1. Find \[ \int \frac{1}{x^3 + 4x^2} \, dx. \]

2. Find \[ \int e^{4x} \sin 2x \, dx. \]

3. Find \[ \int \frac{3x^4 - 4x - 12}{x^3 - 2x^2} \, dx. \]

4. Evaluate \[ \int_{1}^{e} \frac{\ln x}{x^2} \, dx. \]

5. Evaluate \[ \int_{1/4}^{\infty} \frac{15}{2x^4 + 5x + 2} \, dx, \] or show that it diverges.

6. Find \[ \int \cos \sqrt{x} \, dx. \]

7. The time \( T \) (in hours) to recover after a race is a random variable with PDF \( f(t) = \frac{1}{\sqrt{2T+1}}, \quad [0,4]. \)
   
   a) Find the probability that a person will take less than 90 min. to recover.
   
   b) Find the expected recovery time.

8. The length of the parabola \( y = x^2 \) from \((0,0)\) to \((4,16)\) is given by \( S = \int_{0}^{4} \sqrt{1 + (\frac{dy}{dx})^2} \, dx = \int_{0}^{4} \sqrt{1 + 4x^2} \, dx. \)

   Approximate this length using \( n = 4 \) and
   
   a) the trapezoidal rule.
   
   b) Simpson's rule.

9. Evaluate \[ \int_{0}^{\infty} \frac{1}{x + \sqrt{x}} \, dx, \] or show that it diverges.