mpc2soln10.tex

<div align="center">

SOLUTIONS 10. 14.12.2011

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Q1.

$$div(\mathcal{F} \times \mathcal{G}) = D_1(\mathcal{F} \times \mathcal{G})_1 + D_2(\mathcal{F} \times \mathcal{G})_2 + D_3(\mathcal{F} \times \mathcal{G})_3$$

$$= D_1[F_2G_3 - F_3G_2] + D_2[F_3G_1 - F_1G_3] + D_3[F_1G_2 - F_2G_1]$$

$$= (D_1F_2)G_3 + F_2(D_1G_3) - (D_1F_3)G_2 - F_3(D_1G_2)$$

$$+ (D_2F_3)G_1 + F_3(D_2G_1) - (D_2F_1)G_3 - F_1(D_2G_3)$$

$$+ (D_3F_1)G_2 + F_1(D_3G_2) - (D_3F_2)G_1 - F_2(D_3G_1)$$

$$= G_1[D_2F_3 - D_3F_2] + G_1[D_2F_3 - D_3F_2] + G_1[D_2F_3 - D_3F_2]$$

$$= \mathcal{G}.(\nabla \times \mathcal{F}) - \mathcal{F}.(\nabla \times \mathcal{G}).$$

Q2.

$$\nabla \times (f\mathbf{F}) = [D_2(fF)_3 - D_3(fF)_2]\mathbf{i} + [D_3(fF)_1 - D_1(fF)_3]\mathbf{j} + [D_1(fF)_2 - D_2(fF)_1]\mathbf{k}$$

$$= [(D_2f)F_3 + fD_2F_3 - (D_3f)F_2 - fD_3F_2]\mathbf{i}$$

$$+ [(D_3f)F_1 + fD_3F_1 - (D_1f)F_3 - fD_1F_3]\mathbf{j}$$

$$+ [(D_1f)F_2 + fD_1F_2 - (D_2f)F_1 - fD_2F_1]\mathbf{k}$$

$$= f[(D_2F_3 - D_3F_2)\mathbf{i} + (D_3F_1 - D_1F_3)\mathbf{j} + (D_1F_2 - D_2F_1)\mathbf{k}]$$

$$+ [(\nabla f)_2F_3 - (\nabla f)_3F_2]\mathbf{i} + [(\nabla f)_3F_1 - (\nabla f)_1F_3]\mathbf{j} + [(\nabla f)_1F_2 - (\nabla f)_2F_1]\mathbf{k}$$

$$= f(\nabla \times \mathbf{F}) + (\nabla f) \times \mathbf{F}.$$

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NHB

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