

AI and Neural Network Training

© Margrit Betke

Example of a 3D function and its
partial derivatives:

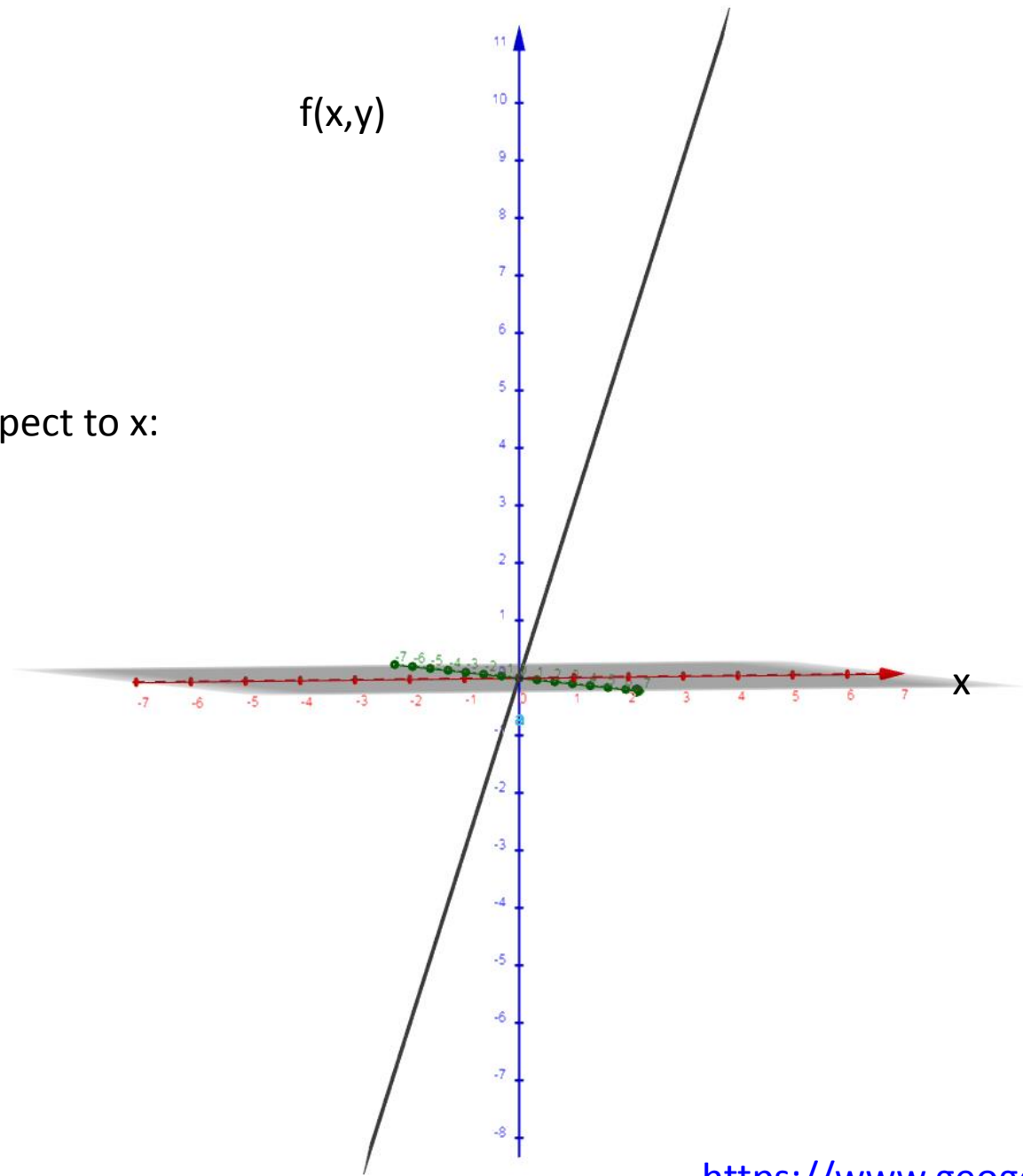
$$f(x,y) = 3x+y$$

$f(x,y)$

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Slope in x:
Derivative with respect to x:

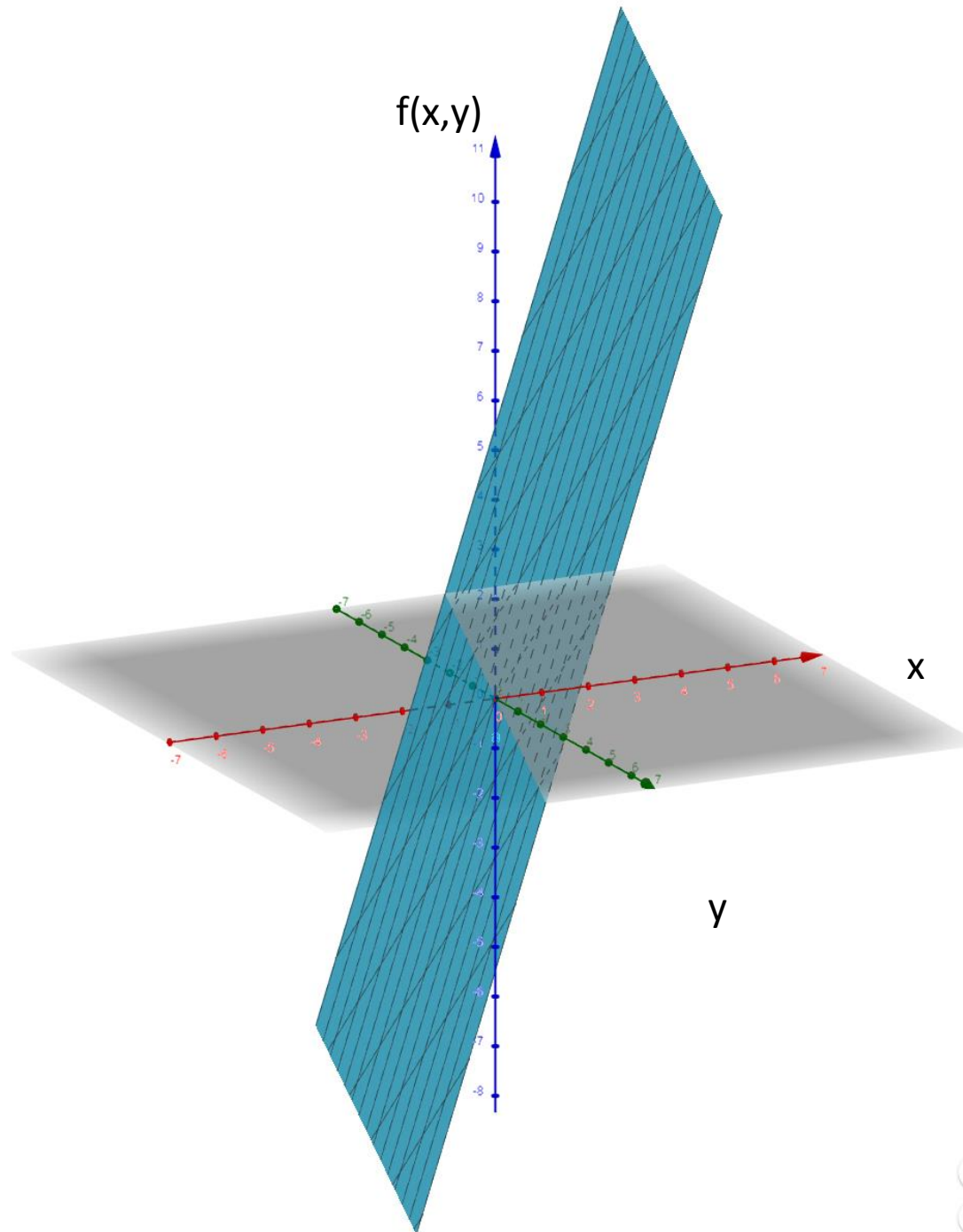
$$= 3$$



$$f(x,y)=3x+y$$

Slope in y:

$$= 1$$



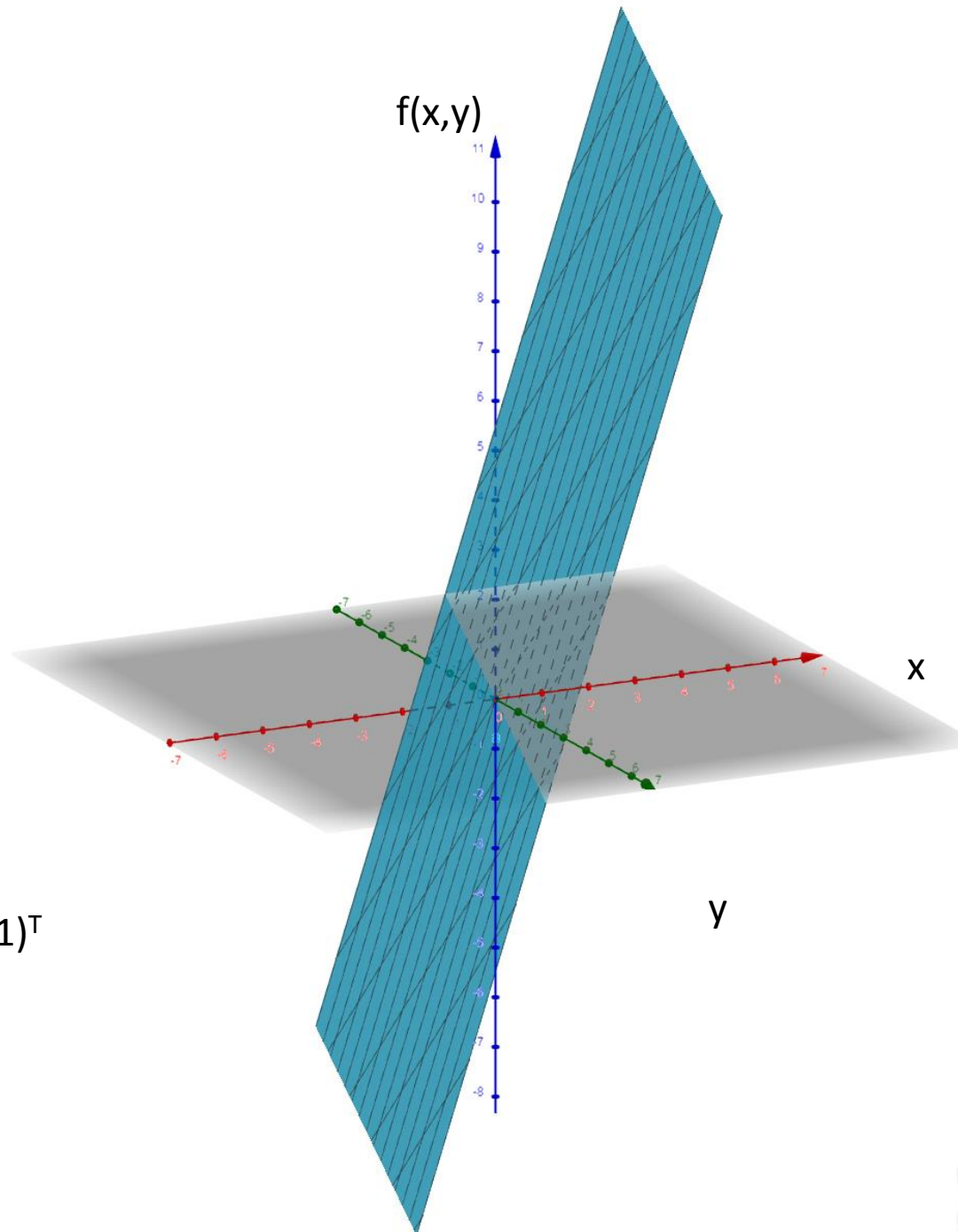
$$f(x,y)=3x+y$$

Slope in y:

$$= 1$$

Gradient:

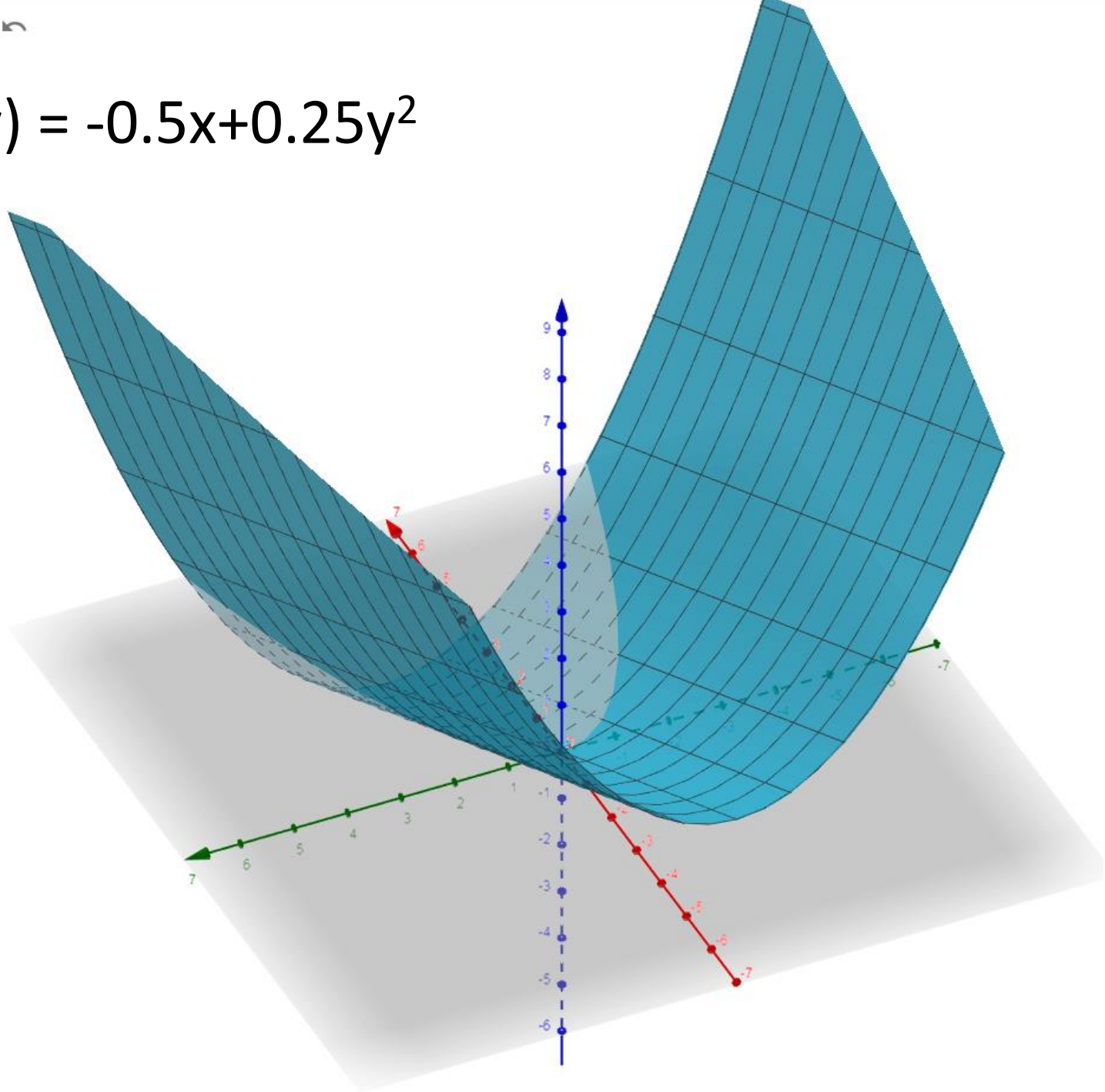
$$= (3, 1)^T$$

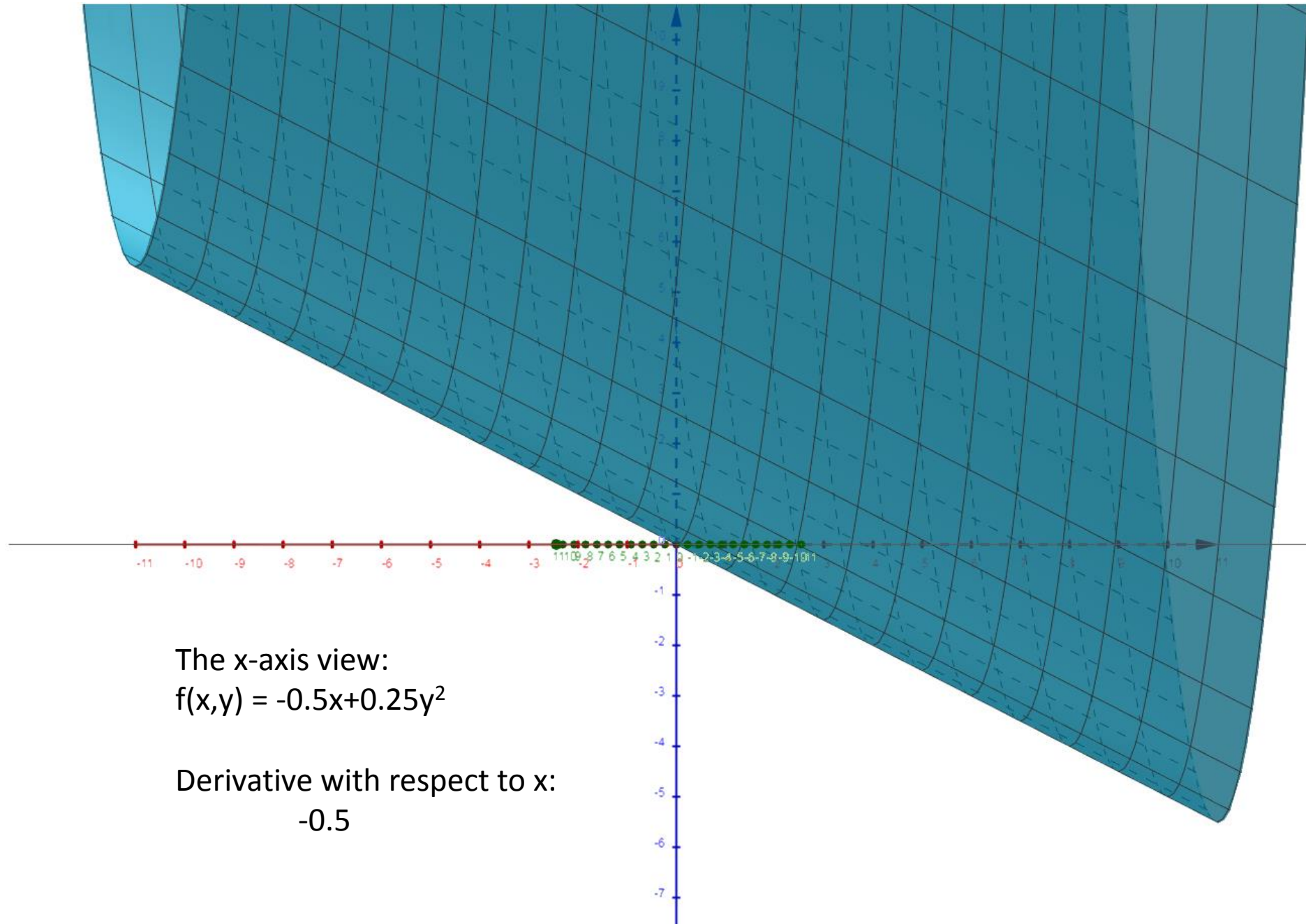


Another example of a 3D function
and its partial derivatives:

$$f(x,y) = -0.5x + 0.25y^2$$

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The x-axis view:

$$f(x,y) = -0.5x + 0.25y^2$$

Derivative with respect to x:

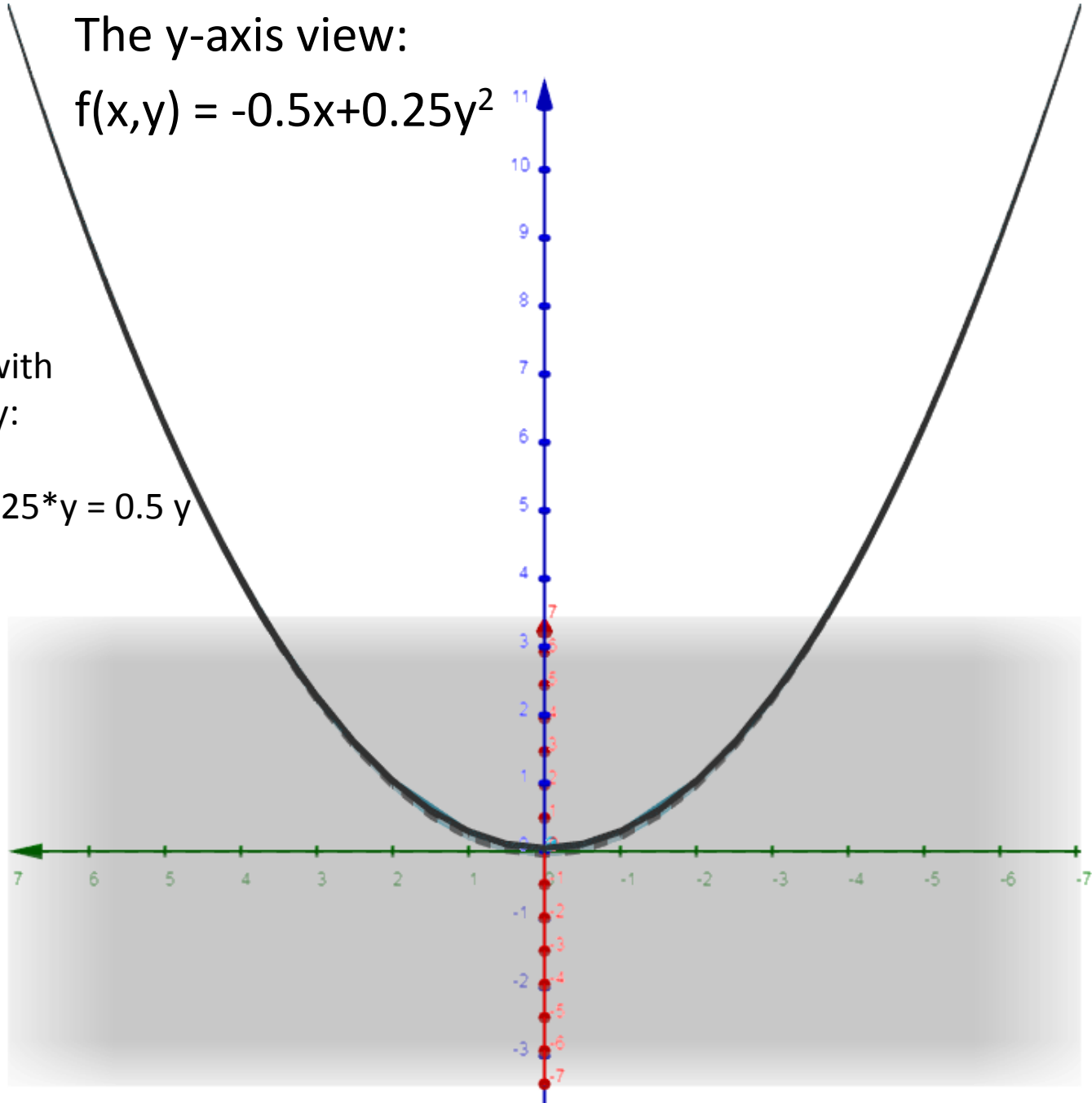
$$-0.5$$

The y-axis view:

$$f(x,y) = -0.5x + 0.25y^2$$

Derivative with respect to y:

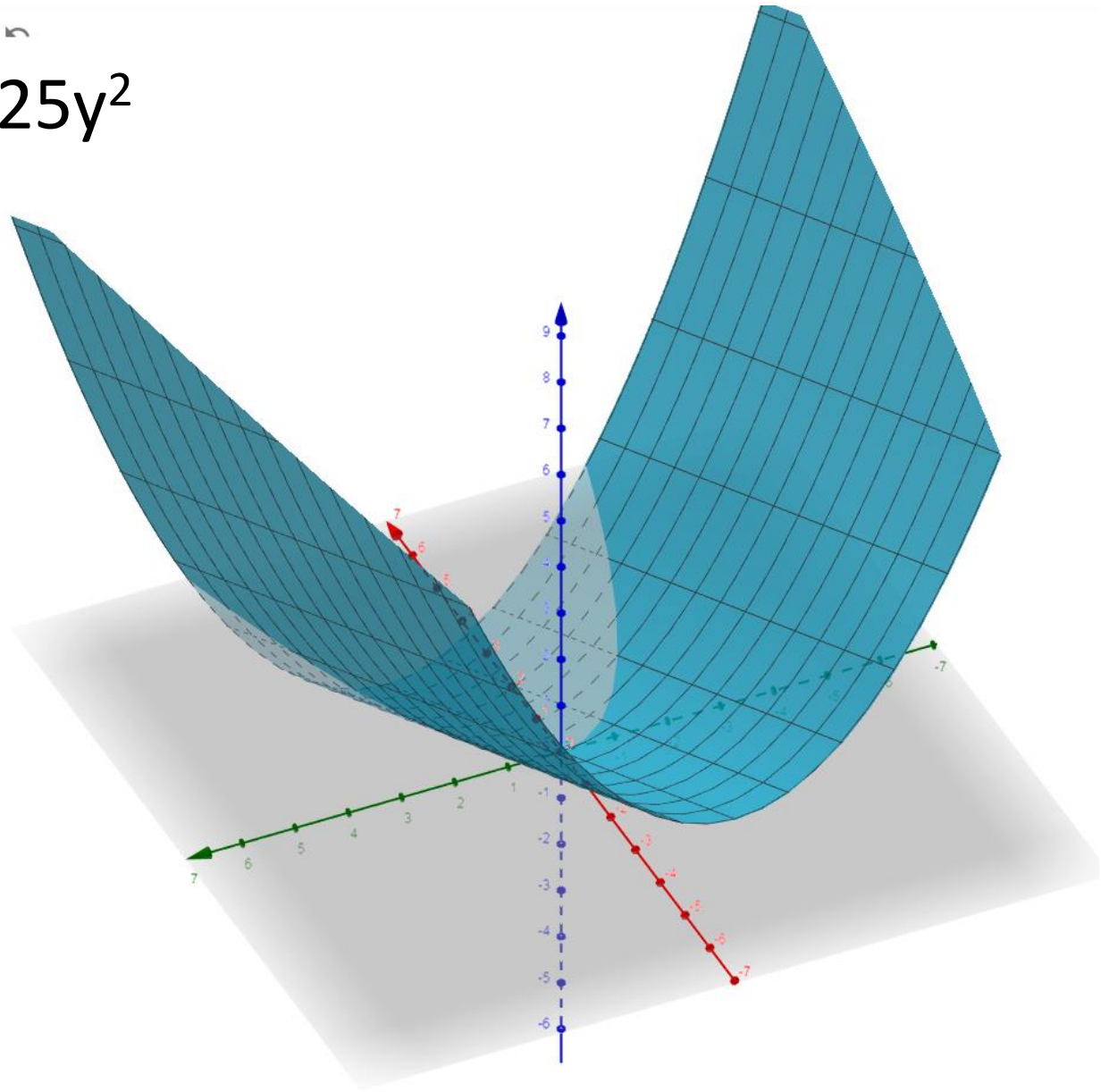
$$= 2 * 0.25 * y = 0.5 y$$



$$f(x,y) = -0.5x + 0.25y^2$$

Gradient

$$= (-0.5, 0.5y)^T$$



$$f(x,y) = -0.5x + 0.25y^2$$
$$= 0.5 (-x + 0.5y^2)$$

$$p(o(\mathbf{x})) = 0.5 o(\mathbf{x}), \quad \text{where } \mathbf{x} = (x,y)$$

General Chain Rule:

Here: $J=1$, $f(x,y)$ is a scalar

$$\partial p / \partial x =$$

$$\partial p / \partial y =$$

