In preparing for the exam, you should first review the problems on Assignments 1 and 2, and then look
at similar problems from the problem sections at the end of sections 2.3 and 2.4. Also, you should read
through sections 2.1, 2.2, 2.3, and 2.4.1 of the text. I’ve included a guide to reviewing these sections below.

At the exam, I will hand out a sheet you can use during the exam, reproducing the chart on the inside
front cover of the text, titled “EIGENVALUE OR BOUNDARY VALUE PROBLEMS for $$\frac{d^2}{dx^2} \phi = -\lambda \phi$$”.

2.1, 2.2. You should read through these short sections just to familiarize yourself with the type of
problem we are solving, and some of the terminology we use.

2.3. This is the key section for this exam. It explains how the method of separation of variables works
when applied to the initial-boundary-value problem for the heat equation given in equations (2.3.1), (2.3.2),
and (2.3.3) on page 35. You should know pretty much everything in this section.

Notice that in class I did things in a slightly different order than in the text. First I explained the material
in section 2.3.4 about how to solve eigenvalue problems. Next I explained the material in section 2.3.6 about
how to express a function $$f(x)$$ as a linear combination of eigenfunctions (in this case $$\sin(n\pi x/L)$$), using the
orthogonality of the eigenfunctions. And only then did I explain the method of separation of variables, as
given in sections 2.3.2, 2.3.3, and 2.3.5.

Note that the final solution to the boundary-value problem in (2.3.1), (2.3.2), and (2.3.3) is given by the
formula for $$u(x, t)$$ given in equation (2.3.30), together with the formula for the coefficients given in equation
(2.3.35).

The example in section 2.3.7 is important, showing what the solution would look like when a specific
function $$f(x)$$ is given as the initial data (in this case, $$f(x) \equiv 100$$).

2.4. You should read carefully through section 2.4.1. (We’ll discuss 2.4.2 in class next week, but the
material in 2.4.2 won’t be part of the first exam.) In section 2.4.1, the method of separation of variables
is again applied to an initial-boundary value problem for the heat equation, but this time the boundary
conditions are different, so we wind up with different eigenfunctions and eigenvalues. The problem being
solved is given in equations (2.4.1), (2.4.2), (2.4.3), and (2.4.4); and its solution is given by the series for
$$u(x, t)$$ appearing in (2.4.19), together with the formulas for the coefficients appearing in (2.4.23) and (2.4.24).

Actually, the eigenvalues for the problem in section 2.4 turn out to be almost the same as the eigenvalues
for the problem in section 2.3; with one important difference: here $$\lambda = 0$$ is an eigenvalue, while in section
2.3 it was not. You should understand clearly how we determined that this was the case. See the paragraph
halfway down page 57, starting with “If $$\lambda = 0 \ldots$$”, and compare to the paragraph at the top of page 41,
starting with “Eigenvalue ($$\lambda = 0$$)” (a little bit deceptively, since $$\lambda = 0$$ is not an eigenvalue here).