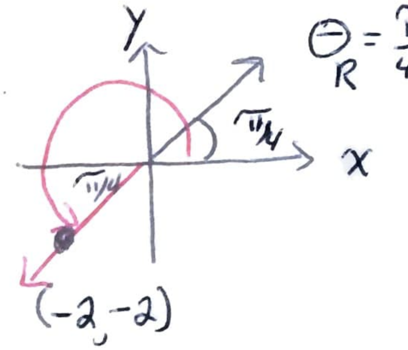
11.7 examples

Convert The point $(-2,-2,5)$ from Rectangular coordinates to cylindrical and spherical coord.

<u>Cyl</u> $r^2 = (-2)^2 + (-2)^2 = 8$ $\quad r = \sqrt{8} = 2\sqrt{2}$



$\tan \Theta_R = \frac{-2}{-2} = 1$ $\quad \Theta_R = \frac{\pi}{4}$.

Note Θ_R is in Quad I,

Point is in Quad III $\quad$ So $\Theta = \frac{5\pi}{4}$

$(2\sqrt{2}, \frac{5\pi}{4}, 5)$ in cyl.

<u>Spherical</u> $\rho^2 = 4 + 4 + 25 = 33$ $\quad \rho = \sqrt{33}$

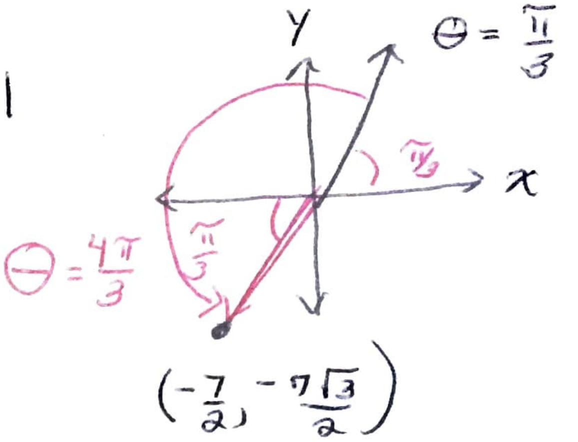
we can use $\Theta = \frac{5\pi}{4}$ because we located The proper xy Quad.

$z = \rho \cos\phi$ $\quad$ so $\quad 5 = \sqrt{33}\cos\phi$ $\quad \phi = \cos^{-1}\left(\frac{5}{\sqrt{33}}\right)$

always safest To use Inverse cosine for ϕ

because $0 \le \cos^{-1}(w) \le \pi$ and $0 \le \phi \le \pi$

Convert $(-7, \frac{\pi}{3}, -2)$ from cylindrical coordinates to Rectangular and spherical



$X = -7 \cos \pi/3 = \frac{-7}{2}$

$y = -7 \sin \pi/3 = \frac{-7\sqrt{3}}{2}$

$z = -2$

$(-\frac{7}{2}, \frac{-7\sqrt{3}}{2}, -2)$ Rect.

In spherical need to use $\Theta = \frac{4\pi}{3}$

$\rho^2 = (-\frac{7}{2})^2 + (-\frac{\sqrt{3}}{2})^2 + (-2) = \frac{49}{4} + \frac{3}{4} + \frac{16}{4} = \frac{68}{4} = 17$

$\rho = \sqrt{17} \qquad \Theta = \frac{4\pi}{3}$

$-2 = \sqrt{17} \cos \phi \qquad \phi = \cos^{-1}(-2/\sqrt{17})$

$(\sqrt{17}, \frac{4\pi}{3}, \cos^{-1}(\frac{-2}{\sqrt{17}}))$