1.44) Considering that $\rho = \sqrt{x^2+y^2}$, $\hat{\boldsymbol{\rho}} = \cos\phi\,\hat{\boldsymbol{x}} + \sin\phi\,\hat{\boldsymbol{y}}$, $\hat{\boldsymbol{\phi}} = -\sin\phi\,\hat{\boldsymbol{x}} + \cos\phi\,\hat{\boldsymbol{y}}$, $\sin\phi = y/\sqrt{x^2+y^2}$, and $\cos\phi = x/\sqrt{x^2+y^2}$, we may write

$$\boldsymbol{A}(\boldsymbol{r}) = \big(A_\rho\cos\phi - A_\phi\sin\phi\big)\hat{\boldsymbol{x}} + \big(A_\rho\sin\phi + A_\phi\cos\phi\big)\hat{\boldsymbol{y}} + A_z\hat{\boldsymbol{z}},$$

$$\boldsymbol{B}(\boldsymbol{r}) = \big(B_\rho\cos\phi - B_\phi\sin\phi\big)\hat{\boldsymbol{x}} + \big(B_\rho\sin\phi + B_\phi\cos\phi\big)\hat{\boldsymbol{y}} + B_z\hat{\boldsymbol{z}},$$

$$\frac{\partial\rho}{\partial x} = \frac{x}{\sqrt{x^2+y^2}} = \frac{x}{\rho} = \cos\phi,$$

$$\frac{\partial\rho}{\partial y} = \frac{y}{\sqrt{x^2+y^2}} = \frac{y}{\rho} = \sin\phi,$$

$$\frac{\partial\sin\phi}{\partial x} = -\frac{xy}{(x^2+y^2)^{3/2}} = -\frac{xy}{\rho^3} = -\frac{\sin\phi\cos\phi}{\rho} \;\rightarrow\; \left(\frac{\partial\phi}{\partial x}\right)\cos\phi = -\frac{xy}{\rho^3} \;\rightarrow\; \frac{\partial\phi}{\partial x} = -\frac{y}{\rho^2} = -\frac{\sin\phi}{\rho},$$

$$\frac{\partial\sin\phi}{\partial y} = \frac{x^2}{(x^2+y^2)^{3/2}} = \frac{x^2}{\rho^3} = \frac{\cos^2\phi}{\rho} \;\rightarrow\; \left(\frac{\partial\phi}{\partial y}\right)\cos\phi = \frac{x^2}{\rho^3} \;\rightarrow\; \frac{\partial\phi}{\partial y} = \frac{x}{\rho^2} = \frac{\cos\phi}{\rho},$$

$$\frac{\partial\cos\phi}{\partial x} = \frac{y^2}{(x^2+y^2)^{3/2}} = \frac{y^2}{\rho^3} = \frac{\sin^2\phi}{\rho},$$

$$\frac{\partial\cos\phi}{\partial y} = -\frac{xy}{(x^2+y^2)^{3/2}} = -\frac{xy}{\rho^3} = -\frac{\sin\phi\cos\phi}{\rho}.$$

We thus have

$$\begin{aligned}
A_x\frac{\partial B_x}{\partial x} &= \big(A_\rho\cos\phi - A_\phi\sin\phi\big)\left(\frac{\partial B_\rho}{\partial x}\cos\phi + \frac{\sin^2\phi}{\rho}B_\rho - \frac{\partial B_\phi}{\partial x}\sin\phi + \frac{\sin\phi\cos\phi}{\rho}B_\phi\right)\\
&= \big(A_\rho\cos\phi - A_\phi\sin\phi\big)\\
&\quad\times\left[\left(\frac{\partial B_\rho}{\partial\rho}\frac{\partial\rho}{\partial x} + \frac{\partial B_\rho}{\partial\phi}\frac{\partial\phi}{\partial x}\right)\cos\phi + \frac{\sin^2\phi}{\rho}B_\rho - \left(\frac{\partial B_\phi}{\partial\rho}\frac{\partial\rho}{\partial x} + \frac{\partial B_\phi}{\partial\phi}\frac{\partial\phi}{\partial x}\right)\sin\phi + \frac{\sin\phi\cos\phi}{\rho}B_\phi\right]\\
&= \big(A_\rho\cos\phi - A_\phi\sin\phi\big)\left[\left(\frac{\partial B_\rho}{\partial\rho}\cos\phi - \frac{\partial B_\rho}{\rho\partial\phi}\sin\phi\right)\cos\phi + \frac{\sin^2\phi}{\rho}B_\rho\right.\\
&\qquad\left. - \left(\frac{\partial B_\phi}{\partial\rho}\cos\phi - \frac{\partial B_\phi}{\rho\partial\phi}\sin\phi\right)\sin\phi + \frac{\sin\phi\cos\phi}{\rho}B_\phi\right]\\
&= A_\rho\left[\left(\frac{\partial B_\rho}{\partial\rho}\cos\phi - \frac{\partial B_\phi}{\partial\rho}\sin\phi\right)\cos^2\phi - \left(\frac{\partial B_\rho}{\rho\partial\phi}\cos\phi - \frac{\partial B_\phi}{\rho\partial\phi}\sin\phi\right)\sin\phi\cos\phi\right]\\
&\quad - A_\phi\left[\left(\frac{\partial B_\rho}{\partial\rho}\cos\phi - \frac{\partial B_\phi}{\partial\rho}\sin\phi\right)\sin\phi\cos\phi - \left(\frac{\partial B_\rho}{\rho\partial\phi}\cos\phi - \frac{\partial B_\phi}{\rho\partial\phi}\sin\phi\right)\sin^2\phi\right]\\
&\quad + \left(\frac{\sin^2\phi\cos\phi}{\rho}A_\rho B_\rho + \frac{\sin\phi\cos^2\phi}{\rho}A_\rho B_\phi - \frac{\sin^3\phi}{\rho}A_\phi B_\rho - \frac{\sin^2\phi\cos\phi}{\rho}A_\phi B_\phi\right).
\end{aligned}$$

$$\begin{aligned}
A_x\frac{\partial B_y}{\partial x} &= \big(A_\rho\cos\phi - A_\phi\sin\phi\big)\left(\frac{\partial B_\rho}{\partial x}\sin\phi - \frac{\sin\phi\cos\phi}{\rho}B_\rho + \frac{\partial B_\phi}{\partial x}\cos\phi + \frac{\sin^2\phi}{\rho}B_\phi\right)\\
&= \big(A_\rho\cos\phi - A_\phi\sin\phi\big)\\
&\quad\times\left[\left(\frac{\partial B_\rho}{\partial\rho}\frac{\partial\rho}{\partial x} + \frac{\partial B_\rho}{\partial\phi}\frac{\partial\phi}{\partial x}\right)\sin\phi - \frac{\sin\phi\cos\phi}{\rho}B_\rho + \left(\frac{\partial B_\phi}{\partial\rho}\frac{\partial\rho}{\partial x} + \frac{\partial B_\phi}{\partial\phi}\frac{\partial\phi}{\partial x}\right)\cos\phi + \frac{\sin^2\phi}{\rho}B_\phi\right]
\end{aligned}$$

$$= \left(A_\rho \cos\phi - A_\phi \sin\phi\right)\left[\left(\frac{\partial B_\rho}{\partial \rho}\cos\phi - \frac{\partial B_\rho}{\rho\partial\phi}\sin\phi\right)\sin\phi - \frac{\sin\phi\cos\phi}{\rho}B_\rho \right.$$
$$\left. + \left(\frac{\partial B_\phi}{\partial \rho}\cos\phi - \frac{\partial B_\phi}{\rho\partial\phi}\sin\phi\right)\cos\phi + \frac{\sin^2\phi}{\rho}B_\phi\right]$$
$$= A_\rho\left[\left(\frac{\partial B_\rho}{\partial \rho}\sin\phi + \frac{\partial B_\phi}{\partial \rho}\cos\phi\right)\cos^2\phi - \left(\frac{\partial B_\rho}{\rho\partial\phi}\sin\phi + \frac{\partial B_\phi}{\rho\partial\phi}\cos\phi\right)\sin\phi\cos\phi\right]$$
$$-A_\phi\left[\left(\frac{\partial B_\rho}{\partial \rho}\sin\phi + \frac{\partial B_\phi}{\partial \rho}\cos\phi\right)\sin\phi\cos\phi - \left(\frac{\partial B_\rho}{\rho\partial\phi}\sin\phi + \frac{\partial B_\phi}{\rho\partial\phi}\cos\phi\right)\sin^2\phi\right]$$
$$-\left(\frac{\sin\phi\cos^2\phi}{\rho}A_\rho B_\rho - \frac{\sin^2\phi\cos\phi}{\rho}A_\rho B_\phi - \frac{\sin^2\phi\cos\phi}{\rho}A_\phi B_\rho + \frac{\sin^3\phi}{\rho}A_\phi B_\phi\right).$$

$$A_x\frac{\partial B_z}{\partial x} = \left(A_\rho\cos\phi - A_\phi\sin\phi\right)\left(\frac{\partial B_z}{\partial \rho}\cos\phi - \frac{\partial B_z}{\rho\partial\phi}\sin\phi\right)$$
$$= A_\rho\left(\frac{\partial B_z}{\partial \rho}\cos\phi - \frac{\partial B_z}{\rho\partial\phi}\sin\phi\right)\cos\phi - A_\phi\left(\frac{\partial B_z}{\partial \rho}\cos\phi - \frac{\partial B_z}{\rho\partial\phi}\sin\phi\right)\sin\phi.$$

$$A_y\frac{\partial B_x}{\partial y} = \left(A_\rho\sin\phi + A_\phi\cos\phi\right)\left(\frac{\partial B_\rho}{\partial y}\cos\phi - \frac{\sin\phi\cos\phi}{\rho}B_\rho - \frac{\partial B_\phi}{\partial y}\sin\phi - \frac{\cos^2\phi}{\rho}B_\phi\right)$$
$$= \left(A_\rho\sin\phi + A_\phi\cos\phi\right)$$
$$\times\left[\left(\frac{\partial B_\rho}{\partial \rho}\frac{\partial\rho}{\partial y} + \frac{\partial B_\rho}{\partial\phi}\frac{\partial\phi}{\partial y}\right)\cos\phi - \frac{\sin\phi\cos\phi}{\rho}B_\rho - \left(\frac{\partial B_\phi}{\partial \rho}\frac{\partial\rho}{\partial y} + \frac{\partial B_\phi}{\partial\phi}\frac{\partial\phi}{\partial y}\right)\sin\phi - \frac{\cos^2\phi}{\rho}B_\phi\right]$$
$$= \left(A_\rho\sin\phi + A_\phi\cos\phi\right)\left[\left(\frac{\partial B_\rho}{\partial \rho}\sin\phi + \frac{\partial B_\rho}{\rho\partial\phi}\cos\phi\right)\cos\phi - \frac{\sin\phi\cos\phi}{\rho}B_\rho \right.$$
$$\left. - \left(\frac{\partial B_\phi}{\partial \rho}\sin\phi + \frac{\partial B_\phi}{\rho\partial\phi}\cos\phi\right)\sin\phi - \frac{\cos^2\phi}{\rho}B_\phi\right]$$
$$= A_\rho\left[\left(\frac{\partial B_\rho}{\partial \rho}\cos\phi - \frac{\partial B_\phi}{\partial \rho}\sin\phi\right)\sin^2\phi + \left(\frac{\partial B_\rho}{\rho\partial\phi}\cos\phi - \frac{\partial B_\phi}{\rho\partial\phi}\sin\phi\right)\sin\phi\cos\phi\right]$$
$$+A_\phi\left[\left(\frac{\partial B_\rho}{\partial \rho}\cos\phi - \frac{\partial B_\phi}{\partial \rho}\sin\phi\right)\sin\phi\cos\phi + \left(\frac{\partial B_\rho}{\rho\partial\phi}\cos\phi - \frac{\partial B_\phi}{\rho\partial\phi}\sin\phi\right)\cos^2\phi\right]$$
$$-\left(\frac{\sin^2\phi\cos\phi}{\rho}A_\rho B_\rho + \frac{\sin\phi\cos^2\phi}{\rho}A_\rho B_\phi + \frac{\sin\phi\cos^2\phi}{\rho}A_\phi B_\rho + \frac{\cos^3\phi}{\rho}A_\phi B_\phi\right).$$

$$A_y\frac{\partial B_y}{\partial y} = \left(A_\rho\sin\phi + A_\phi\cos\phi\right)\left(\frac{\partial B_\rho}{\partial y}\sin\phi + \frac{\cos^2\phi}{\rho}B_\rho + \frac{\partial B_\phi}{\partial y}\cos\phi - \frac{\sin\phi\cos\phi}{\rho}B_\phi\right)$$
$$= \left(A_\rho\sin\phi + A_\phi\cos\phi\right)$$
$$\times\left[\left(\frac{\partial B_\rho}{\partial \rho}\frac{\partial\rho}{\partial y} + \frac{\partial B_\rho}{\partial\phi}\frac{\partial\phi}{\partial y}\right)\sin\phi + \frac{\cos^2\phi}{\rho}B_\rho + \left(\frac{\partial B_\phi}{\partial \rho}\frac{\partial\rho}{\partial y} + \frac{\partial B_\phi}{\partial\phi}\frac{\partial\phi}{\partial y}\right)\cos\phi - \frac{\sin\phi\cos\phi}{\rho}B_\phi\right]$$
$$= \left(A_\rho\sin\phi + A_\phi\cos\phi\right)\left[\left(\frac{\partial B_\rho}{\partial \rho}\sin\phi + \frac{\partial B_\rho}{\rho\partial\phi}\cos\phi\right)\sin\phi + \frac{\cos^2\phi}{\rho}B_\rho \right.$$
$$\left. + \left(\frac{\partial B_\phi}{\partial \rho}\sin\phi + \frac{\partial B_\phi}{\rho\partial\phi}\cos\phi\right)\cos\phi - \frac{\sin\phi\cos\phi}{\rho}B_\phi\right]$$
$$= A_\rho\left[\left(\frac{\partial B_\rho}{\partial \rho}\sin\phi + \frac{\partial B_\phi}{\partial \rho}\cos\phi\right)\sin^2\phi + \left(\frac{\partial B_\rho}{\rho\partial\phi}\sin\phi + \frac{\partial B_\phi}{\rho\partial\phi}\cos\phi\right)\sin\phi\cos\phi\right]$$

$$+A_\phi\left[\left(\frac{\partial B_\rho}{\partial\rho}\sin\phi+\frac{\partial B_\phi}{\partial\rho}\cos\phi\right)\sin\phi\cos\phi+\left(\frac{\partial B_\rho}{\rho\partial\phi}\sin\phi+\frac{\partial B_\phi}{\rho\partial\phi}\cos\phi\right)\cos^2\phi\right]$$
$$+\left(\frac{\sin\phi\cos^2\phi}{\rho}A_\rho B_\rho-\frac{\sin^2\phi\cos\phi}{\rho}A_\rho B_\phi+\frac{\cos^3\phi}{\rho}A_\phi B_\rho-\frac{\sin\phi\cos^2\phi}{\rho}A_\phi B_\phi\right).$$

$$A_y\frac{\partial B_z}{\partial y}=\left(A_\rho\sin\phi+A_\phi\cos\phi\right)\left(\frac{\partial B_z}{\partial\rho}\sin\phi+\frac{\partial B_z}{\rho\partial\phi}\cos\phi\right)$$
$$=A_\rho\left(\frac{\partial B_z}{\partial\rho}\sin\phi+\frac{\partial B_z}{\rho\partial\phi}\cos\phi\right)\sin\phi+A_\phi\left(\frac{\partial B_z}{\partial\rho}\sin\phi+\frac{\partial B_z}{\rho\partial\phi}\cos\phi\right)\cos\phi.$$

$$A_z\frac{\partial B_x}{\partial z}=A_z\left(\frac{\partial B_\rho}{\partial z}\cos\phi-\frac{\partial B_\phi}{\partial z}\sin\phi\right),$$
$$A_z\frac{\partial B_y}{\partial z}=A_z\left(\frac{\partial B_\rho}{\partial z}\sin\phi+\frac{\partial B_\phi}{\partial z}\cos\phi\right),$$
$$A_z\frac{\partial B_z}{\partial z}=A_z\frac{\partial B_z}{\partial z}.$$

Combining the above expressions, we find

$$(\boldsymbol{A}\cdot\boldsymbol{\nabla})\boldsymbol{B}=A_\rho\left[\left(\frac{\partial B_\rho}{\partial\rho}\cos\phi-\frac{\partial B_\phi}{\partial\rho}\sin\phi\right)\cos^2\phi-\left(\frac{\partial B_\rho}{\rho\partial\phi}\cos\phi-\frac{\partial B_\phi}{\rho\partial\phi}\sin\phi\right)\sin\phi\cos\phi\right]\hat{\boldsymbol{x}}$$
$$-A_\phi\left[\left(\frac{\partial B_\rho}{\partial\rho}\cos\phi-\frac{\partial B_\phi}{\partial\rho}\sin\phi\right)\sin\phi\cos\phi-\left(\frac{\partial B_\rho}{\rho\partial\phi}\cos\phi-\frac{\partial B_\phi}{\rho\partial\phi}\sin\phi\right)\sin^2\phi\right]\hat{\boldsymbol{x}}$$
$$+\left(\frac{\sin^2\phi\cos\phi}{\rho}A_\rho B_\rho+\frac{\sin\phi\cos^2\phi}{\rho}A_\rho B_\phi-\frac{\sin^3\phi}{\rho}A_\phi B_\rho-\frac{\sin^2\phi\cos\phi}{\rho}A_\phi B_\phi\right)\hat{\boldsymbol{x}}$$
$$+A_\rho\left[\left(\frac{\partial B_\rho}{\partial\rho}\sin\phi+\frac{\partial B_\phi}{\partial\rho}\cos\phi\right)\cos^2\phi-\left(\frac{\partial B_\rho}{\rho\partial\phi}\sin\phi+\frac{\partial B_\phi}{\rho\partial\phi}\cos\phi\right)\sin\phi\cos\phi\right]\hat{\boldsymbol{y}}$$
$$-A_\phi\left[\left(\frac{\partial B_\rho}{\partial\rho}\sin\phi+\frac{\partial B_\phi}{\partial\rho}\cos\phi\right)\sin\phi\cos\phi-\left(\frac{\partial B_\rho}{\rho\partial\phi}\sin\phi+\frac{\partial B_\phi}{\rho\partial\phi}\cos\phi\right)\sin^2\phi\right]\hat{\boldsymbol{y}}$$
$$-\left(\frac{\sin\phi\cos^2\phi}{\rho}A_\rho B_\rho-\frac{\sin^2\phi\cos\phi}{\rho}A_\rho B_\phi-\frac{\sin^2\phi\cos\phi}{\rho}A_\phi B_\rho+\frac{\sin^3\phi}{\rho}A_\phi B_\phi\right)\hat{\boldsymbol{y}}$$
$$+\left[A_\rho\left(\frac{\partial B_z}{\partial\rho}\cos\phi-\frac{\partial B_z}{\rho\partial\phi}\sin\phi\right)\cos\phi-A_\phi\left(\frac{\partial B_z}{\partial\rho}\cos\phi-\frac{\partial B_z}{\rho\partial\phi}\sin\phi\right)\sin\phi\right]\hat{\boldsymbol{z}}$$
$$+A_\rho\left[\left(\frac{\partial B_\rho}{\partial\rho}\cos\phi-\frac{\partial B_\phi}{\partial\rho}\sin\phi\right)\sin^2\phi+\left(\frac{\partial B_\rho}{\rho\partial\phi}\cos\phi-\frac{\partial B_\phi}{\rho\partial\phi}\sin\phi\right)\sin\phi\cos\phi\right]\hat{\boldsymbol{x}}$$
$$+A_\phi\left[\left(\frac{\partial B_\rho}{\partial\rho}\cos\phi-\frac{\partial B_\phi}{\partial\rho}\sin\phi\right)\sin\phi\cos\phi+\left(\frac{\partial B_\rho}{\rho\partial\phi}\cos\phi-\frac{\partial B_\phi}{\rho\partial\phi}\sin\phi\right)\cos^2\phi\right]\hat{\boldsymbol{x}}$$
$$-\left(\frac{\sin^2\phi\cos\phi}{\rho}A_\rho B_\rho+\frac{\sin\phi\cos^2\phi}{\rho}A_\rho B_\phi+\frac{\sin\phi\cos^2\phi}{\rho}A_\phi B_\rho+\frac{\cos^3\phi}{\rho}A_\phi B_\phi\right)\hat{\boldsymbol{x}}$$
$$+A_\rho\left[\left(\frac{\partial B_\rho}{\partial\rho}\sin\phi+\frac{\partial B_\phi}{\partial\rho}\cos\phi\right)\sin^2\phi+\left(\frac{\partial B_\rho}{\rho\partial\phi}\sin\phi+\frac{\partial B_\phi}{\rho\partial\phi}\cos\phi\right)\sin\phi\cos\phi\right]\hat{\boldsymbol{y}}$$
$$+A_\phi\left[\left(\frac{\partial B_\rho}{\partial\rho}\sin\phi+\frac{\partial B_\phi}{\partial\rho}\cos\phi\right)\sin\phi\cos\phi+\left(\frac{\partial B_\rho}{\rho\partial\phi}\sin\phi+\frac{\partial B_\phi}{\rho\partial\phi}\cos\phi\right)\cos^2\phi\right]\hat{\boldsymbol{y}}$$
$$+\left(\frac{\sin\phi\cos^2\phi}{\rho}A_\rho B_\rho-\frac{\sin^2\phi\cos\phi}{\rho}A_\rho B_\phi+\frac{\cos^3\phi}{\rho}A_\phi B_\rho-\frac{\sin\phi\cos^2\phi}{\rho}A_\phi B_\phi\right)\hat{\boldsymbol{y}}$$

$$+\left[A_\rho\left(\frac{\partial B_z}{\partial \rho}\sin\phi+\frac{\partial B_z}{\rho\partial\phi}\cos\phi\right)\sin\phi+A_\phi\left(\frac{\partial B_z}{\partial \rho}\sin\phi+\frac{\partial B_z}{\rho\partial\phi}\cos\phi\right)\cos\phi\right]\hat{\boldsymbol{z}}$$
$$+A_z\left(\frac{\partial B_\rho}{\partial z}\cos\phi-\frac{\partial B_\phi}{\partial z}\sin\phi\right)\hat{\boldsymbol{x}}+A_z\left(\frac{\partial B_\rho}{\partial z}\sin\phi+\frac{\partial B_\phi}{\partial z}\cos\phi\right)\hat{\boldsymbol{y}}+A_z\frac{\partial B_z}{\partial z}\hat{\boldsymbol{z}}.$$

Further simplifications yield

$$(\boldsymbol{A}\cdot\boldsymbol{\nabla})\boldsymbol{B}=\left\{A_\rho\left[\left(\frac{\partial B_\rho}{\partial \rho}\cos\phi-\frac{\partial B_\phi}{\partial \rho}\sin\phi\right)\cos^2\phi-\left(\frac{\partial B_\rho}{\rho\partial\phi}\cos\phi-\frac{\partial B_\phi}{\rho\partial\phi}\sin\phi\right)\sin\phi\cos\phi\right]\right.$$
$$+A_\rho\left[\left(\frac{\partial B_\rho}{\partial \rho}\cos\phi-\frac{\partial B_\phi}{\partial \rho}\sin\phi\right)\sin^2\phi+\left(\frac{\partial B_\rho}{\rho\partial\phi}\cos\phi-\frac{\partial B_\phi}{\rho\partial\phi}\sin\phi\right)\sin\phi\cos\phi\right]$$
$$-A_\phi\left[\left(\frac{\partial B_\rho}{\partial \rho}\cos\phi-\frac{\partial B_\phi}{\partial \rho}\sin\phi\right)\sin\phi\cos\phi-\left(\frac{\partial B_\rho}{\rho\partial\phi}\cos\phi-\frac{\partial B_\phi}{\rho\partial\phi}\sin\phi\right)\sin^2\phi\right]$$
$$+A_\phi\left[\left(\frac{\partial B_\rho}{\partial \rho}\cos\phi-\frac{\partial B_\phi}{\partial \rho}\sin\phi\right)\sin\phi\cos\phi+\left(\frac{\partial B_\rho}{\rho\partial\phi}\cos\phi-\frac{\partial B_\phi}{\rho\partial\phi}\sin\phi\right)\cos^2\phi\right]$$
$$+\left(\frac{\sin^2\phi\cos\phi}{\rho}A_\rho B_\rho+\frac{\sin\phi\cos^2\phi}{\rho}A_\rho B_\phi-\frac{\sin^3\phi}{\rho}A_\phi B_\rho-\frac{\sin^2\phi\cos\phi}{\rho}A_\phi B_\phi\right)$$
$$-\left(\frac{\sin^2\phi\cos\phi}{\rho}A_\rho B_\rho+\frac{\sin\phi\cos^2\phi}{\rho}A_\rho B_\phi+\frac{\sin\phi\cos^2\phi}{\rho}A_\phi B_\rho+\frac{\cos^3\phi}{\rho}A_\phi B_\phi\right)$$
$$\left.+A_z\left(\frac{\partial B_\rho}{\partial z}\cos\phi-\frac{\partial B_\phi}{\partial z}\sin\phi\right)\right\}\hat{\boldsymbol{x}}$$
$$+\left\{A_\rho\left[\left(\frac{\partial B_\rho}{\partial \rho}\sin\phi+\frac{\partial B_\phi}{\partial \rho}\cos\phi\right)\cos^2\phi-\left(\frac{\partial B_\rho}{\rho\partial\phi}\sin\phi+\frac{\partial B_\phi}{\rho\partial\phi}\cos\phi\right)\sin\phi\cos\phi\right]\right.$$
$$+A_\rho\left[\left(\frac{\partial B_\rho}{\partial \rho}\sin\phi+\frac{\partial B_\phi}{\partial \rho}\cos\phi\right)\sin^2\phi+\left(\frac{\partial B_\rho}{\rho\partial\phi}\sin\phi+\frac{\partial B_\phi}{\rho\partial\phi}\cos\phi\right)\sin\phi\cos\phi\right]$$
$$-A_\phi\left[\left(\frac{\partial B_\rho}{\partial \rho}\sin\phi+\frac{\partial B_\phi}{\partial \rho}\cos\phi\right)\sin\phi\cos\phi-\left(\frac{\partial B_\rho}{\rho\partial\phi}\sin\phi+\frac{\partial B_\phi}{\rho\partial\phi}\cos\phi\right)\sin^2\phi\right]$$
$$+A_\phi\left[\left(\frac{\partial B_\rho}{\partial \rho}\sin\phi+\frac{\partial B_\phi}{\partial \rho}\cos\phi\right)\sin\phi\cos\phi+\left(\frac{\partial B_\rho}{\rho\partial\phi}\sin\phi+\frac{\partial B_\phi}{\rho\partial\phi}\cos\phi\right)\cos^2\phi\right]$$
$$-\left(\frac{\sin\phi\cos^2\phi}{\rho}A_\rho B_\rho-\frac{\sin^2\phi\cos\phi}{\rho}A_\rho B_\phi-\frac{\sin^2\phi\cos\phi}{\rho}A_\phi B_\rho+\frac{\sin^3\phi}{\rho}A_\phi B_\phi\right)$$
$$+\left(\frac{\sin\phi\cos^2\phi}{\rho}A_\rho B_\rho-\frac{\sin^2\phi\cos\phi}{\rho}A_\rho B_\phi+\frac{\cos^3\phi}{\rho}A_\phi B_\rho-\frac{\sin\phi\cos^2\phi}{\rho}A_\phi B_\phi\right)$$
$$\left.+A_z\left(\frac{\partial B_\rho}{\partial z}\sin\phi+\frac{\partial B_\phi}{\partial z}\cos\phi\right)\right\}\hat{\boldsymbol{y}}$$
$$+\left[A_\rho\left(\frac{\partial B_z}{\partial \rho}\sin^2\phi+\frac{\partial B_z}{\rho\partial\phi}\sin\phi\cos\phi+\frac{\partial B_z}{\partial \rho}\cos^2\phi-\frac{\partial B_z}{\rho\partial\phi}\sin\phi\cos\phi\right)\right.$$
$$\left.+A_\phi\left(\frac{\partial B_z}{\partial \rho}\sin\phi\cos\phi+\frac{\partial B_z}{\rho\partial\phi}\cos^2\phi-\frac{\partial B_z}{\partial \rho}\sin\phi\cos\phi+\frac{\partial B_z}{\rho\partial\phi}\sin^2\phi\right)+A_z\frac{\partial B_z}{\partial z}\right]\hat{\boldsymbol{z}}.$$

$$(\boldsymbol{A}\cdot\boldsymbol{\nabla})\boldsymbol{B}=\left[A_\rho\left(\frac{\partial B_\rho}{\partial \rho}\cos\phi-\frac{\partial B_\phi}{\partial \rho}\sin\phi\right)+A_\phi\left(\frac{\partial B_\rho}{\rho\partial\phi}\cos\phi-\frac{\partial B_\phi}{\rho\partial\phi}\sin\phi\right)\right.$$
$$\left.-\left(\frac{\sin\phi}{\rho}A_\phi B_\rho+\frac{\cos\phi}{\rho}A_\phi B_\phi\right)+A_z\left(\frac{\partial B_\rho}{\partial z}\cos\phi-\frac{\partial B_\phi}{\partial z}\sin\phi\right)\right]\hat{\boldsymbol{x}}$$
$$+\left[A_\rho\left(\frac{\partial B_\rho}{\partial \rho}\sin\phi+\frac{\partial B_\phi}{\partial \rho}\cos\phi\right)+A_\phi\left(\frac{\partial B_\rho}{\rho\partial\phi}\sin\phi+\frac{\partial B_\phi}{\rho\partial\phi}\cos\phi\right)\right.$$

$$+\left(\frac{\cos\phi}{\rho}A_\phi B_\rho - \frac{\sin\phi}{\rho}A_\phi B_\phi\right) + A_z\left(\frac{\partial B_\rho}{\partial z}\sin\phi + \frac{\partial B_\phi}{\partial z}\cos\phi\right)\Big]\hat{\boldsymbol{y}}$$
$$+\left(A_\rho\frac{\partial B_z}{\partial\rho} + A_\phi\frac{\partial B_z}{\rho\partial\phi} + A_z\frac{\partial B_z}{\partial z}\right)\hat{\boldsymbol{z}}.$$

$$(\boldsymbol{A}\cdot\boldsymbol{\nabla})\boldsymbol{B} = A_\rho\left(\frac{\partial B_\rho}{\partial\rho}\hat{\boldsymbol{\rho}} + \frac{\partial B_\phi}{\partial\rho}\hat{\boldsymbol{\phi}}\right) + A_\phi\left(\frac{\partial B_\rho}{\rho\partial\phi}\hat{\boldsymbol{\rho}} + \frac{\partial B_\phi}{\rho\partial\phi}\hat{\boldsymbol{\phi}}\right) + A_z\left(\frac{\partial B_\rho}{\partial z}\hat{\boldsymbol{\rho}} + \frac{\partial B_\phi}{\partial z}\hat{\boldsymbol{\phi}}\right)$$
$$-\rho^{-1}\left(A_\phi B_\phi\hat{\boldsymbol{\rho}} - A_\phi B_\rho\hat{\boldsymbol{\phi}}\right) + \left(A_\rho\frac{\partial B_z}{\partial\rho} + A_\phi\frac{\partial B_z}{\rho\partial\phi} + A_z\frac{\partial B_z}{\partial z}\right)\hat{\boldsymbol{z}}.$$

$$(\boldsymbol{A}\cdot\boldsymbol{\nabla})\boldsymbol{B} = A_\rho\left(\frac{\partial B_\rho}{\partial\rho}\hat{\boldsymbol{\rho}} + \frac{\partial B_\phi}{\partial\rho}\hat{\boldsymbol{\phi}} + \frac{\partial B_z}{\partial\rho}\hat{\boldsymbol{z}}\right) + A_\phi\rho^{-1}\left[\left(\frac{\partial B_\rho}{\partial\phi} - B_\phi\right)\hat{\boldsymbol{\rho}} + \left(\frac{\partial B_\phi}{\partial\phi} + B_\rho\right)\hat{\boldsymbol{\phi}} + \frac{\partial B_z}{\partial\phi}\hat{\boldsymbol{z}}\right]$$
$$+A_z\left(\frac{\partial B_\rho}{\partial z}\hat{\boldsymbol{\rho}} + \frac{\partial B_\phi}{\partial z}\hat{\boldsymbol{\phi}} + \frac{\partial B_z}{\partial z}\hat{\boldsymbol{z}}\right).$$
