

got the hang of this. This might seem "obvious" but it's not actually a given property off of the list of number system axioms (the original list of properties from which all other properties are derived) - it needs to be proved. This is asking you to show that any number's additive inverse, i.e. $-A$, is equal to what you get when you multiply the additive inverse of 1 (i.e. -1) times that number, i.e. getting $(-1) \times A$.

To help you out in case you got a bit glassy eyed when we worked through some proofs together in class, here are notes on [a couple of proofs](#) that we looked at in class together - I've written out each step along with commentary. The result is a (very!) long-winded explanation of each proof, but if you look at each step, it should be clear that every step just depends on a basic property from the list of 11 number system properties (explained in the note).



5) This is a subtle point, but things of this sort came up a few times in class and I'd like you to go ahead and get a little practice with this before we say good-bye to our proofs tour! There is in fact a subtle difference between the following two (awfully similar looking!) expressions $(-A) \times B$ and $-(A \times B)$... one is the additive inverse of A times another number, B , while the other is the additive inverse of the product of A times B . Now of course these two end up being the same thing in the end (for any number system that has the basic list of 11 properties) but it's not actually a property on the list itself - it's in fact a result that follows from these properties (i.e. it's something that needs to be shown to be true - it's not just built-in at the start).

Go ahead and prove that they are in fact the same thing - there are several ways to do this at this point given what we've shown in class so far.



One way to do this is to start with the expression $(A + (-A)) \times B$, and work out what this expression equals in two different ways. You will probably need to use the fact that anything times 0 equals 0, which we'd proved in class - you can just state this as a known fact in your proof. Be sure to write down a specific property along with each line of your proof (e.g. distributive property, commutativity, etc., or " $A \times 0 = 0$... proved in class"). Good luck!

6) Finally, having started to investigate multiplication in detail, please look through the [Multiplication Poster](#) that I just posted on the homepage (these are available for purchase online if you're interested - please see <http://mathinyourfeet.blogspot.com/2011/04/multiplication-models-poster.html> (<http://mathinyourfeet.blogspot.com/2011/04/multiplication-models-poster.html>) for one other person's viewpoint on the poster). You might need to zoom in as far as possible to read the small print (which, sorry!, is slightly pixelated - this is a copy of the original poster). On it are 12 different models for thinking about multiplication. We've already talked a bit about the area model and the repeated addition model. Now please choose two other models and critique them, meaning write a brief description (just a couple of paragraphs) of what you consider to be strengths and weaknesses of the two models - no model is perfect - but each one can bring a new perspective on this concept. If nothing else, I'd also like you to gain an appreciation for how many different ways we can approach essentially any topic in mathematics - we should never feel that there is "only one way" to do/teach any concept! No need to post this answer - please just send it to me with your homework, thanks!

Eighth Assignment (due Tuesday, Oct. 31st)

1) Please read the following article on [using black and red chips](#)   to represent positive and negative numbers. As you read the article please use some tokens (or M&M's if you have any handy!) and actually try out the examples that are given in the article. Next, please use the class discussion board to give your appraisal of this system of manipulatives - what do you consider to be the benefits and disadvantages of working with these with students? Do you think it would make a difference whether you were working with this with third graders who were first seeing negative numbers versus working with seventh or eighth graders (when more systematic work with negatives typically happens in U.S. schools)? Would you consider using them with an older class that was still having problems with negative numbers? Please post your thoughtful comments on the discussion board (under the Black/Red Chips discussion) and/or provide a response to someone else's comment as well (and please cut and paste your comment on your problem set so that I'll know you wrote one - thanks!)

2) Next, revisit the idea of subtracting a negative number such as the $2 - (-4)$ problem we did with the chips. Given all that you've thought about such problems in your readings and in class, now please write down two different explanations aimed at middle school students that you could use to explain why it is that subtracting a negative number ends up equivalent to adding the number instead (feel free to use different numeric examples if they fit your explanations more readily, or the idea of debts, filling in holes, etc. - be creative!). The explanations don't have to be verbal - feel free to use pictures as well. Note that whatever you do choose for your explanations should be different from the black/red chips method that you discussed in the last problem.

3) At the beginning of our tour of multiplication I asked how people might define "multiplication." One quick answer was "repeated addition." Now read the following article about this particular question of defining multiplication [Is One Prime?](#)   After you read the article please give your reaction to the points in the article in a short one or two paragraph response that you post on the discussion board (under the Is One Prime discussion). Also, please think of another math concept that you think needs to be introduced and generalized with an open definition (and write a brief description of the math concept you select for your discussion post as well).

4) And off to proofs! To start with please prove that $(-1) \times A$ equals $-A$. Of course we proved this together in class right before the midterm, but I'd like you to go ahead and write it up yourself just to make sure you've