1. Evaluate \( \sin(\theta) + \sin(2\theta) + \cdots + \sin(n\theta) \).

2. Evaluate the integral \[ \int_{0}^{\infty} \frac{\sqrt{x}dx}{(1 + x)^2}. \]

3. Expand the function \( f(x) \) in a sine-cosine Fourier series, where \( f(x) \) is 1 if \( 0 \leq x < \pi \), 0 if \( -\pi \leq x < 0 \), and \( f(x + 2\pi) = f(x) \).

4. Calculate the Laplace transform \( \int_{0}^{\infty} e^{-pt} f(t)dt \) of \( f(t) = e^{-at} \sin(bt) \).

5. Use Laplace transforms to solve the differential equation \( y''' - 4y' + 4y = 4, \ y(0) = 0, \ y'(0) = -2 \). (If \( y \) has Laplace transform \( Y \) then \( y' \) has Laplace transform \( pY - y(0) \) and \( y'' \) has Laplace transform \( p^2Y - py(0) - y'(0) \). Also 1 has Laplace transform \( 1/p \) and \( e^{-at} \) has Laplace transform \( 1/(p + a) \).)

6. Find the exponential Fourier transform

\[ g(\alpha) = \frac{1}{2\pi} \int_{-\infty}^{\infty} f(x)e^{-i\alpha x}dx \]

for the function \( f(x) \) defined by \( f(x) = x \) if \( |x| < 1 \), \( f(x) = 0 \) if \( |x| \geq 1 \).

7. Write and solve the Euler equations \( \frac{d}{dx}(\partial F/\partial y') = \partial F/\partial y \) to make the following integral stationary:

\[ \int_{x_1}^{x_2} (y'^2 + \sqrt{y})dx \]
8. Change the dependent variable from $y$ to $x$ in the following integral, then write and solve the Euler equation to make it stationary.

$$\int_{x_1}^{x_2} (y'^2 + y^2) \, dx$$

9. Calculate the inverse Laplace transform

$$f(t) = \frac{1}{2\pi i} \int_{c-i\infty}^{c+i\infty} F(z)e^{zt} \, dz$$

when $F$ is the function $F(z) = 1/(z^4 - 1)$.

10. Find the shortest distance from the origin to the surface

$$3x^2 + y^2 - 4xz = 4.$$