Topic: **Clustering Analysis** (distance matrics)
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Problem Statement:

Given two objects represented by the tuples (22, 1, 42, 10) and (20, 0, 36, 8):

(a) Compute the *Euclidean distance* between the two objects.

(b) Compute the *Manhattan distance* between the two objects.

(c) Compute the *Minkowski distance* between the two objects, using $q = 3$.

Formulae:

1. Minkowski distance:

$$\left(\sum_{i=1}^{n} |xi - yi|^{q}\right)^{(1/q)}$$

2. Manhattan distance (Special case of Minkowski distance, with q=2)

$$\left(\sum_{i=1}^{n} |xi - yi|\right)$$

3. Euclidean distance (Special case of Minkowski distance, with q=2)

$$\left(\sum_{i=1}^{n} |xi - yi|^{2}\right)^{(1/2)}$$

Solution.

X	**Y**	**Manhatten distance**	**Euclidean distance**	**Minkowski distance**
xi	yi	|xi-yi|	|xi-yi|^2	|xi-yi|^3
22	20	2	4	8
1	0	1	1	1
42	36	6	36	216
10	8	2	4	8
	Sum =	11	45	233
	Sum^(1/q) =	11	6.708203932	6.153449494

Ans.

Manhattan distance

= 11 unit

Euclidean distance

= 6.70820393 unit

Minkowski distance with q=3

$$= \left(\sum_{i=1}^{n} |xi - yi|^3\right)^{(1/3)}$$

= 6.153449494 unit