

PHYS 354 – Midterm 1 Exam Cheat Sheet

Legendre Polynomials

$$P_0(\cos \theta) = 1$$

$$P_1(\cos \theta) = \cos \theta$$

$$P_2(\cos \theta) = \frac{3}{2} \cos^2 \theta - \frac{1}{2}$$

$$P_3(\cos \theta) = \frac{5}{2} \cos^3 \theta - \frac{3}{2} \cos \theta$$

Orthogonality

$$\int_0^a \sin \frac{k\pi y}{a} \sin \frac{n\pi y}{a} dy = \begin{cases} 0, & k \neq n \\ \frac{a}{2}, & k = n \end{cases}$$

$$\int_0^\pi P_l(\cos \theta) P_n(\cos \theta) \sin \theta d\theta = \begin{cases} 0, & l \neq n \\ \frac{2}{2n+1}, & l = n \end{cases}$$

Multipole Expansion

$$V(\vec{r}) = \frac{1}{4\pi\epsilon_0} \int \frac{\rho(\vec{r}')}{r} d\tau'$$

$$V(\vec{r}) = \frac{1}{4\pi\epsilon_0} \sum_{n=0}^{\infty} \frac{1}{r^{n+1}} \int (r')^n P_n(\cos \theta') \rho(\vec{r}') d\tau'$$

Coulomb's Law

$$V(\vec{r}) = \frac{1}{4\pi\epsilon_0} \int \frac{\rho(\vec{r}')}{r} d\tau'$$

Forces

$$\vec{F}_{elec} = \int \rho \vec{E} d\tau$$

Electric Flux

$$\Phi_E = \int \vec{E} \cdot d\vec{a}$$

Gauss' Law

$$\oint \vec{E} \cdot d\vec{a} = \frac{Q_{enc}}{\epsilon_0}$$

You will receive 4 pages of crib-notes from me: this sheet, the inside front and back covers of Griffiths, plus my sheet on solutions to Laplace's eqns. You may also bring your own 8.5" × 11" single-sided cheatsheet (not mechanically reproduced).

Janis McKenna, October 3, 2004.