Review Suggestions for Exam 1

3D vector cross products  Definitions, basic identities including the BAC-CAB rule for $a \times (b \times c)$, triple product $[a, b, c]$ and its relation to dot and cross product.

Arc length  Concept of regular smooth curve and its arc length, reparametrization by arc length including computations in specific examples (given $r(t)$, formula for arc length $s$ as a function of $t$, solving to describe $t$ as a function of $s$).

Curvature  Formal definition, method for computing it in specific examples as a function of $t$ rather than using arc length directly.

Frenet trihedron, torsion  Basic definition of $T, N, B$ in terms of arc length, equivalent defining formulas for torsion, statement of Frenet-Serret formulas and Fundamental Theorem of Curve Theory.

Examples  Curvature and torsion for a line, circle, helix, and how to derive them [for helix only the case $(cost, sin(t), t)$], characterization of these curves by means of curvature and torsion.
Matrix exponentials

Basic definitions:
identities like \( \exp(A+B) = \exp(A) \exp(B) \) if \( AB = BA \),
\( \exp(A) \) for diagonal \( A \), application to solving linear systems of diff. eqs

\[ X' = A(t) \cdot X \]

(not necessary to work examples), evaluation of \( \exp(A) \) for the matrix

\[ A = \begin{pmatrix} 0 & 0 & 0 \\ x & 0 & 0 \\ y & 0 & 0 \end{pmatrix} \]