Exercise 1

Sketch the graph of the Dirichlet kernel

$$K_N(\theta) = \frac{\sin\left(N + \frac{1}{2}\right)\theta}{\sin\frac{1}{2}\theta}$$

in case $N = 10$. Use a computer graphics program if you wish.

Solution

If $N = 10$, then we have

$$K_{10}(\theta) = \frac{\sin\frac{21}{2}\theta}{\sin\frac{1}{2}\theta}.$$

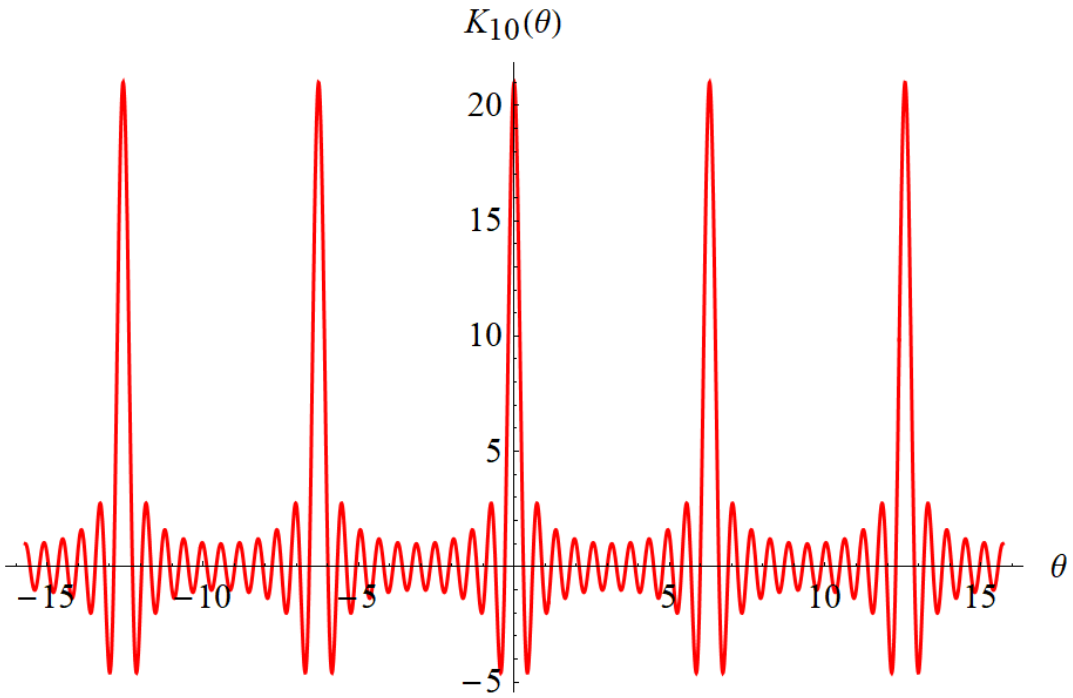

Figure 1: This is a plot of $K_{10}(\theta)$ vs. θ for $-5\pi < \theta < 5\pi$. The highest maxima occur at $0 + 2\pi n$ and the lowest maxima occur at $\pi + 2\pi n$, where n is an integer. The Dirichlet kernel is the function on the front cover of the textbook.