1. (10%) Find the Fourier series of the resulting periodic function of a full-wave rectifier

\[ E(t) \]

\[-2\pi/\omega \rightarrow -\pi/\omega \rightarrow 0 \rightarrow \pi/\omega \rightarrow 2\pi/\omega \]

2. (10%) Find the Fourier series of the square-wave function and show that

\[ 1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \frac{1}{9} + \cdots = \frac{\pi}{4} \]

3. (10%) Evaluate

\[ \int_{-\infty}^{\infty} \frac{dx}{x^4 + 16} \]

4. (10%) Evaluate

\[ \oint_C \tan \pi z \, dz, \quad C : |z| = 1 \]

5. (10%) Find the general solution of

\[ 2 \cos y \, dx = \sin y \, dy \]

6. (10%) Find a general solution of

\[ xy'' + 3y'' = e^x \]

7. (10%) Let \( f(t) = \sin \sqrt{t} \). Show the Laplace transform of \( f(t) \) is

\[ \left( \frac{\sqrt{\pi}}{2} s^{3/2} \right) e^{-t/4} \]

8. (10%) Using Laplace transform to solve the integration

\[ y(t) = \sin 2t + \int_0^t y(\tau) \sin 2(t - \tau) \, d\tau \]

9. (10%) Solve the nonhomogeneous equation

\[ y'' + y = 2 \cos t \]

with given initial value \( y(0) = 3, y'(0) = 4 \)

10. (10%) Calculate the inverse of

\[ \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos x & -\sin x \\ 0 & \sin x & \cos x \end{bmatrix} \]