slope of the result is near 0.1 (but a little lower, because `diff` only approximates differentiation).

9.7 Exercises

The notebook for this chapter is `chap09.ipynb`. You might want to read through it and run the code.

Solutions to these exercises are in `chap09soln.ipynb`.

Exercise 9.1 The goal of this exercise is to explore the effect of `diff` and `differentiate` on a signal. Create a triangle wave and plot it. Apply `diff` and plot the result. Compute the spectrum of the triangle wave, apply `differentiate`, and plot the result. Convert the spectrum back to a wave and plot it. Are there differences between the effect of `diff` and `differentiate` for this wave?

Exercise 9.2 The goal of this exercise is to explore the effect of `cumsum` and `integrate` on a signal. Create a square wave and plot it. Apply `cumsum` and plot the result. Compute the spectrum of the square wave, apply `integrate`, and plot the result. Convert the spectrum back to a wave and plot it. Are there differences between the effect of `cumsum` and `integrate` for this wave?

Exercise 9.3 The goal of this exercise is the explore the effect of integrating twice. Create a sawtooth wave, compute its spectrum, then apply `integrate` twice. Plot the resulting wave and its spectrum. What is the mathematical form of the wave? Why does it resemble a sinusoid?

Exercise 9.4 The goal of this exercise is to explore the effect of the 2nd difference and 2nd derivative. Create a `CubicSignal`, which is defined in `thinkdsp`. Compute the second difference by applying `diff` twice. What does the result look like? Compute the second derivative by applying `differentiate` to the spectrum twice. Does the result look the same?

Plot the filters that corresponds to the 2nd difference and the 2nd derivative and compare them. Hint: In order to get the filters on the same scale, use a wave with framerate 1.