# Dense Layer Forward Pass — By Hand Worksheet

Instructions: For each problem below, compute the dense layer output step by step: 1. Multiply W and x to get Wx 2. Add the bias b 3. Apply the activation function (ReLU) Show your work!

## Problem 1

Input size = 2, Output size = 3

| x | W | b |
|---|---|---|
| [1, 2] | [[1, -1], [0, 2], [3, 1]] | [0, 1, -1] |

## Problem 2

Input size = 3, Output size = 2

| x | W | b |
|---|---|---|
| [2, -1, 0] | [[1, 0, -2], [-1, 2, 1]] | [1, -2] |

## Problem 3

Input size = 2, Output size = 2

| x | W | b |
|---|---|---|
| [3, 1] | [[2, -1], [-3, 4]] | [-1, 2] |

# Answer Key (for instructor)

## Problem 1

Wx = [-1, 4, 5], Wx+b = [-1, 5, 4], ReLU → [0, 5, 4]

## Problem 2

Wx = [2*1 + -1*0 + 0*(-2), 2*(-1) + -1*2 + 0*1] = [2, -4]
Wx+b = [2+1, -4-2] = [3, -6], ReLU → [3, 0]

## Problem 3

Wx = [3*2 + 1*(-1), 3*(-3) + 1*4] = [5, -5]
Wx+b = [5-1, -5+2] = [4, -3], ReLU → [4, 0]