

Professor Rejto, Secs; 51,52,53,54.

Calculators and open books are not allowed. All work must be self-contained and shown !

1. (42 pts.) Evaluate,

$$\int \sin x \cos x dx.$$

2. (36 pts.)

- (a) Evaluate,

$$\int x \cos x dx.$$

- (b) Evaluate,

$$\int \frac{r^3}{\sqrt{9+r^2}} dr.$$

Hint: Either use integration by parts or use the substitution $x = 3 \tan \theta$.

3. (36 pts.)

- (a) Evaluate,

$$\int \frac{1}{x^2 - 2x - 4} dx.$$

- (b) Evaluate,

$$\int \frac{2x}{(x+1)^2} dx.$$

4. (36 pts.)

- (a) Define the improper integral:

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

- (b) Show that the improper integral,

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

does exist.