Homework Stories Rubric

The **purpose** of writing explanations is twofold. First, you will notice how your own understanding grows when you try to explain your solution to someone else. You might even realize that it is not complete or has a major gap in it. Second, it will give me the means to assess your true understanding of the mathematics.

This is a core class, so it is perfectly appropriate for me to have you **writing**. I am of the opinion that many people have trouble writing because they cannot precisely express their ideas at the level of individual sentences. In mathematics, there is a critical need for precision, so it offers a fertile ground for working on writing in the small. That's what we will do here.

Imagine your **audience** to be the average student in our class who has not thought about this particular problem yet. Mention everything necessary to make the student understand the problem and your solution. Don't assume that the professor is your audience. This will usually lead to solutions that are too short and don't show whether you truly understand the solution or not.

Grading and Revisions: Mastered or not yet mastered?
Each homework story will be graded on a pass/fail basis with helpful comments for revision if needed. You can revise each assignment, due a week after your work was returned to you. If my feedback was not helpful enough yet, come see me so I can help you master the story.

To pass the assignment:

- You need to convince me that you **make sense** of the mathematical ideas, following the requirement and components listed below.
- You need to have a complete, legitimate mathematical solution/explanation.
- Your write well enough that a fellow student could make sense of it -- even if the material was new to her/him. See requirements below.
- You mention at least one **mistake or gap** that you encountered during your exploration or writing process.
- Your typed homework story is about **2-4 pages** long. Handwritten homework stories may be longer. I suggest typing your work so that you can more easily revise it. You can include images by taking a picture of a hand drawn figure and including it in your word document. You can include equations with the equations editor in word.
- You spent at least **1-3 hours** on each homework story.
- You hand in your story and revisions on **PLATO**. This can be done by creating a pdf document of your handwritten solution using the app GeniusScan. The reason for online submissions only is that we will both be better able to keep track of the revised material, feedback and improvements.
- (minor mistakes and problems are acceptable).

The main **requirements/components** for an explanation are:

- Restate the problem/task in the beginning of the explanation.
- Include the history of your solution process, for example "First I tried…", "But then I noticed…", "I changed my thinking because…". The writing about your process can be informal.
- Report productive mistakes in your writing and how you learned from them. Mistakes are important and help us make sense of the big ideas.
- Reference other people's work if appropriate: "My partner showed me that…", "My groups had the idea…"
- Make sure that each sentence is true, either you explain why it is true or the sentence refers to information we used in class.
- If you are not sure if a sentence is true, you have to state that, e.g. "I believe that…" or "I conjecture that…". Be aware though that your final explanation can only be complete if you are certain that all your sentences are true.
- Use counter examples to show that a statement is false.
- Show an example of your thinking to make the solution easier to understand for the reader.
- Draw a picture if possible to make the solution easier to understand for the reader. Draw neatly and describe the pictures.
- The writing is handwritten and legible or typed.
- Your explanation shows clear organization: In which order should the reader read the sentences and look at the pictures?
- The explanation contains few spelling or grammatical errors.
- All sentences are complete (not fragments), even if you write equations and refer to pictures.
- All quantities are clearly identified; in particular, the identity of all pronouns is unambiguous. For example: "*I know this works because it is going up*". What do you mean by "this"? And what do you mean by "it"?
- Avoid "key words" as a substitute for an explanation. Example: "This is true because you can *cross multiply*."
- If you cannot solve/explain the problem or explain, show all your attempts and explain what did not work. This will help you toward a revision.

Suggestions:

- Work on a first draft. Then rewrite/rethink and write the version you want to hand in.
- Admit honestly any lack of understanding.
- Ask any questions you have before you hand in your solution. You can ask your fellow students and/or your instructor.

Example of a "mini" homework story:

Problem:
Why do you have to find a common denominator when you add fractions?

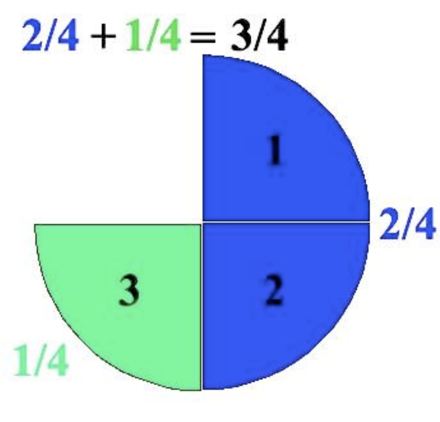
Audience: Students (Grades 4-16) who already make sense of equivalent fractions.

Solution:
I remember thinking that it would be so much easier if we could just add across, just adding the numerators and denominators. I was annoyed that mathematicians invented a rule that is so complicated. But then I realized that with my simpler rule 1/2+1/2 would equal 2/4 which is the same as ½. That would make no sense since 1/2+1/2 is equal to 1, not 1/2.

If you add objects, i.e. count how many there are altogether, you have to make sure that the objects are of the same kind. I often hear teachers say that you can't add apples and oranges. Well, technically you can: 2 apples and 4 oranges are 6 pieces of fruit, right? But you can't say that it would be 6 apples or 6 oranges. So if I want to be precise about the kind of object I am dealing with, then I need to make sure that all the objects I want to add are of the same kind.

If I, for instance, add ¼ to ½ I can think of ½ as two fourths and so I am adding one fourth to two fourths which will give me 3 fourths. In the picture below you can see how ½ (the blue area) is equal to two fourths (the blue area split up). Now we can count in fourths (which are quarter circles in the picture) and we get a total of 3 fourths.

Given any two fractions, I can change the fractions into equivalent fractions until the two fractions share the same denominator. If two fractions have the same denominator, they are referring to the same part of the whole. They might have different amounts of those parts, but since the parts are the same they are referring to the same kind of object and I can add them.



I am still not sure about why we can *multiply* fractions by multiplying across, why don't we have to use common denominators here as well?