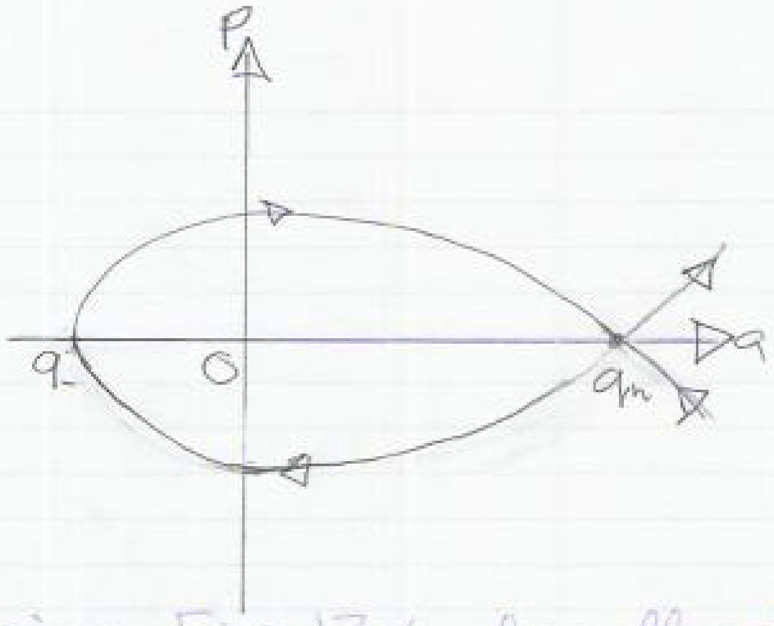
3)

14 1/6



Explain notation

Using Fig 13.4 for illustrative purposes choose $q(0) = q_-$ where q_- is as shown on the diagram ($q_h = q(0)$ will also give $p(t) = -p(-t)$ but we would not have $\lim_{t \to \pm\infty} q_s(t) = q_h$ since q_h is a (saddle) hyperbolic fixed point)

From the symmetry of the separatrix $q_s(p_s) = q_s(-p_s)$. From the uniqueness of solns of differential eqtns, if we solve for q in terms of t the eqtn $t = \int_{q_h}^{q} \frac{dq}{\sqrt{2(E - V(q))}}$ and then, since $p = \dot{q}$, for p in terms of t, we can put $q_s(p(t)) = q_s(-p(t))$, but since with the initial conditions given, the solns for q and p are unique we must have that $p_s(t) = -p_s(-t)$ so that $q_s(p(t)) = q_s(-p(t))$ becomes

$$q_s(p(t)) = q_s(-p(-t))$$
$$q_s(p(t)) = q_s(--p(t)) = q_s(p(t))$$

to conform to this uniqueness condition.

Thus $q_s(t)$ is even and $p_s(t)$ is odd

ie $q_s(t) = q_s(-t)$

$p_s(t) = -p_s(-t)$

7/10

Meaning of ~~Form of Hamilton~~ Form of Hamilton's equations ~~phase portrait~~ for $-t$

$p(-t)$ $q(-t)$ etc.