Name: **Student ID Number:**

Physics 110A: Final Exam

December 12, 2012

- Read directions/problems carefully. It's worth the minute to **read every word**.
- Answer questions on paper provided (and backs, if needed)
- Show all work/reasoning; really stinks to get points off for a correct answer!
- No calculators are needed/permitted
- No formula sheets are permitted; use those appearing below
- But don't be a formula hunter problem solver. **Use your head first**!

$\int \frac{dx}{1+x^2} = \text{arctan}x$

$\int \frac{dx}{1-x^2} = \text{arctanh}x$

$\int \frac{dx}{\sqrt{1-x^2}} = \text{arcsin}x$

$\int \frac{dx}{\sqrt{1+x^2}} = \text{arcsinh}x$

$\int \tan x \ dx = -\ln\cos x$

$\int \text{tanh}x \ dx = \ln \text{cosh}x$

$A^2 = \frac{f_0^2}{(\omega_o^2-\omega^2)^2+4\beta^2\omega^2}$

$\tan\delta = \frac{2\beta\omega}{\omega_0^2-\omega^2}$

$E = \frac{1}{2}\mu\dot{r}^2 + \frac{\ell^2}{2\mu r^2} - \frac{GM\mu}{r} = T_{\text{radial}} + U_{\text{eff}}$

$r = \frac{s}{1+\epsilon\cos\phi}$

$s = \frac{\ell^2}{GM\mu^2}$

$a = \frac{s}{1-\epsilon^2} = \frac{b}{\sqrt{1-\epsilon^2}}$

$E_{\text{tot}} = -\frac{GM\mu}{2a} = \frac{G^2M^2\mu^3}{2\ell^2}(\epsilon^2-1)$

$\tau^2 = \frac{4\pi^2a^3}{GM}$

$T = \frac{1}{2}\sum_{j,k} M_{jk}\dot{q}_j\dot{q}_k$

$U = \frac{1}{2}\sum_{j,k} K_{jk}q_jq_k;\ K_{jk} = \frac{\partial^2 U}{\partial q_j\partial q_k}$