Name: _____

TA's Name:

Instructions: You must show supporting work to receive full and partial credits. No text book, notes, formula sheets allowed.

1(18pts) (9pts each) (a) Evaluate the integral by the method of integration by parts $\int xe^{2x}dx$

(b) Evaluate the integral by completing squares: $\int \frac{x}{x^2 + 2x + 2} dx$

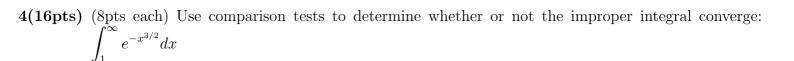
2(18pts) (9pts each) (a) Use trigonometric substitution to evaluate $\int \sqrt{1+x^2} \, dx$. You may use the formulas: $\int \sec^n x \, dx = \frac{1}{n-1} \sec^{n-2} x \tan x + \frac{n-2}{n-1} \int \sec^{n-2} x \, dx \text{ and } \int \sec x \, dx = \ln|\sec x + \tan x| + c$

(b) Evaluate the integral $\int \frac{2x+2}{x^2+2x} dx$ using partial fractions.

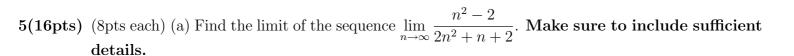
3(16pts) (8pts each) Determine by definition whether the improper integrals converge. Find the value of any convergent integral. **Make sure to show all details.**

(a)
$$\int_{1}^{2} \frac{x^2}{\sqrt{x^3 - 1}} dx$$

(b)
$$\int_0^\infty \frac{1}{1+x^2} \ dx$$



(b) Evaluate the trigonometric integral $\int \sin^2 x \cos^3 x \, dx$.



(b) Use the Squeeze Theorem to find the limit $\lim_{n\to\infty} \frac{\sqrt{n} + \sin n}{\sqrt{n} + 2}$. Make sure to include sufficient details.

6(16pts) (8pts each) Write down the first few terms in the series. Determine if the series converge. Find the sum of any convergent series. **Make sure to include sufficient details.**

(a)
$$\sum_{k=1}^{\infty} (-1)^{k-1} \frac{e^k}{3^{k+1}}$$

(b)
$$\sum_{k=0}^{\infty} (-1)^k \cos \frac{1}{k^2}$$