

## 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  $\gamma(t)$ , 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 definitions 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  $(\cos t, \sin t, t)$ ], 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

$$A = \begin{pmatrix} 0 & 0 & 0 \\ x & 0 & 0 \\ y & z & 0 \end{pmatrix}.$$