Student handout In this unit, you will explore the most common partial differential equations that arise in physics contexts. You will learn the separation of variables procedure to solve these equations.

Motivating Questions

- How are *partial* differential equations (PDEs) different from *ordinary* differential equations (ODEs)?
- What new kinds of physics can we learn from solving partial differential equations?
- What can we learn about physics and geometry from the separation of variables procedure?

Key Activities/Problems

- Problem: Laplace's Equation in Polar Coordinates
- Activity: Separation of Variables - Spherical Harmonics

Unit Learning Outcomes

At the end of this unit, you should be able to:

- Identify and classify several common PDEs.
- Identify the number and types of boundary and initial conditions that are appropriate to different PDEs.
- Identify the conditions where the separation of variables is appropriate and useful.
- Solve simple partial differential equations through the separation of variables procedure.