$$p(r,\theta,\psi,t) = e^{j\omega t}\sum_{n=0}^{\infty}\sum_{m=0}^{n}\begin{Bmatrix} j_n(kr) \\ \cancel{n_n(kr)}\end{Bmatrix}\begin{Bmatrix} \cancel{\cos(m\psi)} \\ \cancel{\sin(m\psi)}\end{Bmatrix} P_n^m(\cos\theta)$$

$m=0$

Jackson

$$|p(a,\theta)| = \sum_{n=0}^{\infty} A_n j_n(ka) P_n(\cos\theta) = p_0\,\delta(\theta-\pi/4)$$

$\int_{-1}^{1}(\cdot)P_m(z)dz$ to both sides where $z=\cos\theta$:

$$A_m j_m(ka)\cdot\frac{2}{2m+1} = \int_{z=-1}^{1} p_0\,\delta(\theta-\pi/4)P_m(\cos\theta)\,dz$$

Since $z=\cos\theta$, $dz=-\sin\theta\,d\theta$, and the RHS can be written:

$$\int_{\theta=\pi}^{0} p_0\,\delta(\theta-\pi/4)P_m(\cos\theta)(-\sin\theta)\,d\theta = \int_{0}^{\pi} p_0\,\delta(\theta-\tfrac{\pi}{4})P_m(\cos\theta)\sin\theta\,d\theta$$

$$= p_0 P_m(\cos\tfrac{\pi}{4})\cdot\left(+\sin\left(\tfrac{\pi}{4}\right)\right)$$

$$= +\frac{\sqrt{2}}{2}p_0 P_m\left(\frac{\sqrt{2}}{2}\right)$$

These are n's. Sorry!

$$\Rightarrow \boxed{A_n = +\frac{\sqrt{2}}{2}\cdot\frac{2n+1}{2}\cdot\frac{P_n(\sqrt{2}/2)}{j_n(ka)}p_0}$$