Douglass Houghton Workshop, Section 1, Wed 02/11/26

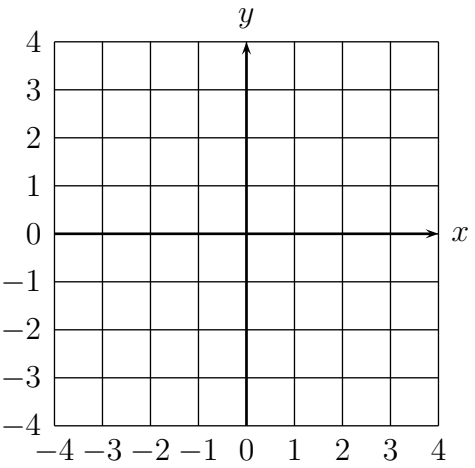
Worksheet Follow love and it will flee, flee love and it will follow

1. Former DHSP students Marlee and Terren have a complicated relationship. Each influences how attracted the other is. Let

$$x = \text{How attracted Marlee is to Terren}$$
$$y = \text{How attracted Terren is to Marlee}$$

and suppose that the two are related by the differential equations

$$\frac{dx}{dt} = 2 - x - y \qquad \text{and} \qquad \frac{dy}{dt} = x - 1.$$



   (a) Use the differential equations to describe the characters in this story. Questions to ask: What kind of a guy is Terren? What strategy can Marlee use to attract him? What happens to Marlee when Terren begins to like her? How should he act to attract her?

   (b) Now draw a grid on the board, and at each corner draw a little arrow in the direction that (x, y) is moving. (You'll probably want to find dy/dx.) This is called a *slope field* for the system.

   (c) What happens in the long run?

   (d) Now write the story of Marlee and Terren's relationship, being true to their characters and the differential equations.

2. Find $\int_{-\pi}^{\pi} \sin(mx)\sin(nx)\,dx$, given that m and n are positive integers.