Instructions: I recommend taking this as if it were a real test. Then I would go through the problems using the book. We will go over this test on Tuesday as part of our review.

(1) Determine if the following integrals are convergent or divergent. Evaluate the ones that are convergent.

(a) $\int_{-\infty}^{\infty} xe^{-x^2} \, dx$

(b) $\int_{0}^{\infty} \frac{1}{x^2+2x-15} \, dx$

(c) $\int_{3}^{\infty} \frac{x}{x^2-x} \, dx$

(2) Find the length of the curve $y = 1 + 6x^{\frac{2}{3}}$, $0 \leq x \leq 1$

(3) Find the length of the curve $x = \frac{1}{3} \sqrt{y(y-3)}$, $1 \leq y \leq 9$

(4) Find the area of the surface obtained by rotating the curve $9x = y^2 + 18$, $2 \leq x \leq 6$ about the x-axis.

(5) Find the area of the surface obtained by rotating the curve $x = \sqrt{a^2 - y^2}$, $0 \leq y \leq \frac{a}{2}$ about the y-axis.

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(7) Find the centroid of the region bounded by $y = \frac{1}{x}$, $y = 0$, $x = 1$, $x = 2$.

(8) The marginal revenue from the sale of $x$ units of a product is $12 - 0.0004x$. If the revenue from the sale of the first 1000 units is $12,400, find the revenue from the sale of the first 5000 units.

(9) A demand curve is given by $p = \frac{450}{x+8}$. Find the consumer surplus when the selling price is $10.
(10) For the function \( f(x) = c e^{-x} \) for \( x \geq 0 \) and \( f(x) = 0 \) for \( x < 0 \) do the following:
(a) Find the value of \( c \) that makes \( f(x) \) into a probability density function.
(b) Find \( P(3 < x \leq 5) \)
(c) Find \( \mu \)

(11) For the following, determine if the sequence converges or diverges. For those that converge, find the limit. Justify your answer.

(a) \( a_n = \frac{n^3}{n^3 + 1} \)
(b) \( a_n = \sqrt{\frac{n+1}{9n+1}} \)

(12) For the following, determine if the series is convergent or divergent. If the series is convergent, find its sum. Justify all steps for showing it is either divergent or convergent.

(a) \( \sum_{k=2}^{\infty} \frac{k^2}{k^2 - 1} \)
(b) \( \sum_{n=1}^{\infty} \frac{1+2^n}{3^n} \)