Student handout

- Go to Fourier Basis Functions and play with the simulation near the top of the page.
  1. What function does a_m correspond to? What does m mean?
  2. What function does b_m correspond to? What does m mean?
  3. What values can m take?
- Go to Fourier Series: Exploration and look at the simulation near the top of the page. It shows the graph of a function in blue.
  1. Move the sliders until the green curve matches the blue one. *Only three of the sliders need to be set to nonzero values.*
  2. Based on the graph, why might you anticipate which values of a_m and b_m are nonzero, larger or smaller, positive or negative?

1 Instructor's Guide

1.1 Introduction

First, make sure that students understand what it means to add two functions (pointwise). The SWBQ: Adding Functions Pointwise can be helpful with this.

Students can also be asked to build any unique superposition function using the PhET simulation Fourier: Making Waves. This helps the students to grasp and apply the idea of superposition.

1.2 The Prompts:

See the handout.

1.3 Student Conversations

- Many, but NOT all, students have prior knowledge of superposition and successfully decompose the superposition function without too much trouble.
- Some students simply "guess-and-check" their answers.
- One effective way to guide students is to ask them what they see as the dominant component in the oscillatory nature of the function. Do NOT give this prompt too early, let it emerge from the student conversations naturally, if possible.

1.4 Wrap-up

The wrap-up discussion focuses on the application of the superposition principle. The discussion should emphasize that this method of "guess-and-check" is helpful as a learning tool but not practical. This is a good way to introduce the need for the algebraic form of Fourier Series.

1.5 Extensions

If students enjoy this activity, encourage them to play more at the PhET Fourier: Making Waves