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

$$\boxed{F_{xy} = \frac{\partial^2 f}{\partial y \partial x}}$$

$$\frac{df}{dx} = 6x^2 + 3y^2$$

$$\frac{d^2 f}{dx^2} = 12x$$

$$\frac{d^3 f}{dx^3} = 12$$

$$\frac{\partial^2 f}{\partial x \partial y} = \frac{\partial}{\partial x} \frac{df}{dy}$$

$$\frac{df}{dy} = 6xy$$

$$6xy \frac{\partial}{\partial x} = 6y$$

$$\frac{\partial f}{\partial x} = 6xy$$

$$\frac{\partial^2 f}{\partial x^2} = 6x$$

$$\frac{\partial^3 f}{\partial y^3} = 0$$

$$\frac{\partial^2 f}{\partial y \partial x} = \frac{\partial}{\partial y} \frac{df}{dx}$$

$$\frac{df}{dx} = 6x^2 + 3y^2$$

$$6x^2 + 3y^2 \frac{\partial}{\partial y} = 6y$$

F_{xy} and F_{yx} don't need to be equal. If there are partial derivatives for every xy then $F_{xy} = F_{yx}$