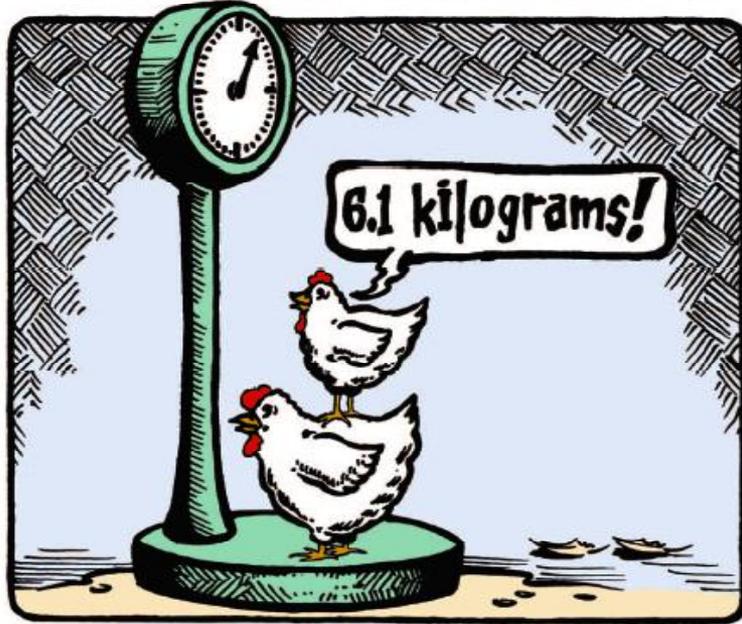
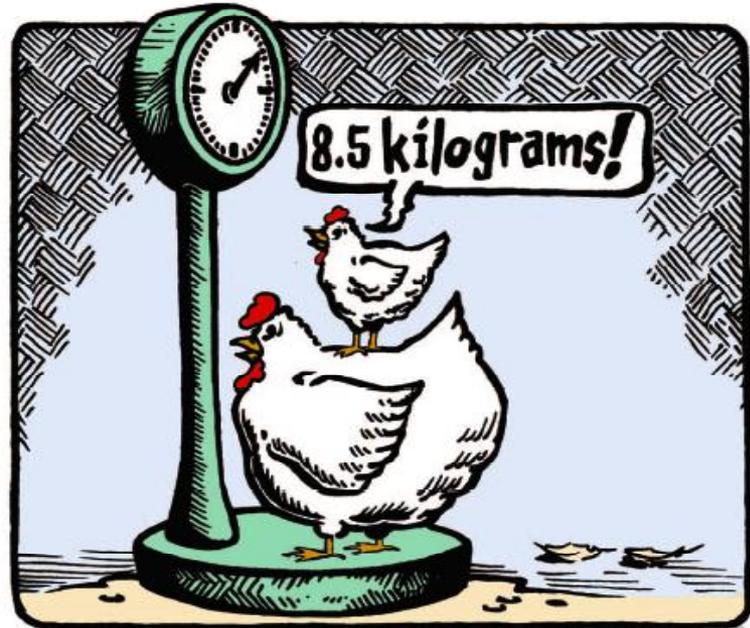
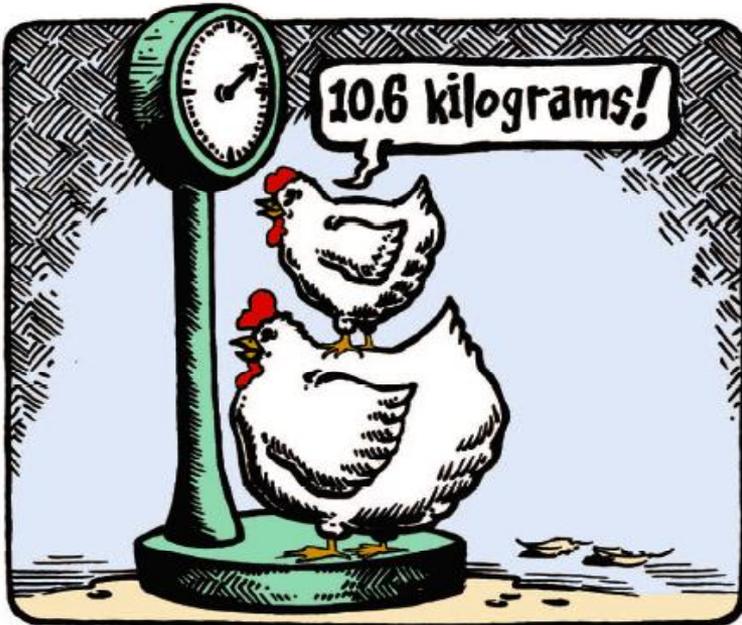


What do teachers need to know to teach mathematics well?

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It is about the students and evidence
that they are learning.

■ What do teachers need to know
to teach well?

and/or

■ How should teachers come to
know?

Content knowledge

- But not “everything”
- Think deeply about simple things
- Not all math is equally important

Curriculum trajectories

- What comes before and what follows
- “learning lines”

Look for and make use of structure

- Look closely to discern a structure
- Step back for an overview and shift to a new perspective

Arithmetic to algebra: “Met-befores”

(Tall, 2004)

■ Place value

$$2x^2 + 3x + 5 \quad \longleftrightarrow \quad 2 \cdot 10^2 + 3 \cdot 10 + 5$$

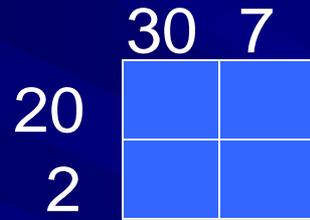
$$2x + 3x \quad \longleftrightarrow \quad 2 \cdot 10 + 3 \cdot 10$$

$$2x^3 + 3x \quad \longleftrightarrow \quad 2 \cdot 10^2 + 3 \cdot 10$$

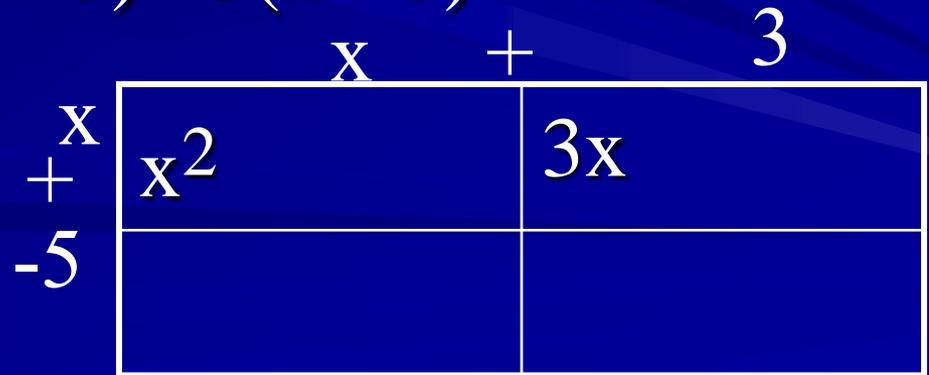
$$1 + 0.2 + 0.03 + 0.45 = 1 + \frac{2}{10} + \frac{3}{100} + \frac{45}{100}$$

The distributive property

■ $(22)(37) = 22(30) + 22(7)$



■ $(x+3)(x+-5) = x(x+-5) + 3(x+-5)$



Learn math by doing math

And talking about it.

Construct viable arguments & critique the reasoning of others

- make conjectures and build a logical progression of ideas
- evaluate arguments, decide whether they make sense, and ask useful questions to clarify or improve the arguments
- distinguish correct reasoning from that which is flawed and explain any flaws

Math should make sense

- make sense of problems and persevere in solving them
- communicate precisely to others
- use clear definitions in discussion and in reasoning
- state the meaning of symbols used, specifying units of measure, and labeling axes
- note the assumptions made

NCTM: Reasoning and Sense Making in High School

- Algebra
- Data Analysis
- Geometry

Polya's Ten Commandments

Read faces of students

Give students **“know how”**, **attitudes of mind, habit of methodical work**

Let students guess before you tell them

Suggest it; do not force it down their throats (Polya, 1965, p. 116)

Polya's Ten Commandments

Be interested in the subject

Know the subject

Know about ways of learning

Let students learn guessing

Let students learn proving

Look at features of problems that suggest solution methods (Polya, 1965,p. 116)

References

- Common Core Standards. *College and Career Standards for Mathematics* (2010). Council of Chief State School Officers (CCSSO) and (National Governor's Association (NGA)).
- National Council of Teachers of Mathematics. (2009). *Focus in High School Mathematics: Reasoning and Sense Making*. Reston VA: The Council.
- Polya, G. (1965). *Mathematical discovery: On understanding, learning, and teaching problem solving*.

