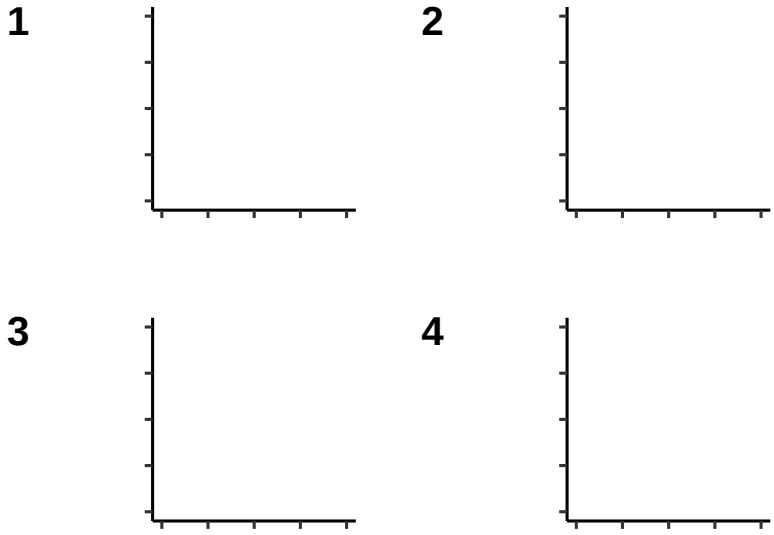
Dice and dose-response relationships

Dose-response relationships frequently show up in biological (and other) systems. Indeed, I bet you can think of at least four *different* ways some *response* changes with the dose of some *cause*. Let's write those down:

1.
2.
3.
4.

In fact, draw graphs of those relationships. Add labels (including units if you can) and put reasonable numbers on the two axes.



It's good to keep this diversity in mind if only so that you don't make the mistake of assuming every dose-response relationship means the same thing.

Dice as pathogens

To develop a more intuitive sense of at least one way we can get a dose-response relationship, let's roll some dice. I like thinking about pathogens, so let's imagine that we are the hosts and each die is a single pathogen. A pathogen/die only causes an infection if it comes up a "6", otherwise you fight it off. We are going to simulate exposures to different doses of pathogens/dice to see how the probability of infection changes with the dose.

Of course a single host is either infected or uninfected, so a single person's data would like a series of zeros and ones. We want to determine what the *probability* of infection is at different doses, which we can estimate as the *proportion* of hosts[1] that are infected[2] at each dose.

[1] Students rolling dice.

[2] Roll at least one 6.

Dice	Number.of.Hosts	Number.Infected	Proportion
1			
2			
3			
4			
5			
7			
10			
15			
20			
30			
40			

Then let's plot these data on two graphs, one with a linear x-axis and one with a logarithmic x-axis.