5.8 Handout 1

This part of the handout sets up the sodium channel mechanism. Currently, we are *not* incorporating the other mechanisms (potassium channel and sodium blocker) into the model yet. The equation we are *suggesting* is

$$\frac{dv}{dt} = -v(v-a)(v-1).$$

Note: v is *scaled*, so that it only goes between 0 (minimum voltage) and 1 (maximum voltage). These are not numbers you would measure in a lab; they are essentially a fraction of the total voltage.

1. Make a phase-line for the sodium channel voltage.

2. Sketch a graph of $\frac{dv}{dt}$ versus v (feel free to use a calculator).

3. Does this phase-line match what how we expect sodium channels in the neuron function (in the absence of other mechanisms)?

4. Suppose the cell recieves an influx of positive charge from another neuron, and it bumps the voltage above the threshold a. Sketch a graph of the voltage as a function of time using the phase-line diagram. Based on this graph, what happens to the neuron?

This part of the handout sets up the potassium channel. We let w represent the degree to which the potassium channel is open. We *suggest* that

$$\frac{dw}{dt} = \epsilon(v - \gamma w)$$

where ϵ and γ are postive numbers.

- What do the parameters ϵ and γ represent?

- When $v = 0$, what does the equation predict the potassium channel will do? Does this make sense biologically?

- When $v = 1$, what does the equation predict the potassium channel will do? Does this make sense biologically? [Hint: make a phase-plane diagram with $v = 1$ in the formula.]