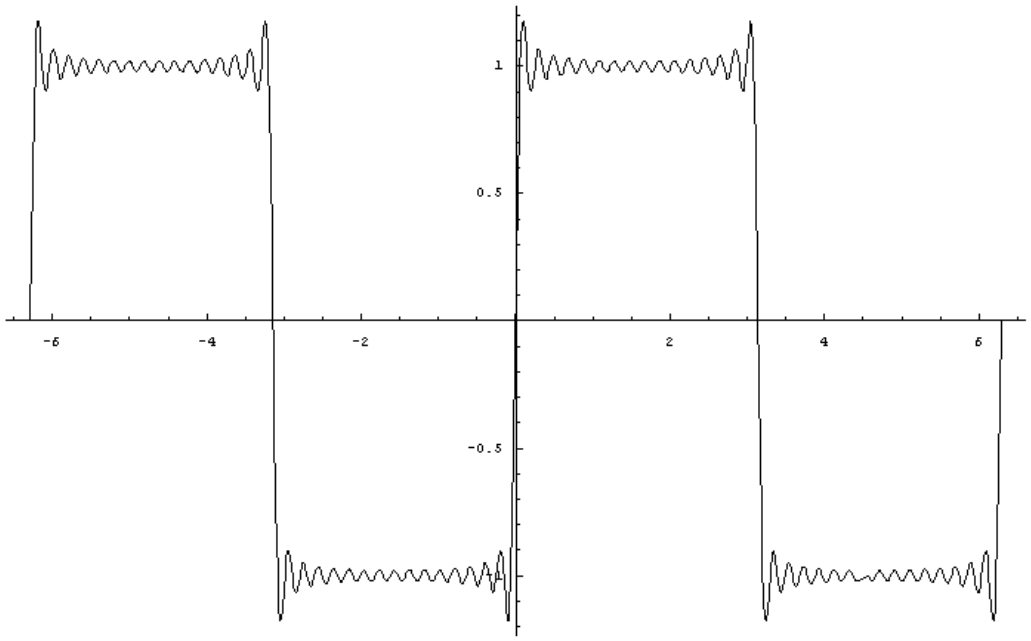
Mathematica (10)

Mathematica's plotting capability is useful in visualizing Fourier series. Consider the function we discussed in class, namely f(x) = 1 for $0 < x < \pi$ and –1 for $-\pi < x < 0$.

```
f[x_] =
 (4 / Pi) (Sin[x] + Sin[3 x] / 3 + Sin[5 x] / 5 + Sin[7 x] / 7 + Sin[9 x] / 9 + Sin[11 x] / 11 +
    Sin[13 x] / 13 + Sin[15 x] / 15 + Sin[17 x] / 17 + Sin[19 x] / 19 + Sin[21 x] / 21 + Sin[23 x] / 23 +
    Sin[25 x] / 25 + Sin[27 x] / 27 + Sin[29 x] / 29 + Sin[31 x] / 31)
```

$$\frac{1}{\pi}\left(4\left(\text{Sin}[x]+\frac{1}{3}\text{Sin}[3x]+\frac{1}{5}\text{Sin}[5x]+\frac{1}{7}\text{Sin}[7x]+\frac{1}{9}\text{Sin}[9x]+\frac{1}{11}\text{Sin}[11x]+\frac{1}{13}\text{Sin}[13x]+\frac{1}{15}\text{Sin}[15x]+\frac{1}{17}\text{Sin}[17x]+\frac{1}{19}\text{Sin}[19x]+\frac{1}{21}\text{Sin}[21x]+\frac{1}{23}\text{Sin}[23x]+\frac{1}{25}\text{Sin}[25x]+\frac{1}{27}\text{Sin}[27x]+\frac{1}{29}\text{Sin}[29x]+\frac{1}{31}\text{Sin}[31x]\right)\right)$$

```
Plot[f[x], {x, -2 Pi, 2 Pi}]
```




```
- Graphics -
```

It is clear by keeping a substantial number of terms in the Fourier expansion of f(x) that the higher frequency terms serve to cancel the oscillations but there is an overshoot at the discontinuities which will not go away although its width approaches zero.