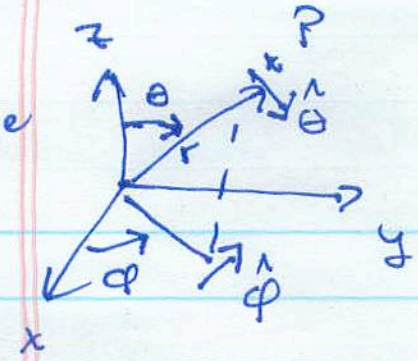
D° as class example

2.14



a) $\bar{A} = A_r \hat{r} + A_\theta \hat{\theta} + A_\phi \hat{\phi}$

where $A_r = \bar{A} \cdot \hat{r}$, $A_\theta = \bar{A} \cdot \hat{\theta}$, $A_\phi = \bar{A} \cdot \hat{\phi}$

$\hat{x} \cdot \hat{r} = \cos\phi (\sin\theta)$

$\hat{x} \cdot \hat{\theta} = \cos\phi (\cos\theta)$

$\hat{x} \cdot \hat{\phi} = -\sin\phi$

e.g. $\hat{\imath} = \hat{r} \sin\theta \cos\phi + \hat{\theta} \cos\theta \cos\phi - \hat{\phi} \sin\phi$

$\hat{\jmath} \cdot \hat{r} = \sin\theta \sin\phi$
$\hat{\jmath} \cdot \hat{\theta} = \cos\theta \sin\phi$
$\hat{\jmath} \cdot \hat{\phi} = \cos\phi$
$\Rightarrow \hat{\jmath} = \hat{r} \sin\theta\sin\phi + \hat{\theta} \cos\theta\sin\phi + \hat{\phi}\cos\phi$

$\hat{k} \cdot \hat{r} = \cos\theta$
$\hat{k} \cdot \hat{\theta} = -\sin\theta$
$\hat{k} \cdot \hat{\phi} = 0$
$\Rightarrow \hat{k} = \hat{r}\cos\theta - \hat{\theta}\sin\theta$

b)

$\hat{r} \cdot \hat{\imath} = \sin\theta\cos\phi$
$\hat{r} \cdot \hat{\jmath} = \sin\theta\sin\phi$
$\hat{r} \cdot \hat{k} = \cos\theta$
$\Rightarrow \hat{r} = \hat{\imath}\sin\theta\cos\phi + \hat{\jmath}\sin\theta\sin\phi + \hat{k}\cos\theta$

$\hat{\theta} \cdot \hat{\imath} = \cos\theta\cos\phi$
$\hat{\theta} \cdot \hat{\jmath} = \cos\theta\sin\phi$
$\hat{\theta} \cdot \hat{k} = -\sin\theta$
$\Rightarrow \hat{\theta} = \hat{\imath}\cos\theta\cos\phi + \hat{\jmath}\cos\theta\sin\phi - \hat{k}\sin\theta$

$\hat{\phi} \cdot \hat{\imath} = -\sin\phi$
$\hat{\phi} \cdot \hat{\jmath} = \cos\phi$
$\hat{\phi} \cdot \hat{k} = 0$
$\Rightarrow \hat{\phi} = -\hat{\imath}\sin\phi + \hat{\jmath}\cos\phi$