The People of Vector Calculus

September 6, 2009

(Approximate) Time Line

FTC: 1666

Divergence Theorem: 1762

Green's Theorem: 1825

Stokes's Theorem: 1850

Vectors: 1880s

Sir Isaac Newton (1642–1727): English

Gottfried Wilhelm von Leibniz (1646–1716): German

Divergence Theorem

Joseph-Louis Lagrange (1736–1813): French; b. Italian (1762)

Johann Carl Friedrich Gauss (1777–1855): German (1813)

Mikhail Vasilievich Ostrogradsky (1801–1862): Ukranian (1831)

George Green (1793 – 1841): English

1825: Green's Theorem/Formulas/Function
in "An Essay on the Application of Mathematical Analysis to the Theories of Electricity and Magnetism" (self-published in 1828, about 50 copies)
1833–1837: undergraduate studies at Cambridge

Planimeter

$$\text{area}(G) = \oint_{\partial G} x\,dy = -\oint_{\partial G} y\,dx = \frac{1}{2}\oint_{\partial G} x\,dy - y\,dx = \frac{1}{2}\oint_{\partial G} r^2\,d\theta$$

Mechanical: \$300 Electronic: \$650

Green's Formulas in Space

Laplacian: $\boldsymbol{\Delta} f = \operatorname{div}(\operatorname{grad} f)$
Normal derivative:

$$\frac{df}{dn} = (\operatorname{grad} f) \cdot \widehat{\boldsymbol{n}}$$

First formula:

$$\iiint\limits_G f\,\boldsymbol{\Delta} g\,dV = -\iiint\limits_G (\operatorname{grad} f) \cdot (\operatorname{grad} g)\,dV + \iint\limits_{\partial G} f\,\frac{dg}{dn}\,d\sigma$$

Second formula:

$$\iiint\limits_G (f\,\boldsymbol{\Delta} g - g\,\boldsymbol{\Delta} f)\,dV = \iint\limits_{\partial G} \left(f\,\frac{dg}{dn} - g\,\frac{df}{dn} \right) d\sigma$$

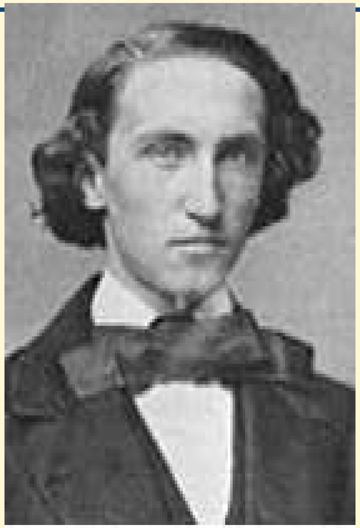
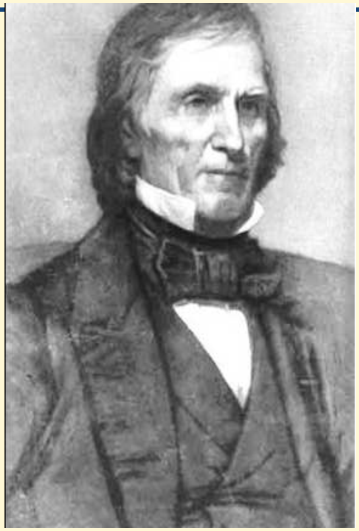
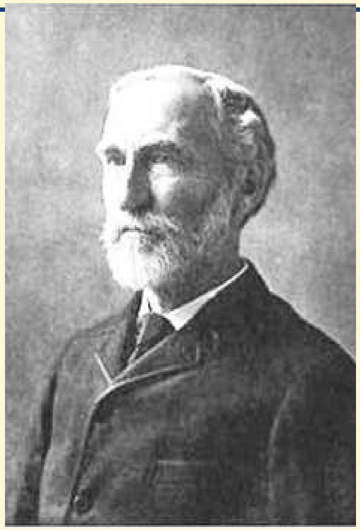
Kelvin and Stokes

Kelvin, William Thomson, 1st Baron (1824–1907): British

George Gabriel Stokes (1819–1903): British

The Theorem: 1850, in a letter FROM Kelvin TO Stokes.

1880s: Introduction of Vectors


Josiah Willard Gibbs (1839–1903): American from New Haven, CT
Professor at Yale: 1871; first publication: 1873.

Oliver Heaviside (1850–1925): English, self-taught, many brilliant ideas (e.g. Laplace transform to solve ODEs)