1. (34 pts) Evaluate the following integrals and simplify your answers.

(a)
$$\int (\tan^2 \theta + 1) \sec^2 \theta \, d\theta$$

(b)
$$\int \frac{2x^2 - 5x + 6}{x^3 + 3x} \, dx$$

(c)
$$\int \frac{dx}{x^2 \sqrt{25 - x^2}}$$

- 2. (26 points) Consider the integral $I = \int_{-1}^{1} (2-x)e^x dx$.
 - (a) Estimate the value of I using the trapezoidal approximation T_2 . Express your answer in terms of the number e and simplify.
 - (b) Estimate the error for the approximation T_2 . Express your answer in terms of the number e and simplify.
 - (c) Find the exact value of the integral.
- 3. (22 points) Determine whether the following integrals are convergent or divergent. Explain your reasoning fully for each integral. If the integral converges, find its value.

(a)
$$\int_{2}^{\infty} \frac{x^{2}}{\sqrt{x^{6} - 4}} dx$$

(b) $\int_{-1}^{0} \frac{e^{1/x}}{x^{2}} dx$

4. (18 points) Consider the region \mathcal{R} in Quadrant 1 bounded by the curves $y = (x-3)^2$ and y = -3x+9.

- (a) Use the grid provided below to sketch the region \mathcal{R} . Shade in the region \mathcal{R} .
- (b) Using only disks or washers, set up, but do not evaluate, an integral to find the volume of the solid generated by rotating \mathcal{R} about:
 - i. the *x*-axis,
 - ii. the line x = 3.

