

## STEP III, 2003 Q10

- 10 A particle moves along the  $x$ -axis in such a way that its acceleration is  $kx\dot{x}$  where  $k$  is a positive constant. When  $t = 0$ ,  $x = d$  (where  $d > 0$ ) and  $\dot{x} = U$ .
- (i) Find  $x$  as a function of  $t$  in the case  $U = kd^2$  and show that  $x$  tends to infinity as  $t$  tends to  $\frac{\pi}{2dk}$ .
- (ii) If  $U < 0$ , find  $x$  as a function of  $t$  and show that it tends to a limit, which you should state in terms of  $d$  and  $U$ , as  $t$  tends to infinity.



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