**General Project Instructions:**

**These instructions apply to all projects in this class – you should refer to it every time you work on a project in this class.**

*The project in this class will have you playing two different roles. During the projects, we will simply say something like “Student 1 now plays the role of the Prover” and that student should read the instructions for the Prover here.*

**You will use a *Project Report Sheet* to write down all of your work for each project. Each group will share a single sheet, and submit the final typed project on this sheet as a whole group at the end of each project.** These sheets have two main columns: the leftmost one is for the *Prover*, and the rightmost column is for the *Explainer*.Be sure to follow the instructions on these sheets and to fill them out completely – failure to follow directions can cause you to lose points off your grade.

**For each problem, your group will write a solution out STEP-BY-STEP, writing one line at a time. The entire group will discuss what to write in each part of the line**, but one person will be in charge of doing the actual writing for each part.

**Here is a short summary of the three roles: (See the example that follows to get a better idea of how these roles really work.)**

* ***The Prover:*** **Your job is to lead the discussion about how to prove the given equation or fact.** The entire group will discuss what to put down in the *Prover* step, but as the *Prover*, **it will be your responsibility to choose exactly what to write down, and you must do the actual writing.** After discussing it as a group, you will write out each line of the proof for the given equation. You should only write out **one step at a** time, and **each new step should go on a new** line.
* ***The Explainer:*** **Your job is to lead the discussion about how to explain the reasons behind each step of the proof that your group has just written.** The entire group will discuss what to put down in the *Explainer* step, but as the *Explainer*, **it will be your responsibility to choose exactly what to write down, and to do the actual writing.** You will begin by discussing with your group what the correct explanation would be describing why what the *Prover* has written down is correct. If you feel that some part of the *Prover*’s work is incorrect or unclear, ask the *Prover* to explain that step and agree as a group on any corrections. Then, to the right of that step, **write a single sentence or two in English that explains the reasoning behind that particular step**.

**Throughout the project, you will rotate your roles for each problem**: if you are the *Explainer* for problem 1) a), play the role of *Prover* for problem 1) b), and the role of *Explainer* again for problem 1) c). If there are 3 or more of you in a group, this means that you may occasionally not have a writing role to play for a particular problem; however, you are still required to participate actively in the group discussion by reading what the other students have written and commenting on whether it is correct or could be improved on the group discussion board.

**Example of the work done step-by-step as three students play these roles:**

*Here the students are asked to prove that* $a^{r}a^{s}=a^{r+s}$ *for integers* $r,s$*. In this example, the students do one line of the proof at a time, with a new step on each line. This is the final product of what the group ends up with, but the students have already discussed each of the steps below on the discussion board.*

|  |  |
| --- | --- |
| $$ **Prover:\_Maria Perez\_\_\_\_\_\_\_** | **Explainer:\_\_Sean Woods\_\_\_\_\_\_\_\_\_\_\_\_\_\_** |
| $$\begin{matrix}a^{r}a^{s}\\\end{matrix}\begin{matrix}=\\\end{matrix}\begin{matrix}(a\cdots a)⋅\\r times\end{matrix}\begin{matrix}(a\cdots a)\\s times\end{matrix}$$ | $a^{r}$*means that we should multiply* $r-$*many* $a$*’s together and* $a^{s}$*means that we should multiply* $s-$*many* $a$*’s together.* |
| $$\begin{matrix}=\\\end{matrix}\begin{matrix}a\cdots a\\\left(r+s\right)times\end{matrix}$$ | *We can remove the parentheses because everything on the right side is multiplication - with multiplication, the way we group things does not change the outcome. In addition,* $r-$*many* $a$*’s and* $s-$*many* $a$*’s being multiplied together means that we are multiplying a total of* $(r+s)-$*many* $a$*’s together.* |
| $$=a^{r+s}$$ | *A product of of* $(r+s)-$*many* $a$*’s is just the power* $a^{r+s}$*.* |

***Some examples of posts on the group discussion board that were used to revise this problem and write the final version above:***

***Original first step by the prover, Maria Perez:***

$$\begin{matrix}a^{r}a^{s}\\\end{matrix}\begin{matrix}=\\\end{matrix}\begin{matrix}(a\cdots a)⋅\\\end{matrix}\begin{matrix}(a\cdots a)\\\end{matrix}$$

***Comment on this work by another group member:***

*I suggest that we rewrite the first Prover step in problem 1) here to show that* $a$ *is being multiplied* $r$ *times on the left and* $s$ *times on the right, like this:*

$$\begin{matrix}a^{r}a^{s}\\\end{matrix}\begin{matrix}=\\\end{matrix}\begin{matrix}(a\cdots a)⋅\\r times\end{matrix}\begin{matrix}(a\cdots a)\\s times\end{matrix}$$

***Original first explanation made by the explainer, Sean Woods, on the second step of the problem:***

*We can remove the parentheses because everything on the right side is multiplication - with multiplication, the way we group things does not change the outcome.*

***Comment on this work by another group member:***

*I suggest adding the following sentence to the end of the explanation in step two of problem 1), to make it clearer and provide more detail:*

*In addition,* $r-$*many* $a$*’s and* $s-$*many* $a$*’s being multiplied together means that we are multiplying a total of* $(r+s)-$*many* $a$*’s together.*