

analytic mechanics, part C. Maes

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Name: .....

1. Suppose that the real-valued function  $g$  is defined on an open interval  $U \subset \mathbb{R}$ . Assume that  $g$  is convex on  $U$  and differentiable in  $x_0$ . Show that for all  $x \in U$ ,

$$g(x) - g(x_0) \geq g'(x_0) (x - x_0)$$

For higher dimensions, we want  $f$  defined on an open convex set  $U \subset \mathbb{R}^n$ . How to state then the inequality?

2. Discuss the problem of the harmonic oscillator using the Hamilton-Jacobi method.

Hint: to get an integral of the Hamilton-Jacobi equation, try writing  $S = -at + f(x)$ .

3. A bead of mass  $m$  slides freely on a frictionless circular wire of radius  $r$ . The circular wire rotates itself in a horizontal plane about some chosen point on the circular wire with a constant angular velocity  $\omega$ . Derive the motion of the bead.