## [mex201] Particle in time-dependent field

Consider the dynamical system described by the time-dependent Hamiltonian

$$H(q, p, t) = \frac{p^2}{2m} - mAtq,$$

where $A$ is a constant. (a) Find Hamilton's principal function $S(q, P, t)$ as the solution of the Hamilton-Jacobi equation. (b) Derive the solutions $q(t), p(t)$ from $S(q, P, t)$ for initial conditions $q(0) = 0$, $p(0) = mv_0$.

**Solution:**