```python
import numpy as np

# Sigmoid activation function and its derivative
def sigmoid(x):
    return 1 / (1 + np.exp(-x))

def sigmoid_derivative(output):
    return output * (1 - output)

# Training data (e.g., XOR function or any dataset you want)
X = np.array([
    [0, 0],
    [0, 1],
    [1, 0],
    [1, 1]
])

# Expected output
y = np.array([[0], [1], [1], [0]])

# Seed for reproducibility
np.random.seed(42)

# Network architecture
input_neurons = X.shape[1]
hidden_neurons = 4
output_neurons = 1

# Weight and bias initialization
weights_input_hidden = np.random.uniform(size=(input_neurons,
hidden_neurons))
bias_hidden = np.random.uniform(size=(1, hidden_neurons))
weights_hidden_output = np.random.uniform(size=(hidden_neurons,
output_neurons))
bias_output = np.random.uniform(size=(1, output_neurons))

# Training parameters
epochs = 1000
learning_rate = 0.5

# Training loop
for epoch in range(epochs):
    # --- Forward Propagation ---
    hidden_layer_input = np.dot(X, weights_input_hidden) + bias_hidden
    hidden_layer_output = sigmoid(hidden_layer_input)

    final_input = np.dot(hidden_layer_output, weights_hidden_output) +
bias_output
    predicted_output = sigmoid(final_input)

    # --- Backward Propagation ---
```

```python
    error = y - predicted_output
    d_output = error * sigmoid_derivative(predicted_output)

    error_hidden = d_output.dot(weights_hidden_output.T)
    d_hidden = error_hidden * sigmoid_derivative(hidden_layer_output)

    # Update weights and biases
    weights_hidden_output += hidden_layer_output.T.dot(d_output) *
learning_rate
    bias_output += np.sum(d_output, axis=0, keepdims=True) *
learning_rate

    weights_input_hidden += X.T.dot(d_hidden) * learning_rate
    bias_hidden += np.sum(d_hidden, axis=0, keepdims=True) *
learning_rate

    # Optionally print loss
    if epoch % 1 == 0:
        loss = np.mean(np.square(error))
        print(f"Epoch {epoch} Loss: {loss:.4f}")
```
```
Epoch 0 Loss: 0.2497
Epoch 1 Loss: 0.2497
Epoch 2 Loss: 0.2496
Epoch 3 Loss: 0.2496
Epoch 4 Loss: 0.2496
Epoch 5 Loss: 0.2496
Epoch 6 Loss: 0.2496
Epoch 7 Loss: 0.2496
Epoch 8 Loss: 0.2496
Epoch 9 Loss: 0.2496
Epoch 10 Loss: 0.2496
Epoch 11 Loss: 0.2496
Epoch 12 Loss: 0.2496
Epoch 13 Loss: 0.2496
Epoch 14 Loss: 0.2496
Epoch 15 Loss: 0.2496
Epoch 16 Loss: 0.2496
Epoch 17 Loss: 0.2495
Epoch 18 Loss: 0.2495
Epoch 19 Loss: 0.2495
Epoch 20 Loss: 0.2495
Epoch 21 Loss: 0.2495
Epoch 22 Loss: 0.2495
Epoch 23 Loss: 0.2495
Epoch 24 Loss: 0.2495
Epoch 25 Loss: 0.2495
Epoch 26 Loss: 0.2495
Epoch 27 Loss: 0.2495
Epoch 28 Loss: 0.2495
```

```
Epoch 29 Loss: 0.2495
Epoch 30 Loss: 0.2495
Epoch 31 Loss: 0.2494
Epoch 32 Loss: 0.2494
Epoch 33 Loss: 0.2494
Epoch 34 Loss: 0.2494
Epoch 35 Loss: 0.2494
Epoch 36 Loss: 0.2494
Epoch 37 Loss: 0.2494
Epoch 38 Loss: 0.2494
Epoch 39 Loss: 0.2494
Epoch 40 Loss: 0.2494
Epoch 41 Loss: 0.2494
Epoch 42 Loss: 0.2494
Epoch 43 Loss: 0.2494
Epoch 44 Loss: 0.2494
Epoch 45 Loss: 0.2493
Epoch 46 Loss: 0.2493
Epoch 47 Loss: 0.2493
Epoch 48 Loss: 0.2493
Epoch 49 Loss: 0.2493
Epoch 50 Loss: 0.2493
Epoch 51 Loss: 0.2493
Epoch 52 Loss: 0.2493
Epoch 53 Loss: 0.2493
Epoch 54 Loss: 0.2493
Epoch 55 Loss: 0.2493
Epoch 56 Loss: 0.2493
Epoch 57 Loss: 0.2492
Epoch 58 Loss: 0.2492
Epoch 59 Loss: 0.2492
Epoch 60 Loss: 0.2492
Epoch 61 Loss: 0.2492
Epoch 62 Loss: 0.2492
Epoch 63 Loss: 0.2492
Epoch 64 Loss: 0.2492
Epoch 65 Loss: 0.2492
Epoch 66 Loss: 0.2492
Epoch 67 Loss: 0.2492
Epoch 68 Loss: 0.2492
Epoch 69 Loss: 0.2491
Epoch 70 Loss: 0.2491
Epoch 71 Loss: 0.2491
Epoch 72 Loss: 0.2491
Epoch 73 Loss: 0.2491
Epoch 74 Loss: 0.2491
Epoch 75 Loss: 0.2491
Epoch 76 Loss: 0.2491
Epoch 77 Loss: 0.2491
```

```
Epoch 78 Loss: 0.2491
Epoch 79 Loss: 0.2491
Epoch 80 Loss: 0.2490
Epoch 81 Loss: 0.2490
Epoch 82 Loss: 0.2490
Epoch 83 Loss: 0.2490
Epoch 84 Loss: 0.2490
Epoch 85 Loss: 0.2490
Epoch 86 Loss: 0.2490
Epoch 87 Loss: 0.2490
Epoch 88 Loss: 0.2490
Epoch 89 Loss: 0.2490
Epoch 90 Loss: 0.2489
Epoch 91 Loss: 0.2489
Epoch 92 Loss: 0.2489
Epoch 93 Loss: 0.2489
Epoch 94 Loss: 0.2489
Epoch 95 Loss: 0.2489
Epoch 96 Loss: 0.2489
Epoch 97 Loss: 0.2489
Epoch 98 Loss: 0.2489
Epoch 99 Loss: 0.2489
Epoch 100 Loss: 0.2488
Epoch 101 Loss: 0.2488
Epoch 102 Loss: 0.2488
Epoch 103 Loss: 0.2488
Epoch 104 Loss: 0.2488
Epoch 105 Loss: 0.2488
Epoch 106 Loss: 0.2488
Epoch 107 Loss: 0.2488
Epoch 108 Loss: 0.2488
Epoch 109 Loss: 0.2487
Epoch 110 Loss: 0.2487
Epoch 111 Loss: 0.2487
Epoch 112 Loss: 0.2487
Epoch 113 Loss: 0.2487
Epoch 114 Loss: 0.2487
Epoch 115 Loss: 0.2487
Epoch 116 Loss: 0.2487
Epoch 117 Loss: 0.2487
Epoch 118 Loss: 0.2486
Epoch 119 Loss: 0.2486
Epoch 120 Loss: 0.2486
Epoch 121 Loss: 0.2486
Epoch 122 Loss: 0.2486
Epoch 123 Loss: 0.2486
Epoch 124 Loss: 0.2486
Epoch 125 Loss: 0.2486
Epoch 126 Loss: 0.2485
```

```
Epoch 127 Loss: 0.2485
Epoch 128 Loss: 0.2485
Epoch 129 Loss: 0.2485
Epoch 130 Loss: 0.2485
Epoch 131 Loss: 0.2485
Epoch 132 Loss: 0.2485
Epoch 133 Loss: 0.2484
Epoch 134 Loss: 0.2484
Epoch 135 Loss: 0.2484
Epoch 136 Loss: 0.2484
Epoch 137 Loss: 0.2484
Epoch 138 Loss: 0.2484
Epoch 139 Loss: 0.2484
Epoch 140 Loss: 0.2483
Epoch 141 Loss: 0.2483
Epoch 142 Loss: 0.2483
Epoch 143 Loss: 0.2483
Epoch 144 Loss: 0.2483
Epoch 145 Loss: 0.2483
Epoch 146 Loss: 0.2483
Epoch 147 Loss: 0.2482
Epoch 148 Loss: 0.2482
Epoch 149 Loss: 0.2482
Epoch 150 Loss: 0.2482
Epoch 151 Loss: 0.2482
Epoch 152 Loss: 0.2482
Epoch 153 Loss: 0.2482
Epoch 154 Loss: 0.2481
Epoch 155 Loss: 0.2481
Epoch 156 Loss: 0.2481
Epoch 157 Loss: 0.2481
Epoch 158 Loss: 0.2481
Epoch 159 Loss: 0.2481
Epoch 160 Loss: 0.2480
Epoch 161 Loss: 0.2480
Epoch 162 Loss: 0.2480
Epoch 163 Loss: 0.2480
Epoch 164 Loss: 0.2480
Epoch 165 Loss: 0.2480
Epoch 166 Loss: 0.2479
Epoch 167 Loss: 0.2479
Epoch 168 Loss: 0.2479
Epoch 169 Loss: 0.2479
Epoch 170 Loss: 0.2479
Epoch 171 Loss: 0.2478
Epoch 172 Loss: 0.2478
Epoch 173 Loss: 0.2478
Epoch 174 Loss: 0.2478
Epoch 175 Loss: 0.2478
```

```
Epoch 176 Loss: 0.2477
Epoch 177 Loss: 0.2477
Epoch 178 Loss: 0.2477
Epoch 179 Loss: 0.2477
Epoch 180 Loss: 0.2477
Epoch 181 Loss: 0.2476
Epoch 182 Loss: 0.2476
Epoch 183 Loss: 0.2476
Epoch 184 Loss: 0.2476
Epoch 185 Loss: 0.2476
Epoch 186 Loss: 0.2475
Epoch 187 Loss: 0.2475
Epoch 188 Loss: 0.2475
Epoch 189 Loss: 0.2475
Epoch 190 Loss: 0.2475
Epoch 191 Loss: 0.2474
Epoch 192 Loss: 0.2474
Epoch 193 Loss: 0.2474
Epoch 194 Loss: 0.2474
Epoch 195 Loss: 0.2473
Epoch 196 Loss: 0.2473
Epoch 197 Loss: 0.2473
Epoch 198 Loss: 0.2473
Epoch 199 Loss: 0.2473
Epoch 200 Loss: 0.2472
Epoch 201 Loss: 0.2472
Epoch 202 Loss: 0.2472
Epoch 203 Loss: 0.2472
Epoch 204 Loss: 0.2471
Epoch 205 Loss: 0.2471
Epoch 206 Loss: 0.2471
Epoch 207 Loss: 0.2471
Epoch 208 Loss: 0.2470
Epoch 209 Loss: 0.2470
Epoch 210 Loss: 0.2470
Epoch 211 Loss: 0.2470
Epoch 212 Loss: 0.2469
Epoch 213 Loss: 0.2469
Epoch 214 Loss: 0.2469
Epoch 215 Loss: 0.2469
Epoch 216 Loss: 0.2468
Epoch 217 Loss: 0.2468
Epoch 218 Loss: 0.2468
Epoch 219 Loss: 0.2467
Epoch 220 Loss: 0.2467
Epoch 221 Loss: 0.2467
Epoch 222 Loss: 0.2467
Epoch 223 Loss: 0.2466
Epoch 224 Loss: 0.2466
```

```
Epoch 225 Loss: 0.2466
Epoch 226 Loss: 0.2465
Epoch 227 Loss: 0.2465
Epoch 228 Loss: 0.2465
Epoch 229 Loss: 0.2465
Epoch 230 Loss: 0.2464
Epoch 231 Loss: 0.2464
Epoch 232 Loss: 0.2464
Epoch 233 Loss: 0.2463
Epoch 234 Loss: 0.2463
Epoch 235 Loss: 0.2463
Epoch 236 Loss: 0.2462
Epoch 237 Loss: 0.2462
Epoch 238 Loss: 0.2462
Epoch 239 Loss: 0.2461
Epoch 240 Loss: 0.2461
Epoch 241 Loss: 0.2461
Epoch 242 Loss: 0.2460
Epoch 243 Loss: 0.2460
Epoch 244 Loss: 0.2460
Epoch 245 Loss: 0.2459
Epoch 246 Loss: 0.2459
Epoch 247 Loss: 0.2459
Epoch 248 Loss: 0.2458
Epoch 249 Loss: 0.2458
Epoch 250 Loss: 0.2457
Epoch 251 Loss: 0.2457
Epoch 252 Loss: 0.2457
Epoch 253 Loss: 0.2456
Epoch 254 Loss: 0.2456
Epoch 255 Loss: 0.2456
Epoch 256 Loss: 0.2455
Epoch 257 Loss: 0.2455
Epoch 258 Loss: 0.2454
Epoch 259 Loss: 0.2454
Epoch 260 Loss: 0.2454
Epoch 261 Loss: 0.2453
Epoch 262 Loss: 0.2453
Epoch 263 Loss: 0.2452
Epoch 264 Loss: 0.2452
Epoch 265 Loss: 0.2452
Epoch 266 Loss: 0.2451
Epoch 267 Loss: 0.2451
Epoch 268 Loss: 0.2450
Epoch 269 Loss: 0.2450
Epoch 270 Loss: 0.2449
Epoch 271 Loss: 0.2449
Epoch 272 Loss: 0.2449
Epoch 273 Loss: 0.2448
```

```
Epoch 274 Loss: 0.2448
Epoch 275 Loss: 0.2447
Epoch 276 Loss: 0.2447
Epoch 277 Loss: 0.2446
Epoch 278 Loss: 0.2446
Epoch 279 Loss: 0.2445
Epoch 280 Loss: 0.2445
Epoch 281 Loss: 0.2444
Epoch 282 Loss: 0.2444
Epoch 283 Loss: 0.2443
Epoch 284 Loss: 0.2443
Epoch 285 Loss: 0.2442
Epoch 286 Loss: 0.2442
Epoch 287 Loss: 0.2441
Epoch 288 Loss: 0.2441
Epoch 289 Loss: 0.2440
Epoch 290 Loss: 0.2440
Epoch 291 Loss: 0.2439
Epoch 292 Loss: 0.2439
Epoch 293 Loss: 0.2438
Epoch 294 Loss: 0.2438
Epoch 295 Loss: 0.2437
Epoch 296 Loss: 0.2436
Epoch 297 Loss: 0.2436
Epoch 298 Loss: 0.2435
Epoch 299 Loss: 0.2435
Epoch 300 Loss: 0.2434
Epoch 301 Loss: 0.2434
Epoch 302 Loss: 0.2433
Epoch 303 Loss: 0.2432
Epoch 304 Loss: 0.2432
Epoch 305 Loss: 0.2431
Epoch 306 Loss: 0.2431
Epoch 307 Loss: 0.2430
Epoch 308 Loss: 0.2429
Epoch 309 Loss: 0.2429
Epoch 310 Loss: 0.2428
Epoch 311 Loss: 0.2427
Epoch 312 Loss: 0.2427
Epoch 313 Loss: 0.2426
Epoch 314 Loss: 0.2426
Epoch 315 Loss: 0.2425
Epoch 316 Loss: 0.2424
Epoch 317 Loss: 0.2424
Epoch 318 Loss: 0.2423
Epoch 319 Loss: 0.2422
Epoch 320 Loss: 0.2421
Epoch 321 Loss: 0.2421
Epoch 322 Loss: 0.2420
```

```
Epoch 323 Loss: 0.2419
Epoch 324 Loss: 0.2419
Epoch 325 Loss: 0.2418
Epoch 326 Loss: 0.2417
Epoch 327 Loss: 0.2416
Epoch 328 Loss: 0.2416
Epoch 329 Loss: 0.2415
Epoch 330 Loss: 0.2414
Epoch 331 Loss: 0.2413
Epoch 332 Loss: 0.2413
Epoch 333 Loss: 0.2412
Epoch 334 Loss: 0.2411
Epoch 335 Loss: 0.2410
Epoch 336 Loss: 0.2409
Epoch 337 Loss: 0.2409
Epoch 338 Loss: 0.2408
Epoch 339 Loss: 0.2407
Epoch 340 Loss: 0.2406
Epoch 341 Loss: 0.2405
Epoch 342 Loss: 0.2405
Epoch 343 Loss: 0.2404
Epoch 344 Loss: 0.2403
Epoch 345 Loss: 0.2402
Epoch 346 Loss: 0.2401
Epoch 347 Loss: 0.2400
Epoch 348 Loss: 0.2399
Epoch 349 Loss: 0.2398
Epoch 350 Loss: 0.2397
Epoch 351 Loss: 0.2397
Epoch 352 Loss: 0.2396
Epoch 353 Loss: 0.2395
Epoch 354 Loss: 0.2394
Epoch 355 Loss: 0.2393
Epoch 356 Loss: 0.2392
Epoch 357 Loss: 0.2391
Epoch 358 Loss: 0.2390
Epoch 359 Loss: 0.2389
Epoch 360 Loss: 0.2388
Epoch 361 Loss: 0.2387
Epoch 362 Loss: 0.2386
Epoch 363 Loss: 0.2385
Epoch 364 Loss: 0.2384
Epoch 365 Loss: 0.2383
Epoch 366 Loss: 0.2382
Epoch 367 Loss: 0.2381
Epoch 368 Loss: 0.2380
Epoch 369 Loss: 0.2379
Epoch 370 Loss: 0.2377
Epoch 371 Loss: 0.2376
```

```
Epoch 372 Loss: 0.2375
Epoch 373 Loss: 0.2374
Epoch 374 Loss: 0.2373
Epoch 375 Loss: 0.2372
Epoch 376 Loss: 0.2371
Epoch 377 Loss: 0.2370
Epoch 378 Loss: 0.2368
Epoch 379 Loss: 0.2367
Epoch 380 Loss: 0.2366
Epoch 381 Loss: 0.2365
Epoch 382 Loss: 0.2364
Epoch 383 Loss: 0.2362
Epoch 384 Loss: 0.2361
Epoch 385 Loss: 0.2360
Epoch 386 Loss: 0.2359
Epoch 387 Loss: 0.2357
Epoch 388 Loss: 0.2356
Epoch 389 Loss: 0.2355
Epoch 390 Loss: 0.2353
Epoch 391 Loss: 0.2352
Epoch 392 Loss: 0.2351
Epoch 393 Loss: 0.2349
Epoch 394 Loss: 0.2348
Epoch 395 Loss: 0.2347
Epoch 396 Loss: 0.2345
Epoch 397 Loss: 0.2344
Epoch 398 Loss: 0.2343
Epoch 399 Loss: 0.2341
Epoch 400 Loss: 0.2340
Epoch 401 Loss: 0.2338
Epoch 402 Loss: 0.2337
Epoch 403 Loss: 0.2336
Epoch 404 Loss: 0.2334
Epoch 405 Loss: 0.2333
Epoch 406 Loss: 0.2331
Epoch 407 Loss: 0.2330
Epoch 408 Loss: 0.2328
Epoch 409 Loss: 0.2327
Epoch 410 Loss: 0.2325
Epoch 411 Loss: 0.2323
Epoch 412 Loss: 0.2322
Epoch 413 Loss: 0.2320
Epoch 414 Loss: 0.2319
Epoch 415 Loss: 0.2317
Epoch 416 Loss: 0.2315
Epoch 417 Loss: 0.2314
Epoch 418 Loss: 0.2312
Epoch 419 Loss: 0.2311
Epoch 420 Loss: 0.2309
```

```
Epoch 421 Loss: 0.2307
Epoch 422 Loss: 0.2305
Epoch 423 Loss: 0.2304
Epoch 424 Loss: 0.2302
Epoch 425 Loss: 0.2300
Epoch 426 Loss: 0.2299
Epoch 427 Loss: 0.2297
Epoch 428 Loss: 0.2295
Epoch 429 Loss: 0.2293
Epoch 430 Loss: 0.2291
Epoch 431 Loss: 0.2290
Epoch 432 Loss: 0.2288
Epoch 433 Loss: 0.2286
Epoch 434 Loss: 0.2284
Epoch 435 Loss: 0.2282
Epoch 436 Loss: 0.2280
Epoch 437 Loss: 0.2278
Epoch 438 Loss: 0.2276
Epoch 439 Loss: 0.2275
Epoch 440 Loss: 0.2273
Epoch 441 Loss: 0.2271
Epoch 442 Loss: 0.2269
Epoch 443 Loss: 0.2267
Epoch 444 Loss: 0.2265
Epoch 445 Loss: 0.2263
Epoch 446 Loss: 0.2261
Epoch 447 Loss: 0.2259
Epoch 448 Loss: 0.2256
Epoch 449 Loss: 0.2254
Epoch 450 Loss: 0.2252
Epoch 451 Loss: 0.2250
Epoch 452 Loss: 0.2248
Epoch 453 Loss: 0.2246
Epoch 454 Loss: 0.2244
Epoch 455 Loss: 0.2242
Epoch 456 Loss: 0.2239
Epoch 457 Loss: 0.2237
Epoch 458 Loss: 0.2235
Epoch 459 Loss: 0.2233
Epoch 460 Loss: 0.2231
Epoch 461 Loss: 0.2228
Epoch 462 Loss: 0.2226
Epoch 463 Loss: 0.2224
Epoch 464 Loss: 0.2222
Epoch 465 Loss: 0.2219
Epoch 466 Loss: 0.2217
Epoch 467 Loss: 0.2215
Epoch 468 Loss: 0.2212
Epoch 469 Loss: 0.2210
```

```
Epoch 470 Loss: 0.2208
Epoch 471 Loss: 0.2205
Epoch 472 Loss: 0.2203
Epoch 473 Loss: 0.2200
Epoch 474 Loss: 0.2198
Epoch 475 Loss: 0.2196
Epoch 476 Loss: 0.2193
Epoch 477 Loss: 0.2191
Epoch 478 Loss: 0.2188
Epoch 479 Loss: 0.2186
Epoch 480 Loss: 0.2183
Epoch 481 Loss: 0.2181
Epoch 482 Loss: 0.2178
Epoch 483 Loss: 0.2176
Epoch 484 Loss: 0.2173
Epoch 485 Loss: 0.2170
Epoch 486 Loss: 0.2168
Epoch 487 Loss: 0.2165
Epoch 488 Loss: 0.2163
Epoch 489 Loss: 0.2160
Epoch 490 Loss: 0.2158
Epoch 491 Loss: 0.2155
Epoch 492 Loss: 0.2152
Epoch 493 Loss: 0.2150
Epoch 494 Loss: 0.2147
Epoch 495 Loss: 0.2144
Epoch 496 Loss: 0.2142
Epoch 497 Loss: 0.2139
Epoch 498 Loss: 0.2136
Epoch 499 Loss: 0.2133
Epoch 500 Loss: 0.2131
Epoch 501 Loss: 0.2128
Epoch 502 Loss: 0.2125
Epoch 503 Loss: 0.2122
Epoch 504 Loss: 0.2120
Epoch 505 Loss: 0.2117
Epoch 506 Loss: 0.2114
Epoch 507 Loss: 0.2111
Epoch 508 Loss: 0.2109
Epoch 509 Loss: 0.2106
Epoch 510 Loss: 0.2103
Epoch 511 Loss: 0.2100
Epoch 512 Loss: 0.2097
Epoch 513 Loss: 0.2094
Epoch 514 Loss: 0.2092
Epoch 515 Loss: 0.2089
Epoch 516 Loss: 0.2086
Epoch 517 Loss: 0.2083
Epoch 518 Loss: 0.2080
Epoch 519 Loss: 0.2077
```

```
Epoch 520 Loss: 0.2074
Epoch 521 Loss: 0.2071
Epoch 522 Loss: 0.2068
Epoch 523 Loss: 0.2065
Epoch 524 Loss: 0.2063
Epoch 525 Loss: 0.2060
Epoch 526 Loss: 0.2057
Epoch 527 Loss: 0.2054
Epoch 528 Loss: 0.2051
Epoch 529 Loss: 0.2048
Epoch 530 Loss: 0.2045
Epoch 531 Loss: 0.2042
Epoch 532 Loss: 0.2039
Epoch 533 Loss: 0.2036
Epoch 534 Loss: 0.2033
Epoch 535 Loss: 0.2030
Epoch 536 Loss: 0.2027
Epoch 537 Loss: 0.2024
Epoch 538 Loss: 0.2021
Epoch 539 Loss: 0.2018
Epoch 540 Loss: 0.2015
Epoch 541 Loss: 0.2012
Epoch 542 Loss: 0.2009
Epoch 543 Loss: 0.2006
Epoch 544 Loss: 0.2003
Epoch 545 Loss: 0.2000
Epoch 546 Loss: 0.1997
Epoch 547 Loss: 0.1994
Epoch 548 Loss: 0.1991
Epoch 549 Loss: 0.1988
Epoch 550 Loss: 0.1985
Epoch 551 Loss: 0.1982
Epoch 552 Loss: 0.1979
Epoch 553 Loss: 0.1976
Epoch 554 Loss: 0.1973
Epoch 555 Loss: 0.1969
Epoch 556 Loss: 0.1966
Epoch 557 Loss: 0.1963
Epoch 558 Loss: 0.1960
Epoch 559 Loss: 0.1957
Epoch 560 Loss: 0.1954
Epoch 561 Loss: 0.1951
Epoch 562 Loss: 0.1948
Epoch 563 Loss: 0.1945
Epoch 564 Loss: 0.1942
Epoch 565 Loss: 0.1939
Epoch 566 Loss: 0.1936
Epoch 567 Loss: 0.1933
Epoch 568 Loss: 0.1930
```

```
Epoch 569 Loss: 0.1927
Epoch 570 Loss: 0.1924
Epoch 571 Loss: 0.1920
Epoch 572 Loss: 0.1917
Epoch 573 Loss: 0.1914
Epoch 574 Loss: 0.1911
Epoch 575 Loss: 0.1908
Epoch 576 Loss: 0.1905
Epoch 577 Loss: 0.1902
Epoch 578 Loss: 0.1899
Epoch 579 Loss: 0.1896
Epoch 580 Loss: 0.1893
Epoch 581 Loss: 0.1890
Epoch 582 Loss: 0.1887
Epoch 583 Loss: 0.1884
Epoch 584 Loss: 0.1881
Epoch 585 Loss: 0.1877
Epoch 586 Loss: 0.1874
Epoch 587 Loss: 0.1871
Epoch 588 Loss: 0.1868
Epoch 589 Loss: 0.1865
Epoch 590 Loss: 0.1862
Epoch 591 Loss: 0.1859
Epoch 592 Loss: 0.1856
Epoch 593 Loss: 0.1853
Epoch 594 Loss: 0.1850
Epoch 595 Loss: 0.1847
Epoch 596 Loss: 0.1844
Epoch 597 Loss: 0.1841
Epoch 598 Loss: 0.1838
Epoch 599 Loss: 0.1834
Epoch 600 Loss: 0.1831
Epoch 601 Loss: 0.1828
Epoch 602 Loss: 0.1825
Epoch 603 Loss: 0.1822
Epoch 604 Loss: 0.1819
Epoch 605 Loss: 0.1816
Epoch 606 Loss: 0.1813
Epoch 607 Loss: 0.1810
Epoch 608 Loss: 0.1807
Epoch 609 Loss: 0.1804
Epoch 610 Loss: 0.1801
Epoch 611 Loss: 0.1798
Epoch 612 Loss: 0.1794
Epoch 613 Loss: 0.1791
Epoch 614 Loss: 0.1788
Epoch 615 Loss: 0.1785
Epoch 616 Loss: 0.1782
Epoch 617 Loss: 0.1779
```

```
Epoch 618 Loss: 0.1776
Epoch 619 Loss: 0.1773
Epoch 620 Loss: 0.1770
Epoch 621 Loss: 0.1767
Epoch 622 Loss: 0.1763
Epoch 623 Loss: 0.1760
Epoch 624 Loss: 0.1757
Epoch 625 Loss: 0.1754
Epoch 626 Loss: 0.1751
Epoch 627 Loss: 0.1748
Epoch 628 Loss: 0.1745
Epoch 629 Loss: 0.1742
Epoch 630 Loss: 0.1738
Epoch 631 Loss: 0.1735
Epoch 632 Loss: 0.1732
Epoch 633 Loss: 0.1729
Epoch 634 Loss: 0.1726
Epoch 635 Loss: 0.1723
Epoch 636 Loss: 0.1719
Epoch 637 Loss: 0.1716
Epoch 638 Loss: 0.1713
Epoch 639 Loss: 0.1710
Epoch 640 Loss: 0.1707
Epoch 641 Loss: 0.1703
Epoch 642 Loss: 0.1700
Epoch 643 Loss: 0.1697
Epoch 644 Loss: 0.1694
Epoch 645 Loss: 0.1690
Epoch 646 Loss: 0.1687
Epoch 647 Loss: 0.1684
Epoch 648 Loss: 0.1681
Epoch 649 Loss: 0.1677
Epoch 650 Loss: 0.1674
Epoch 651 Loss: 0.1671
Epoch 652 Loss: 0.1667
Epoch 653 Loss: 0.1664
Epoch 654 Loss: 0.1661
Epoch 655 Loss: 0.1657
Epoch 656 Loss: 0.1654
Epoch 657 Loss: 0.1650
Epoch 658 Loss: 0.1647
Epoch 659 Loss: 0.1644
Epoch 660 Loss: 0.1640
Epoch 661 Loss: 0.1637
Epoch 662 Loss: 0.1633
Epoch 663 Loss: 0.1630
Epoch 664 Loss: 0.1626
Epoch 665 Loss: 0.1623
Epoch 666 Loss: 0.1619
```

```
Epoch 667 Loss: 0.1615
Epoch 668 Loss: 0.1612
Epoch 669 Loss: 0.1608
Epoch 670 Loss: 0.1605
Epoch 671 Loss: 0.1601
Epoch 672 Loss: 0.1597
Epoch 673 Loss: 0.1594
Epoch 674 Loss: 0.1590
Epoch 675 Loss: 0.1586
Epoch 676 Loss: 0.1582
Epoch 677 Loss: 0.1579
Epoch 678 Loss: 0.1575
Epoch 679 Loss: 0.1571
Epoch 680 Loss: 0.1567
Epoch 681 Loss: 0.1563
Epoch 682 Loss: 0.1559
Epoch 683 Loss: 0.1555
Epoch 684 Loss: 0.1551
Epoch 685 Loss: 0.1547
Epoch 686 Loss: 0.1543
Epoch 687 Loss: 0.1539
Epoch 688 Loss: 0.1535
Epoch 689 Loss: 0.1531
Epoch 690 Loss: 0.1527
Epoch 691 Loss: 0.1523
Epoch 692 Loss: 0.1518
Epoch 693 Loss: 0.1514
Epoch 694 Loss: 0.1510
Epoch 695 Loss: 0.1505
Epoch 696 Loss: 0.1501
Epoch 697 Loss: 0.1497
Epoch 698 Loss: 0.1492
Epoch 699 Loss: 0.1488
Epoch 700 Loss: 0.1483
Epoch 701 Loss: 0.1479
Epoch 702 Loss: 0.1474
Epoch 703 Loss: 0.1470
Epoch 704 Loss: 0.1465
Epoch 705 Loss: 0.1460
Epoch 706 Loss: 0.1456
Epoch 707 Loss: 0.1451
Epoch 708 Loss: 0.1446
Epoch 709 Loss: 0.1442
Epoch 710 Loss: 0.1437
Epoch 711 Loss: 0.1432
Epoch 712 Loss: 0.1427
Epoch 713 Loss: 0.1422
Epoch 714 Loss: 0.1417
Epoch 715 Loss: 0.1412
```

```
Epoch 716 Loss: 0.1407
Epoch 717 Loss: 0.1402
Epoch 718 Loss: 0.1397
Epoch 719 Loss: 0.1392
Epoch 720 Loss: 0.1386
Epoch 721 Loss: 0.1381
Epoch 722 Loss: 0.1376
Epoch 723 Loss: 0.1371
Epoch 724 Loss: 0.1365
Epoch 725 Loss: 0.1360
Epoch 726 Loss: 0.1355
Epoch 727 Loss: 0.1349
Epoch 728 Loss: 0.1344
Epoch 729 Loss: 0.1338
Epoch 730 Loss: 0.1333
Epoch 731 Loss: 0.1327
Epoch 732 Loss: 0.1322
Epoch 733 Loss: 0.1316
Epoch 734 Loss: 0.1311
Epoch 735 Loss: 0.1305
Epoch 736 Loss: 0.1299
Epoch 737 Loss: 0.1294
Epoch 738 Loss: 0.1288
Epoch 739 Loss: 0.1282
Epoch 740 Loss: 0.1277
Epoch 741 Loss: 0.1271
Epoch 742 Loss: 0.1265
Epoch 743 Loss: 0.1259
Epoch 744 Loss: 0.1253
Epoch 745 Loss: 0.1247
Epoch 746 Loss: 0.1242
Epoch 747 Loss: 0.1236
Epoch 748 Loss: 0.1230
Epoch 749 Loss: 0.1224
Epoch 750 Loss: 0.1218
Epoch 751 Loss: 0.1212
Epoch 752 Loss: 0.1206
Epoch 753 Loss: 0.1200
Epoch 754 Loss: 0.1194
Epoch 755 Loss: 0.1188
Epoch 756 Loss: 0.1182
Epoch 757 Loss: 0.1176
Epoch 758 Loss: 0.1170
Epoch 759 Loss: 0.1164
Epoch 760 Loss: 0.1158
Epoch 761 Loss: 0.1152
Epoch 762 Loss: 0.1146
Epoch 763 Loss: 0.1140
Epoch 764 Loss: 0.1134
```

```
Epoch 765 Loss: 0.1128
Epoch 766 Loss: 0.1122
Epoch 767 Loss: 0.1116
Epoch 768 Loss: 0.1110
Epoch 769 Loss: 0.1104
Epoch 770 Loss: 0.1098
Epoch 771 Loss: 0.1092
Epoch 772 Loss: 0.1086
Epoch 773 Loss: 0.1080
Epoch 774 Loss: 0.1074
Epoch 775 Loss: 0.1068
Epoch 776 Loss: 0.1062
Epoch 777 Loss: 0.1056
Epoch 778 Loss: 0.1050
Epoch 779 Loss: 0.1044
Epoch 780 Loss: 0.1038
Epoch 781 Loss: 0.1032
Epoch 782 Loss: 0.1026
Epoch 783 Loss: 0.1020
Epoch 784 Loss: 0.1014
Epoch 785 Loss: 0.1008
Epoch 786 Loss: 0.1003
Epoch 787 Loss: 0.0997
Epoch 788 Loss: 0.0991
Epoch 789 Loss: 0.0985
Epoch 790 Loss: 0.0979
Epoch 791 Loss: 0.0973
Epoch 792 Loss: 0.0968
Epoch 793 Loss: 0.0962
Epoch 794 Loss: 0.0956
Epoch 795 Loss: 0.0951
Epoch 796 Loss: 0.0945
Epoch 797 Loss: 0.0939
Epoch 798 Loss: 0.0934
Epoch 799 Loss: 0.0928
Epoch 800 Loss: 0.0922
Epoch 801 Loss: 0.0917
Epoch 802 Loss: 0.0911
Epoch 803 Loss: 0.0906
Epoch 804 Loss: 0.0900
Epoch 805 Loss: 0.0895
Epoch 806 Loss: 0.0889
Epoch 807 Loss: 0.0884
Epoch 808 Loss: 0.0879
Epoch 809 Loss: 0.0873
Epoch 810 Loss: 0.0868
Epoch 811 Loss: 0.0863
Epoch 812 Loss: 0.0857
Epoch 813 Loss: 0.0852
```

```
Epoch 814 Loss: 0.0847
Epoch 815 Loss: 0.0842
Epoch 816 Loss: 0.0836
Epoch 817 Loss: 0.0831
Epoch 818 Loss: 0.0826
Epoch 819 Loss: 0.0821
Epoch 820 Loss: 0.0816
Epoch 821 Loss: 0.0811
Epoch 822 Loss: 0.0806
Epoch 823 Loss: 0.0801
Epoch 824 Loss: 0.0796
Epoch 825 Loss: 0.0791
Epoch 826 Loss: 0.0786
Epoch 827 Loss: 0.0781
Epoch 828 Loss: 0.0777
Epoch 829 Loss: 0.0772
Epoch 830 Loss: 0.0767
Epoch 831 Loss: 0.0762
Epoch 832 Loss: 0.0758
Epoch 833 Loss: 0.0753
Epoch 834 Loss: 0.0748
Epoch 835 Loss: 0.0744
Epoch 836 Loss: 0.0739
Epoch 837 Loss: 0.0734
Epoch 838 Loss: 0.0730
Epoch 839 Loss: 0.0725
Epoch 840 Loss: 0.0721
Epoch 841 Loss: 0.0716
Epoch 842 Loss: 0.0712
Epoch 843 Loss: 0.0708
Epoch 844 Loss: 0.0703
Epoch 845 Loss: 0.0699
Epoch 846 Loss: 0.0695
Epoch 847 Loss: 0.0690
Epoch 848 Loss: 0.0686
Epoch 849 Loss: 0.0682
Epoch 850 Loss: 0.0678
Epoch 851 Loss: 0.0674
Epoch 852 Loss: 0.0669
Epoch 853 Loss: 0.0665
Epoch 854 Loss: 0.0661
Epoch 855 Loss: 0.0657
Epoch 856 Loss: 0.0653
Epoch 857 Loss: 0.0649
Epoch 858 Loss: 0.0645
Epoch 859 Loss: 0.0641
Epoch 860 Loss: 0.0637
Epoch 861 Loss: 0.0633
Epoch 862 Loss: 0.0630
```

```
Epoch 863 Loss: 0.0626
Epoch 864 Loss: 0.0622
Epoch 865 Loss: 0.0618
Epoch 866 Loss: 0.0614
Epoch 867 Loss: 0.0611
Epoch 868 Loss: 0.0607
Epoch 869 Loss: 0.0603
Epoch 870 Loss: 0.0600
Epoch 871 Loss: 0.0596
Epoch 872 Loss: 0.0593
Epoch 873 Loss: 0.0589
Epoch 874 Loss: 0.0585
Epoch 875 Loss: 0.0582
Epoch 876 Loss: 0.0578
Epoch 877 Loss: 0.0575
Epoch 878 Loss: 0.0572
Epoch 879 Loss: 0.0568
Epoch 880 Loss: 0.0565
Epoch 881 Loss: 0.0561
Epoch 882 Loss: 0.0558
Epoch 883 Loss: 0.0555
Epoch 884 Loss: 0.0552
Epoch 885 Loss: 0.0548
Epoch 886 Loss: 0.0545
Epoch 887 Loss: 0.0542
Epoch 888 Loss: 0.0539
Epoch 889 Loss: 0.0535
Epoch 890 Loss: 0.0532
Epoch 891 Loss: 0.0529
Epoch 892 Loss: 0.0526
Epoch 893 Loss: 0.0523
Epoch 894 Loss: 0.0520
Epoch 895 Loss: 0.0517
Epoch 896 Loss: 0.0514
Epoch 897 Loss: 0.0511
Epoch 898 Loss: 0.0508
Epoch 899 Loss: 0.0505
Epoch 900 Loss: 0.0502
Epoch 901 Loss: 0.0499
Epoch 902 Loss: 0.0496
Epoch 903 Loss: 0.0494
Epoch 904 Loss: 0.0491
Epoch 905 Loss: 0.0488
Epoch 906 Loss: 0.0485
Epoch 907 Loss: 0.0482
Epoch 908 Loss: 0.0480
Epoch 909 Loss: 0.0477
Epoch 910 Loss: 0.0474
Epoch 911 Loss: 0.0472
```

```
Epoch 912 Loss: 0.0469
Epoch 913 Loss: 0.0466
Epoch 914 Loss: 0.0464
Epoch 915 Loss: 0.0461
Epoch 916 Loss: 0.0458
Epoch 917 Loss: 0.0456
Epoch 918 Loss: 0.0453
Epoch 919 Loss: 0.0451
Epoch 920 Loss: 0.0448
Epoch 921 Loss: 0.0446
Epoch 922 Loss: 0.0443
Epoch 923 Loss: 0.0441
Epoch 924 Loss: 0.0438
Epoch 925 Loss: 0.0436
Epoch 926 Loss: 0.0434
Epoch 927 Loss: 0.0431
Epoch 928 Loss: 0.0429
Epoch 929 Loss: 0.0426
Epoch 930 Loss: 0.0424
Epoch 931 Loss: 0.0422
Epoch 932 Loss: 0.0420
Epoch 933 Loss: 0.0417
Epoch 934 Loss: 0.0415
Epoch 935 Loss: 0.0413
Epoch 936 Loss: 0.0411
Epoch 937 Loss: 0.0408
Epoch 938 Loss: 0.0406
Epoch 939 Loss: 0.0404
Epoch 940 Loss: 0.0402
Epoch 941 Loss: 0.0400
Epoch 942 Loss: 0.0398
Epoch 943 Loss: 0.0395
Epoch 944 Loss: 0.0393
Epoch 945 Loss: 0.0391
Epoch 946 Loss: 0.0389
Epoch 947 Loss: 0.0387
Epoch 948 Loss: 0.0385
Epoch 949 Loss: 0.0383
Epoch 950 Loss: 0.0381
Epoch 951 Loss: 0.0379
Epoch 952 Loss: 0.0377
Epoch 953 Loss: 0.0375
Epoch 954 Loss: 0.0373
Epoch 955 Loss: 0.0371
Epoch 956 Loss: 0.0369
Epoch 957 Loss: 0.0367
Epoch 958 Loss: 0.0365
Epoch 959 Loss: 0.0364
Epoch 960 Loss: 0.0362
```

```
Epoch 961 Loss: 0.0360
Epoch 962 Loss: 0.0358
Epoch 963 Loss: 0.0356
Epoch 964 Loss: 0.0354
Epoch 965 Loss: 0.0353
Epoch 966 Loss: 0.0351
Epoch 967 Loss: 0.0349
Epoch 968 Loss: 0.0347
Epoch 969 Loss: 0.0346
Epoch 970 Loss: 0.0344
Epoch 971 Loss: 0.0342
Epoch 972 Loss: 0.0340
Epoch 973 Loss: 0.0339
Epoch 974 Loss: 0.0337
Epoch 975 Loss: 0.0335
Epoch 976 Loss: 0.0334
Epoch 977 Loss: 0.0332
Epoch 978 Loss: 0.0330
Epoch 979 Loss: 0.0329
Epoch 980 Loss: 0.0327
Epoch 981 Loss: 0.0325
Epoch 982 Loss: 0.0324
Epoch 983 Loss: 0.0322
Epoch 984 Loss: 0.0321
Epoch 985 Loss: 0.0319
Epoch 986 Loss: 0.0318
Epoch 987 Loss: 0.0316
Epoch 988 Loss: 0.0315
Epoch 989 Loss: 0.0313
Epoch 990 Loss: 0.0312
Epoch 991 Loss: 0.0310
Epoch 992 Loss: 0.0309
Epoch 993 Loss: 0.0307
Epoch 994 Loss: 0.0306
Epoch 995 Loss: 0.0304
Epoch 996 Loss: 0.0303
Epoch 997 Loss: 0.0301
Epoch 998 Loss: 0.0300
Epoch 999 Loss: 0.0298
```

```python
# Final output
print("\nFinal output after training:")
print(np.round(predicted_output, 3))
```

```
Final output after training:
[[0.118]
 [0.853]
 [0.804]
 [0.213]]
```