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MATB42: Assignment #8 Mar 20th 2018

1. (a) Let $f, g : \mathbb{R}^n \to \mathbb{R}$; $\boldsymbol{F}$, $\boldsymbol{G} : \mathbb{R}^n \to \mathbb{R}$; and define Δ, the *Laplacian*, by $\Delta f = \sum_{i=1}^{n} \frac{\partial^2 f}{\partial x_i^2}$.

   Verify the following identities

   (i) $\text{div}(\boldsymbol{F} + \boldsymbol{G}) = \text{div } \boldsymbol{F} + \text{div } \boldsymbol{G}$.

   (ii) $\text{div}(f\boldsymbol{F}) = f \text{ div } \boldsymbol{F} + \boldsymbol{F} \cdot \text{grad} f$.

   (iii) $\Delta(fg) = f\Delta g + g\Delta f + 2(\text{grad} f) \cdot (\text{grad} g)$.