

$$\begin{aligned}
 f(x_1 + \dot{x}_1 \mathbf{d}_1, x_2 + \dot{x}_2 \mathbf{d}_2) &= \\
 (x_1 + \dot{x}_1 \mathbf{d}_1)(x_2 + \dot{x}_2 \mathbf{d}_2) + \sin(x_1 + \dot{x}_1 \mathbf{d}_1) &= \\
 x_1 x_2 + (x_2 + \cos(x_1)) \dot{x}_1 \mathbf{d}_1 + x_1 \dot{x}_2 \mathbf{d}_2
 \end{aligned}$$