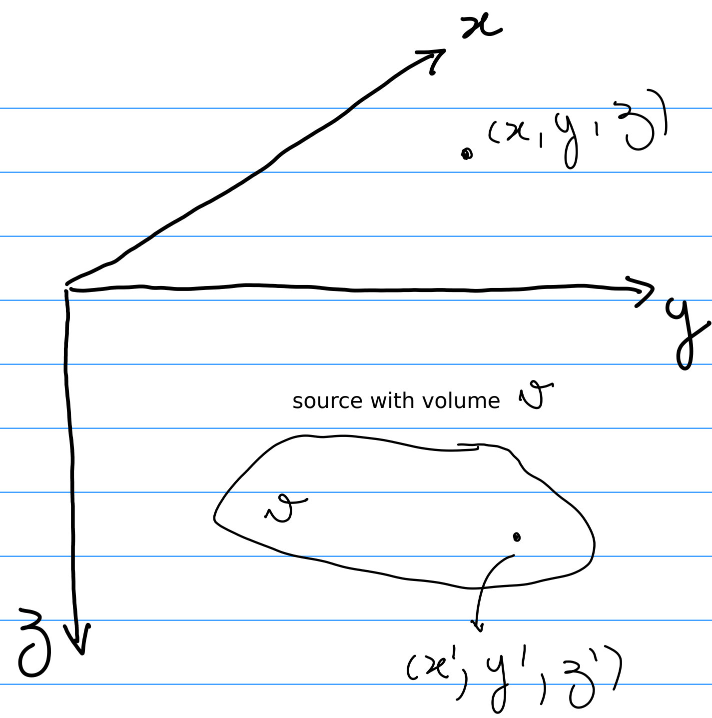
Poisson's relation



scalar magnetic potetial produced by a source
with constant total magnetization

$$V(x,y,z) = -\nabla\Theta(x,y,z)^T\,\hat{\mathbf{h}}$$

$$\Theta(x,y,z) = C_m\,h \iiint_{\vartheta} \frac{1}{r}\,d\vartheta$$

$$\hat{\mathbf{h}} = \begin{bmatrix} \cos I \cos D \\ \cos I \sin D \\ \sin D \end{bmatrix}$$

$$V(x,y,z) = -\begin{bmatrix} \partial_x\Theta \\ \partial_y\Theta \\ \partial_z\Theta \end{bmatrix}^T \hat{\mathbf{h}}\ , \quad \partial_\alpha\Theta \equiv \frac{\partial\Theta(x,y,z)}{\partial\alpha} = C_m\,h \iiint_{\vartheta} \frac{\alpha'-\alpha}{r^3}\,d\vartheta$$

$$\alpha = x, y, z$$

gravitational potential produced by a source
with constant density

$$U(x,y,z) = G\rho \iiint_{\vartheta} \frac{1}{r}\,d\vartheta$$

$$\nabla U(x,y,z) = \begin{bmatrix} \partial_x U \\ \partial_y U \\ \partial_z U \end{bmatrix}$$

gradient of the gravitational potential
(gravitational acceleration)

alfa-component of the gravitational acceleration

$$\partial_\alpha U \equiv \frac{\partial U(x,y,z)}{\partial\alpha} = G\rho \iiint_{\vartheta} \frac{\alpha'-\alpha}{r^3}\,d\vartheta\ , \quad \alpha = x, y, z$$

$$\partial_\alpha\Theta = \frac{C_m\,h}{G\rho}\,\partial_\alpha U$$

$$V(x,y,z) = \frac{C_m\,h}{G\rho}\,\nabla U(x,y,z)^T\,\hat{\mathbf{h}}$$

$$\nabla\Theta(x,y,z) = \frac{C_m\,h}{G\rho}\,\nabla U(x,y,z)$$

Under the conditions imposed here, the scalar magnetic potential represents the directional derivative of the gravitational potential along the total-magnetization direction of the source. This equation is known as Poisson's relation (Blakely, 1996, p. 91)