

NAME (*please print*): \_\_\_\_\_

HONOR CODE PLEDGE: \_\_\_\_\_

SIGNATURE: \_\_\_\_\_

Please write your answers clearly to all problems, showing all work and carefully justifying your answers. You are not allowed to use any notes or review sheets or calculators during the exam. You have exactly 75 minutes to complete the exam. Good Luck!

Problem Number	Possible Points	Points Earned:
1	20	
2	20	
3	20	
4	20	
5	20	
6	20	
7	0	
Total:	120	

(20) 1. Please compute  $\int \sin(\ln x) dx$ .

(20) 2. Please compute  $\int \frac{9x^3 - 3x + 1}{x^3 + x} dx$ .

(20) 3. Please compute  $\int_1^e \frac{(\ln y)^2 dy}{y\sqrt{1+(\ln y)^2}}$ .

(20) 4. Please compute  $\int_0^{\infty} x^2 e^{-x} dx$ .

(20) 5. Please evaluate one (and only one) of the following integrals:

$$a) \int \tan^4(4x) \sec^4(4x) dx$$

$$b) \int \sec^3(x) dx$$

$$c) \int \cos(17x) \sin(3x) dx$$

- (20) 6. For each of the integrals below, determine whether or not the integral converges and carefully justify your reasoning.

a)  $\int_{-2}^2 e^{x^2} \cos(17x^{11}) dx$

b)  $\int_1^{\infty} \frac{x^{11} + 7x^5 + 1}{x^{18} + 3x^2 + 5} dx$

c)  $\int_{-1}^1 \frac{1}{x^{18}} dx$

- (0) 7. (Extra Credit – 10 points): The Gamma function  $\Gamma(x)$  is defined for  $x > 0$  by the integral:

$$\Gamma(x) := \int_0^{\infty} t^{x-1} e^{-t} dt.$$

Please evaluate  $\Gamma(1)$  and use integration by parts to show  $\Gamma(x+1) = x\Gamma(x)$ . What is  $\Gamma(5)$ ?