

Answers to problem set 4 FYS4130 at UiO, Spring 2012

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4.2

a) $\frac{\partial \dot{p}}{\partial p} = -\gamma, \frac{\partial \dot{q}}{\partial q} = \frac{\partial \dot{x}}{\partial x} = 0$

b) $\rho(t) = e^{\gamma t}$. A evolves as $A(t) = Ae^{-\gamma t}$.

5.4

a) $c_h = \frac{1}{M} \frac{\partial E}{\partial T} = -\frac{c^2}{T}$

b) $S = \frac{k_B}{4} \frac{A}{L^2}$

c) $S_{\max} = 1.74 \cdot 10^{66} \text{ S}_{\text{bit}}, \quad S_{\text{bit}} = k_B \ln 2$

5.5

1. False
2. False
3. False (system absorbs work)
4. True
5. True
6. True

5.6

a) $\dot{Q} = 200 \text{ W}$

b) The motor runs $22/570 \approx 3.9\%$ of the time.

5.7

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