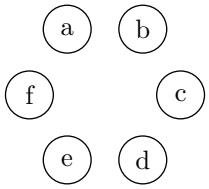
1 Invertible Functions

Assume the inputs to the following functions are all real numbers. Compute the inverse of the following functions or explain why no such inverse exists:

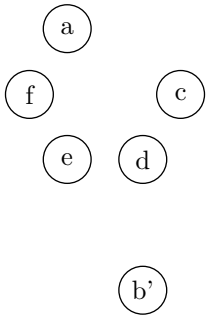
$$f(x) = x^3 + 9x^2 + 26x + 24$$
$$g(x, y) = 10x + y$$
$$h(x) = 5x + 9$$

2 Nogaxeh

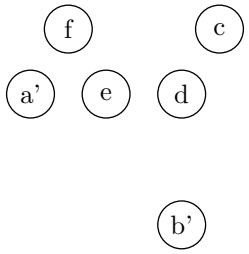
Here we have six points (circles) on a plane arranged into a regular hexagon.



We define a move on this configuration of points, by taking any one point, and reflecting it over another point. For instance, we could take the point b, and reflect it over point d to get the new configuration shown below:



We could then take this configuration, and reflect point a over point f to get yet another configuration:



Note that each of these configurations still has six points. We delete the old location of the point each time, and we can only reflect over points that exist in the new configuration.

Can you make a larger regular hexagon: that is a hexagon with a longer side length than the original? If you can, how? If not, why not?

3 Macrohard

Company Macrohard is being restructured. The company has decided to run a lottery for its one thousand employees. Each employee is equally likely to get each position. Each employee is also equally likely to get a pay rise or pay reduction (their pay definitely won't stay the same). Which of these lottery tickets are worth buying?

Ticket A costs \$1 for a chance to guess the new CEO. If you guess correctly, the ticket pays you \$100.

Ticket B costs \$1 for a chance to guess the new board of ten directors. If you guess correctly, the ticket pays you $\$1,000,000,000$ (yes, that is one billion dollars).

Ticket C costs \$1 for a chance to guess the employees that are getting a pay raise. If you guess precisely correctly, this ticket pays you $\$1,000,000,000$, but if you guess 80% or more correct, this ticket will still pay you $\$1,000,000$.