

DIFFERENTIAL GEOMETRY HOMEWORK 1

LECTURER: SIU-CHEONG LAU

- (1) Find the arc length of the segment in a parabola $y = x^2$ between $(0, 0)$ and (b, b^2) for $b > 0$.
- (2) Suppose we walk along the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ in a constant speed v . Find a relation between the magnitude of acceleration $a(t)$ and the speed v in the form

$$a(t) = |\kappa|(t) \cdot v^2.$$

- (3) Suppose we draw all the tangent vectors to the curve $(3t, 3t^2, 2t^3)$ (from the origin). Show that it forms a subset of a circular cone with axis being the line $x - z = y = 0$. (BONUS: what is the complement of the subset in the cone?)

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