

1. Find the Fourier series expansion of $f(\theta) = \theta^2$ on the domain $-\pi < \theta < \pi$, and use it to show that

$$\sum_{n=1}^{\infty} \frac{1}{n^2} = \frac{\pi^2}{6} \quad \text{and} \quad \sum_{n=1}^{\infty} \frac{(-1)^n}{n^2} = -\frac{\pi^2}{12}.$$

This is the standard way to derive these useful formulae.