Review for MAT 341 Midterm
March, 2016

Solve first order linear ode's both homogeneous and non-homogeneous
Solve $\ddot{u} + k\dot{u} + pu = 0$ for k and p constants.
Show that there is only one solution u of the equation above with a given $u(0)$ and $\dot{u}(0)$.
Understand superposition for linear equations. (the sum of two solutions is also a solution and a constant times a solution is a solution)
Boundary value problem: Solve $\ddot{u} + k\dot{u} + pu = 0$ given $u(a)$ and $u(b)$. Is the solution necessarily unique?
Find heat flow in a cylinder and the velocity of water in a pipe using the assumptions made in class.
Define a periodic function.
Define the Fourier series of a function on the interval $(-a, a)$. This includes the formula for the Fourier coefficients.
Define orthogonal and orthonormal sets in a vector space with inner product.
Define the span of a set of vectors.
Define even and odd functions.
Prove that $\{\sin nx\}$ is an orthogonal set with respect to the inner product:
$\langle f, g\rangle = \int_{-\pi}^{\pi} f(x)g(x)dx$
Define pointwise and uniform convergence for a sequence of functions. Show that the uniform limit of a sequence of continuous functions is continuous.
Let $\{a_n, b_n\}$ be the Fourier coefficients of a function f. Show that if

$$\Sigma_0^\infty |a_n| + |b_n| < \infty$$

then the Fourier series of f converges uniformly.
Define convergence in mean.
Given $f(x) = \Sigma_1^\infty a_n \cos nx$ find a solution of

$$\ddot{u} + \alpha\dot{u} + \beta u = f$$

assuming that α is not zero.