Part I: (60 Points/10 Points each) Problems 1-7: Evaluate the definite integrals and find the indefinite integrals. **Please complete 6 out of the 7 problems**. Be sure to write down your evil plan(s) or strategies; especially if you get stuck on a problem. Provide exact answers only. **Cross out the problem that you do not want graded**.

1. $\int \arcsin 2x dx$

2. $\int \left(\frac{\ln x}{\sqrt{x}} \right)^2 dx$

3. $\int_0^2 (x-1)\sqrt{2x+1}dx$

4. $\int \tan^4\theta \sec^4\theta d\theta$

5. $\int \sin 5x \cos x dx$

6. $\int_0^1 \frac{1}{x^2+1}\,dx$

7. $\int_0^1 \frac{x^2 - x}{x^2 + x + 1} dx$

Part II: (14 Points) Problems 8-9: Find the indefinite integrals. **Please complete 1 out of the 2 problems**. Be sure to write down your evil plan(s) or strategies; especially if you get stuck on a problem. Provide exact answers only. **Cross out the problem that you do not want graded**.

8. $\int e^{-x} \sin x dx$

9. $\int \sec^3 x dx$

Part III: (16 Points/8 points each). Problems 10-11. Evaluate the following limits. Exact answers only, please.

10. $\lim_{x \to 0} x^{\sqrt{x}}$

11. $\lim_{x \to \infty} x \ln x$

Part V: (10 Points). Problem 12. Solve the following application. Exact answers only, please.

Find the area of the region bounded by $f(x) = \cos^4 x$, $y = 0$, $x = \frac{\pi}{4}$, and. $x = \frac{\pi}{3}$.

$$\sin mx \sin nx = \frac{1}{2}(\cos[(m-n)x] - \cos[(m+n)x])$$

$$\sin mx \cos nx = \frac{1}{2}(\sin[(m-n)x] + \sin[(m+n)x])$$

$$\cos mx \cos nx = \frac{1}{2}(\cos[(m-n)x] + \cos[(m+n)x])$$