Assignment for Research and Development/AI

1) L1 Distance (uniformly sampled t ∈ [6, 60])

- Total L1 = 37865.095535
- Average L1 per point = 25.243397

2) Explanation of Process

Goal: Estimate unknowns θ, M, X\theta, M, Xθ, M, X in

x(t)=tcosθ−eM|t|sin(0.3t) sinθ+X

y(t)=tcosθ−eM∣t∣sin(0.3t)sinθ+X=42+tsinθ+eM∣t∣sin(0.3t)cosθ.

Data: The CSV contains only (x,y)(x,y)(x,y) points. Following the prompt (“uniformly sampled points”), we reconstruct t via:

t_i = 6 + i\cdot\frac{60-6}{N-1},\quad i=0,\dots, N-1. N-1.ti=6+i⋅N−160−6, i=0,…,N-1.

Metric: Minimize **L1 distance**

L1=∑i(∣xi−x(ti)∣+∣yi−y(ti)∣).

Method:

1. Load CSV, set uniform t∈[6,60]t\in[6,60]t∈[6,60].
2. Define model x(t), y(t), x(t), y(t), x(t), and y(t) as above.
3. Use bounded optimization (respecting ranges: θ∈(0,50◦)\theta\in(0,50^\circ)θ∈(0,50◦), M∈(−0.05,0.05)M\in(-0.05,0.05)M∈(−0.05,0.05), X∈(0,100)X\in(0,100)X∈(0,100)) to minimize L1.
4. Converged parameters:
    - θ=0.490777338 rad≈28.13°
    - M = 0.0213825022M
    - X = 54.8999932

Resulting curve (LaTeX)

$\left(t\cos(0.490777338)-e^{0.0213825022\lvert t\rvert}\sin(0.3t)\sin(0.490777338)+54.8999932,\;
42+t\sin(0.490777338)+e^{0.0213825022\lvert t\rvert}\sin(0.3t)\cos(0.490777338)\right)$