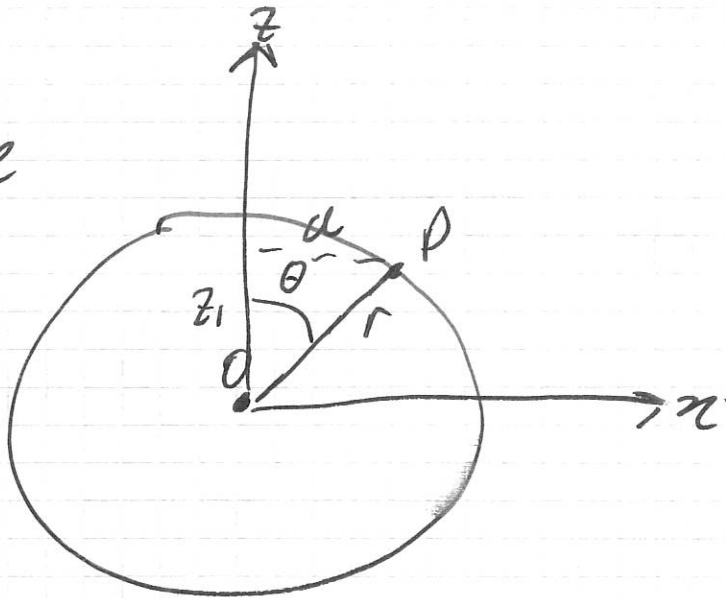


Main Questions Part D

Brace Goodfrey
dq681

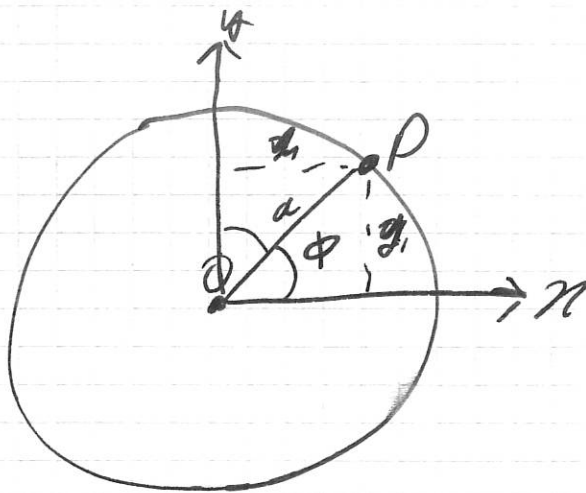
4

① Side



①

② Top-down



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

~~Cartesian coordinates~~
 ~~$x = r \sin \theta \cos \phi$~~
 ~~$y = r \sin \theta \sin \phi$~~
 ~~$z = r \cos \theta$~~

~~①~~ $z = r \cos \theta$

② $a = r \sin \theta$

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

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

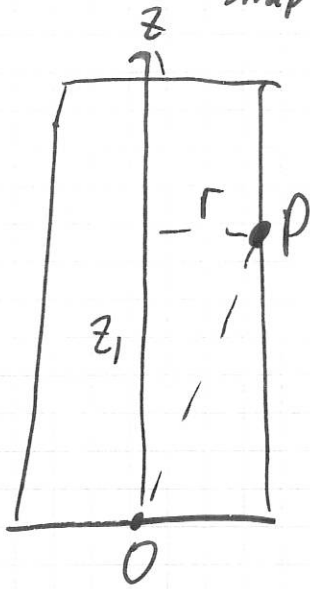
②

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

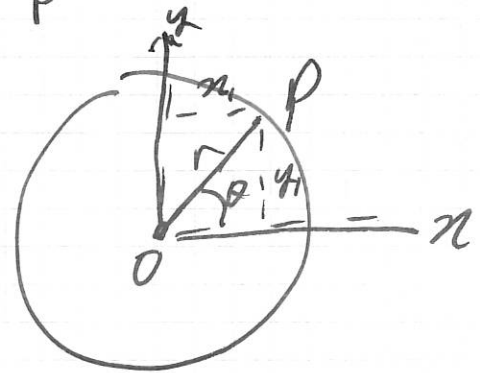
↔ swap ↔

5

Side:



Top:



$$\rightarrow ① z = z$$

$$② x = r \sin(\theta) \cos(\phi) = r \cos \theta$$

$$③ y = r \sin \theta$$

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

6

$$a) \begin{aligned} r \cos \theta &= 1 \\ r \sin \theta &= 2 \end{aligned} \rightarrow r^2 (\cos^2 \theta + \sin^2 \theta) = r^2 = 1^2 + 2^2 = 5$$

$$\rightarrow r = \sqrt{5}$$

~~7.1.1~~

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

$$\approx 1.1 \text{ rads}$$

$$\rightarrow \underline{\underline{(\sqrt{5}, 1.1, 5)}}$$

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

(3)

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

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

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