# 1 Mechanics

## 1.1 Formulae

- $F\Delta t = m\Delta v$
- $W = \Delta K$
- $I = I_{\text{cm}} + mD^2$
- $r_{\text{cm}} = \dfrac{1}{m_{\text{total}}} \displaystyle\int r \mathrm{d}m$
- $L = mvr$
- $\omega_f^2 = \omega_i^2 + 2\alpha\Delta\theta$
- $\Delta\theta = \dfrac{1}{2}(\omega_f + \omega_i)\Delta t$
- $F_{g\parallel} = mg\sin\theta$ ; $F_{g\perp} = mg\cos\theta$ ($\theta$: angle of incline)
- $F_x = -\dfrac{\mathrm{d}U}{\mathrm{d}x}$

- $v_{\text{ideal}} = \sqrt{rg\tan\theta}$ (banked curve)
- $v_{\text{escape}} = \sqrt{\dfrac{2GM}{r_e}}$

# 2 EMag

## 2.1 Formulae

- $E_x = \displaystyle\int \frac{1}{4\pi\varepsilon_0}\frac{1}{r^2}\mathrm{d}q = \int \frac{1}{4\pi\varepsilon_0}\frac{\lambda}{r^2}\mathrm{d}r$
- $i_L(t) = I(1 - e^{-t/\tau})$
- $q_C(t) = Q(1 - e^{-t/\tau})$
- $\tau_{\text{RL}} = \dfrac{L}{R}$; $\tau_{RC} = RC$
- $\varepsilon_{\text{induced}} = \vec{B}v\ell$; $I_{\text{induced}} = \dfrac{\vec{B}v\ell}{R}$

- $F_{\text{mag}} = ILB$
- $\Phi_E = \dfrac{Q}{\varepsilon_0} = \oint E \cdot \mathrm{d}A$
- $V_C = E \cdot d$

## 2.2 Notes

- Current/Charge is at max after 5 $\tau$'s
- Terminal velocity occurs when $F_{\text{mag}} = F_{\text{ext/grav}}$