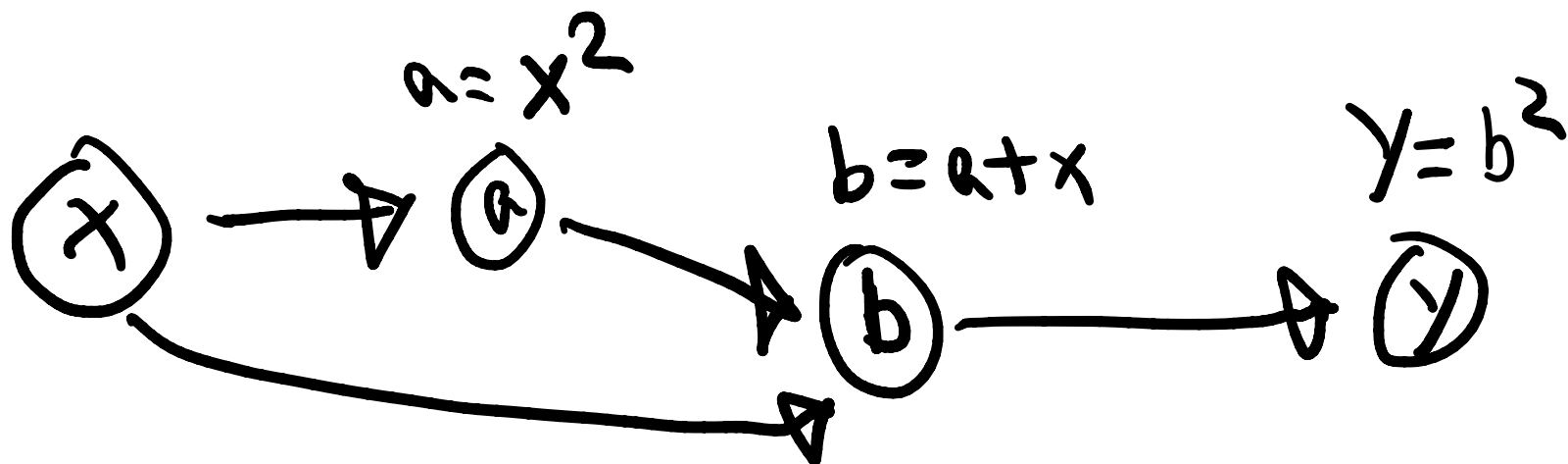
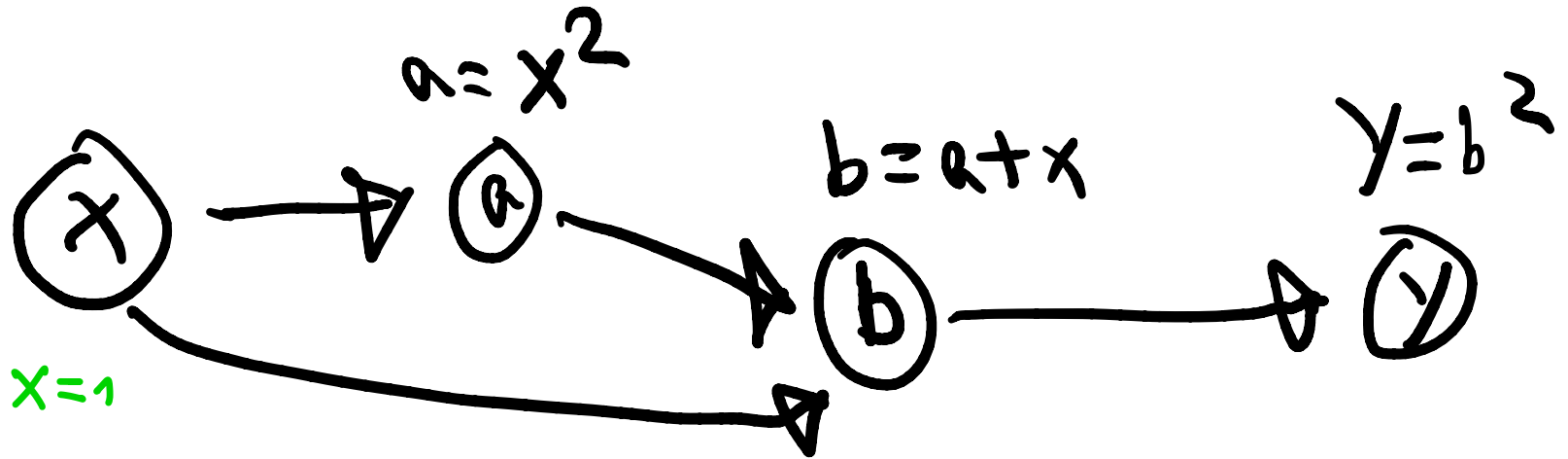


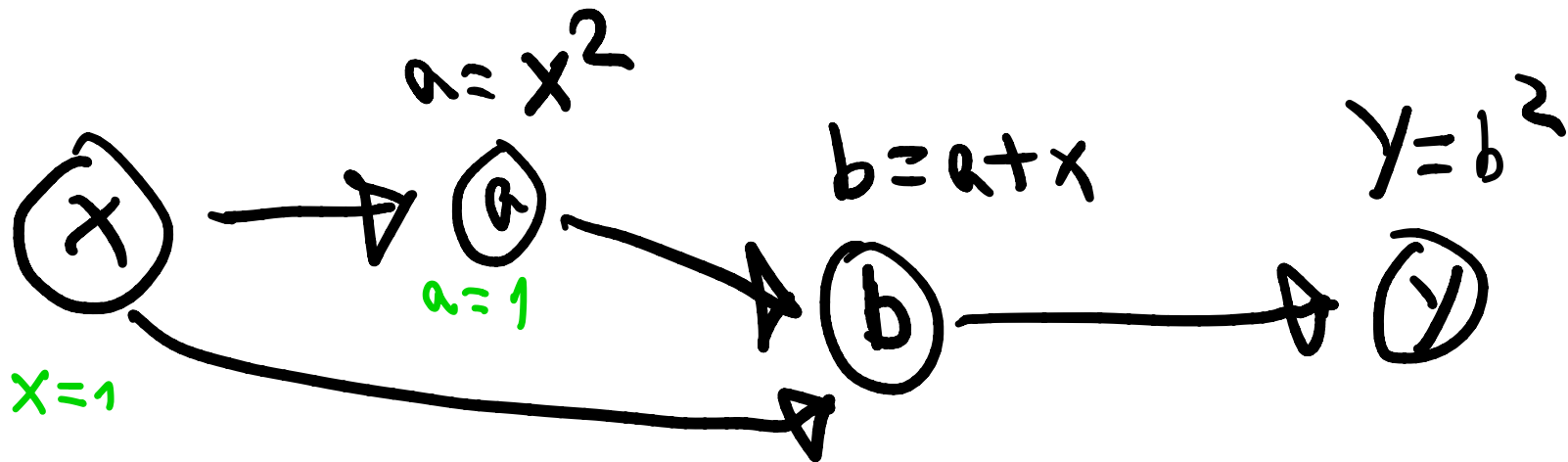
$$y = (x + x^2)^2$$



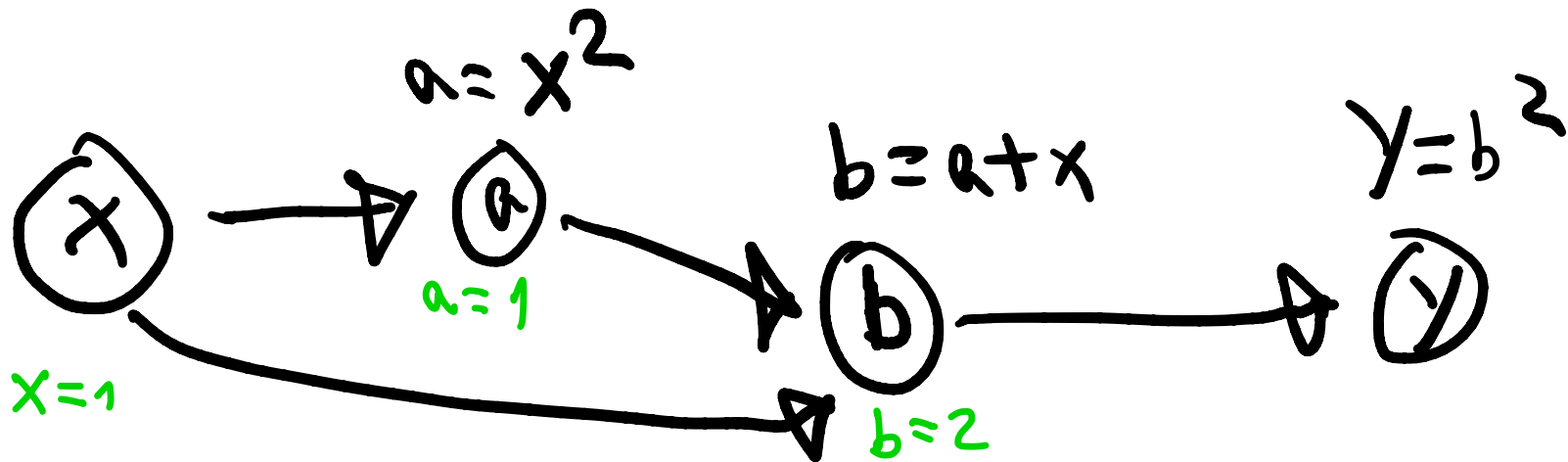
Forward Pass



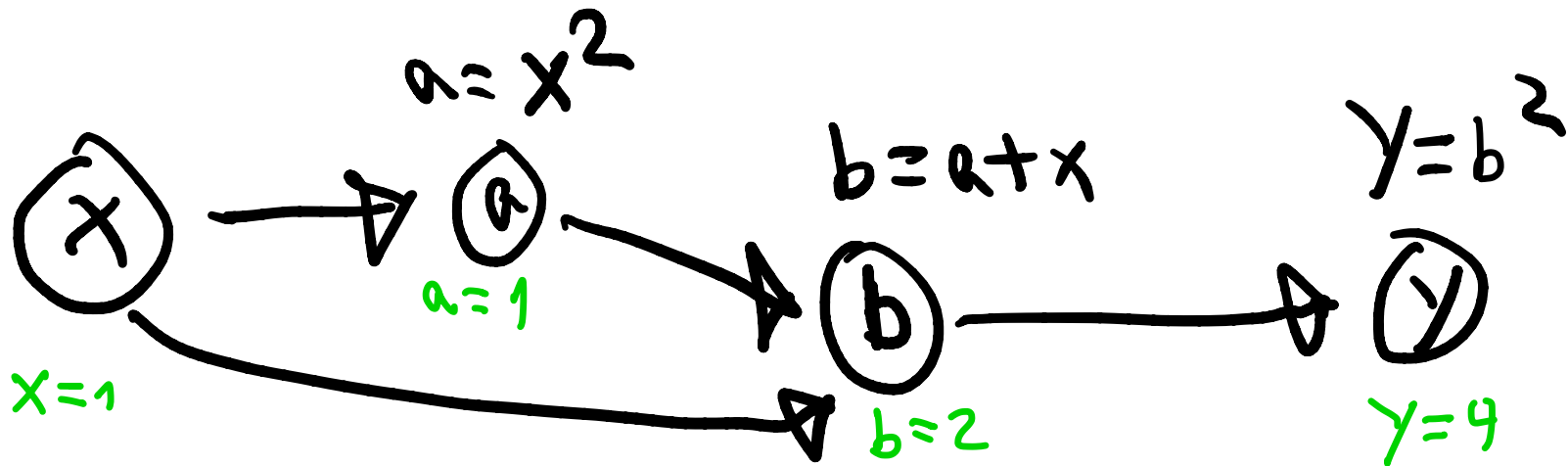
Forward Pass



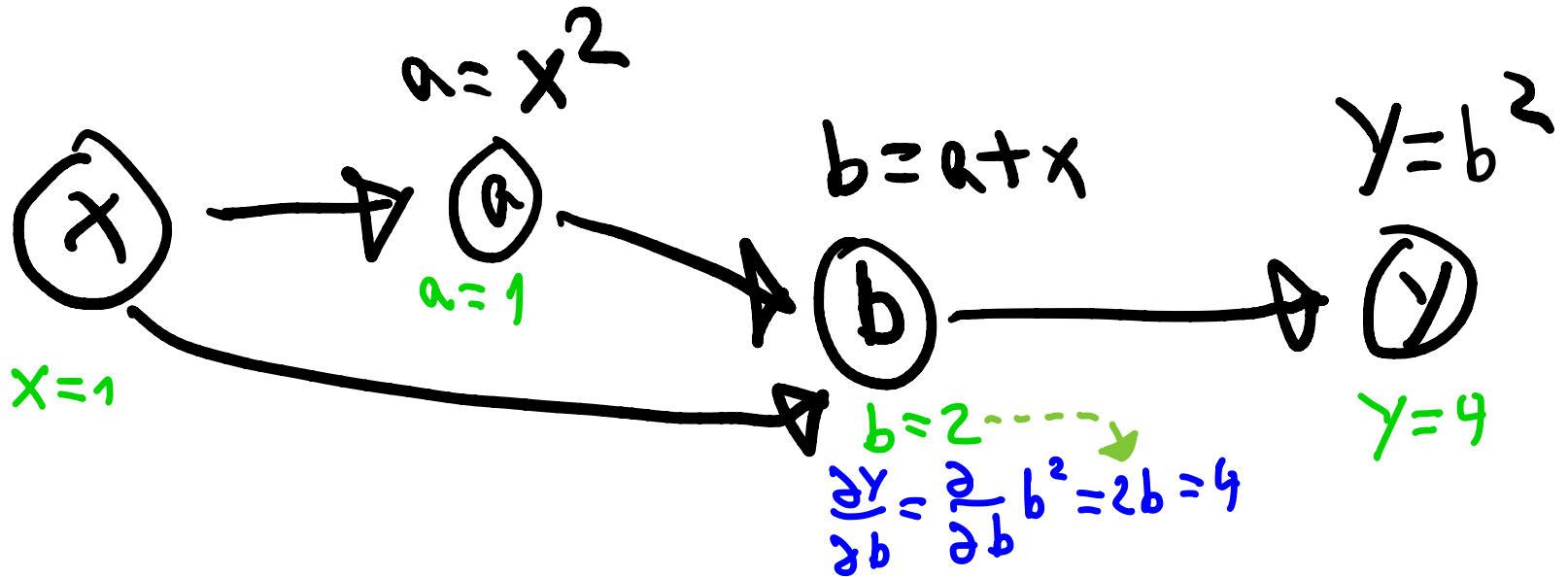
Forward Pass



Forward Pass



Backward Pass



Backward Pass

$$\frac{\partial y}{\partial a} = \frac{\partial b}{\partial a} \frac{\partial y}{\partial b} = \frac{\partial b}{\partial a} 4$$

$$a = x^2$$

$$b = a + x$$

$$y = b^2$$

x

$$x = 1$$

a

$$a = 1$$

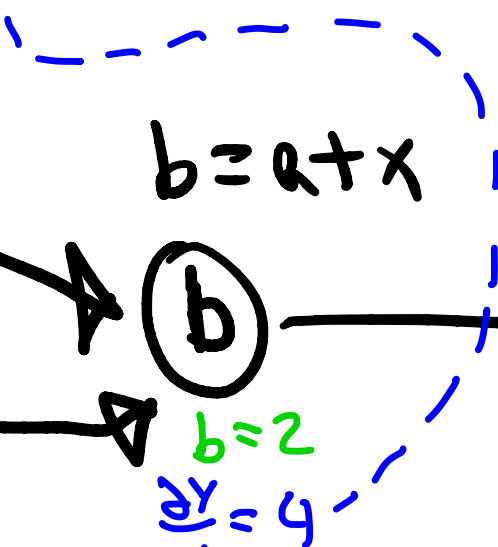
b

$$b = 2$$

$$\frac{\partial y}{\partial b} = 4$$

y

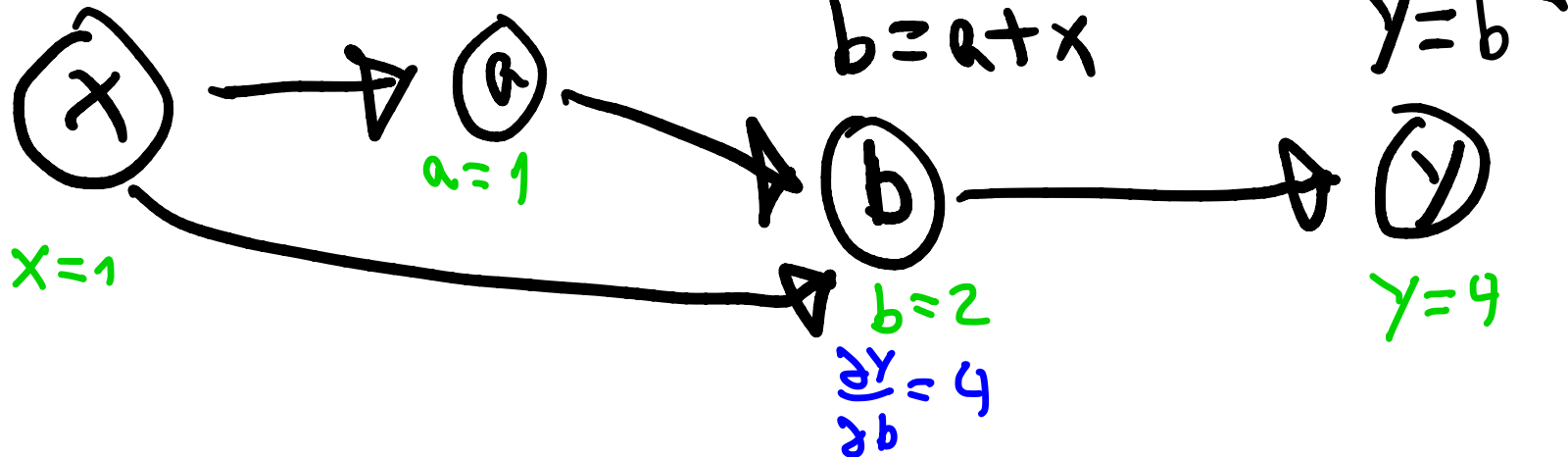
$$y = 4$$



Backward Pass

$$\frac{\partial y}{\partial a} = \frac{\partial b}{\partial a} \cdot 4 = \frac{\partial (a+x)}{\partial a} \cdot 4 = 1 \cdot 4 = 4$$

$$a = x^2$$



Backward Pass

$$\frac{\partial y}{\partial a} = 4$$

$$a = x^2$$

$$b = a + x$$

$$y = b^2$$

x

a

b

y

$$a = 1$$

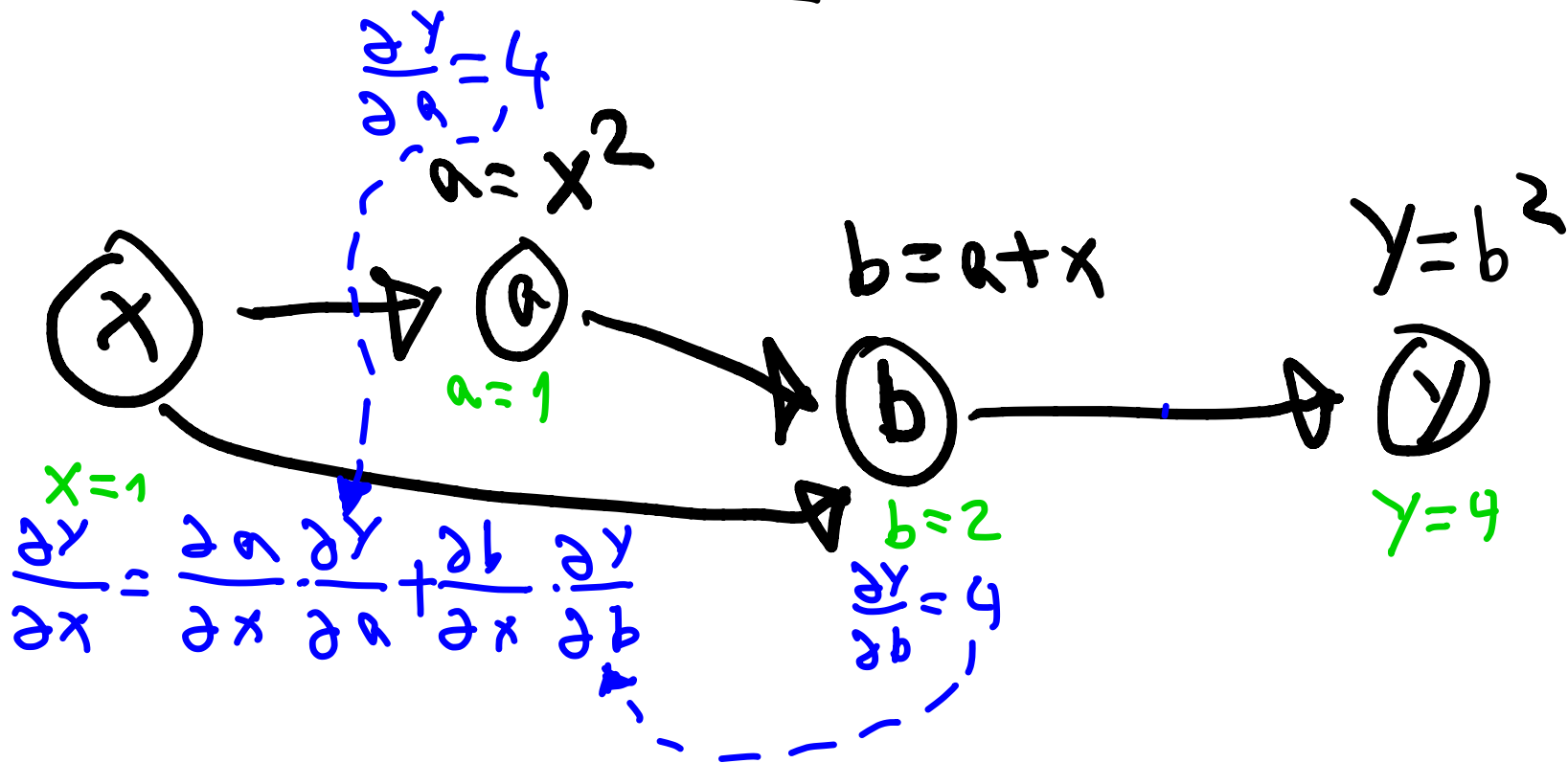
$$b = 2$$

$$y = 4$$

$$\frac{\partial y}{\partial x} = \frac{\partial a}{\partial x} \cdot \frac{\partial y}{\partial a} + \frac{\partial b}{\partial x} \cdot \frac{\partial y}{\partial b}$$

$$\frac{\partial y}{\partial b} = 4$$

Backward Pass



Backward Pass

$$\frac{\partial y}{\partial a} = 4$$

$$a = x^2$$

x



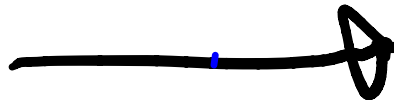
a

$$a = 1$$



$$b = a + x$$

b



$$y = b^2$$

y

$$y = 4$$

$$\frac{\partial y}{\partial x} = \frac{\partial a}{\partial x} 4 + \frac{\partial b}{\partial x} 4$$

$$b = 2$$
$$\frac{\partial y}{\partial b} = 4$$

Backward Pass

$$\frac{\partial y}{\partial a} = 4$$

$$a = x^2$$

$$b = a + x$$

$$y = b^2$$

x

a

b

y

$$a = 1$$

$$b = 2$$

$$y = 4$$

$$x = 1$$

$$\begin{aligned}\frac{\partial y}{\partial x} &= \frac{\partial a}{\partial x} \cdot 4 + \frac{\partial b}{\partial x} \cdot 4 \\ &= \frac{\partial x^2}{\partial x} \cdot 4 + \frac{\partial (a+x)}{\partial x} \cdot 4\end{aligned}$$

$$\frac{\partial y}{\partial b} = 4$$

Backward Pass

$$\frac{\partial y}{\partial a} = 4$$

$$a = x^2$$

x



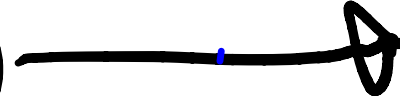
a

$$a = 1$$



b

$$b = a + x$$



y

$$y = b^2$$

$$y = 4$$

$$b = 2$$
$$\frac{\partial y}{\partial b} = 4$$

$$x = 1$$
$$\frac{\partial y}{\partial x} = \frac{\partial a}{\partial x} 4 + \frac{\partial b}{\partial x} 4$$
$$= 2 \cdot 4 + 1 \cdot 4$$

Backward Pass

