Mix the ~~Tricks~~

Tina Cardone, Ashli Black

Do Now: Do Some Math!

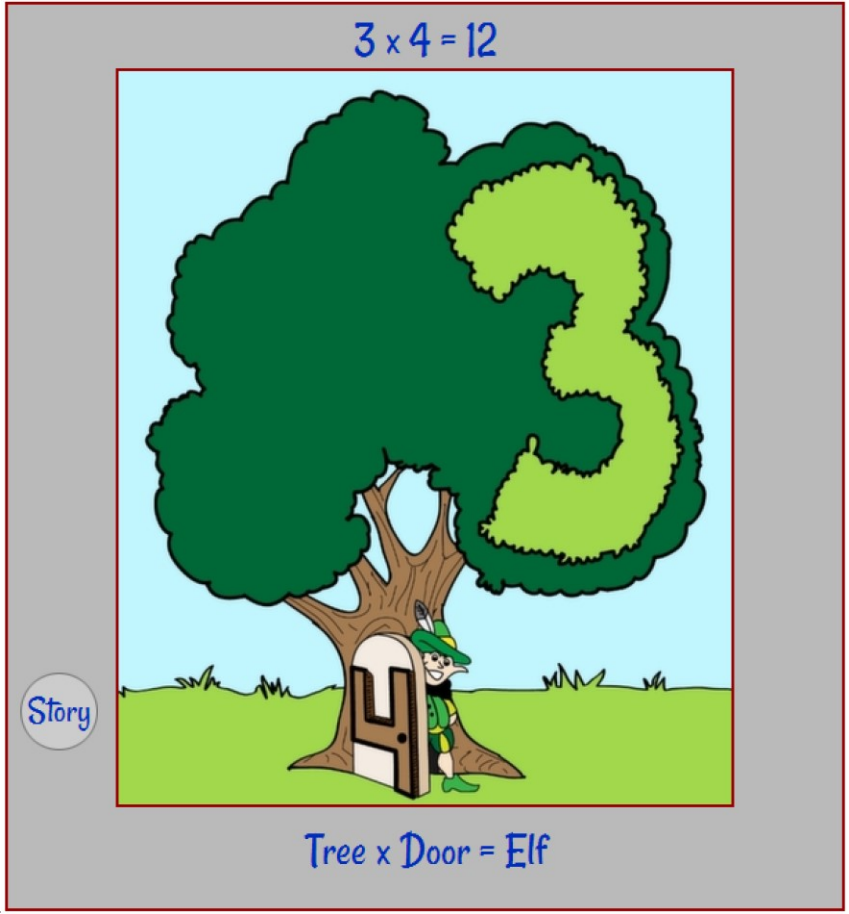
- How would you solve the problems on your own?
- How might a student solve these problems?
- What are some possible misconceptions/errors?
- What tricks might cause students to make mistakes?

1. $(-4) - 7$
2. $100/(-2)$
3. $\dfrac{8x}{30} = \dfrac{48}{18}$

Nix the Tricks

TINA CARDONE

ASHLI BLACK



http://www.multiplication.com/learn/learn-fact/3/x/4

Is it a trick?

- Method
  - Kids can explain: **Shortcut**
  - “Because __ said so”: **Trick**
- Definition
  - New term: **Mnemonic**
  - Based on previous terms: **Trick**

Math Makes Sense

After 3 hours, your phone battery is at 93%.

How long do you expect it will last before it dies?

http://fivetwelvethirteen.wordpress.com/2014/09/21/number-talk-phone-battery/

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- A few students used estimation or proportional reasoning.
- Many students didn't calculate - they said the initial situation was unreasonable and made estimates based on their own experiences.

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Math Makes Sense

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How long do you expect it will last before it dies?

- A few students used estimation or proportional reasoning.
- Many students didn't calculate - they said the initial situation was unreasonable and made estimates based on their own experiences.
- The final group, which was the largest, said - with complete confidence - it will last 31 hours, because 93 / 3 = 31.

http://fivetwelvethirteen.wordpress.com/2014/09/21/number-talk-phone-battery/

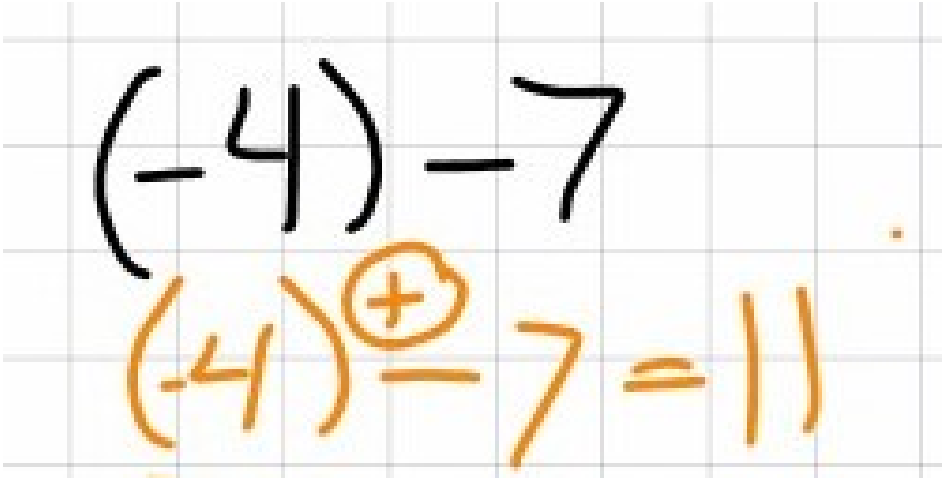
Math Mistakes

What mistakes might you expect?

$$1.\ (-4) - 7$$

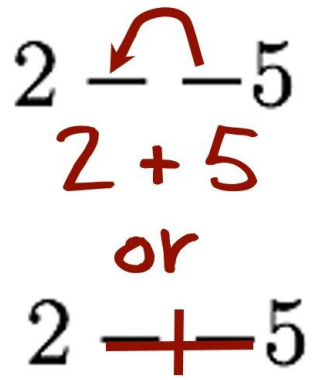
Math Mistakes

Two negatives make a positive



http://mathmistakes.org/?p=328

Two negatives make a positive



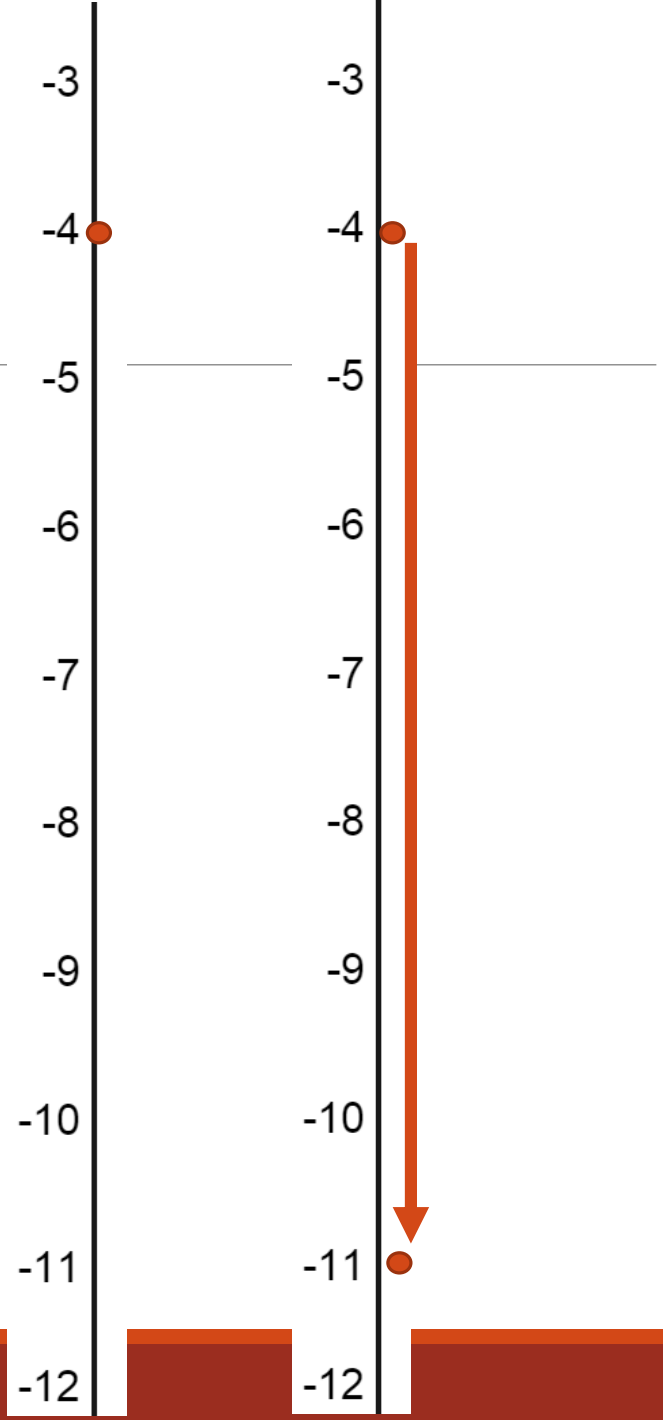
Fix:

Define subtraction as adding the opposite.

Number Lines for Adding Integers

1. $(-4) - 7$

$(-4) + (-7)$



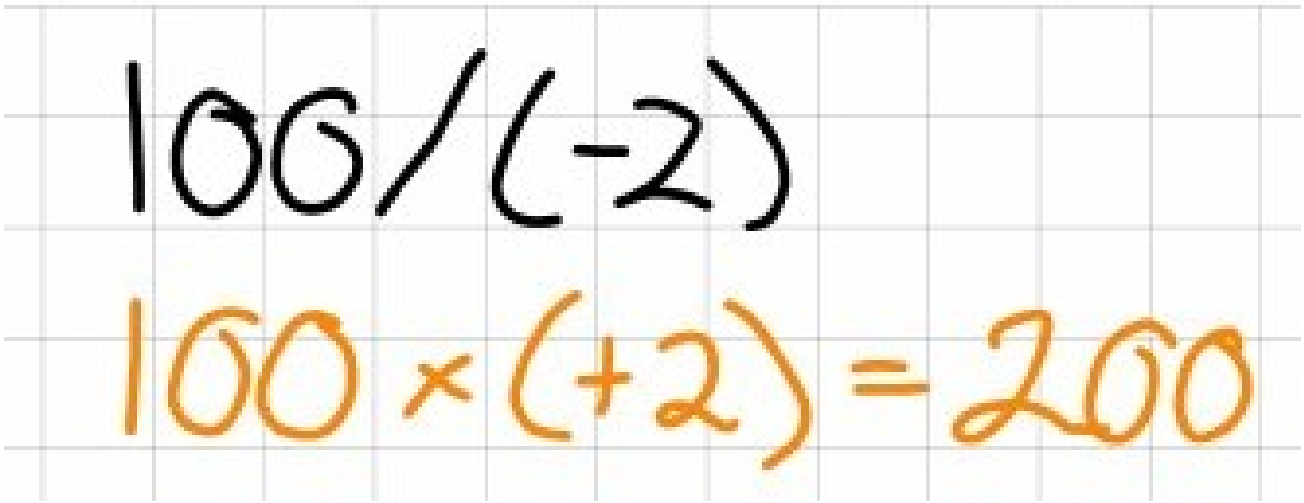
Math Mistakes

What mistakes might you expect on this problem?

$$2.\ \ 100/(-2)$$

Math Mistakes

Same change flip, keep change change



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Same Change Flip

$$\frac{2}{3} \div \frac{4}{5} = \frac{2}{3} \cdot \frac{5}{4}$$

Fix:

Discover/prove the method of multiplying by the reciprocal.

Multiply by the Reciprocal

$\frac{2}{3} \div \frac{2}{3} = 1$ easy!

$\frac{2}{3} \div \frac{1}{3} = 2$ makes sense

$\frac{4}{5} \div \frac{3}{5} = \frac{4}{3}$ not as obvious, but still dividing the numerators

$\frac{4}{5} \div \frac{1}{2} = \ ?$ no idea!

Multiply by the Reciprocal

$$\frac{4}{5} \div \frac{1}{2} = \ ?$$ no idea!

$$\frac{8}{10} \div \frac{5}{10} = \frac{8}{5}$$ makes sense

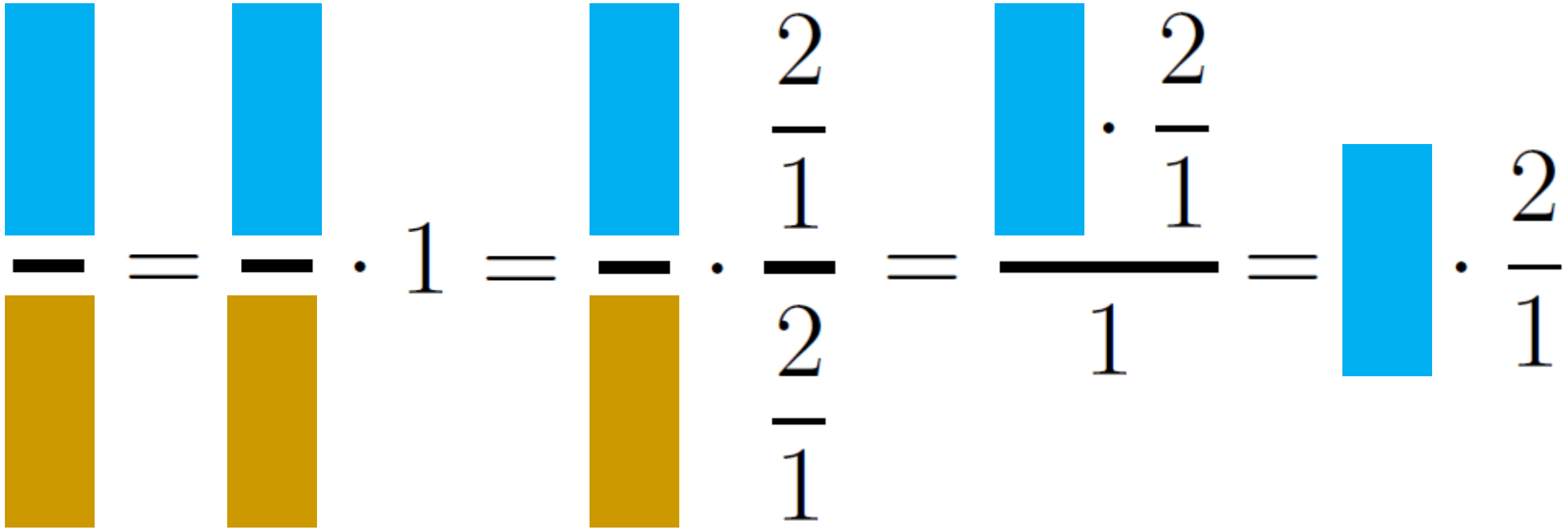
Multiply by the Reciprocal

$$\blacksquare \div \frac{1}{2} = \frac{\blacksquare \cdot 2}{\blacksquare \cdot 2} \div \frac{1 \cdot 5}{2 \cdot 5}$$

$$= \frac{4 \cdot 2}{1 \cdot 5} = \frac{\blacksquare \cdot 2}{\blacksquare \cdot 1}$$

$$= \blacksquare \cdot \frac{2}{1}$$

Multiply by the Reciprocal



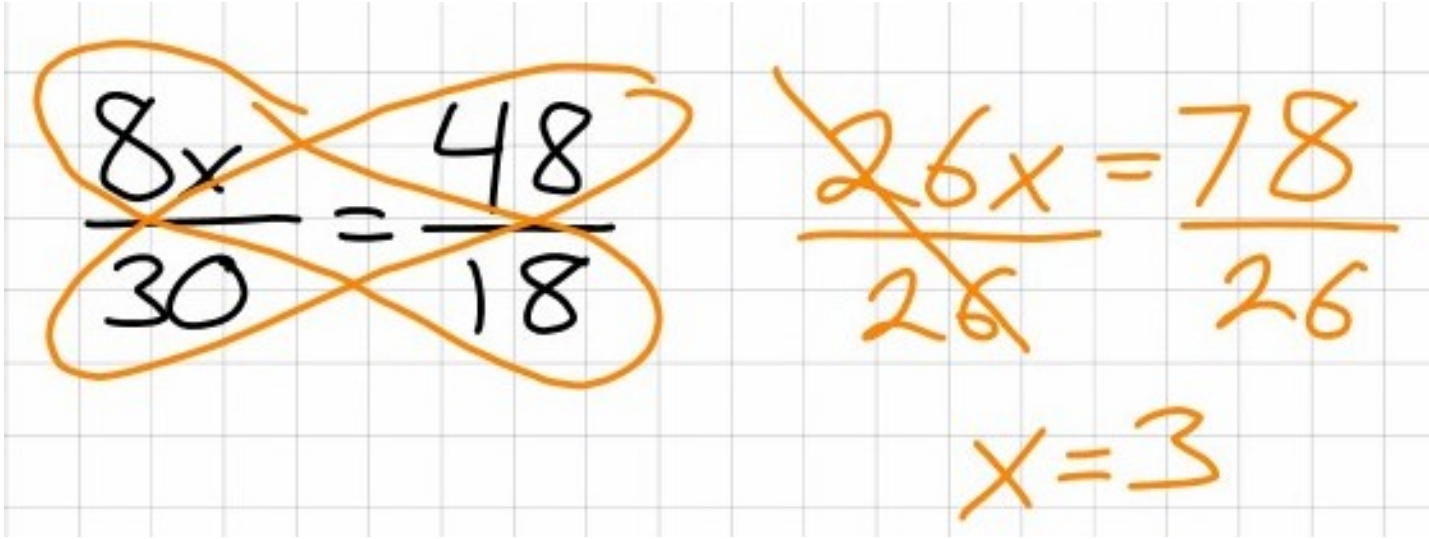
Math Mistakes

What mistakes might you expect on this problem?

$$3.\ \frac{8x}{30} = \frac{48}{18}$$

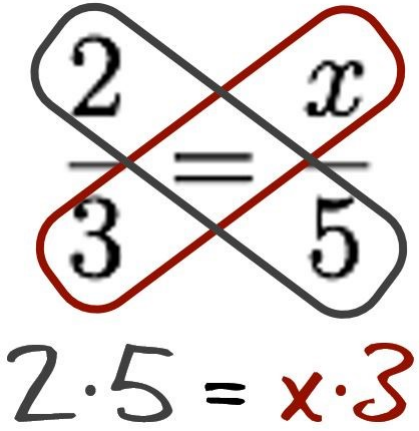
Math Mistakes

Cross multiply… cross something!



http://mathmistakes.org/?p=1320

Cross Multiply



Fix:

Solve proportions like any other equation – using inverse operations

Inverse Operations

$$30 \cdot \frac{8x}{30} = \frac{48}{18} \cdot 30$$

$$\frac{1}{8} \cdot 8x = \frac{48 \cdot 30}{18} \cdot \frac{1}{8}$$

$$x = \frac{48 \cdot 30}{18 \cdot 8}$$

Nixing Those Tricks

Is HARD!

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Is HARD!

Hard for kids who have already learned them

Nixing Those Tricks

Is HARD!

Hard for kids who have already learned them

Hard for kids who are used to learning them

Nixing Those Tricks

Is HARD!

Hard for kids who have already learned them

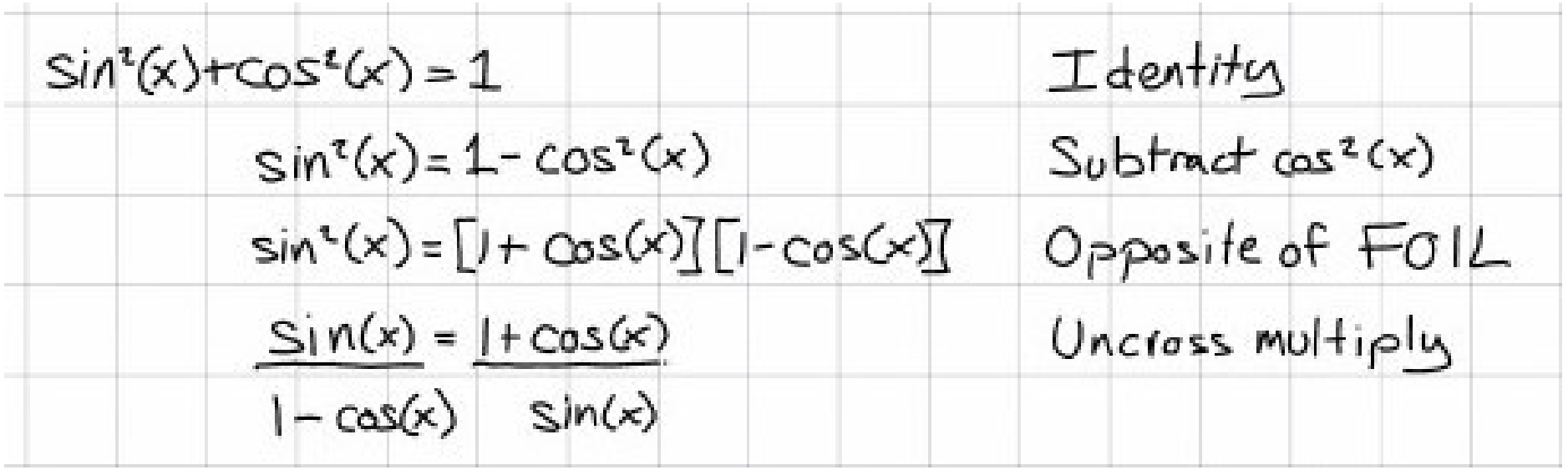
Hard for kids who are used to learning them

Hard for teachers who have them in their vocabulary

Nixing Those Tricks

$\sin^2(x)+\cos^2(x)=1$	Identity
$\sin^2(x)=1-\cos^2(x)$	Subtract $\cos^2(x)$
$\sin^2(x)=[1+\cos(x)][1-\cos(x)]$	Opposite of FOIL
$\frac{\sin(x)}{1-\cos(x)}=\frac{1+\cos(x)}{\sin(x)}$	Uncross multiply

Nixing Those Tricks



Students have no idea how to undo a trick – because they don't know what they are doing!

Understanding something includes having an idea of the inverse.

Attend to Precision

Operation	Inverse
Add	Subtract
Multiply	Divide
Cross Multiply	?
FOIL	??

FOIL

$$(2x+3)(x-4)$$

First Inside

$$2x^2 - 8x + 3x - 12$$

Outside Last

Fix:

Use the distributive property.

FOIL

$$(x-4)$$
$$=(2x+3)(x)+(2x+3)(-4)$$

	2x	**3**
x		
−4		

FOIL

$$(2x+3)(x-4)$$
$$=(2x+3)\blacksquare+(2x+3)\blacksquare$$
$$=2x^2+3x-8x-12$$

	2x	**3**
x	$2x^2$	$3x$
-4	$-8x$	-12

FOIL

$$(2x+3)(x-4)$$
$$=(2x+3)(x)+(2x+3)(-4)$$
$$=2x^2 \quad - 12$$
$$=2x^2-5x-12$$

	2x	**3**
x	$2x^2$	$3x$
-4	$-8x$	-12

Focus on Understanding

With Tricks Students:

- Are stuck if they forget

$$2 + (-5)$$

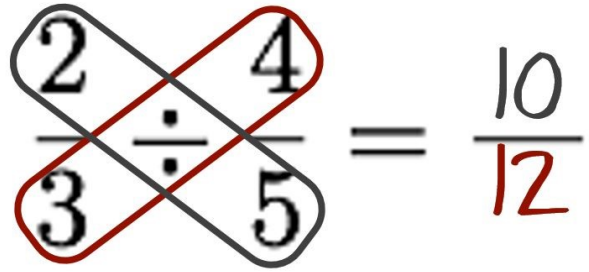
Keep Change Change

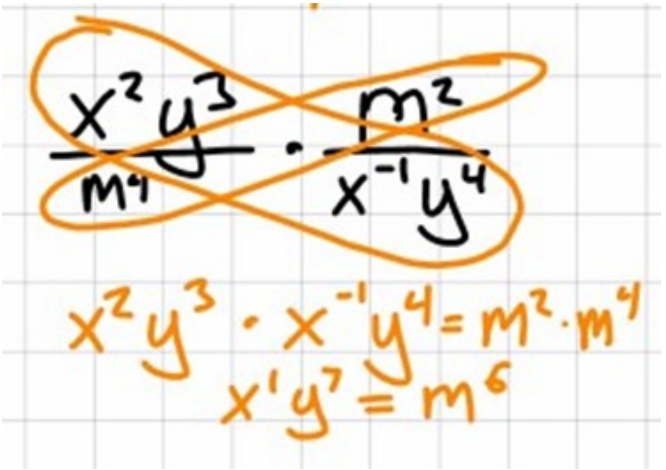
$$2 - (+5)$$

Focus on Understanding

With Tricks Students:

- Are stuck if they forget
- Generalize to dissimilar contexts





Focus on Understanding

With Tricks Students:

- Are stuck if they forget
- Generalize to dissimilar contexts
- Don't generalize to similar context

$$(2x+3)(x-4)$$

First Inside Outside Last

$$2x^2 - 8x + 3x - 12$$

$$(2x+3)(4x^2+x-4)$$

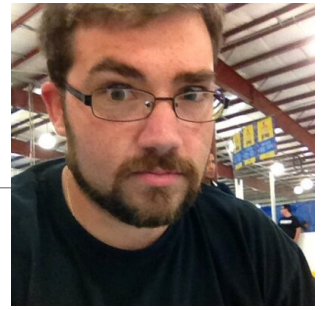
Focus on Understanding

With Tricks Students:

- Are stuck if they forget
- Generalize to dissimilar contexts
- Don’t generalize to similar context

It’s Not Too Late

“I nixed a trick!”



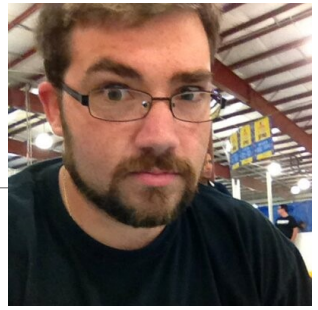
Day 120:

I think I have successfully cured my pre-algebra students of using "cross-multiply." When we started proportions, I heard it with every other problem. Now, I don't think I've heard it in over a week. What I'm hearing instead is "don't we multiply 15 to both sides?"

http://relearningtoteach.blogspot.com/2014/03/day-120-buffon-and-quiz.html

It’s Not Too Late

“I nixed a trick!”



Day 143:

After we completed the 8 word problems, I asked a simple question:
Me: "What did I not see in any of these problems? What tactic was not used?"
S: "Cross-multiplication."
Me: "Did anyone even think to use it?"
S: **silence**

YES!!! One trick nixed!

http://relearningtoteach.blogspot.com/2014/04/day-143-pointed-questions-and-jelly.html

Now What?

READY TO MAKE A CHANGE:

NixTheTricks.com

See other's ideas

Make a suggestion

Have a debate