Find the flux of the field
\[ \mathbf{F} = x\mathbf{i} + y\mathbf{j} + 2z\mathbf{k} \]
through the part of the plane \( z = x + y \) given by the equations \( 0 \leq x \leq 1, \ 0 \leq y \leq 2 \).

**Solution.** This is the graph of the function \( g(x, y) = x + y \) for \( (x, y) \in D \), where \( D = [0, 1] \times [0, 2] \). And

\[ \mathbf{F} = Pi + Qj + Rk, \quad \text{where} \quad P = x, \ Q = y, \ R = 2z. \]

The flux is expressible as the following double integral:

\[ \iint_D (-Pg_x - Qg_y + R) \, dA = \iint_D (-x - 1 - y + 1 + 2z) \, dA = \iint_D (2z - x - y) \, dA. \]

Plug in \( z = g(x, y) = x + y \):

\[ \iint_D (2(x + y) - x - y) \, dA = \iint_D (x + y) \, dA. \]

It remains to calculate this double integral:

\[ \int_0^1 \int_0^2 (x + y) \, dy \, dx = \int_0^1 \left( xy + \frac{y^2}{2} \right) \bigg|_{y=0}^{y=2} \, dx = \int_0^1 (2x + 2) \, dx = (x^2 + 2x) \bigg|_{x=0}^{x=1} = 3 \]