Task 1 — Manual Feedforward (3 inputs, 3 hidden layers)

Architecture:

`3 (input) → 3 (hidden1) → 3 (hidden2) → 3 (hidden3) → 1 (output)`

Activations: ReLU on all hidden layers, Sigmoid on output.

Given fixed values (use these exact numbers):

- **Input** $x \in \mathbb{R}^3$

$$x = \begin{bmatrix} 0.8 \\ 0.4 \\ 0.3 \end{bmatrix}$$

- **Layer 1** (3×3)

$$W_1 = \begin{bmatrix} 0.20 & -0.10 & 0.30 \\ 0.05 & 0.40 & -0.20 \\ 0.10 & 0.00 & 0.25 \end{bmatrix}, \quad b_1 = \begin{bmatrix} 0.01 \\ 0.02 \\ -0.03 \end{bmatrix}$$

- **Layer 2** (3×3)

$$W_2 = \begin{bmatrix} 0.30 & -0.20 & 0.10 \\ 0.60 & 0.10 & -0.40 \\ -0.50 & 0.20 & 0.20 \end{bmatrix}, \quad b_2 = \begin{bmatrix} 0.00 \\ 0.05 \\ 0.01 \end{bmatrix}$$

- **Layer 3** (3×3)

$$W_3 = \begin{bmatrix} 0.20 & 0.20 & -0.10 \\ -0.30 & 0.50 & 0.30 \\ 0.40 & -0.20 & 0.10 \end{bmatrix}, \quad b_3 = \begin{bmatrix} 0.02 \\ -0.01 \\ 0.00 \end{bmatrix}$$

- **Output layer** (3×1)

$$W_4 = \begin{bmatrix} 0.70 \\ -0.60 \\ 0.50 \end{bmatrix}, \quad b_4 = \begin{bmatrix} 0.10 \end{bmatrix}$$

What to compute (show all steps):

1. $z_1 = W_1 x + b_1,\ a_1 = \mathrm{ReLU}(z_1)$
2. $z_2 = W_2 a_1 + b_2,\ a_2 = \mathrm{ReLU}(z_2)$
3. $z_3 = W_3 a_2 + b_3,\ a_3 = \mathrm{ReLU}(z_3)$
4. $z_4 = W_4^\top a_3 + b_4,\ \hat{y} = \sigma(z_4)$ where σ is Sigmoid

Report deliverables:

- A neatly formatted table with rows for $z_1, a_1, z_2, a_2, z_3, a_3, z_4, \hat{y}$.
- Short note explaining why ReLU zeroed any negative entries (if any).

Task 2 — Code the Same Feedforward with Fixed Arrays (verify Task 1)

Implement the same forward pass using **plain NumPy arrays or TensorFlow** (no randoms, no training) and verify your numbers from Task 1.

Report deliverables:

- Full code listing.
- Screenshot of the console output.
- A short comparison paragraph confirming your **manual** vs **program** values match (or explaining any discrepancy due to rounding).