1. (34 pts) Evaluate the following integrals and simplify your answers.
(a) $\int\left(\tan ^{2} \theta+1\right) \sec ^{2} \theta d \theta$
(b) $\int \frac{2 x^{2}-5 x+6}{x^{3}+3 x} d x$
(c) $\int \frac{d x}{x^{2} \sqrt{25-x^{2}}}$
2. (26 points) Consider the integral $I=\int_{-1}^{1}(2-x) e^{x} d x$.
(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) $\int_{2}^{\infty} \frac{x^{2}}{\sqrt{x^{6}-4}} d x$
(b) $\int_{-1}^{0} \frac{e^{1 / x}}{x^{2}} d x$
4. (18 points) Consider the region $\mathcal{R}$ in Quadrant 1 bounded by the curves $y=(x-3)^{2}$ and $y=-3 x+9$.
(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 $x=3$.

