$$f(x,y) = x(y+1) - x^2$$

$$= xy + x - x^2$$

$$f_x(x,y) = y + 1 - 2x \quad \left(\begin{matrix}\text{with repect}\\ \text{to } x\end{matrix}\right)$$

$$f_y(x,y) = x + 0 - 0$$

$$= x \quad \left(\begin{matrix}\text{with repect}\\ \text{to } y\end{matrix}\right)$$

$f(x) = 2x$ $f'(x) = 2x^0$	$f(x) = k$ $f(x) = 0$
$f(y) = 7y$ $f'(y) = 7$	

$$f(x,y) = 3x^2y^5 + \cos(x)\sin(y) \cdot x - y \cdot e^y \cdot x$$

$$f_x(x,y) = 6xy^5 + \sin(y)\cdot(\cos(x)\cdot x' + (\cos(x))\cdot x)$$

$$3y^5 \quad x^2 \to 2x \quad x' = 1 \quad (\cos(x))' = -\sin(x)$$

$$+ \sin(y)(\cos(x) - x\sin(x))$$

$$y \cdot e^y$$

Product Rule

$$(fg)' = f'g + f \cdot g'$$

$$f_y = 15x^2y^4 + \cos(x)\cdot\cos(y)\cdot x - x\cdot(e^y + ye^y)$$

$\cos(x)\,\cos\sin(y)\,x$

first fun　　second fun　　third fun

$$f(x,y) = \cos(x)\cdot\sin(y)\cdot x$$

$$f_{y}(x,y) = \left(\cos(x)\cdot x\right)\cdot\left(\sin(y)\right)'$$

$$= \left(\cos(x)x\right)\cdot\left(\cos(y)\right)$$

$$= x\cdot\cos(x)\cos(y)$$

$$f(x_1, x_2, \ldots, x_n) = \langle \text{something} \rangle$$

$$f_{x_k}(x_1, x_2, \ldots, x_n) = \left(\begin{matrix}\text{everything} \\ \text{without } x_k\end{matrix}\right) \cdot \left(\begin{matrix}\text{everything} \\ \text{with } x_k\end{matrix}\right)'$$

$$f(x,y) = e^{xy}$$

$$f_x(x,y) = y e^{xy}$$

$$f_y(x,y) = x e^{xy}$$

Chain Rules

$$f(x,y) = y \cdot e^y \cdot x$$

$$f_x(x,y) = y e^y$$

$$f_y(x,y) = (x) \cdot \left((y)' \cdot e^y + y \cdot (e^y)' \right)$$

$$= (x) \cdot (e^y + y e^y)$$

$$f(x,y) = e^{x^2 \cdot y} \cdot y \cdot \cos(x) + \sin(y) \cdot e^{\sin(y)\cos(y)}$$

$$f_x(x,y) = (y) \cdot \left(e^{x^2 y} \cdot \cos(x)\right)' \quad \text{Product Rule}$$

Chain Rule

Product Rule

$$= (y) \cdot \left(\left(e^{x^2 y}\right)' \cdot \cos(x) + e^{x^2 y} \cdot (\cos(x))'\right)$$

$$= (y) \cdot \left(e^{x^2 \cdot y} \cdot 2xy \cdot \cos(x) + e^{x^2 y} \cdot (-\sin(x))\right)$$

$+ 0$

f_y is homework

$$g(x,y) = \sin(y) \cdot e^{\cos(y)\sin(y)}$$

$$g'_x(x,y) = 0$$

$$E(x,y,z,w,v,a,b) = xyzwv^2ab$$

$$E_x = yzwv^2ab \qquad E_v = xyzw \cdot (2v)ab$$

$$E_y = xzwv^2ab$$