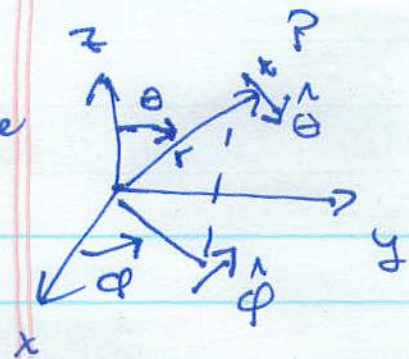


Q 2  
as  
class  
example  
2.14



a)  $\vec{A} = A_r \hat{r} + A_\theta \hat{\theta} + A_\phi \hat{\phi}$   
 where  $A_r = \vec{A} \cdot \hat{r}$ ,  $A_\theta = \vec{A} \cdot \hat{\theta}$ ,  $A_\phi = \vec{A} \cdot \hat{\phi}$

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

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

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

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

b)  $\hat{r} \cdot \hat{z} = \sin\theta \cos\phi$   
 $\hat{r} \cdot \hat{y} = \sin\theta \sin\phi$   
 $\hat{r} \cdot \hat{k} = \cos\theta$   
 $\hat{z} = \hat{r} \sin\theta \cos\phi + \hat{y} \sin\theta \sin\phi + \hat{k} \cos\theta$

$\hat{\theta} \cdot \hat{z} = \cos\theta \cos\phi$   
 $\hat{\theta} \cdot \hat{y} = \cos\theta \sin\phi$   
 $\hat{\theta} \cdot \hat{k} = -\sin\theta$   
 $\hat{\theta} = \hat{z} \cos\theta \cos\phi + \hat{y} \cos\theta \sin\phi - \hat{k} \sin\theta$

$\hat{\phi} \cdot \hat{z} = -\sin\phi$   
 $\hat{\phi} \cdot \hat{y} = \cos\phi$   
 $\hat{\phi} \cdot \hat{k} = 0$   
 $\hat{\phi} = -\hat{z} \sin\phi + \hat{y} \cos\phi$