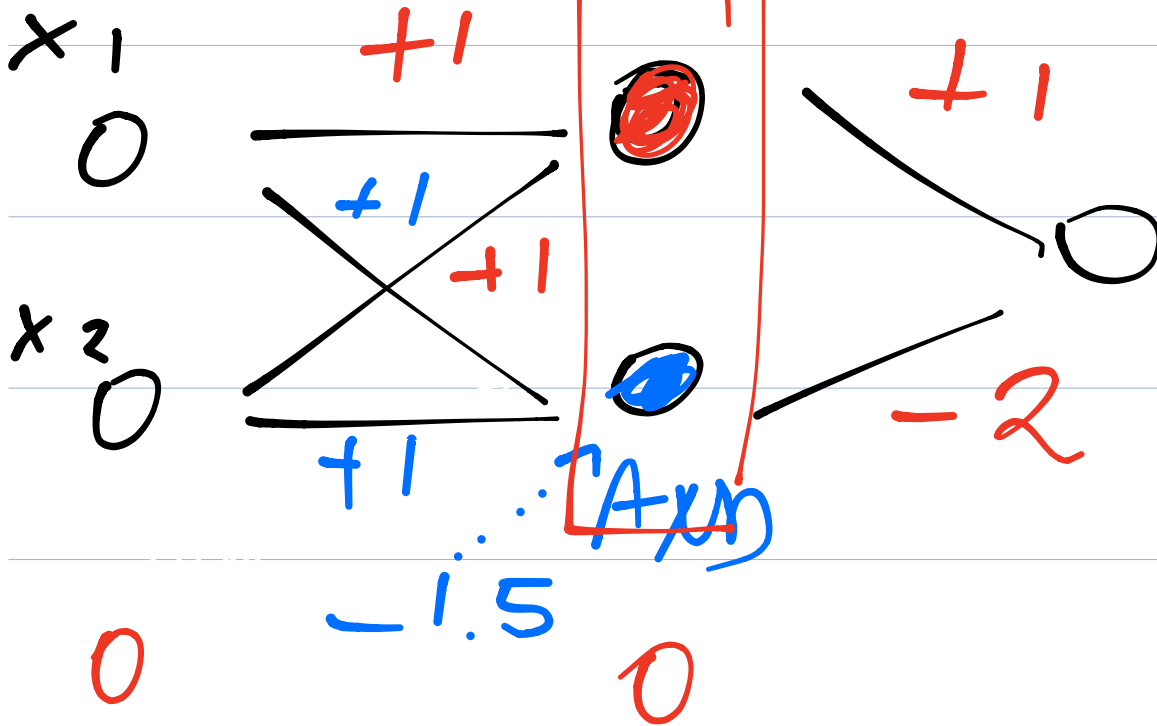


$x_1$        $x_2$        $x_1 x_2$        $x_3$   
 -       $x_1 x_3$   
 -       $x_2 x_3$   
 $x_1 x_2 x_3$

$$V + 1$$

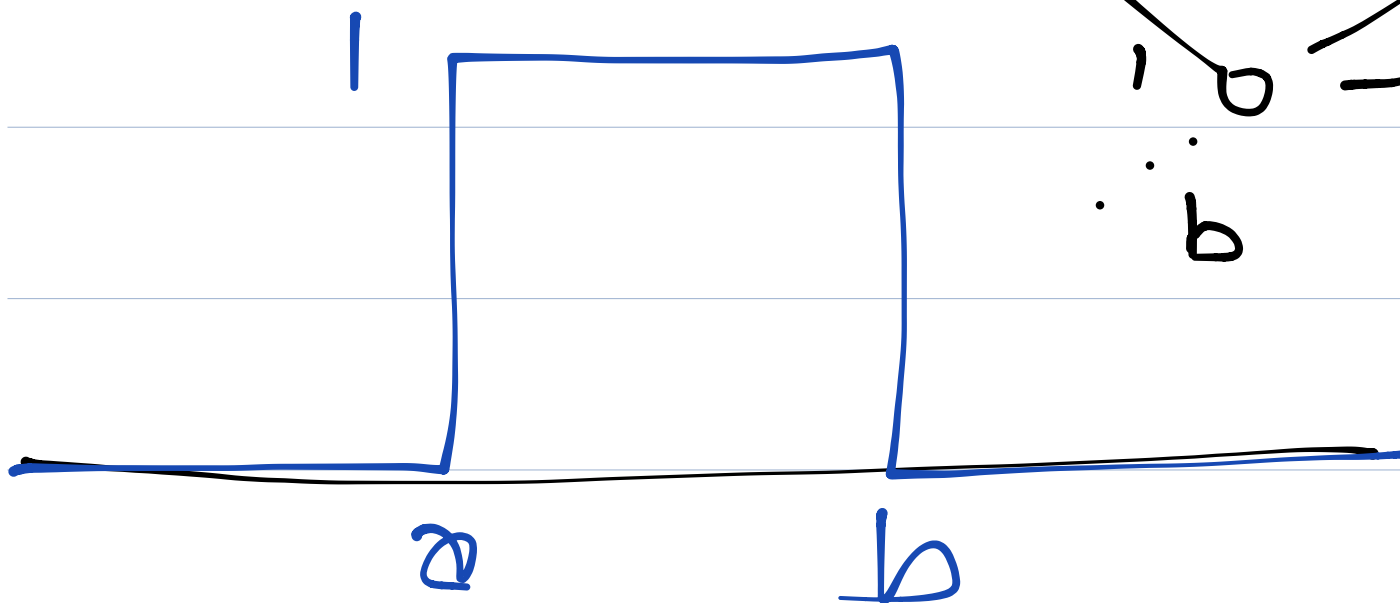
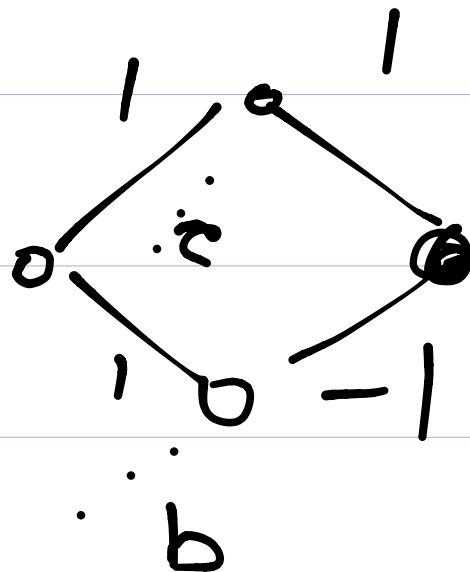
$$\boxed{X - 1}$$

$$-1 \quad \checkmark \quad +1$$



0

0



$$f(x) = \sin(\cos(x))$$

$$\frac{df}{dx} = \underbrace{\cos(\cos(x))}_{\uparrow} \cdot \underbrace{-\sin(x)}_{\uparrow}$$

Forward-Mode AD:  $\frac{d^*}{dx}, \frac{d^*}{dy}$

$$f = \sin(x^2 + y^2) + 3x$$

$$x=3 \quad y=2$$

$$\frac{dx}{dx} = 1 \quad \frac{dy}{dx} = 0$$

$$a = x \cdot x$$

$$a = 9 \quad da/dx = 6$$

$$\underline{b = y \cdot y}$$

$$b = 4 \quad db/dx = 4 \cdot \frac{dy}{dx} = 0$$

$$c = a + b$$

$$c = 13 \quad dc/dx = 6 + 0 = 6$$

$$d = \sin c$$

$$d = 0 \quad dd/dx = 1 \cdot 6 = 6$$

$$e = 3x$$

$$e = 9 \quad de/dx = 3$$

$$f = d + e$$

$$\underline{f = 9} \quad \underline{df/dx = 3 + 6 = 9}$$

$$f = \sin(x^2 + y^2) + 3x$$

$$x=3 \quad y=1$$

$$\frac{dx}{dy} = 0$$

$$\frac{dy}{dy} = 1$$

$$a = x \cdot x \quad a = 9$$

$$da/dy = 6 \cdot 0 = 0$$

$$\underline{b = y \cdot y} \quad b = 1$$

$$db/dy = 2 \cdot 1 = 2$$

$$c = a + b \quad c = 10$$

$$dc/dy = 2$$

$$d = \sin c \quad d = 0$$

$$dd/dy = 1 \cdot 2 = 2$$

$$e = 3x$$

$$e = 9$$

$$de/dy = 3 \cdot 0 = 0$$

$$f = d + e$$

$$f = 9$$

$$\boxed{df/dy} = 2 + 0 = 2$$

Reverse-mode AD:  $\frac{df}{dx}$

$$f = \sin(x^2 + y^2) + 3x$$

$$x=3 \quad y=2$$

$$a = x \cdot x$$

$$b = y \cdot y$$

$$c = a + b$$

$$d = \sin c$$

$$e = 3x$$

$$f = d + e$$

$$df/de$$

$$df/df = 1$$

