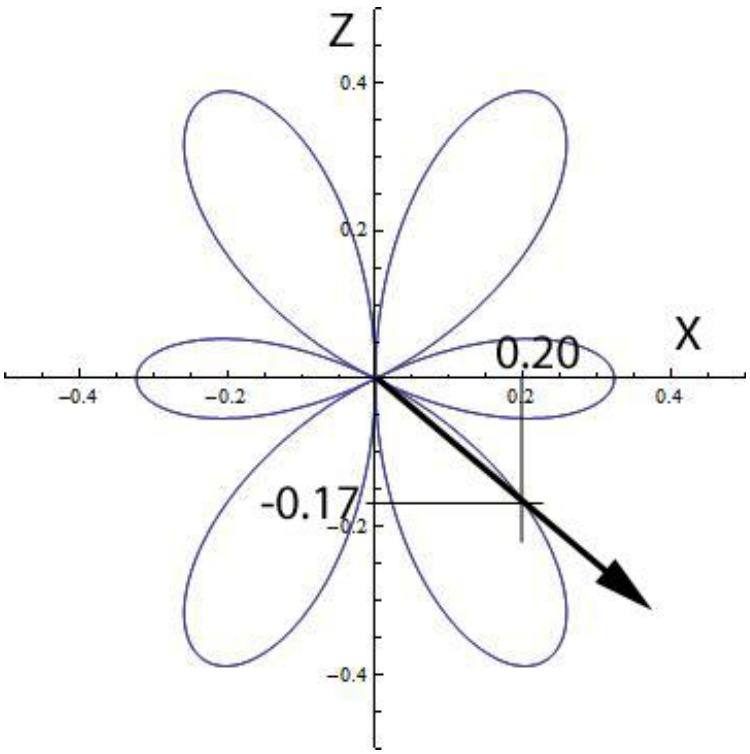
PHYS 360: Quantum Mechanics NAME:________________________

Reading Quiz

Date 10/31/8

Reading: Griffiths, pages 131-160

1) The graph below shows the representation of $Y_l^m(\theta, \phi)$, the spherical harmonic for $l = 3, m = 1$.



What is the magnitude and phase of $Y_3^1(\theta, \phi)$ for the angle $\theta = 130°$, $\varphi = 0°$ (indicated by the arrow in the graph)?

a) $|Y_3^1| = 0.26$ and phase = 0
b) $|Y_3^1| = 0.26$ and there is not enough info to determine phase
c) $|Y_3^1| = 0.2$ and phase = 130°
d) $|Y_3^1| = 0.17$ and phase = 130°
e) $|Y_3^1| = -0.26$ and phase = 0

TURN OVER

2) The normalized hydrogen wave functions are given by:

$$\psi_{nlm} = \sqrt{\left(\frac{2}{na}\right)^3 \frac{(n-l-1)!}{2n[(n+l)!]^3}} e^{-\frac{r}{na}} \left(\frac{2r}{na}\right)^l \left[L_{n-l-1}^{2l+1}\left(\frac{2r}{na}\right)\right] Y_l^m(\theta,\phi)$$

What is the radial wavefunction R_{20} $(n = 2, l = 0)$? You may use the table below:

TABLE 4.6: Some associated Laguerre polynomials, $L_{q-p}^{p}(x)$.

$L_0^0 = 1$	$L_0^2 = 2$
$L_1^0 = -x + 1$	$L_1^2 = -6x + 18$
$L_2^0 = x^2 - 4x + 2$	$L_2^2 = 12x^2 - 96x + 144$
$L_0^1 = 1$	$L_0^3 = 6$
$L_1^1 = -2x + 4$	$L_1^3 = -24x + 96$
$L_2^1 = 3x^2 - 18x + 18$	$L_2^3 = 60x^2 - 600x + 1200$

a) $\frac{1}{\sqrt{2}} a^{-3/2} \left(1 - \frac{1}{2}\frac{r}{a}\right) \exp(-r/2a)$
b) $\frac{1}{\sqrt{2}} a^{-3/2} \left(1 + \frac{1}{2}\frac{r}{a}\right) \exp(-r/2a)$
c) $\frac{1}{\sqrt{2}} a^{-3/2} \left(4 - \frac{r}{a}\right) \exp(-r/2a)$
d) $\frac{1}{\sqrt{2}} a^{-3/2} \left(1 - 4\frac{r}{a}\right) \exp(-r/2a)$
e) $\frac{1}{\sqrt{2}} a^{-3/2} \left(1 + 4\frac{r}{a}\right) \exp(-r/2a)$