

## A “Lulu” of a Function

Go to url: <http://tapor1.mcmaster.ca/~sgs/cgi-bin/Maths/mathscgi?theme=none&lang=en&do=activity&activity=lulu&level=0> (from Nathalie Sinclair's AliveMaths site, applet programmed by Stéfan Sinclair)

1. “Basic” problem: Think of “your actions” as inputs to a function, and Lulu’s actions as output. Your actions might be to move left, up, down, or right (use L, U, D, or R). Notice how Lulu responds to each of these actions, and write an algebraic *formula* to describe the function that is Lulu’s response, using  $f$  as the name of your function. For example, if “you” move one to the right, notice that Lulu moves two to the left. Thus, you might write  $f(R) = 2L$ . Is  $f(R + U) = f(U + R)$ ? Can you show that moves are (or are not) commutative, in the sense that it does (or doesn’t) matter in which order you move? Describe the domain and the range of your function.
2. Variation 1: Click on the “What if you and Lulu start at different places” prompt. Now, think of your location and Lulu’s location as two inputs, and the location of the meeting spot as the output. Is this a function? That is, for any starting positions, is there only one possible meeting place? You might wish to add “no meeting possible” to the range... would you then have a function? Your challenge: write down a formula (actually, a *pair* of formulas... one for each coordinate) for predicting where the rendezvous takes place. Use the “randomize” feature to check your formula. If your work does result in a function, describe its domain and range. If it doesn’t, explain why it doesn’t.
3. Variation 2: Once you have investigated Variation 1, click on the “What if Lulu uses a different move rule?” prompt. Answer the questions in both the problems above (the movement formula and the meeting place formula). For both, describe domain and range or explain why no function exists.
4. Variation 3: Investigate the “What if you can choose Lulu’s rule?” prompt. Lulu has three different pre-programmed moves; find the movement formula and meeting place formula for the “new” rule. For both, describe domain and range or explain why no function exists.
5. Variation 4: Investigate the “What if you can create your own movement rules for Lulu?” prompt. You can try using the “equation builder,” or you can try typing in formulas. See if you can make rules to cause the meeting place to be in a particular spot. For both, describe domain and range or explain why no function exists.

For a .pdf file, go to <http://www.uni.uiuc.edu/~hcrussel/LuluFunctions.pdf>