IT'S NOT JUST A CARELESS MISTAKE!

Dr. Mary Pat Sjostrom

Winthrop University
Mathematics Education Program Director

mpshoemath@gmail.com

Overview

- Introductions
  - What level do you teach?
  - Why did you choose to attend this presentation?
  - What do you perceive are common causes of student errors?
- Outline presentation
  - Student work samples
    - Identify error patterns
    - Plan remediation
  - One student's experience
  - Avoiding the development of errors
  - Future curricular directions

Incorrect Algorithm

(Student work sample)

10.3 x 1.4

- What was she thinking?
  - Lined up decimal points
  - Answer: 144.2
- Why?
  - Addition algorithm
- What do we do?
  - Estimation
  - Does that make sense?

CCSS-M 5.NBT.

Incorrect Algorithm

Student work sample: Added fractions by adding numerators and denominators.

- Number sense!
- One-half + one-half cannot equal two-fourths because that's one-half!

Misconceptions of Division

- Student work sample: 3.22 divided by 1.4
  - Quotient too small
  - Answer .113
- Student work sample: 22857 divided by 19
  - Answer 123
  - Missed 0 in quotient
- Student work sample: 22857 divided by 19
  - Answer 1203.1
  - Subtraction error led to remainder of 10, put .1 in quotient

4.NBT.6, 5.NBT.6

Inefficient Algorithm

9126 ÷ 676

udent work sample:
epeatedly multiplied 676 by numbers: 2, 5, 8, 12, 13

ood understanding of inverse relationship of multiplication and division.
rseverance!

ut very inefficient algorithm.

Final answer:

$$13\frac{388}{676}$$

Close! 13.5

4.NBT.6
5.NBT.6

If at first you don't succeed...

- Student work sample: 763 x 87
  - Solved three different times using standard algorithm.
  - Got three different answers!

But how will he decide?

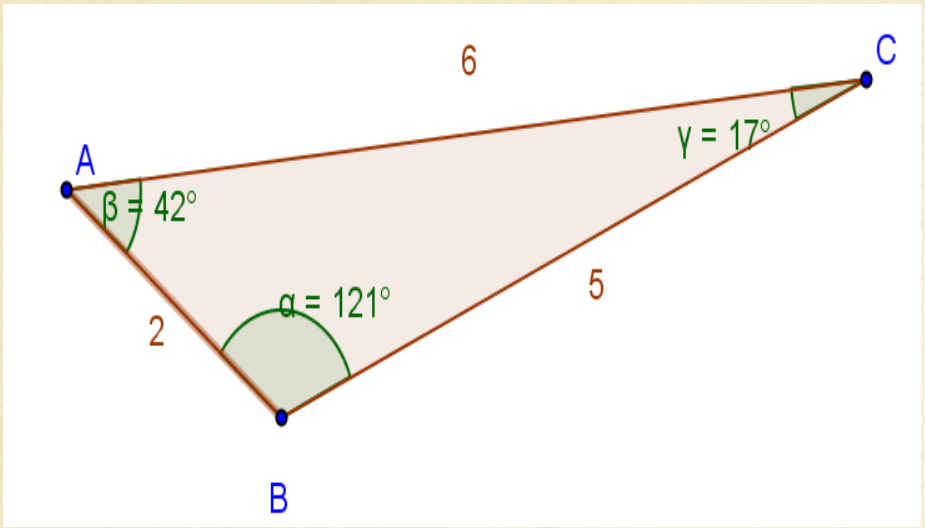
Misunderstanding in Algebra

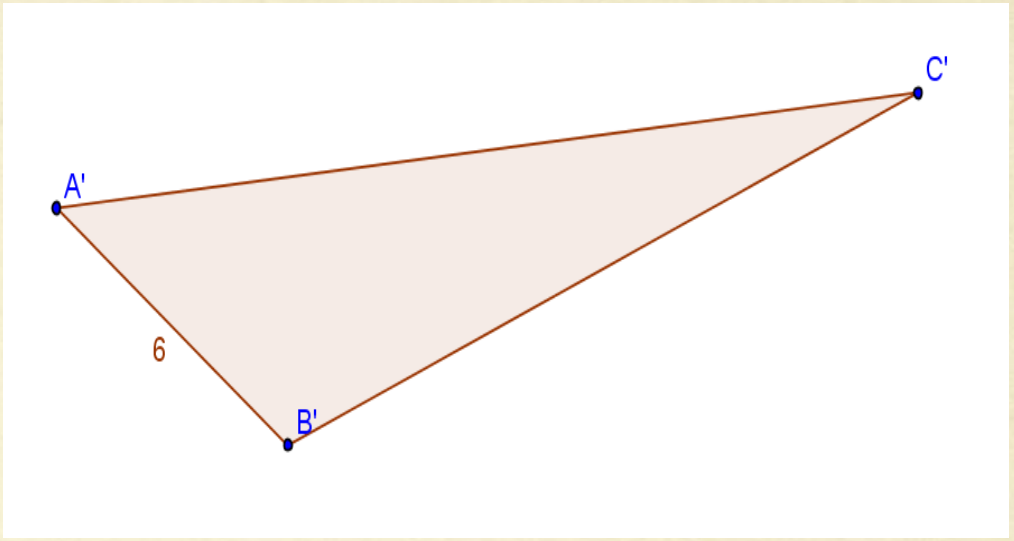
- $8x - x = 8$
- $4y - 4 = y$
- $3 \times (a \times b) = (3 \times a) \times (3 \times b)$
- $(x + y)^2 = x^2 + y^2$

6.EE, 7.EE

Overgeneralize

These triangles are similar. The measure of AB is 2 units; A'B' is 6 units.





The measure of AC is 6 units. Find the length of A'C'.

The measure of angle CAB is 42°. Find the measure of angle C'A'B'.

Error: Multiply angles by scale factor.

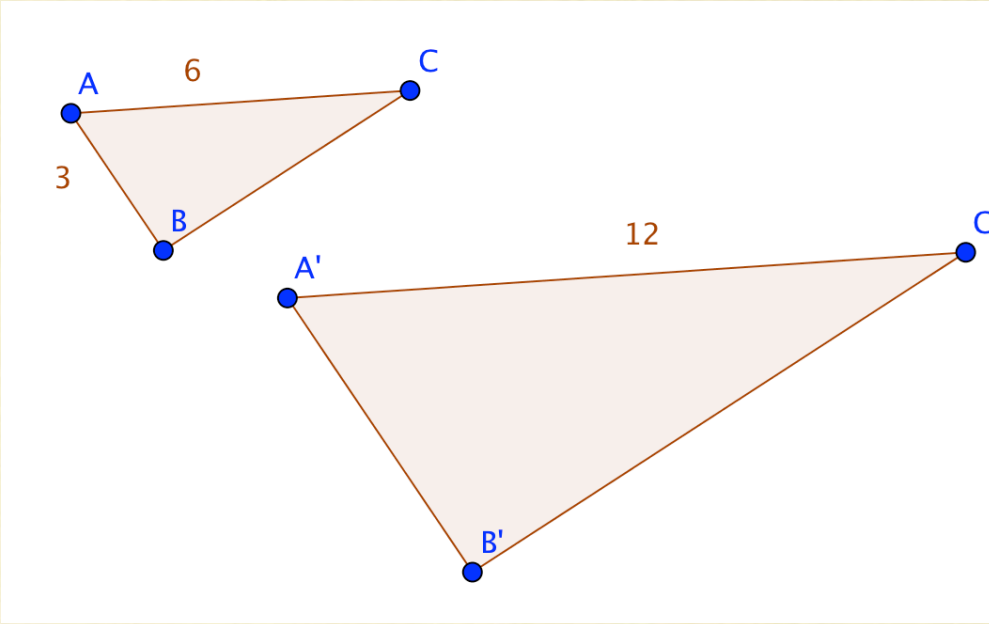
S-M 8.G.4

Overgeneralize

These triangles are similar. The measure of AC is 6 units; A'C' is 12 units.

The area of ABC is 7 units.

Find the area of A'B'C'.



or: Multiply area by scale factor rather
n by square of scale factor.

-M 8.G.4

WANTED

AUNT SALLY

Problems with PEMDAS

Student work sample)

- Think order is always M then D, A then S
- Examine mnemonics from other countries
- Should know order isn't rigid
- Don't understand purpose of ( ) and other grouping symbols (fraction bars)
- Students learn without understanding!

6.EE.2

Language for Algorithms

- Keep-change-change 16 – (-5)
- Keep-change-flip
- Divide decimals by "moving the decimal point"
- Cross-multiply – When? Why?
- Cross-cancel – What does that even mean?

6.NS.1, 6.NS.3, 7.NS.1

My Experience

- I teach preservice teachers: Early Childhood, Elementary, Special Education
- Mathematics for Teachers courses to develop deep understanding of the content, but it's difficult when students don't know the procedures they will have to teach.
- Test, remediate one-on-one or very small group, using manipulatives, emphasizing reasoning.
- Then identify and analyze errors, discuss and write notes for themselves on methods and concepts.
- Then practice and check.

Avoiding Error Development

- Take time to teach with understanding: conceptual understanding before procedural fluency
  - CCSS Fractions: 3rd grade focus on meaning, 4th on add/subtr like denom, 5th unlike
- Help students see connections.
  - For example, Addition: join LIKE things
    - Ones, tens, hundreds
    - Tenths, hundredths (don't just line up decimal points)
    - Like denominators: 1 fifth + 3 fifths

Avoiding Error Development

- Have students develop algorithms – research supports this.
- Have students analyze and discuss errors.
- Compare/contrast algorithms.
- Use mathematically correct language.
  - CCSS Mathematical Practice 6: Attend to precision.
  - Mathematically proficient students try to communicate precisely to others.

Computational Skills

- What's important?
  - Understanding
  - Reasoning
  - Estimation
- As access to technology increases, what skills do students need?
  - Many young teachers don't know we used to find square roots by hand!
  - Do we need to teach students to do long division by hand?
  - What about other computational skills?

References

- Ashlock, R. B. (2006). *Error Patterns in Computation.* Pearson.
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