1. Solve the following differential equations:
   (a) $y' - 2y = 0$
   (b) $y' - 2y = t - 3$
   (c) $y' - 2y = e^{3t}$
   (d) $y'' - 4y = 0$
   (e) $y'' + 4y = 0$
   (f) $y'' + 4y' + 3y = 10$.

2. The function
$$f(x) = \begin{cases} 0 & -\pi \le x < -\pi/2, \\ 1 & -\pi/2 \le x < \pi/2, \\ 0 & \pi/2 \le x \le \pi, \end{cases}$$
can be extended to be periodic of period 2π. Sketch the graph of the resulting function, and compute its Fourier series.

3. The function
$$f(t) = |x|, \qquad \text{for } x \in [-\pi, \pi]$$
can be extended to be periodic of period 2π. Sketch the graph of the resulting function, and compute its Fourier series.

4. The function
$$f(x) = \begin{cases} 0 & -\pi \le x < 0, \\ x & 0 \le x \le \pi, \end{cases}$$
can be extended to be periodic of period 2π. Sketch the graph of the resulting function, and compute its Fourier series.

5. Consider the 2π-periodic function defined by
$$f(x) = \begin{cases} x^2 & -\pi \le x < \pi, \\ f(x - 2k\pi), & -\pi + 2k\pi \le x < \pi + 2k\pi. \end{cases}$$
Sketch this function (at least for $k = -2, -1, 0, 1, 2$) and compute its Fourier series.

6. Find the Fourier series of the following functions *without* computing any integrals.
   (a) $f(x) = 2 - 3\sin 4x + 5\cos 6x$,
   (b) $f(x) = \sin^2 x$ [*Hint*: Use a standard trig identity.]

7. Determine which of the following functions are even, which are odd, and which are neither even nor odd:
   (a) $f(t) = x^3 + 3x$.
   (b) $f(t) = x^2 + |x|$.
   (c) $f(t) = e^x$.
   (d) $f(t) = \frac{1}{2}(e^x + e^{-x})$.
   (e) $f(t) = \frac{1}{2}(e^x - e^{-x})$.