



$$\begin{aligned}
P_1 &= (x, y, 0) & P_3 &= (x, y + dy, 0) \\
P_2 &= (x + dx, y, 0) & P_4 &= (x + dx, y + dy, 0) \\
Q_1 &= (x, y, f(x, y)) \\
Q_2 &= (x + dx, y, f(x + dx, y)) \\
Q_3 &= (x, y + dy, f(x, y + dy)) \\
Q_4 &= (x + dx, y + dy, f(x + dx, y + dy))
\end{aligned}$$

Since

$$f(x + dx, y) = f(x, y) + f_x(x, y)dx + O(dx^2)$$

$$f(x, y + dy) = f(x, y) + f_y(x, y)dy + O(dy^2)$$

and

$$\begin{aligned}
f(x + dx, y + dy) \\
&= f(x, y) + f_x(x, y)dx \\
&\quad + f_y(x, y)dy + O(dx^2 + dy^2)
\end{aligned}$$

we have

$$\overrightarrow{Q_1Q_2} = \overrightarrow{Q_3Q_4} = (dx, 0, f_x(x, y)dx) + O(\dots)$$

$$\overrightarrow{Q_1Q_3} = \overrightarrow{Q_2Q_4} = (0, dy, f_y(x, y)dy) + O(\dots)$$