Final Exam: Some problems for review

The exam will be from **8 AM - 10:50 AM on Wednesday, December 6, 2023** at the regular classroom (SCB 303). It will be done on paper as opposed to computer.

This is a comprehensive exam with an emphasis on Sections 10.5, 10.6, 11.1-11.9. It is a closed book exam. You can bring the 2-sided cheat sheet handed in class. Don't write anything on this cheat sheet before the exam. A scientific calculator is allowed. Graphing/ programmable/ transmittable calculators are not allowed. Phones are not allowed.

You should review the two midterm exams, homework problems, worksheets, quizzes, and examples given in the lectures. It is always a good idea to study for the exam with someone. Some more problems to practice:

1) Find the volume of the solid obtained by rotating the region bounded by two curves $y = 2x$ and $y = x^2$ about the x-axis.

2) Evaluate the integrals

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

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

   (c) $\int (\cos x + \sin x)^2 dx$

   (d) $\int_{-2}^{-1} \frac{dx}{x^2-2x}$

   (e) $\int_{-1}^{1} \frac{dx}{x^2-2x}$

3) Find the length of the curve $y = 4(x-1)^{3/2}$, $1 \le x \le 4$.

4) Solve the differential equation $y' = y + x$.

5) Solve the differential equation $y'x = e^{2y}$.

6) Use Euler's method with step size 0.1 to estimate $y(0.3)$, where $y(x)$ is the solution of the initial-value problem $y' = y + xy$, $y(0) = 1$.

7) Sketch the polar curve $r = 2 + \cos\theta$, $0 \le \theta \le 2\pi$.

8) Find the slope of the tangent line to the given curve at the point corresponding to the specified value of the parameter.

   (a) $x = \ln t$, $y = 1 + t^2$, $t = 1$

   (b) $r = e^{-\theta}$, $\theta = \pi$

9) Find the length of the following curves

   (a) $x = 3t^2$, $y = 2t^3$, $0 \le t \le 2$

   (b) $r = 1/\theta$, $\pi \le \theta \le 2\pi$

10) Identify the type of conic section, foci, vertices, directrix lines of the following equations. Sketch the curve.

   (a) $6y^2 + x - 36y + 55 = 0$

(b) $25x^2 + 4y^2 + 50x - 16y = 59$

11) Write a polar equation of an ellipse with eccentricity $5/2$ and vertex $(2, \pi)$.

12) Find the limits of the following sequences:

(a) $a_n = \cos(n\pi/6)$

(b) $a_n = \frac{\ln n}{\sqrt{n}}$

13) Find the radius of convergence and interval of convergence of the series $\sum_{n=1}^{\infty} \frac{(x+2)^2}{n4^n}$.

14) Find a power series representation for the function

$$f(x) = \frac{2}{3 + 4x^2}$$

and determine the interval of convergence.