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Inches and Centimeters. Daniel measured several things in inches and in centimeters and he made the following table:

Object	inches	centimeters	in./cm.
Book (long dimension)	9	22.8	0.3947
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Pen (length)	$5\frac{6}{16}$	13.6	0.3952
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He conjectured that "inches over centimeters" is a constant, which is approximately equal to 0.39.

Liana said this is wrong, because the conversion table in her book says 1 inch = 2.54 centimeters. Therefore, dividing both sides by centimeters, we get:

$$\text{inch/centimeter} = 2.54. \tag{1}$$

She also said, "An inch is bigger than a centimeter, so when we take the ratio of an inch to a centimeter, we must get a number that is larger than 1."

Daniel said that Liana is wrong. His table shows that the correct value of "inches/centimeters" is:

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Please help Daniel and Liana figure out why they can't agree.

Daniel says "inches over centimeters" is a constant which is approximately equal to 0.39

Liana says that the conversion table in her book says 1 inch = 2.54

Daniel is actually stating that there is (approximately) .39 inches per centimeter while Liana is saying that there is 2.54 centimeters in an inch.

Daniel: ~~2.54~~ $\frac{\text{inch}}{\text{centimeter}} = \frac{1}{2.54} = .39$

Liana: inches per centimeters per inch

2.54 : ~~.3911~~

Therefore their confusion is this: Daniel is stating the rate of inches per centimeter whereas Liana is stating centimeters per inch.

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Please help Daniel and Liana figure out why they can't agree.

Liana is stating the appr value per her text book.
Daniel's statement is based on a comparison of one centimeter to one inch. I think Daniel is stating what part of a inch is represented by a centimeter. Daniel is comparing an inch and a centimeter.,

$\frac{1}{2.54}$ $\frac{\text{centi}}{\text{inch}} = \frac{1}{.39}$

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Liana and Daniel's ratios are different because of the location of their units. Liana claims inch/cm = 2.54, but she is not taking into account the one inch for every 2.54 cm. Therefore her ratio should be $\frac{in}{cm} = \frac{1}{2.54}$ which would lead to Daniel's findings from his table. Her claim that this ratio should be > 1 is also incorrect because cm are smaller than inches therefore when measuring the length of an object, the number of cm will be greater than the number of inches. Hence, 0.39.

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Liana's 1st statement about dividing both sides of 1in=2.54cm by "cm" to get $\frac{1in}{cm} = 2.54$ is not accurate. Units of measure are not quantities, but rather magnitudes and thus cannot be treated like numbers. Daniel's reasoning is more clear in the fact he took several examples to estimate the constant value of in/cm including 1in=2.54 cm. When dividing 1in/2.54cm = .39 in per cm. This accurately explains that .39 of an inch will fit in one cm.

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Please help Daniel and Liana figure out why they can't agree.

Daniel is correct. In order to correctly assess this problem one must realize that 1 inch = 2.54 cm is actually a ratio which holds true for other values: $\frac{1 \text{ inch}}{2.54 \text{ cm}}$. I believe Liana went fundamentally wrong ~~because~~ when she tried to divide both sides by "centimeters", seperating the unit from the quantity itself. If she had manipulated the problem correctly she would achieved equation, which proves to be true by substitution

$\frac{1 \text{ inch}}{2.54 \text{ cm}} = \frac{2.54 \text{ cm}}{2.54 \text{ cm}} \rightarrow \frac{1 \text{ inch}}{2.54 \text{ cm}} = 1$. Her answer could not be proved this way.

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Daniel is right when he made a table and figure out that an inch over centimeter is 0.39. And he proves further that dividing cm by inch is 2.54. Thus he says there is 2.54 cm for every inch or centimeters per inch = 2.54.

Liana is right and wrong. Right when she says 1 inch = 2.54 centimeters But wrong when she says "An inch is bigger than centimeter, so when we take the ratio, we must get an answer that is larger than 1. which is not always the case when the unit is different

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Daniel: $\frac{1\text{ in}}{2.54} \cong \frac{2.54\text{ cm}}{2.54}$

.39 in $\cong$ 1 cm.

The number of inches per centimeter is .39 This is the number that you will get if we are talking about the number of inches per cm.

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Liana does not have a clear understanding of ratios, conversion factors, or equations. From 1in = 2.54cm, Liana should have divided both sides of the equation by 2.54cm to get $\frac{1\text{in}}{2.54\text{cm}} = \frac{2.54\text{cm}}{2.54\text{cm}} \Rightarrow 0.39\,\frac{\text{in}}{\text{cm}} = 1$.

She divided one inch by one centimeter as if it were.

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$c = cm$ $\quad c = 2.54i$ inch/centimeter = 2.54. $\quad \frac{1\ in}{1\ cm} = 2.54$ (1)

$i = in$ $\quad i = .39c$

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Daniel and Liana are using ratios differently. There are 2.54 cm "in" 1 inch, so it would be correct to read Liana's (1) as 1 inch ÷ 1 cm = 2.54. Daniel's statement (2) is correct if read as a ratio - $\frac{1\ in}{1\ cm} : \frac{.39}{1}$ or $\frac{.39\ in}{1\ cm} = 1.$ Statement (3) can similarly be expressed as a ratio - $\frac{1\ cm}{1\ in} = \frac{2.54}{1}$ or $\frac{2.54\ cm}{1\ in} = 1.$ Both are correct, each is a different side of the same coin.

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They can't agree because Liana is wrong. 1 inch = 2.54 cm implies that 1 cm = $\frac{1}{2.54}$ inches = 0.39 inches. Now since an inch is larger than a cm, the ratio will be less than 1. Centimeters per inch means how many centimeters can fit in one inch. Since cm are smaller than inches, 2.54 cm can fit in one inch. Therefore, 0.39.. inches can fit in 1 cm. So Daniel is correct. Also, inches and centimeters are units and are not variables. Liana makes this mistake and tries to divide by the units.

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$\frac{in}{cm} = \frac{1}{2.54} = 0.39\ldots$ $\quad \frac{cm}{in} = \frac{2.54}{1} = 2.54$

Liana did not set up her ratio proportion correctly. If you are dividing inches by cm, you will result in 0.39...

She did $\frac{1in}{cm} = \frac{2.54cm}{cm}$, dividing by the unit cm.

However, if you divide $\frac{in}{cm}$ like $\frac{9}{22.8}$ in the chart, you will get 0.39..., not 2.54.

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$5/gal
1 gal is $5

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Earlier today it was stated that a Number statement is: "inches measured by centimeters = 2.54" ← Liana's view point

And a magnitude statement is: "1 in = 2.54 cm" ← Daniel's view point

I think both are correct and are having an argument based in definitions of the words they're using to describe the math.

Instructions. Always include explanations, so that other readers can tell what you did and why you did it. Never write outside the box.

Inches and Centimeters. Daniel measured several things in inches and in centimeters and he made the following table:

Object	inches	centimeters	in./cm.
Book (long dimension)	9	22.8	0.3947
Book (short dimension)	$5\frac{15}{16}$	15.2	0.3906
Paper clip (long dim.)	$1\frac{5}{16}$	3.3	0.3977
Paper clip (short dim.)	$\frac{5}{16}$	0.8	0.3906
Pen (length)	$5\frac{6}{16}$	13.6	0.3952
Phone	$3\frac{10}{16}$	9.1	0.3984

He conjectured that "inches over centimeters" is a constant, which is approximately equal to 0.39.

Liana said this is wrong, because the conversion table in her book says 1 inch = 2.54 centimeters. Therefore, dividing both sides by centimeters, we get:

$$\text{inch/centimeter} = 2.54. \quad \frac{1\text{ in}}{2.54\text{ cm}} = \tag{1}$$

She also said, "An inch is bigger than a centimeter, so when we take the ratio of an inch to a centimeter, we must get a number that is larger than 1."

Daniel said that Liana is wrong. His table shows that the correct value of "inches/centimeters" is:

$$\text{inches/centimeters} = 0.39\ldots. \tag{2}$$

He also said that $1/(2.54) = 0.393701$, so if you invert both sides of (2), you get

$$\text{centimeter/inch} = 2.54. \tag{3}$$

He added, "2.54 is the number of centimeters per inch, so (3) is right, because

$$\text{centimeters per inch} = 2.54.$$

Liana said that Daniel is wrong, because the number of centimeters per inch is the number you get when you divide a centimeter into an inch, not what you get when you try to find out how many inches there are in a centimeter (which would be 0.39).

Please help Daniel and Liana figure out why they can't agree.

~~They are both correct.~~ Liana is wrong; ~~.39 inches per~~ it takes 2.54 centimeters cm to equal 1 inch, and .39 inches per cm. ~~Different conversions, & steps of~~ ~~reasoning, the same thing~~ she is trying to convert magnitude statement & just go instead of going through all the steps.

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Linda is looking at the problem as a ratio of centimeters to an inch; i.e. there is 2.54 centimeters in a inch $\frac{1\text{in}}{1\text{cm}} = 2.54$

Daniel is looking at a ratio of an inch to a centimeter; i.e. there is .39 inches in a centimeter $\frac{1\text{cm}}{1\text{in}} = .39$

Both are right they are just working with reciprocals of each other.

Linda is comparing the smaller unit to the bigger unit = $\frac{s}{b}$

Daniel is comparing the bigger unit to the smaller unit = $\frac{b}{s}$

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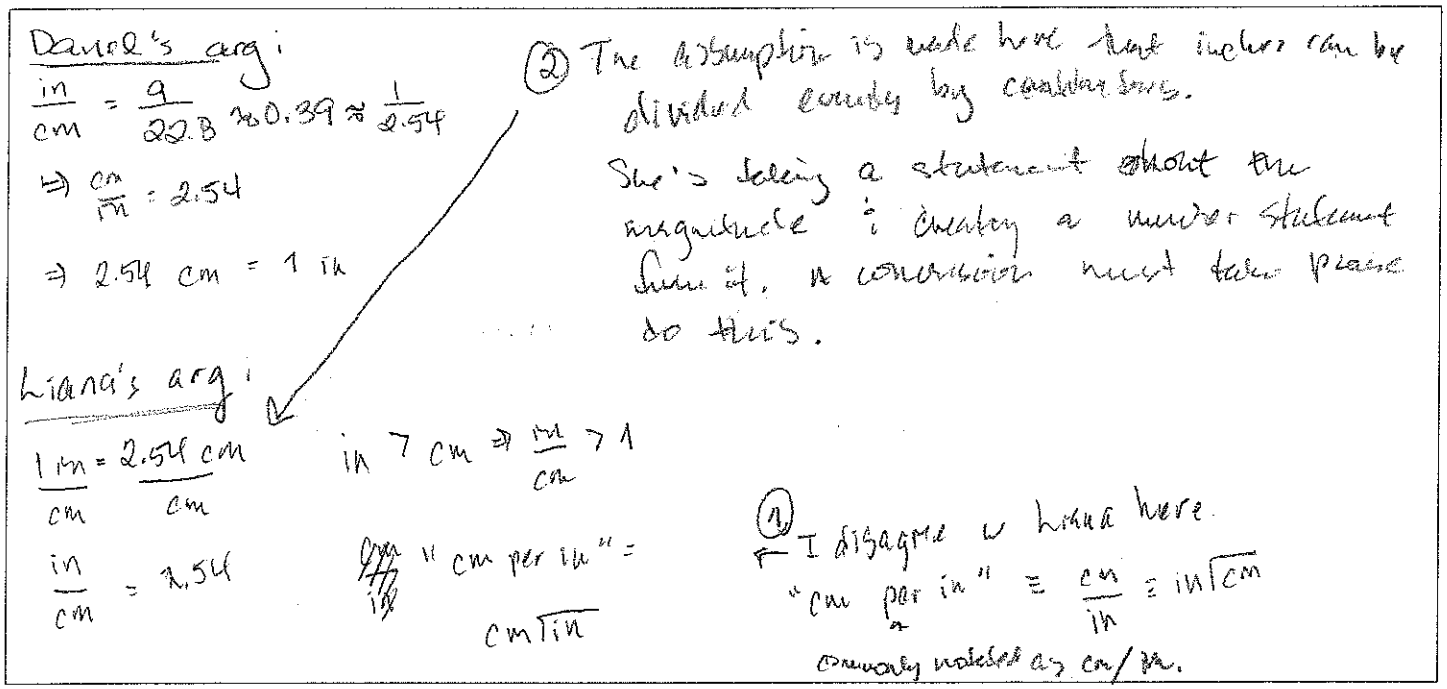

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2.54 cm per inch:

$$\frac{2.54\text{ cm}}{1\text{ inch}}$$

Daniel is comparing inches to cm. as a fraction.

Liana is looking at the ratio, ignoring that a ratio makes a fraction.
She is comparing centimeters per inch which is 2.54, but stating it as in/cm.
Can't go from magnitude statement to number statement w/out converting.