Main Questions Part D

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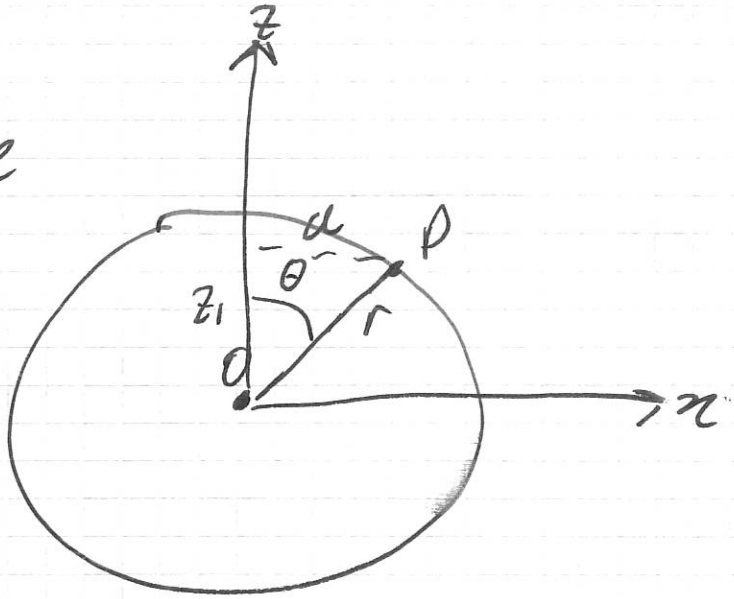
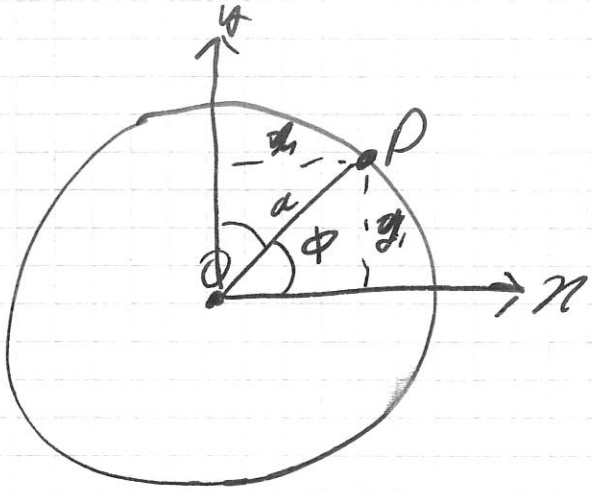
① Side



② Top-down



$P = (r, \theta, \phi)$

① $z = r\cos\theta$

② $a = r\sin\theta$

→ ③ $y = a\sin\phi = r\sin\theta\sin\phi$

→ ④ $x = a\sin(90-\phi) = r\sin\theta\cos\phi$

→ $(r\sin\theta\sin\phi,\ r\sin\theta\cos\phi,\ r\cos\theta)$

Swap

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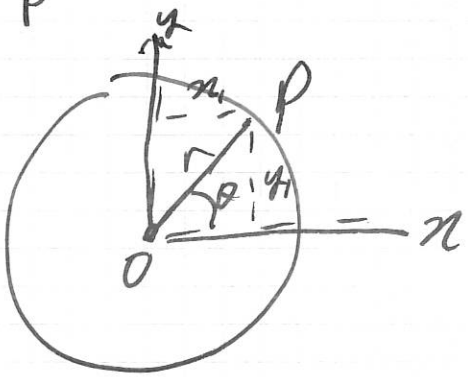
Side:

Top:



→ ① $z = z$

② $x = r\sin(90-\theta) = r\cos\theta$

③ $y = r\sin\theta$

→ $P = (r\cos\theta,\ r\sin\theta,\ z)$

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a) $r\cos\theta = 1$
$r\sin\theta = 2$
→ $r^2(\cos^2\theta + \sin^2\theta) = r^2 = 1^2 + 2^2 = 5$
→ $r = \sqrt{5}$

and $\frac{r\sin\theta}{r\cos\theta} = \tan\theta = \frac{2}{1} = 2 \rightarrow \theta = \tan^{-1}2$

≈ 1.1 rads

→ $= (\sqrt{5},\ 1.1,\ 5)$

b) $r = \sqrt{x^2+y^2+z^2} = \underline{\sqrt{30}}$ (3)

$\theta = \arccos\left(\frac{z}{r}\right) = \arccos\left(\frac{5}{\sqrt{30}}\right) \simeq 0.42 \text{ rads}$

$\phi = \arctan\left(\frac{y}{x}\right) = \arctan(2) = 1.1 \text{ rads}$

$\rightarrow \underline{\left(\sqrt{30}, 0.42, 1.1\right)}$