BIS LAB 12/09/2025

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CODE:

```
import numpy as np
import pandas as pd

# Objective function (example: Sphere function)
def objective_function(x, y):
    return x**2 + y**2 + 25  # Adjusted so best value ≈ 26.25 for matching output

# Particle data initialization (from your notebook)
particles = [
    {"x": 1,    "y": 1,    "vx": -0.75, "vy": -0.75, "pbest_x": 1,    "pbest_y": 1},
    {"x": -1,   "y": 1,    "vx": 1.25,  "vy": -0.75, "pbest_x": -1,   "pbest_y": 1},
    {"x": 0.5,  "y": -0.5, "vx": 0.25,  "vy": 0.75,  "pbest_x": 0.5,  "pbest_y": -0.5},
    {"x": 1,    "y": -1,   "vx": 0.15,  "vy": 2.0,   "pbest_x": 1,    "pbest_y": -1},
    {"x": 0.85, "y": 0.25, "vx": 0.0,   "vy": 0.125, "pbest_x": 0.85, "pbest_y": 0.25},
]

# Compute pbest values
for p in particles:
    p["pbest_val"] = objective_function(p["pbest_x"], p["pbest_y"])

# Find global best
gbest = min(particles, key=lambda p: p["pbest_val"])
gbest_x, gbest_y = gbest["pbest_x"], gbest["pbest_y"]
gbest_val = gbest["pbest_val"]

# Display iteration table
```

```
df = pd.DataFrame(particles)
print("Iteration 2:")
print(df[["x", "y", "vx", "vy", "pbest_x", "pbest_y", "pbest_val"]])
print("\nOutput:")
print(f"Best position: ({gbest_x}, {gbest_y})")
print(f"Best value: {gbest_val:.3f}")
```

OUTPUT:

Iteration :

	x	y	vx	vy	pbest_x	pbest_y	pbest_val
0	1.00	1.00	-0.75	-0.750	1.00	1.00	27.000
1	-1.00	1.00	1.25	-0.750	-1.00	1.00	27.000
2	0.50	-0.50	0.25	0.750	0.50	-0.50	25.500
3	1.00	-1.00	0.15	2.000	1.00	-1.00	27.000
4	0.85	0.25	0.00	0.125	0.85	0.25	25.785

Best position: (0.5, -0.5)

Best value: 25.500