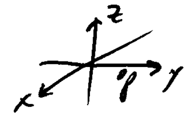
2.1 Convert the following Cartesian points to cylindrical and spherical coordinates:
(a) $P(2, 5, 1)$ (c) $R(6, 2, -4)$

a) Point $P(2,5,1)$



positive octant $\Rightarrow 0 \le \theta < 90°$, $0 \le \phi < 90°$

(2.7) $\rho = \sqrt{x^2+y^2} = \sqrt{2^2+5^2} = 5.385\,m$

$\phi = \tan^{-1}(y/x) = \tan^{-1}\left(\frac{5}{2}\right) = 68.199°$

$z = z = 1\,m$

$\underline{\underline{P_{cyl}(5.385\,m,\ 68.199°,\ 1\,m)}}$

(2.21) $r = \sqrt{x^2+y^2+z^2} = \sqrt{2^2+5^2+1^2} = 5.477\,m$

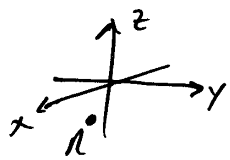
$\theta = \tan^{-1}\frac{\sqrt{x^2+y^2}}{z} = \tan^{-1}\frac{\sqrt{2^2+5^2}}{1} = 79.48°$

$\phi = \tan^{-1}(y/x) = \tan^{-1}(5/2) = 68.199°$

$\underline{\underline{P_{sph}(5.477\,m,\ 79.48°,\ 68.199°)}}$

c) Point $R(6,2,-4)$ $z<0 \Rightarrow \theta > 90°$

$x > y > 0 \Rightarrow 0 < \phi < 90°$



(2.7) $\rho = \sqrt{x^2+y^2} = \sqrt{6^2+2^2} = 6.325\,m$

$\phi = \tan^{-1}(y/x) = \tan^{-1}(2/6) = 18.435°$

$z = z = -4\,m$

$\underline{\underline{R_{cyl}(6.325\,m,\ 18.435°,\ -4\,m)}}$

(2.21) $r = \sqrt{x^2+y^2+z^2} = \sqrt{6^2+2^2+(-4)^2} = 7.483\,m$

$\theta = \tan^{-1}\frac{\sqrt{x^2+y^2}}{z} = \tan^{-1}\frac{\sqrt{6^2+2^2}}{-4} = -57.6885°$ not possible

$\overset{+180°}{=}\ 122.312°$

$\phi = \tan^{-1}(y/x) = \tan^{-1}(2/6) = 18.435°$

$\underline{\underline{R_{sph}(7.483\,m,\ 122.312°,\ 18.435°)}}$