

Math 2431

Here are some of the topics discussed before the second exam:

- vectors in \mathbb{R}^n , matrices
 - addition, multiplication by a scalar
 - product of matrices, and matrix \times vector; properties (linear maps = matrix maps)
 - norm and dot product of vectors, angles and areas
- systems of linear equations: $Ax = b$
 - row echelon form via Gauss elimination
 - reduced row echelon form is unique
 - finding solutions
 - rank
 - consistent and inconsistent systems
 - if consistent: # of param's = # unknowns – rank A
 - superposition (§3.4)
 - solutions for low-dimensional systems
- matrices, linearity, inverses
 - linear maps (= matrix maps)
 - linear maps in \mathbb{R}^2
 - superposition (§3.4, §4.7)
 - computing inverses (via row reduction)
 - solving $Ax = b$ with A^{-1}
 - 2 x 2 determinants and inverses; $\text{area}(A(P)) = |\det(A)| \text{area}(P)$
- systems of ODE's
 - one ODE, initial value problems ($x' = f(x, t)$, $x(t_0) = x_0$)
 - $x' = \lambda x \implies x(t) = x_0 e^{\lambda t}$
 - graphic representations: phase-space and time-series portraits
 - autonomous ODE's ($x' = g(x)$); equilibria ($g(x) = 0$) and stability of hyperbolic equilibria ($g'(x_0) \neq 0$)
 - 2 x 2 systems (see much more in Chapter 6)
 - solving 2 x 2 systems if eigenvalues are real and distinct; sinks, sources, saddles
- vector spaces
 - definition
 - subspaces (V vector space, $W \subset V$; W subspace $\iff W$ closed under addition and multiplication by scalars)
e.g.: $\text{null}(A) = \{x \in \mathbb{R}^n \mid Ax = 0\}$, $\{X \in (\mathcal{C}^1)^n \mid X' = CX\}$
 - span of a family of vectors
 - spanning sets