

A Jacobian is similar to a gradient but for a vector of functions (it is therefore a vector of gradients).

$$f(x, y) = 3x^2y$$

$$g(x, y) = 2x + y^8$$

$$\mathbf{J} = \begin{bmatrix} \nabla f(x, y) \\ \nabla g(x, y) \end{bmatrix} = \begin{bmatrix} \frac{\partial f(x, y)}{\partial x} & \frac{\partial f(x, y)}{\partial y} \\ \frac{\partial g(x, y)}{\partial x} & \frac{\partial g(x, y)}{\partial y} \end{bmatrix} = \begin{bmatrix} 6yx & 3x^2 \\ 2 & 8y^7 \end{bmatrix}$$

*NOTE* Notation used is the "numerator layout" although many use denominator layout which is transposed.

$$\begin{bmatrix} 6yx & 2 \\ 3x^2 & 8y^7 \end{bmatrix} \text{ vs } \begin{bmatrix} 6yx & 3x^2 \\ 2 & 8y^7 \end{bmatrix}$$

## 1 | Further Sources

See [here](#) for videos and [here](#) for good sources.