Exercise 1
Which systems of functions are orthogonal with respect to the inner product

\[ \langle f, g \rangle = \int_{-\pi}^{\pi} f(x)g(x) \, dx : \]

(i) \( \{1, x, \cos x\} \);
(ii) \( \{1, \sin \frac{x}{2}, \sin 2x\} \);
(iii) \( \{1, x, x^2\} \).

Exercise 2
Identify even and odd functions and find their Fourier series for \( -\pi \leq x \leq \pi \):

(i) \( f(x) = x^2 \);
(ii) \( f(x) = \begin{cases} -x & \text{if } -\pi \leq x < 0 \\ x & \text{if } 0 < x \leq \pi. \end{cases} \)