Mid-Term Exam Formula Sheet

$$\int_0^a \sin\frac{m\pi y}{a}\sin\frac{n\pi y}{a}dy = \frac{a}{2}\delta_{mn} \tag{1}$$

Legendre Polynomials

$$P_\ell(x) = \frac{1}{2^\ell \ell!}\left(\frac{d}{dx}\right)^\ell (x^2-1)^\ell \tag{2}$$

$$
\begin{aligned}
P_0 &= 1 & (3)\\
P_1 &= x & (4)\\
P_2 &= (3x^2-1)/2 & (5)\\
P_3 &= (5x^3-3x)/2 & (6)\\
P_4 &= (35x^4-30x^2+3)/8 & (7)\\
P_5 &= (63x^5-70x^3+15x)/8 & (8)
\end{aligned}
$$

$$\int_{-1}^1 P_\ell(x)P_{\ell'}(x)dx = \frac{2}{2\ell+1}\delta_{\ell\ell'} \tag{9}$$

General Solution to Laplace's Equation

$$V(r,\theta) = \sum_\ell \left(A_\ell r^\ell + \frac{B_\ell}{r^{\ell+1}}\right) P_\ell(\cos\theta) \tag{10}$$