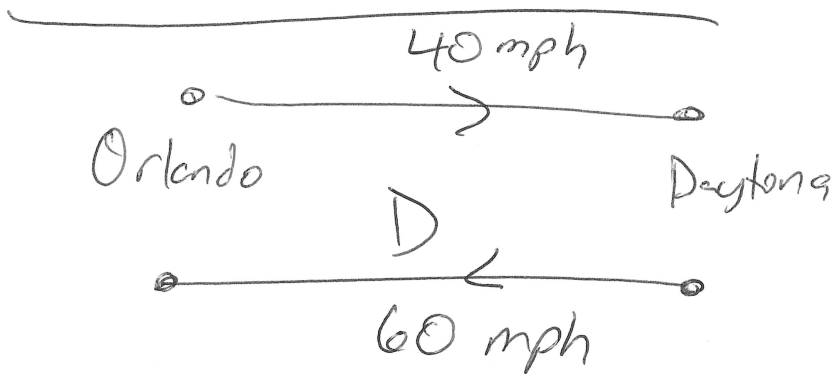
$$c^2 = a^2 + b^2$$

Technique:

Finding 2 Different Expressions for  
the same quantity

We set areas equal to each other but  
learned something about distances!

# Problem #3



Question: What is the average speed of the round trip?

Many people answer ~~50~~ 50 mph.

Real Answer is 48 mph.

Why do so many people get this wrong?

Thinking Fast Thinking Slow - Daniel Kahneman

Specifically, to do school mathematics

you HAVE TO force yourself to

THINK SLOW.

$$D = (40 \text{ mph}) t_1$$

$$D = (60 \text{ mph}) t_2$$

$$2D = r \left( \frac{5D}{120} \right)$$

$$r = \frac{2 \times 120}{5} = \boxed{48 \text{ mph}}$$

$$t_1 = \frac{D}{40}, t_2 = \frac{D}{60}$$

$$t_{\text{total}} = \frac{D}{40} + \frac{D}{60} = \frac{3D+2D}{120} = \frac{5D}{120}$$