

Math 22 LE 1 Sample Exam

I. Evaluate the following integrals.

1.  $\int \cos x (\csc x + \sin^3 x \cos^3 x) dx$

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

3.  $\int \frac{8 + 4x - 3x^2}{(1 - 2x)(x^2 + 9)} dx$

4.  $\int_1^{+\infty} \frac{\ln x}{x^2} dx$

5.  $\int_0^1 \frac{x^2}{(1 - x^3)^{3/2}} dx$

6.  $\int_0^1 \sin^2 \pi x \cos^2 \pi x dx$

7.  $\int \frac{\sec^4(2x)}{\tan^9(2x)} dx$

II. Find a parametrization for the following curves:

1. The circle centered at (2,1) of radius 3.
2. The branch of the hyperbola  $(y - 1)^2 - x^2 = 1$  below the axis.
3. The triangle with vertices (1,0), (0,5) and (0,0).

III. Given the parametric curve C with equations

$$x(t) = \ln(1 + t^2), y = \tan^{-1}t$$

- (a) Determine the values of t where C has a vertical or a horizontal tangent line.
- (b) Find  $\frac{d^2y}{dx^2}$  at t=1.
- (c) Is C concave up or concave down when t = 2?
- (d) Set up an integral for the arclength of C from (0,0) to  $(\ln 2, \frac{\pi}{4})$ .