

**Homework 32: 11.4 separation of variables**

This homework is to be done mostly by hand. Part of 26, 50, and additional problem part (b) is to be done with *Mathematica*. Print and attach your *Mathematica* work.

11.4 textbook problems:

- 8.
- 25.
26. Also use *Mathematica* to check using `DSolve`. If the solutions look different, the easiest way to confirm they are the same is to run `Simplify` on the *difference* of the two solutions to see if it is 0. Print your *Mathematica* work.
- 37.
44. May use formula table.
50. Use *Mathematica* to plot slope fields. First, plot the slope field for positive  $x$  and  $y$ , then for positive  $x$  and negative  $y$ , and finally show a particular solution in the positive  $x$  and  $y$  quadrant with the slope field. When doing this, use something like `{x,0.1,5}` to avoid plotting near  $x = 0$ . (Why? Write a sentence to explain this.)

Additional problem:

- (1) Consider the differential equation  $dy/dt = 100 - y$  on page 586 regarding how a person learns.
  - (a) Find the general solution by hand.
  - (b) Use *Mathematica* to create a slope field and draw particular solutions on the slope field for initial conditions  $(0, 0)$ ,  $(0, 20)$ , and  $(0, 100)$ . When plotting, use `{t,0,6}`, `PlotRange->{0,110}`. Choose the correct order for `Show` to make the output reasonably pretty.
  - (c) What do the particular solutions mean in practice? Discuss each solution briefly.
  - (d) By looking only at the differential equation, how can we predict the solution when  $(0, 100)$  is the initial condition?