The following useful information will appear on the exam:

$$\boldsymbol{\nabla}(f\,g) = f\boldsymbol{\nabla}g + g\boldsymbol{\nabla}f, \qquad \boldsymbol{\nabla}\cdot(f\mathbf{A}) = \mathbf{A}\cdot\boldsymbol{\nabla}f + f\boldsymbol{\nabla}\cdot\mathbf{A}$$

$$\boldsymbol{\nabla}\cdot(\mathbf{A}\times\mathbf{B}) = \mathbf{B}\cdot\boldsymbol{\nabla}\times\mathbf{A} - \mathbf{A}\cdot\boldsymbol{\nabla}\times\mathbf{B}, \qquad \boldsymbol{\nabla}\times(f\mathbf{A}) = (\boldsymbol{\nabla}f)\times\mathbf{A} + f\boldsymbol{\nabla}\times\mathbf{A}.$$

$$\boldsymbol{\nabla}\times(\boldsymbol{\nabla}\times\mathbf{A}) = \boldsymbol{\nabla}(\boldsymbol{\nabla}\cdot\mathbf{A}) - \nabla^2\mathbf{A}.$$

Cylindrical Coordinates $\mathbf{r}(\rho,\phi,z)$	Spherical Coordinates $\mathbf{r}(r,\theta,\phi)$
$\mathbf{r} = \rho(\cos\phi\,\widehat{\boldsymbol{i}} + \sin\phi\,\widehat{\boldsymbol{j}}) + z\,\widehat{\boldsymbol{k}}$	$\mathbf{r} = r(\sin\theta\cos\phi\,\widehat{\boldsymbol{i}} + \sin\theta\sin\phi\,\widehat{\boldsymbol{j}} + \cos\theta\,\widehat{\boldsymbol{k}})$
$\widehat{\boldsymbol{r}} = \cos\phi\,\widehat{\boldsymbol{i}} + \sin\phi\,\widehat{\boldsymbol{j}} + \widehat{\boldsymbol{k}}$	$\widehat{\boldsymbol{r}} = \sin\theta\cos\phi\,\widehat{\boldsymbol{i}} + \sin\theta\sin\phi\,\widehat{\boldsymbol{j}} + \cos\theta\,\widehat{\boldsymbol{k}}$
$d\mathbf{r} = d\rho\,\widehat{\boldsymbol{\rho}} + \rho\,d\phi\,\widehat{\boldsymbol{\phi}} + dz\,\widehat{\boldsymbol{k}}$	$d\mathbf{r} = dr\,\widehat{\boldsymbol{r}} + r\,d\theta\,\widehat{\boldsymbol{\theta}} + r\sin\theta\,d\phi\,\widehat{\boldsymbol{\phi}}$
$dV = \rho\,d\rho\,d\phi\,dz$	$dV = r^2\sin\theta\,dr\,d\theta\,d\phi$
$d\mathbf{A} = \widehat{\boldsymbol{\rho}}\,\rho\,dz d\phi + \widehat{\boldsymbol{k}}\,\rho\,d\rho d\phi + \widehat{\boldsymbol{\phi}}\,d\rho dz$	$d\mathbf{A} = r^2\sin\theta\,d\theta\,d\phi\,\widehat{\boldsymbol{r}} + r\sin\theta\,dr\,d\phi\,\widehat{\boldsymbol{\theta}} + r\,dr\,d\theta\,\widehat{\boldsymbol{\phi}}$
$\boldsymbol{\nabla}h = \frac{\partial h}{\partial\rho}\widehat{\boldsymbol{\rho}} + \frac{1}{\rho}\left(\frac{\partial h}{\partial\phi}\right)\widehat{\boldsymbol{\phi}} + \frac{\partial h}{\partial z}\widehat{\boldsymbol{k}}$	$\boldsymbol{\nabla}h = \frac{\partial h}{\partial r}\widehat{\boldsymbol{r}} + \frac{1}{r}\left(\frac{\partial h}{\partial\theta}\right)\widehat{\boldsymbol{\theta}} + \frac{1}{r\sin\theta}\frac{\partial h}{\partial\phi}\widehat{\boldsymbol{\phi}}$
$\boldsymbol{\nabla}\cdot\mathbf{V} = \frac{1}{\rho}\frac{\partial}{\partial\rho}(\rho V_\rho) + \frac{1}{\rho}\frac{\partial V_\phi}{\partial\phi} + \frac{\partial V_z}{\partial z}$	$\boldsymbol{\nabla}\cdot\mathbf{V} = \frac{1}{r^2}\frac{\partial}{\partial r}(r^2 V_r) + \frac{1}{r\sin\theta}\frac{\partial(\sin\theta V_\theta)}{\partial\theta} + \frac{1}{r\sin\theta}\frac{\partial V_\phi}{\partial\phi}$
$\boldsymbol{\nabla}\times\mathbf{V} = \frac{1}{\rho}\begin{vmatrix}\widehat{\boldsymbol{\rho}} & \rho\,\widehat{\boldsymbol{\phi}} & \widehat{\boldsymbol{k}} \\ \frac{\partial}{\partial\rho} & \frac{\partial}{\partial\phi} & \frac{\partial}{\partial z} \\ V_\rho & \rho V_\phi & V_z\end{vmatrix}$	$\boldsymbol{\nabla}\times\mathbf{V} = \frac{1}{r^2\sin\theta}\begin{vmatrix}\widehat{\boldsymbol{r}} & r\,\widehat{\boldsymbol{\theta}} & r\sin\theta\,\widehat{\boldsymbol{\phi}} \\ \frac{\partial}{\partial r} & \frac{\partial}{\partial\theta} & \frac{\partial}{\partial\phi} \\ V_r & rV_\theta & r\sin\theta\,V_\phi\end{vmatrix}$
$\nabla^2 h = \frac{1}{\rho}\frac{\partial}{\partial\rho}\left(\rho\frac{\partial h}{\partial\rho}\right) + \frac{1}{\rho^2}\frac{\partial^2 h}{\partial\phi^2} + \frac{\partial^2 h}{\partial z^2}$	$\nabla^2 h = \frac{1}{r^2}\frac{\partial}{\partial r}\left(r^2\frac{\partial h}{\partial r}\right) + \frac{1}{r^2\sin\theta}\frac{\partial}{\partial\theta}\left(\sin\theta\frac{\partial h}{\partial\theta}\right) + \frac{1}{r^2\sin^2\theta}\frac{\partial^2 h}{\partial\phi^2}$

Fourier Series for a function $f(x)$ with period L:

$$f(x) = \frac{a_0}{2} + \sum_{n=1}^{\infty} a_n\cos\left(\frac{2n\pi x}{L}\right) + \sum_{n=1}^{\infty} b_n\sin\left(\frac{2n\pi x}{L}\right)$$

$$a_n = \frac{2}{L}\int_{-L/2}^{L/2} f(x)\cos\left(\frac{2n\pi x}{L}\right)dx, \qquad b_n = \frac{2}{L}\int_{-L/2}^{L/2} f(x)\sin\left(\frac{2n\pi x}{L}\right)dx.$$