4A10, 2011, Answers

Q1
(a) –
(b) –

Q2
(a) –
(b) –
(c) –

Q3
(a) –
(b) $FL=k(\theta_2+\theta_1)$
(c) $mUL(\theta_2+\theta_1) = 2FL+k\theta_1$
(d) $X = (FL^2/k)(5 - 2mUL/k)$
(e) –
(f) –

Q4
(a) –
(b) $k > (U_1 + U_2)^2/(2T)$
(c) $2(U_1 - U_2 + 2c)(c_g - c) = kT$, so $c = c_g$ only when $k = 0$ or $T = 0$.
(d) $c_g = c + kT/(4c)$; this is zero when $k = 2U^2/(3T)$; it is absolutely unstable.