MAT 132 FALL 2011 FINAL EXAM TOPICS AND GUIDELINES

- Compute integrals by the techniques we studied. (In the exam, you will have to determine which technique is appropriate.)
  - (i) Substitution. Example $\int e^x/(1+e^{2x})dx$.
  - (ii) Partial fractions. Example $\int(x-1)/(x^2+4)dx$.
  - (iii) Parts: Examples $\int x^2\cos(x)dx$
  - (iv) Trignometric identities: : Examples $\int \cos^3(x)dx$
  - (v) Trignometric substitution: : Examples $\int x^3/\sqrt{1+x^2}dx$
- Determine whether an improper integral is convergent or divergent. You need to compute a "regular" integral, and take the limit. You may also use comparison.
- Areas and arclength
  - (i) Sketch the region enclosed by two given the graphs of two functions and given horizontal or vertical lines.
  - (ii) Express the area of the region as an integral and compute the integral.
  - (iii) Express the length of a given curve as an integral. (in parametric and cartesian coordinates)
- Compute the volume of a given solid of revolution, or of some other solid such as a pyramid.
  - (i) Make a sketch of the solid
  - (ii) Decide how it should be sliced, (disk method, washer, cylindrical shells)
  - (iii) Illustrate the slicing on the picture
  - (iv) use the slices to express the volume as an integral
  - (v) compute the integral to find volume.
  - (vi) Compute and interpret the mean value of a function
  - (vii) Compute work done by a constant and by a varying force.
- Given a differential equation,
  - (i) determine whether a given function is a solution
  - (ii) determine whether a given function is a solution for a given initial value problem
- Solve mixing problems.
- Model using exponential growth model and the logistic model.
- Given a direction field corresponding to a differential equation
  - (i) sketch the graph of solution of the given initial value problem (say y(0) = 1)
  - (ii) determine whether the solution with, say, y(0) = 0 is increasing, decreasing, or neither; find all initial values that give solutions that increase/decrease
  - (iii) find all equilibrium solutions
  - (iv) given several equations and several direction fields, determine which field corresponds to which equation

- Given a differential equation of the form $y' = f(x, y)$, use the Euler method with the given number of steps to approximate a solution $y(x)$ with given initial value. (You will not have to perform complicate operations in the test.)
- Given a separable equation such as, say, $y' = (x + 1)(y^2 - 4)$ or $y' = y^2 - 2y$,
  (i) find all equilibrium solutions
  (ii) find the general solution for the equation
  (iii) find the solution of the given initial value problem
- Sequences
  (i) Determine whether a given sequence is increasing, decreasing, or neither.
  (ii) Determine whether a given sequenceconverges or diverges
  (iii) Find the limit of convergent sequences.
- Series
  (i) Understand geometric and p-series.
  (ii) Determine whether a given series is convergent or divergent.Use one of the following convergence tests (listed here for your reviewing convenience, wont be listed on exam).
    (a) divergence test
    (b) alternating series test
    (c) ratio test
    (d) comparison/limit comparison (possible with a geometric or a p-series)
    (e) integral test
- For a given power series
  (i) find the radius of convergence.
  (ii) If this radius is positive, this gives you an interval without endpoints where the series converges. Find this interval.
  (iii) find the interval of convergence (indicate points that require further testing and check whether the series converges at those points
- For a given function, find the Taylor series centered at a given point (say at x = 0 or x = 3). You may be asked to use any method, or specifically one of the following.
  (i) use the Taylor series formula
  (ii) use algebraic manipulations with geometric series
- Use series to
  (i) compute limits
  (ii) express an integral as series
  (iii) approximate an integral or evaluating a function with a given degree of accuracy.