Say What You Mean, and Mean What You Say!

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What we write and what we say becomes what our students learn,
even our missteps and lazy language!

This is an unintentional consequence but we need to be intentional! Here are a few examples and suggestions.

Collecting Like Terms

$$3xy + 2x + 3y - 2x$$

Be honest… what do you say or what do your students say?

Often I hear: “The 2x’s *cancel.*”

What Should You Say?

We often say cancel because we put a slash through the terms, try underlining or circling the terms instead.

$$3xy + 2x + 3y - 2x$$

We should say “These terms *“add to zero”.*

Perpendicular Slopes

Question: Find the slope of the line perpendicular to the line $5x - 2y = 8$.

Students will often find the slope of the line $m = \frac{5}{2}$. They will then write $m = \frac{5}{2} = \frac{-2}{5}$ this is of course an incorrect statement.

What Should You Write?

$$m = \frac{5}{2} \qquad m \perp = \frac{-2}{5}$$

Be careful what you say: negative reciprocal can be misleading to students.

Say instead: “ opposite reciprocal”

Changing Variables

$$5 - b = 3a \qquad subtracting\ 5$$

this sometimes becomes

$$-B = 3A - 5$$

Are you guilty of this?

Know why this is wrong and when you see this gently correct your students.

Subscripts

Of course we are all aware of the formula for

slope $m = \frac{x_2 - x_1}{y_2 - y_1}$.

I have seen $m = \frac{x2 - x1}{y2 - y1}$ or even $m = \frac{x^2 - x^1}{y^2 - y^1}$. Be sure your students are writing and ***saying*** it correctly.

Strings of Equal Signs

$$-2y = -5x + 8 = y = \frac{5}{2}x - 4$$ Ouch! 

- Model working down the page on the board.
- I have often seen instructors require their students to fold their paper lengthwise to combat this bad habit.

Fractions

Fractions are often ambiguous such as the following:

- $2/3x$
- Does this mean $\frac{2}{3x}$ or $\frac{2}{3}x$?

More Fractions…

$5x + 6\ /4x + 2$

The student often means

$$\frac{5x+6}{4x+2}$$

but is really writing $5x + \frac{6}{4x} + 2$

How Can We Combat This?

- Use only horizontal fractions bars and expect your students to do the same.

Using the Dot for Multiplication

- Encourage your students to not use the dot for multiplication because it can get lost or look like a decimal.
- Example: $\frac{3x+1}{x-2} + \frac{5x+3}{x+2}$
- $$\frac{x+2}{x+2} \cdot \frac{3x+1}{x-2} + \frac{5x+3}{x+2} \cdot \frac{x-2}{x-2}$$

More Assumed Parentheses…

If a student, or you are trying to save space and *really* have to use a slash the parentheses are *not optional*.

$$(5x + 6)/(4x + 2)$$

This is extremely important too when they are using the calculator to graph rational functions.

Cancelling Errors

$\frac{2\pm4\sqrt{3}}{2}$ often becomes $1 \pm 4\sqrt{3}$

How can we model this to avoid this error?

- Separate it as two fractions $\frac{2}{2} \pm \frac{4\sqrt{3}}{2}$ OR
- Factor $\frac{2(1+2\sqrt{3})}{2}$

  Don’t skip steps!

No Slope Vs. Undefined Slope

No Slope?

Does this mean that the line has an Undefined Slope or a Zero Slope?

Mean What You Say!

Zero vs. The Empty Set

I often have students use $\emptyset$, "$the\ empty\ set$" when they want 0, "$zero$".

Make sure you know the difference and model this correctly in your written work.

P.S. My students tell me the chemistry classes use $\emptyset$ for zero…

The Argument of a Function

- Example: Often in Trigonometry I see $\sin\theta\cos\theta$ turn into $\sin\cos$
- Where did the argument of the function go?

$\sin(\ )$ $\cos(\ )$ $\log(\ )$ $\ln(\ )$ etc.

I actually believe that students often do not understand that trigonometric functions and logarithmic functions serve as “operations” that apply to an argument. Each of these have inverse “operations” as well. If they do not understand this it can lead to erroneous cancelling or division. Like so…

$$\frac{\log(x)}{log} = \frac{\log(4)}{\log(4)} + \frac{\log(3x)}{log}$$

They would probably not cancel the f here $\frac{f(x)}{f}$ …

Logarithms “$\log_4 x$”

How do your students say it?

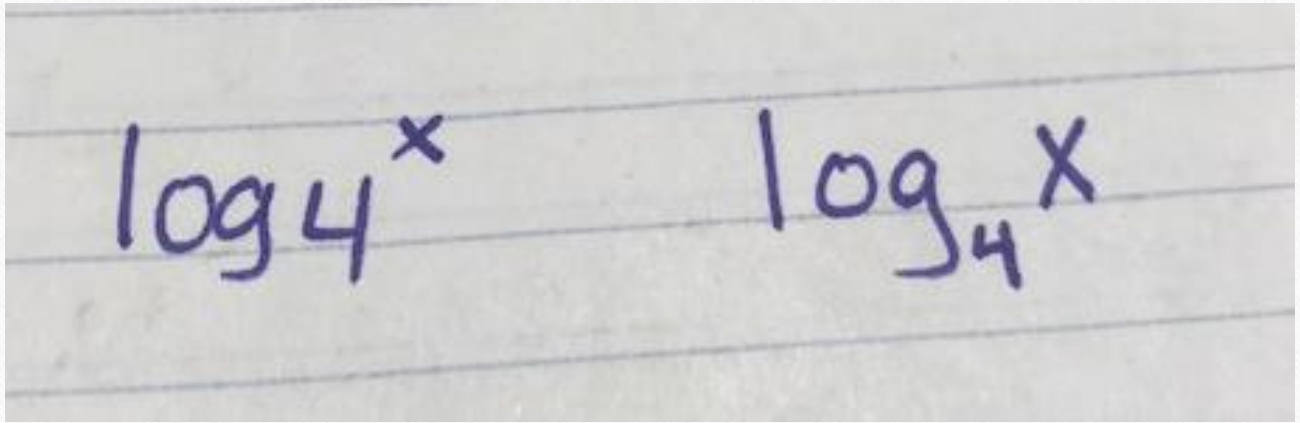
“$\log 4\ of\ x$” or “$\log 4x$" or even "$log4\ to\ the\ x$"

How should we say it? log *BASE* 4 OF x

This way they know the base and they know the argument.

Logarithms "$log_4 x$"

How do your students write it?



I tell my students to make sure the "base is in the "basement"

More on Logarithms…

I have found that if I say “L-N” rather than the “natural log” students understand it better, on the flip side I inevitably get a few students writing “In”.

Still More on Logarithms…

If we write log x+3, rather than log(x+3) there can be confusion, especially with multiplication. $\log xy^2$ might actually mean $y^2 \log x$. (Obviously in print this is not as much of a problem.)

There are those assumed parenthesis again! It is better to write $\log(xy^2)$.

Rounding Vs. Exact Answers

Exact	Approximate
e^{-2}	$\approx .135$
$1+2\sqrt{3}$	≈ 4.464

I believe we should ask "round to the nearest hundredth" rather than "round to two decimal places". We should also ask for EXACT Values.

Units Expectations

- Students should be responsible for answering a question in a complete sentence including the correct units! This means we have to do the same.
- This becomes really important in calculus for example when you have 2 billion people/year and the student says 2 people/year. We need to teach interpretations of our results!

Definitions/Vocabulary

- Teacher: “Which way does the parabola open and how do you know?”
- Student: “It opens down because ***it*** is negative.”

We should hold our students accountable to use correct vocabulary and say “The parabola opens down because the *coefficient of the lead term* is negative” If they answer the other way ask them “What is ‘it’?”

Reciprocal vs. Inverse

Recently while teaching trigonometry I have had several students say that csc(x) is the inverse of sign when they really mean that it is the reciprocal. I also hear “cosecant times x”

More Vocabulary…
Common language they should understand:

Factor

Coefficient

Reciprocal

Conjugate

And many more…

Distribute

Term

Inverse

Argument of a function

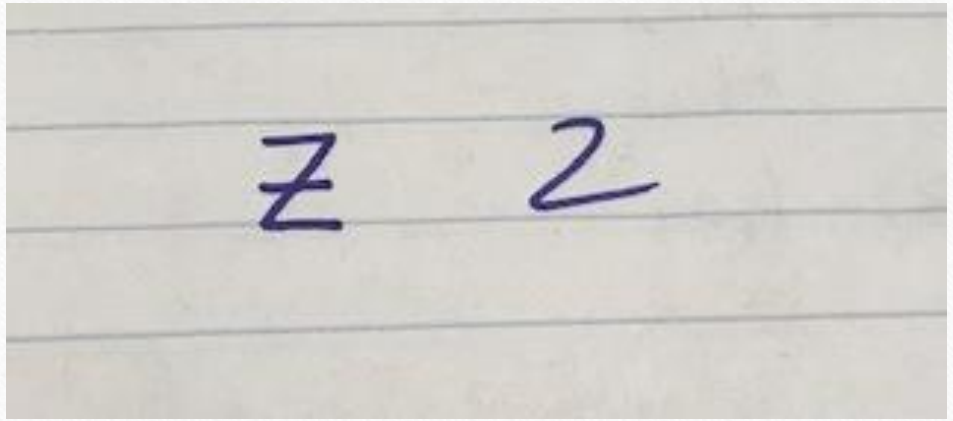
I am not suggesting that students necessarily be tested on vocabulary but that they can speak intelligently about a problem or process.

Helpful Tips

- Hold students accountable for legible work! I often confuse 0, e and 6 or y, 9 and 4.

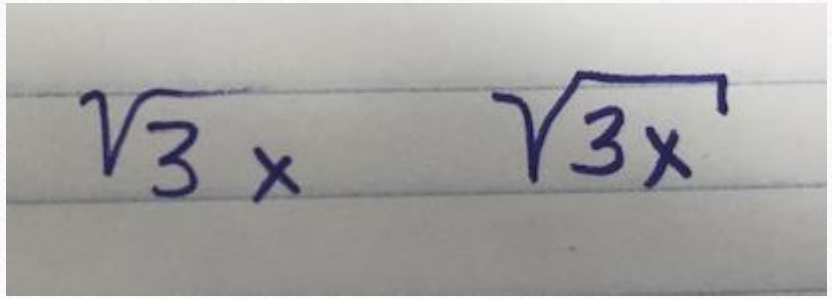
"I'm at that awkward age when I can't read my own handwriting. Do they teach penmanship in college?"

- Put a bar on your Z’s so they do not look like 2’s.

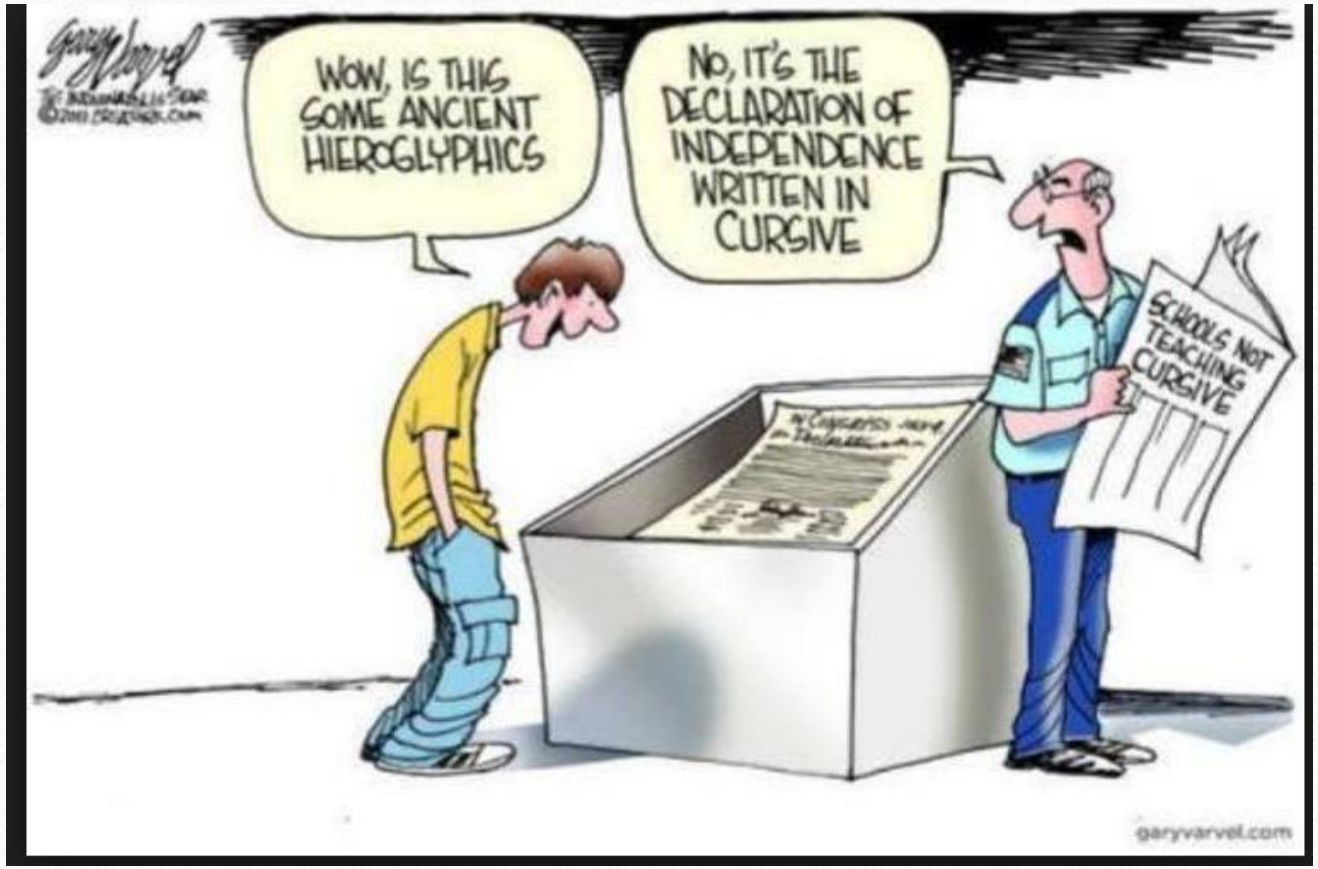


More Helpful Tips…

- Use horizontal bars on your fractions
- Put a little ”hookie do” on your radicals.

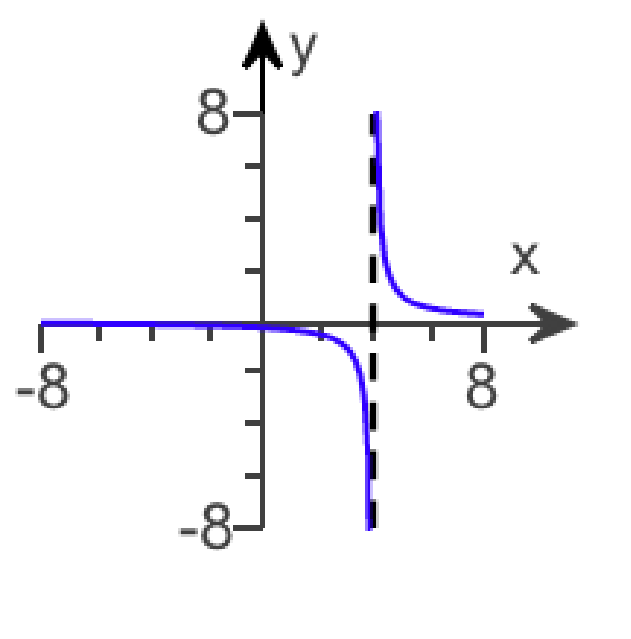


Use print, students today cannot read cursive!



Varvel, Gary. "Schools Not Teaching Cursive." *Indianapolis Star,* 16 July 2011, A12. Cartoon.

And Finally The Bane of My Existence…



It is called an AsympTOTE , NOT an AsympTOPE!

Your Students Will Rise to Your Expectations

In short, be cognizant of how you say things and how you write things you will be surprised at the difference it will make to your teaching and to how your students learn.

We can ALL do better!

Questions?

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