5.33 (a) $\vec{F}_{12} = -\frac{\mu_0}{4\pi} I_1 I_2 \oint\oint \frac{(d\vec{l}_1 \cdot d\vec{l}_2)\,\vec{x}_{12}}{|\vec{x}_{12}|^3}$

Since $\vec{x}_{12} = \vec{x}_1 - \vec{x}_2 + \vec{R}$, and

$$\nabla_R \left(\frac{1}{|\vec{x}_1 - \vec{x}_2 + \vec{R}|} \right) = - \frac{\vec{x}_1 - \vec{x}_2 + \vec{R}}{|\vec{x}_1 - \vec{x}_2 + \vec{R}|^3} = - \frac{\vec{x}_{12}}{|\vec{x}_{12}|^3}$$

we have $\vec{F}_{12} = I_1 I_2 \nabla_R \left(\frac{\mu_0}{4\pi} \oint\oint \frac{d\vec{l}_1 \cdot d\vec{l}_2}{|\vec{x}_1 - \vec{x}_2 + \vec{R}|} \right) = I_1 I_2 \nabla_R M_{12}(\vec{R})$

(b) $$\nabla_R^2 \left(\frac{1}{|\vec{x}_1 - \vec{x}_2 + \vec{R}|} \right) = -4\pi\,\delta(\vec{x}_1 - \vec{x}_2 + \vec{R})$$

Since $\vec{R} \neq \vec{x}_2 - \vec{x}_1$, unless two loops touch. Therefore

$$\nabla_R^2 \left(\frac{1}{|\vec{x}_1 - \vec{x}_2 + \vec{R}|} \right) = 0, \text{ and } \nabla_R^2 M(\vec{R}) = 0$$