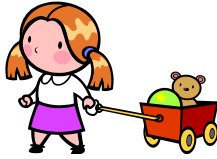


"What's up with that?"

Here are three questions that we were asked in class one day:



Consider families with 3 children:

- Suppose you know that 1 of the 3 children is a girl, but you don't know the gender of the other 2. What's the probability that they are all girls?
- Suppose you know that the *oldest* child is a girl, but you don't know the gender of the other 2. What's the probability that they are all girls?
- Suppose you know that the *oldest* child is a *boy*, but you don't know the gender of the other 2. What's the probability that they are both girls?



Confessions of a student: There were some answers I thought would be the same, but they weren't. And then some I thought would be different, but they were the same. I don't get it. What's up with that?!?!?

"What's up with that?"



"I know how to solve equations really well. I just follow the logic steps. You always have to "undo" whatever is there. So if it's $x+4$, you do -4 from both sides. Simple. Then I'm absent one day, and I get these problems. I do them. One I get one answer and it's right. The next one, I get one answer and it's wrong! The third one, I get 2 answers, and one is right and one is wrong?! *What's up with that?!?! Why doesn't my equation solving method work any more????*"

1. This one I got right

$$2 + \sqrt{(x + 3)} = 6$$

2. This one I got wrong

$$6 + \sqrt{x - 2} = 5$$

3. This one I got half credit

$$4 + \sqrt{x + 2} = x$$

Your task

Step 1: Do the math!

Solve these equations and determine the correct answer for each. And WHY.

As you work, try to figure out why this student is so confused. Or is math really once again not something that makes any sense...

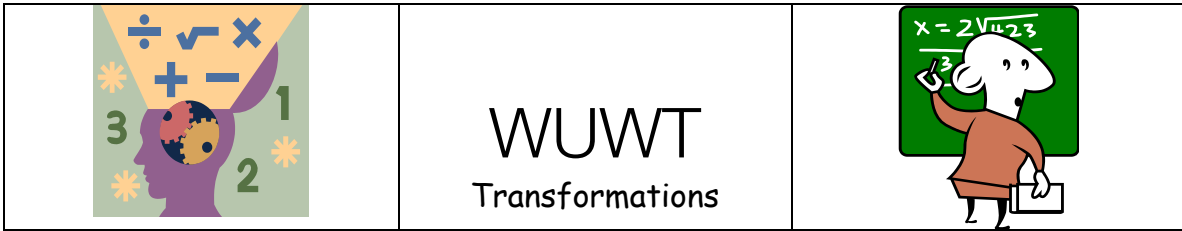
Step 2:

Why is this a question for students? Why is this a puzzle? (Think both about the mathematics and think about how we present prior materials to them. Both can be sources for something like this feeling "counterintuitive" or not making sense to them.)

Step 3:

Teaching ideas!

Generate 2-3 different ways you could approach this in a classroom so that it DOES make sense. Be sure this gets at the *mathematics!* You are not teaching tricks to remember, or rules to follow so you don't mess up. You are teaching for understanding!



Quadratics are a family of functions, with the "parent function" $y = x^2$.

The graph of $y = (x - 2)^2$ is a shift of $y = x^2$ two units to the right. What's up with that? (Why not 2 to the left???)

More generally, why (for any graph?) is it the case that $f(x - h)$ is a shift of $f(x)$ h units to the right?

See what you come up with....



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See what you come up with....

“What’s up with that?”



“I know that using exponents means we multiply. Like 2^3 is $2 \times 2 \times 2$. But I don’t get this whole 0 exponent thing. 2^0 , and in fact, anything to the zero power, is equal to 1. *What’s up with that?!?!* Oh wait, except 0^0 , that’s undefined! *What’s up with that?!?!?!*”

Your task

Do the math!

Offer a line of mathematical reasoning that explains why 2^0 must be equal to 1, and for that matter, why $a^0 = 1$ for $a \neq 0$.

(That is, why does it make sense that $2^0 = 1$?)

As you work, try to figure out why this student is so confused. Or is math really, once again, not something that makes any sense...

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