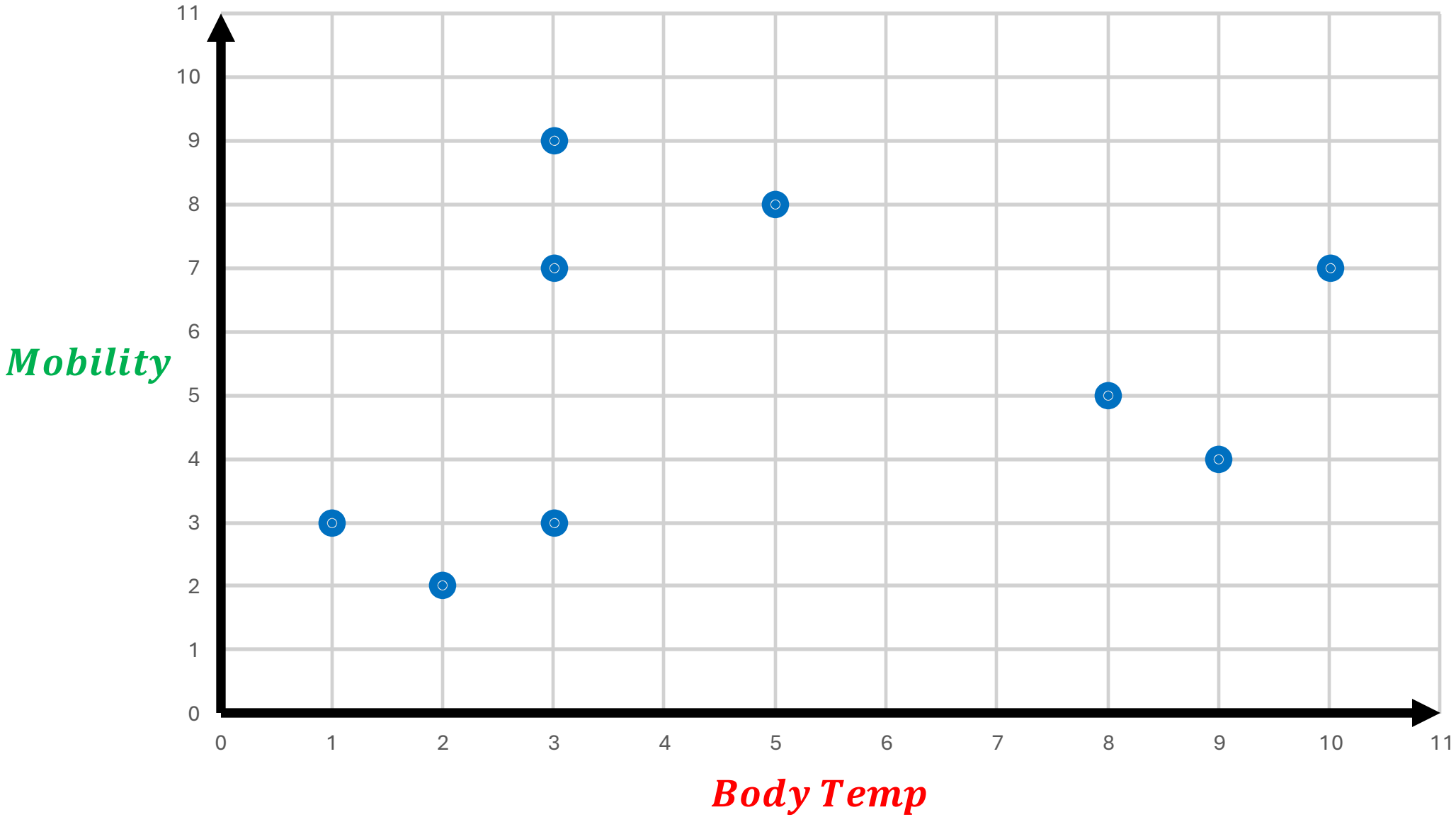
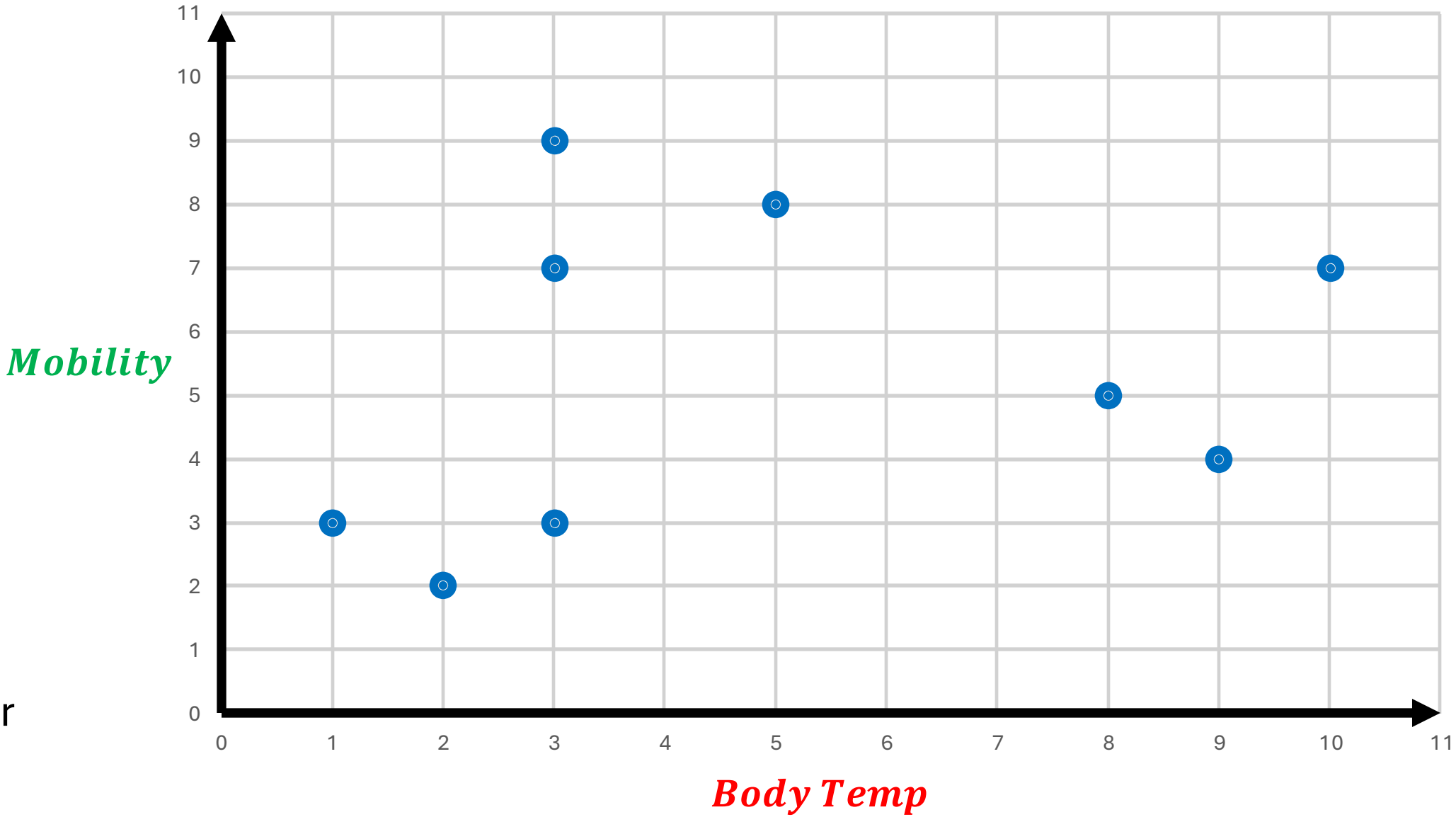
	$Body\ Temp$ (x_1)	$Mobility$ (x_2)
Crocodile	1	3
Iguana	2	2
Swan	5	8
Cat	8	5
Duck	3	9
Giraffe	10	7
Turtle	3	3
Kangaroo	9	4
Eagle	3	7

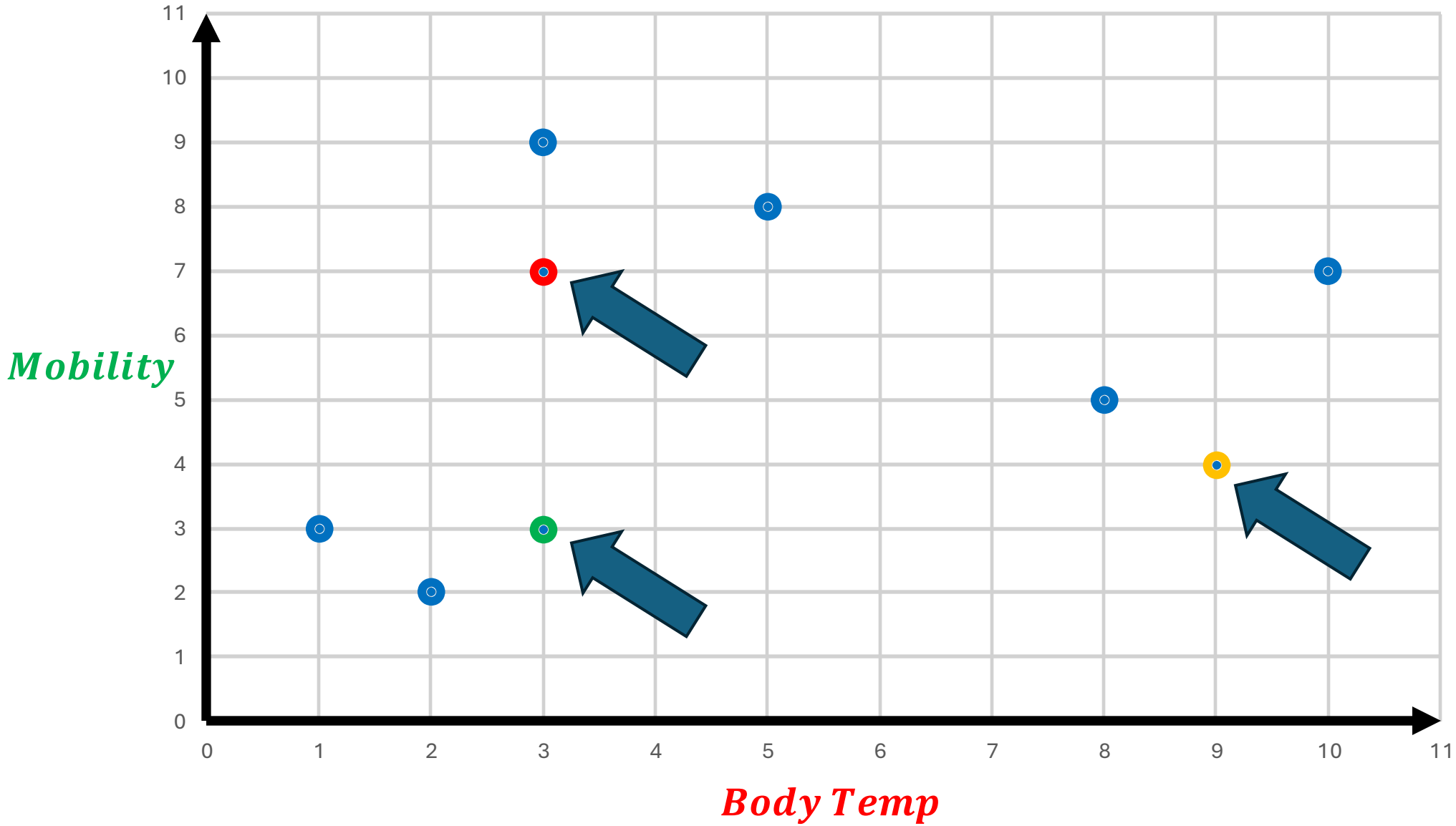

Mobility
Body Temp
0
1
2
3
4
5
6
7
8
9
10
11

Step 1:
Select the number of clusters you want to identify in your data.



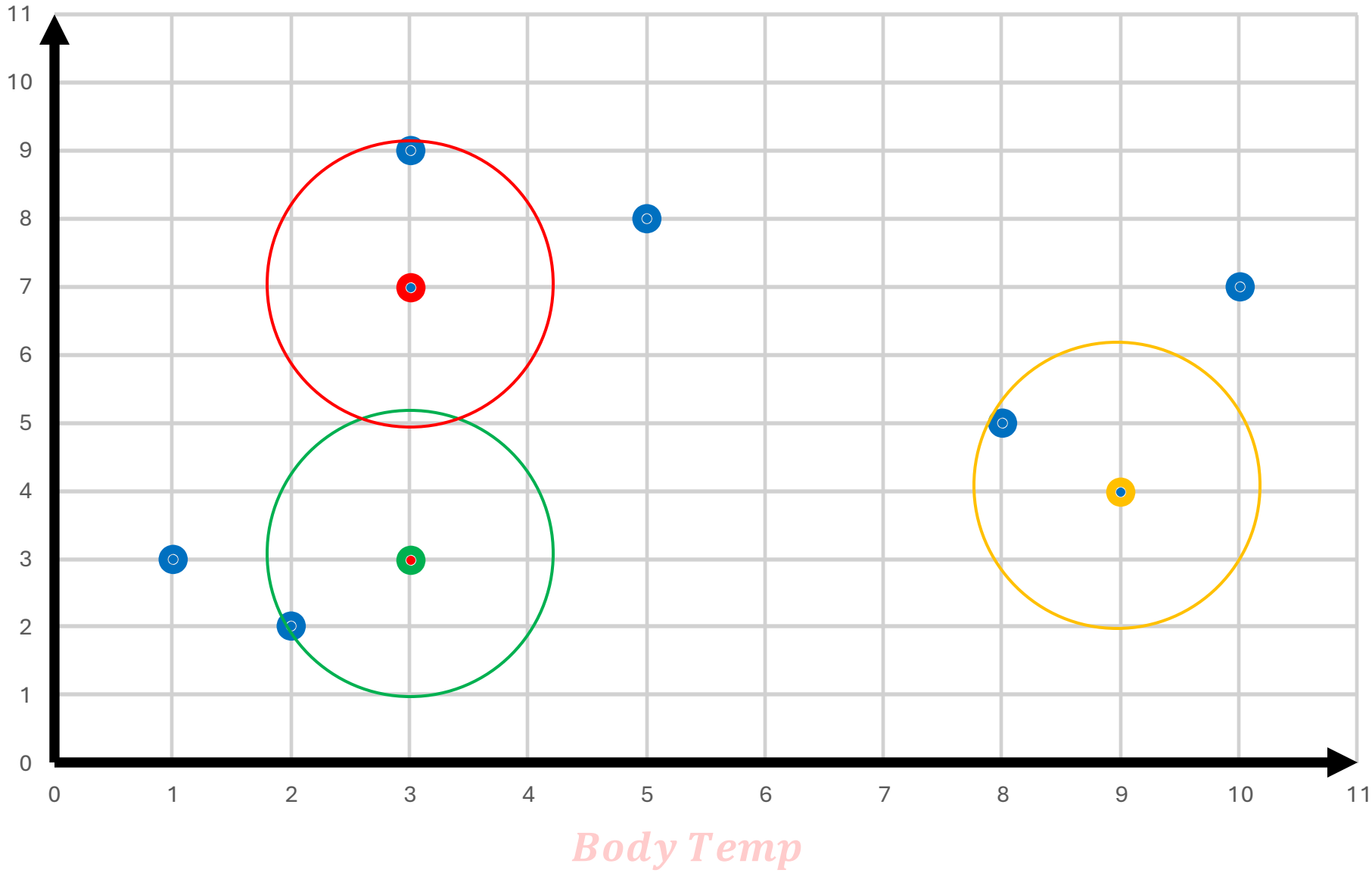
Step 2: Randomly select **K** distinct data points. These are the **initial clusters**

	$Body\ Temp\ (x_1)$	$Mobility\ (x_2)$
Crocodile	1	3
Iguana	2	2
Swan	5	8
Cat	8	5
Duck	3	9
Giraffe	10	7
Turtle	3	3
Kangaroo	9	4
Eagle	3	7


Mobility
Body Temp
0
1
2
3
4
5
6
7
8
9
10
11

Step 3:
Measure the **Euclidean distance** between the **first point** and the **initial clusters**

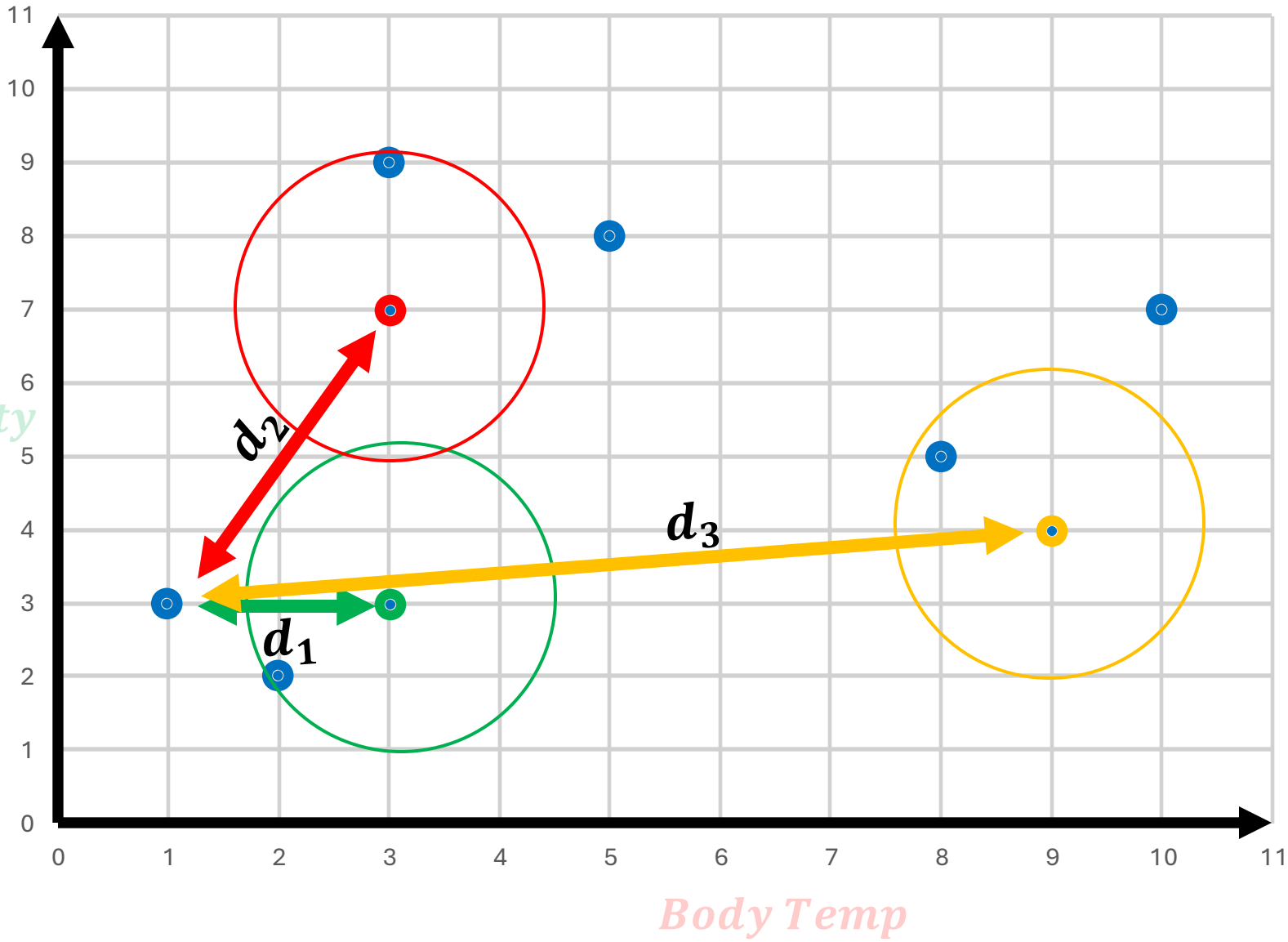
$$D = \sqrt{(x-a)^2+(y-b)^2}$$



$$d_1 = \sqrt{(x - a_1)^2 + (y - b_1)^2}$$

$$d_2 = \sqrt{(x - a_2)^2 + (y - b_2)^2}$$

$$d_3 = \sqrt{(x - a_3)^2 + (y - b_3)^2}$$

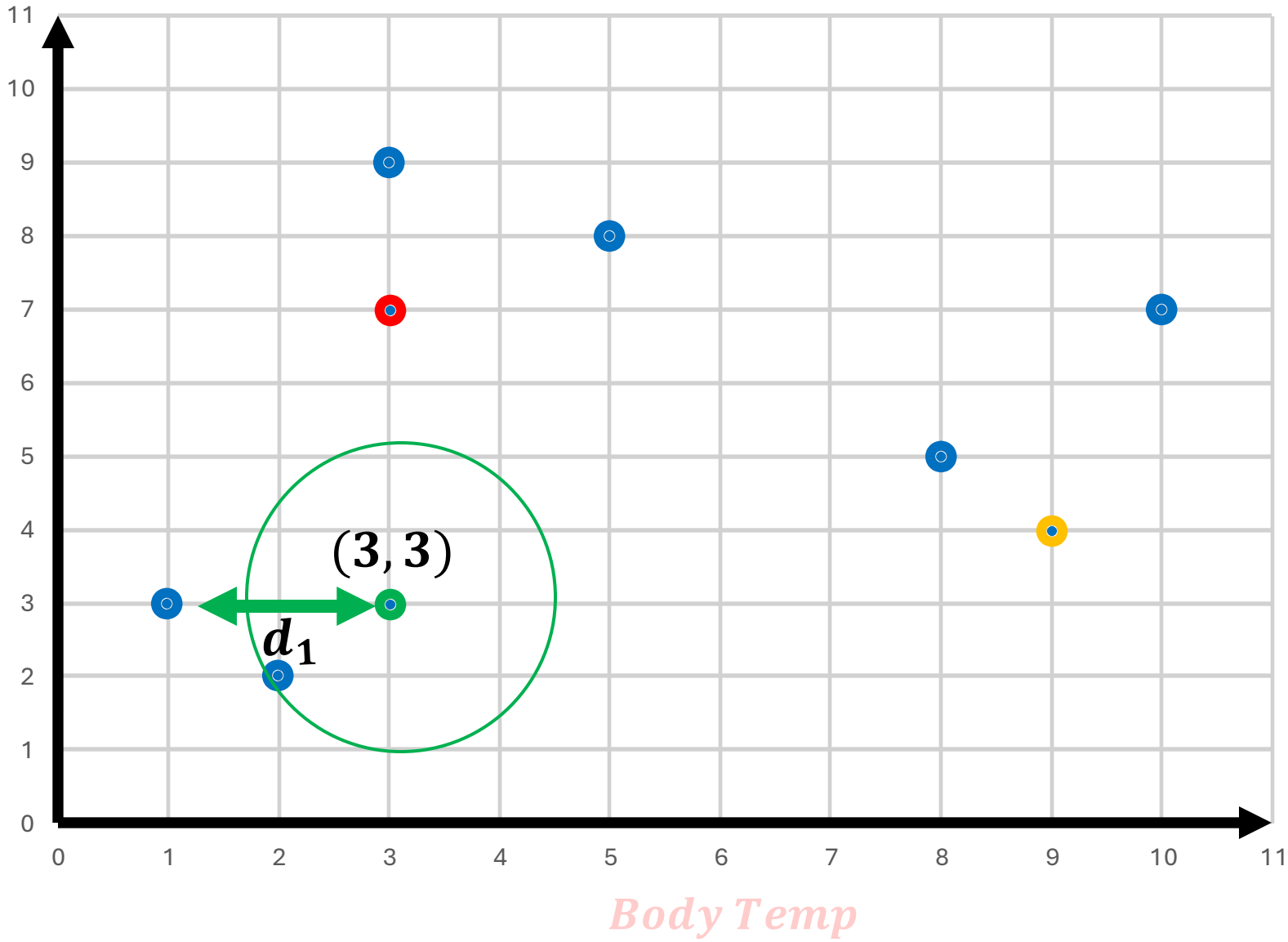


$$d_1 = \sqrt{(x - a_1)^2 + (y - b_1)^2}$$

$$d_1 = \sqrt{(1 - 3)^2 + (3 - 3)^2}$$

$$d_1 = \sqrt{4}$$

$$d_1 = 2$$

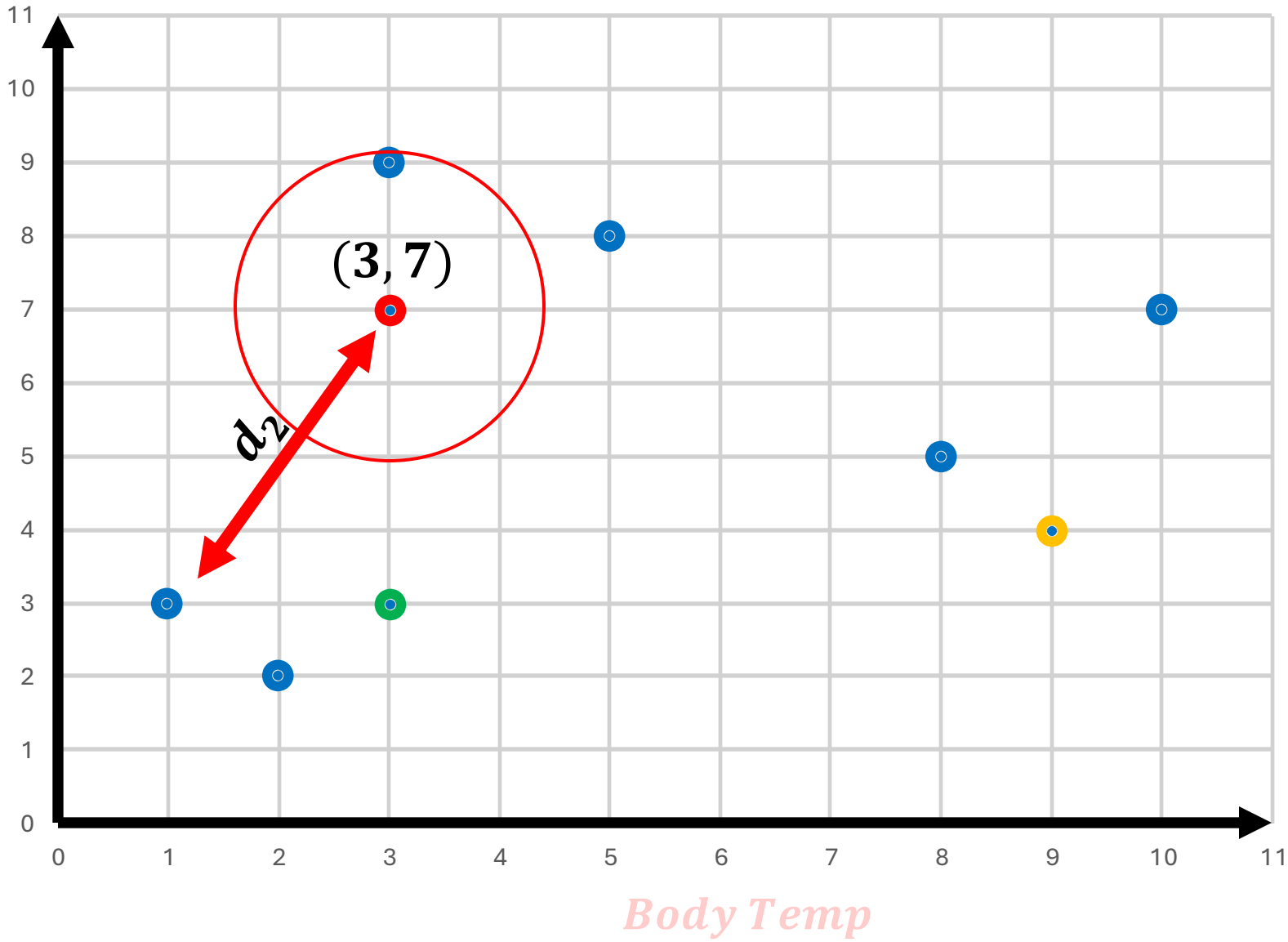


$$d_2 = \sqrt{(x - a_2)^2 + (y - a_2)^2}$$

$$d_2 = \sqrt{(1 - 3)^2 + (3 - 7)^2}$$

$$d_2 = \sqrt{20}$$

$$d_2 = 4.5$$

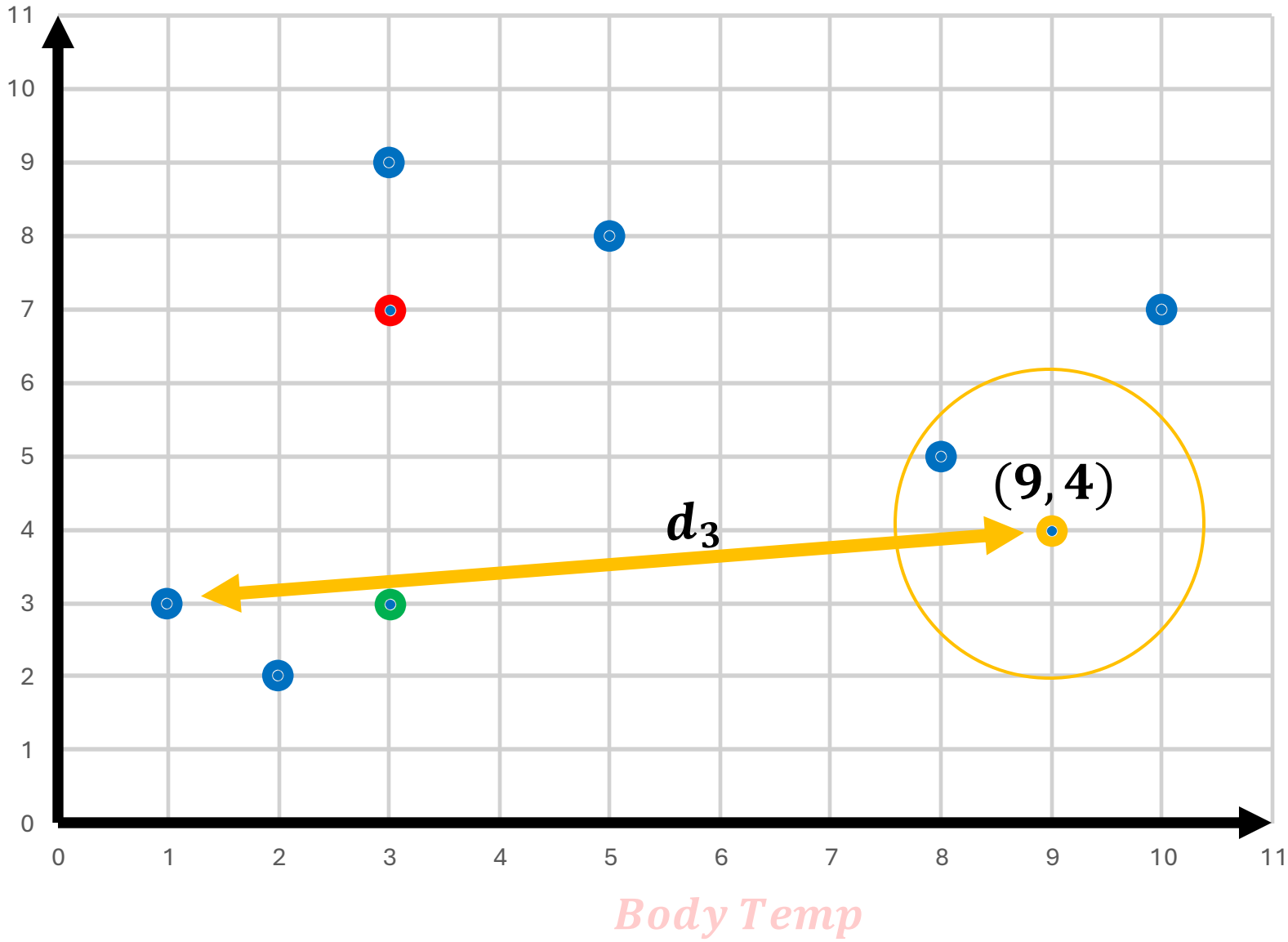


$$d_3 = \sqrt{(x - a_3)^2 + (y - b_3)^2}$$

$$d_3 = \sqrt{(1 - 9)^2 + (3 - 4)^2}$$

$$d_3 = \sqrt{65}$$

$$d_3 = 8.1$$



	$Body\ Temp$	$Mobility$	d_1	d_2	d_3	Cluster
Crocodile	1	3	2	4.5	8.1	
Iguana						
Swan						
Cat						
Duck						
Giraffe						
Turtle						
Kangaroo						
Eagle						

Step 4: Assign the first point to the nearest cluster.

Do this for all data points

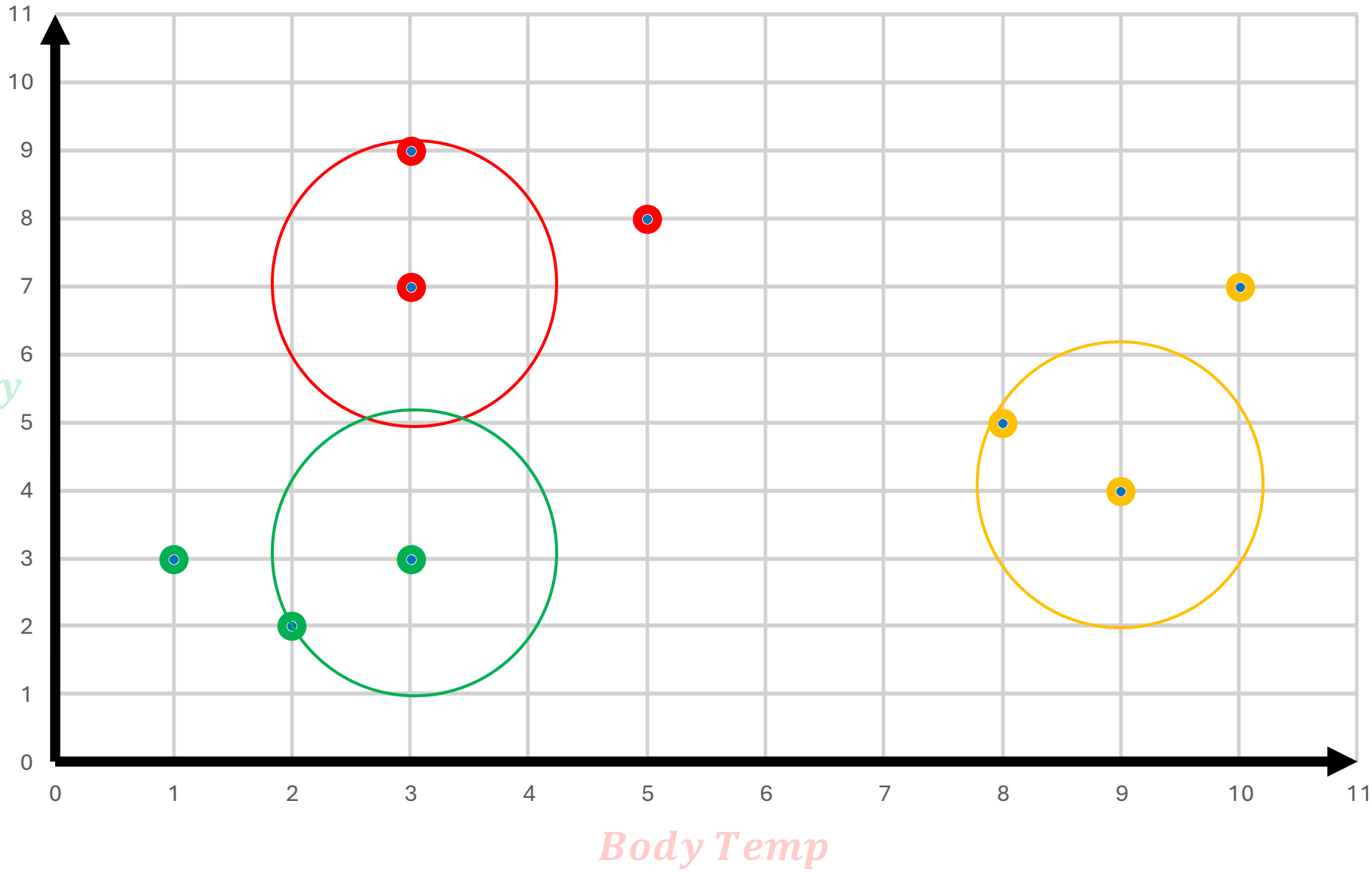
	Body Temp	*Mobility*	d_1	d_2	d_3	Cluster
Crocodile	1	3	2	4.5	8.1	**Reptile**
Iguana						
Swan						
Cat						
Duck						
Giraffe						
Turtle						
Kangaroo						
Eagle						

	Body Temp	*Mobility*	d_1	d_2	d_3	Cluster
Crocodile	1	3	2	4.5	8.1	Reptile
Iguana	2	2	1.4	5.1	7.3	Reptile
Swan	5	8	5.3	2.2	5.7	Bird
Cat	8	5	5.4	5.4	5.1	Mammal
Duck	3	9	6	2	7.9	Bird
Giraffe	10	7	8.1	7	3.2	Mammal
Turtle	3	3	0	4	6.1	Reptile
Kangaroo	9	4	6.1	6.7	0	Mammal
Eagle	3	7	4	0	6.7	Bird

Step 5:

Re-compute the center of newly formed clusters.

The center of a cluster is computed by **taking the mean of all the data points contained in that cluster.**



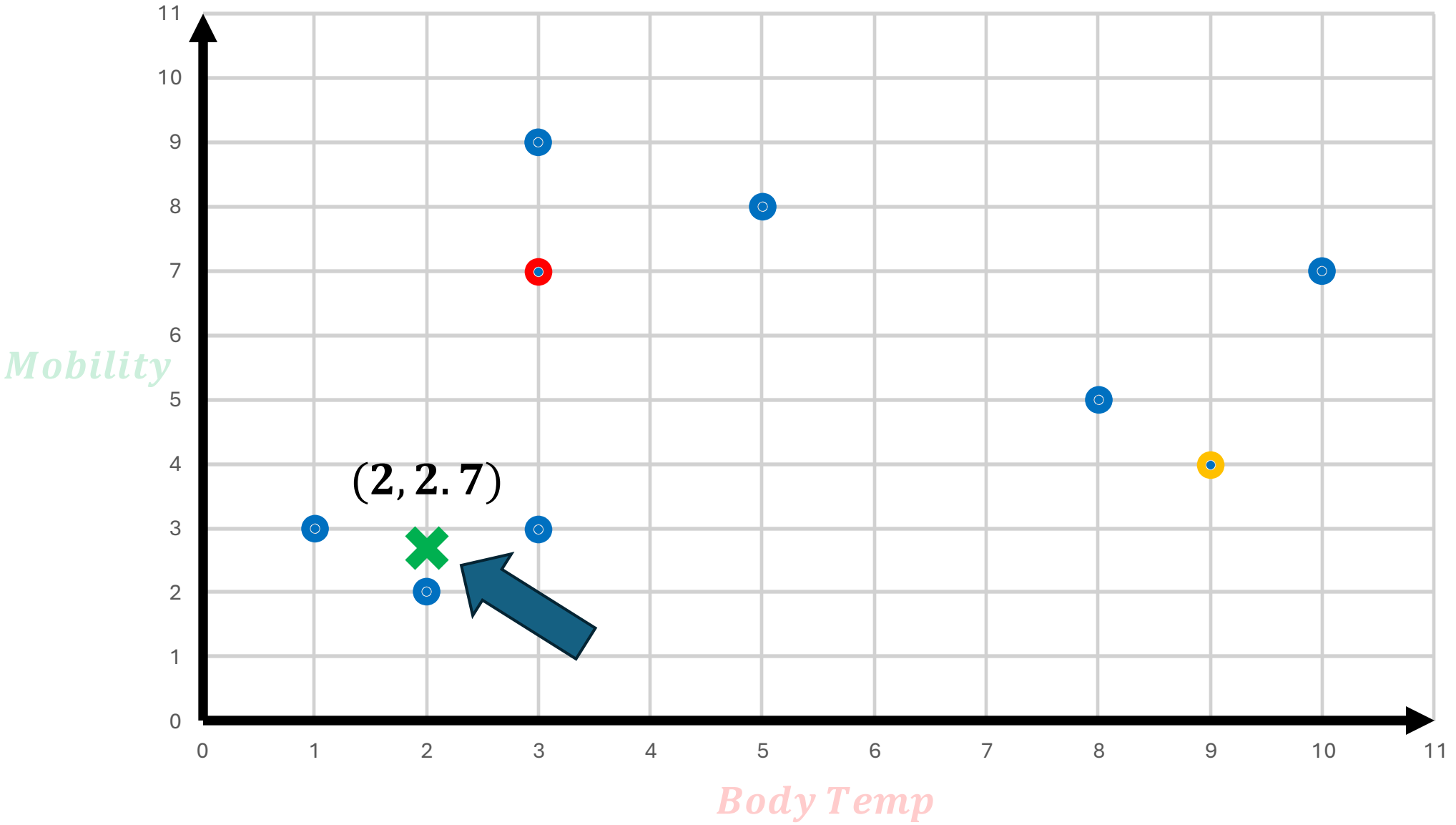
	Body Temp	*Mobility*	Cluster
Crocodile	1	3	Reptile
Iguana	2	2	Reptile
Swan	5	8	Bird
Cat	8	5	Mammal
Duck	3	9	Bird
Giraffe	10	7	Mammal
Turtle	3	3	Reptile
Kangaroo	9	4	Mammal
Eagle	3	7	Bird

New centroid of **Reptile** Cluster:

$$\boldsymbol{a_1} = \frac{(1+2+3)}{3} = \frac{6}{3} = \mathbf{2}$$

$$\boldsymbol{b_1} = \frac{(3+2+3)}{3} = \frac{8}{3} = \mathbf{2.7}$$

$$New\ centroid\ for\ Reptile\ cluster = \boxed{(\mathbf{2}, \mathbf{2.7})}$$


Mobility
Body Temp
(2, 2.7)
0
1
2
3
4
5
6
7
8
9
10
11

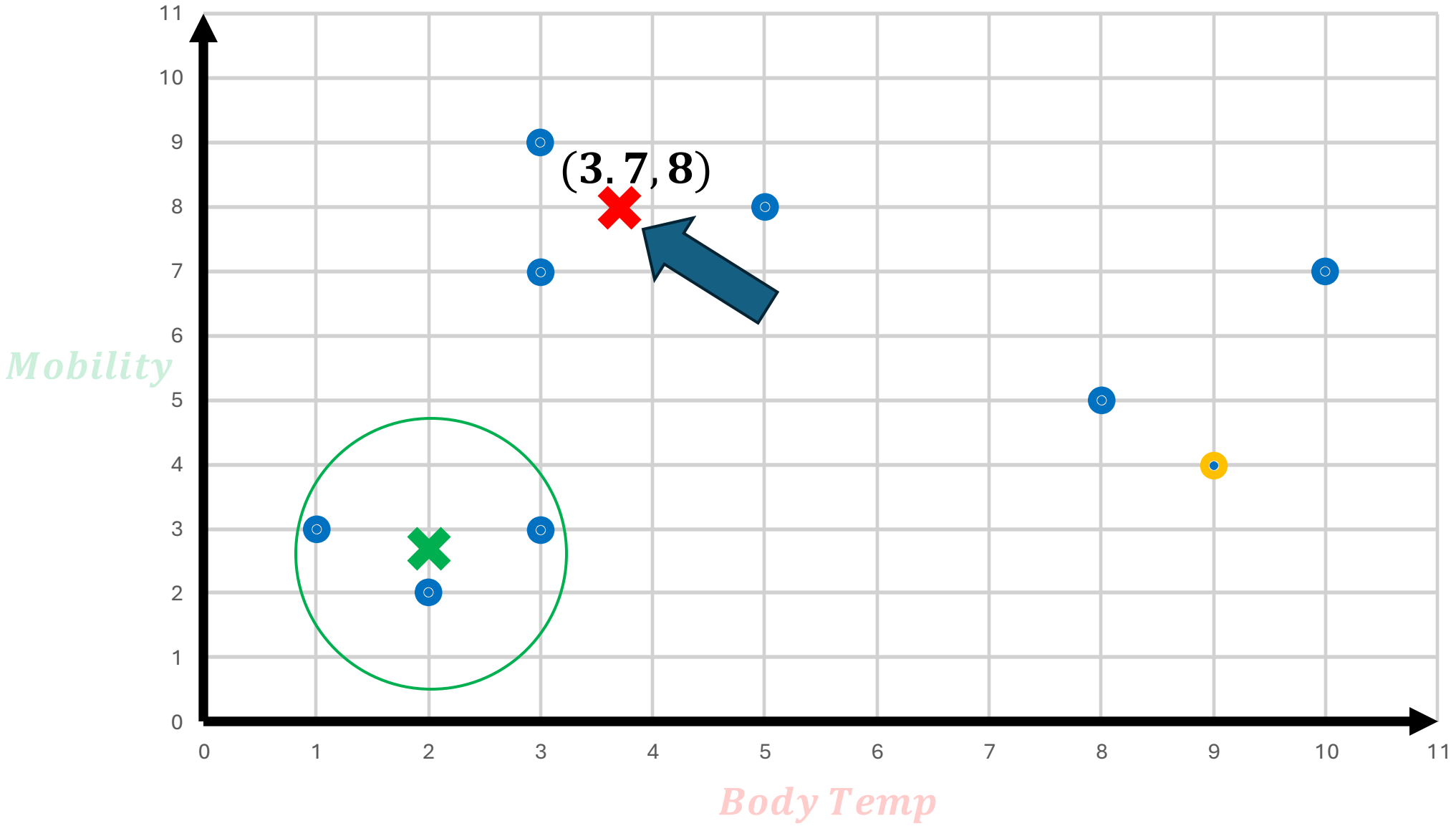
	Body Temp	*Mobility*	Cluster
Crocodile	1	3	Reptile
Iguana	2	2	Reptile
Swan	5	8	Bird
Cat	8	5	Mammal
Duck	3	9	Bird
Giraffe	10	7	Mammal
Turtle	3	3	Reptile
Kangaroo	9	4	Mammal
Eagle	3	7	Bird

New centroid of **Bird** Cluster:

$$\boldsymbol{a_2} = \frac{(5+3+3)}{3} = \frac{11}{3} = 3.7$$

$$\boldsymbol{b_2} = \frac{(8+9+7)}{3} = \frac{24}{3} = 8$$

$$New\ centroid\ for\ bird\ cluster = \boldsymbol{(3.7, 8)}$$


11
10
9
8
7
6
5
4
3
2
1
0
0
1
2
3
4
5
6
7
8
9
10
11
(3, 7, 8)
Mobility
Body Temp

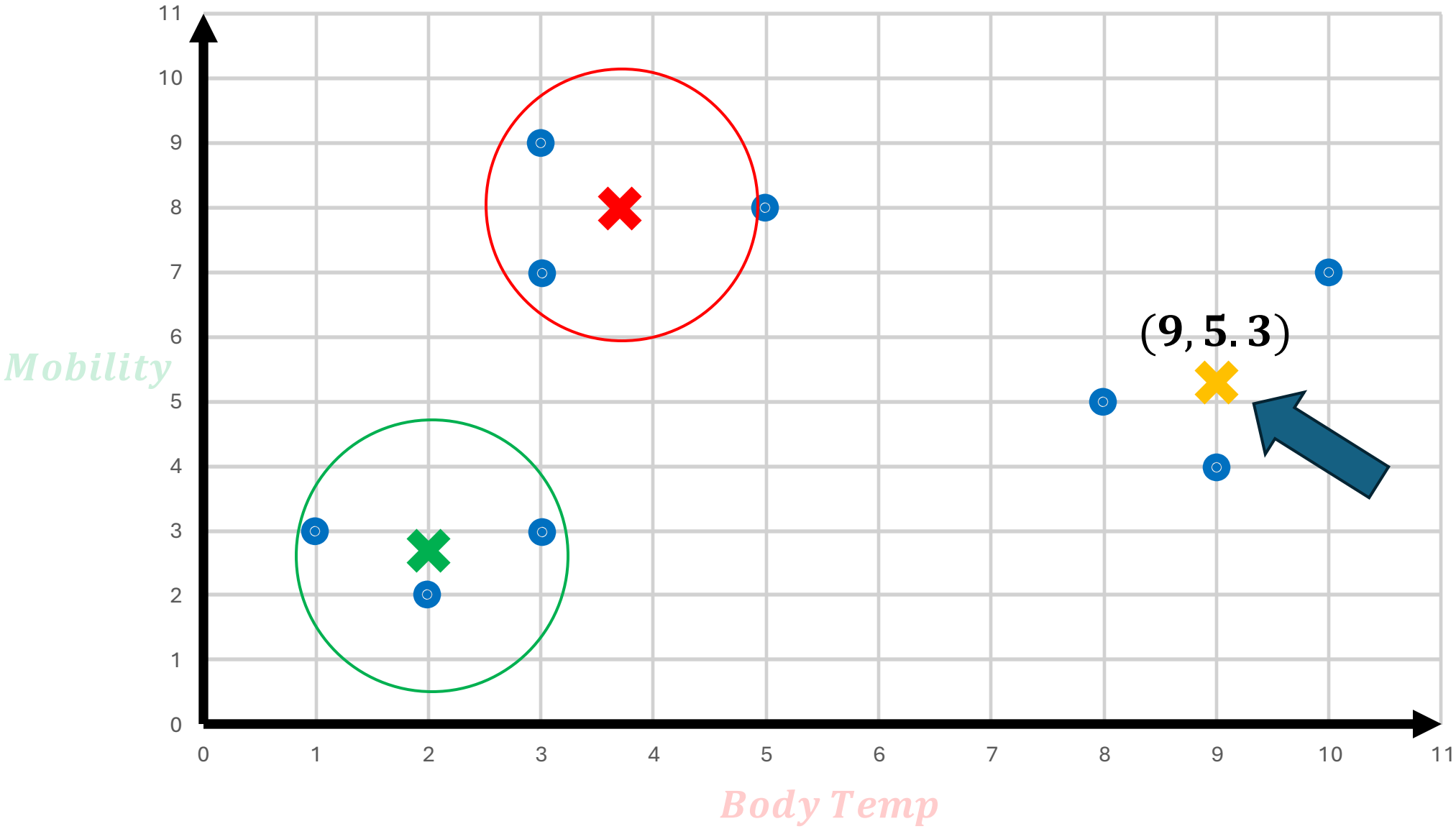
	Body Temp	*Mobility*	Cluster
Crocodile	1	3	Reptile
Iguana	2	2	Reptile
Swan	5	8	Bird
Cat	8	5	Mammal
Duck	3	9	Bird
Giraffe	10	7	Mammal
Turtle	3	3	Reptile
Kangaroo	9	4	Mammal
Eagle	3	7	Bird

New centroid of **Mammal** Cluster:

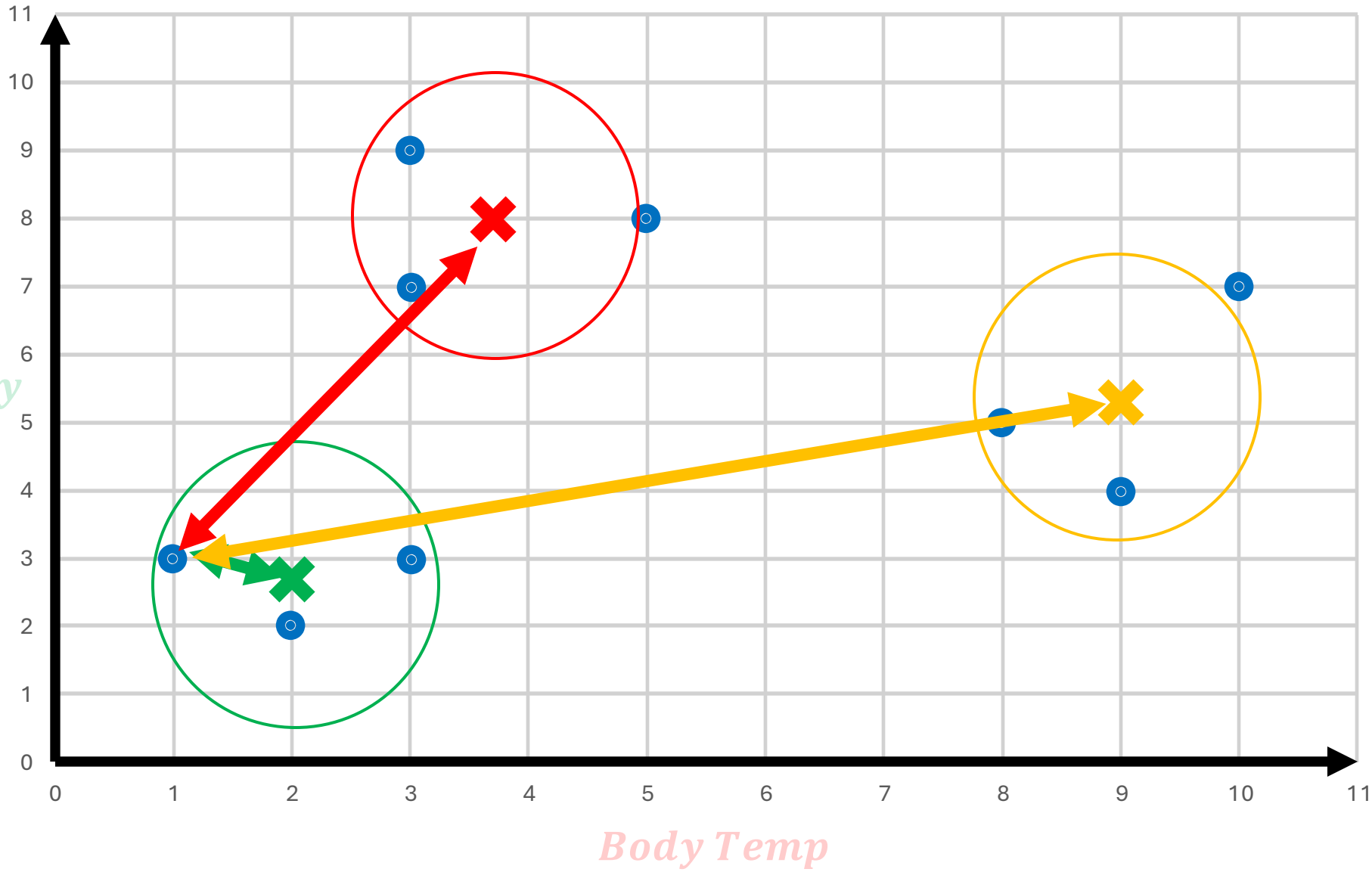
$$\boldsymbol{a_2} = \frac{(8 + 10 + 9)}{3} = \frac{27}{3} = 9$$

$$\boldsymbol{b_2} = \frac{(5 + 7 + 4)}{3} = \frac{16}{3} = 5.3$$

$$New\ centroid\ for\ mammal\ cluster = \boldsymbol{(9, 5.3)}$$


11
10
9
8
7
6
5
4
3
2
1
0
0
1
2
3
4
5
6
7
8
9
10
11
Mobility
Body Temp
(9, 5. 3)

Repeat step 3 to 5:
Measure the **Euclidean distance** between the **all points** and the **new clusters**

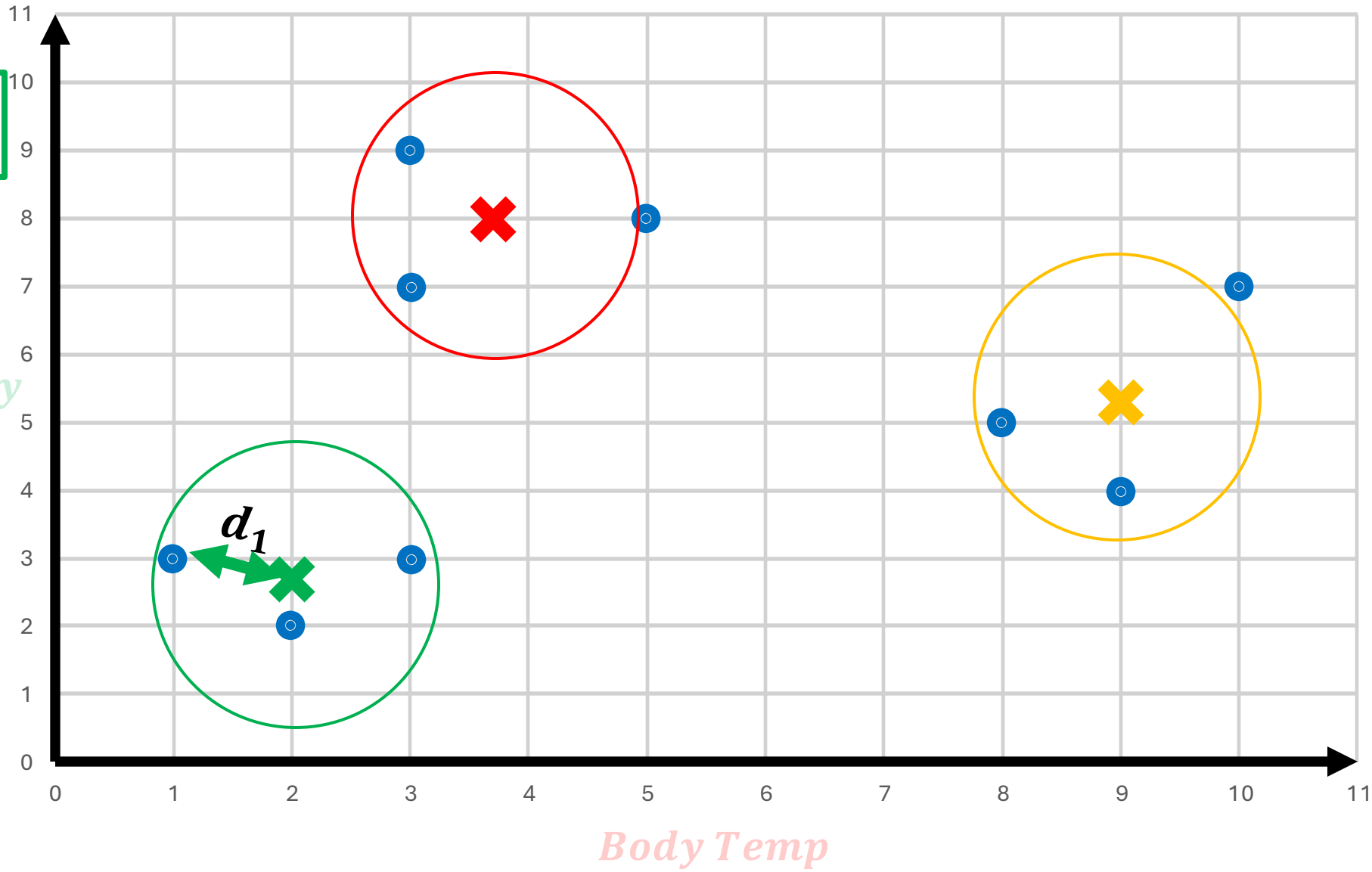


$$d_1 = \sqrt{(x - a_1)^2 + (y - b_1)^2}$$

$$d_1 = \sqrt{(1 - 2)^2 + (3 - 2.7)^2}$$

$$d_1 = \sqrt{1.1}$$

$$d_1 = 1$$

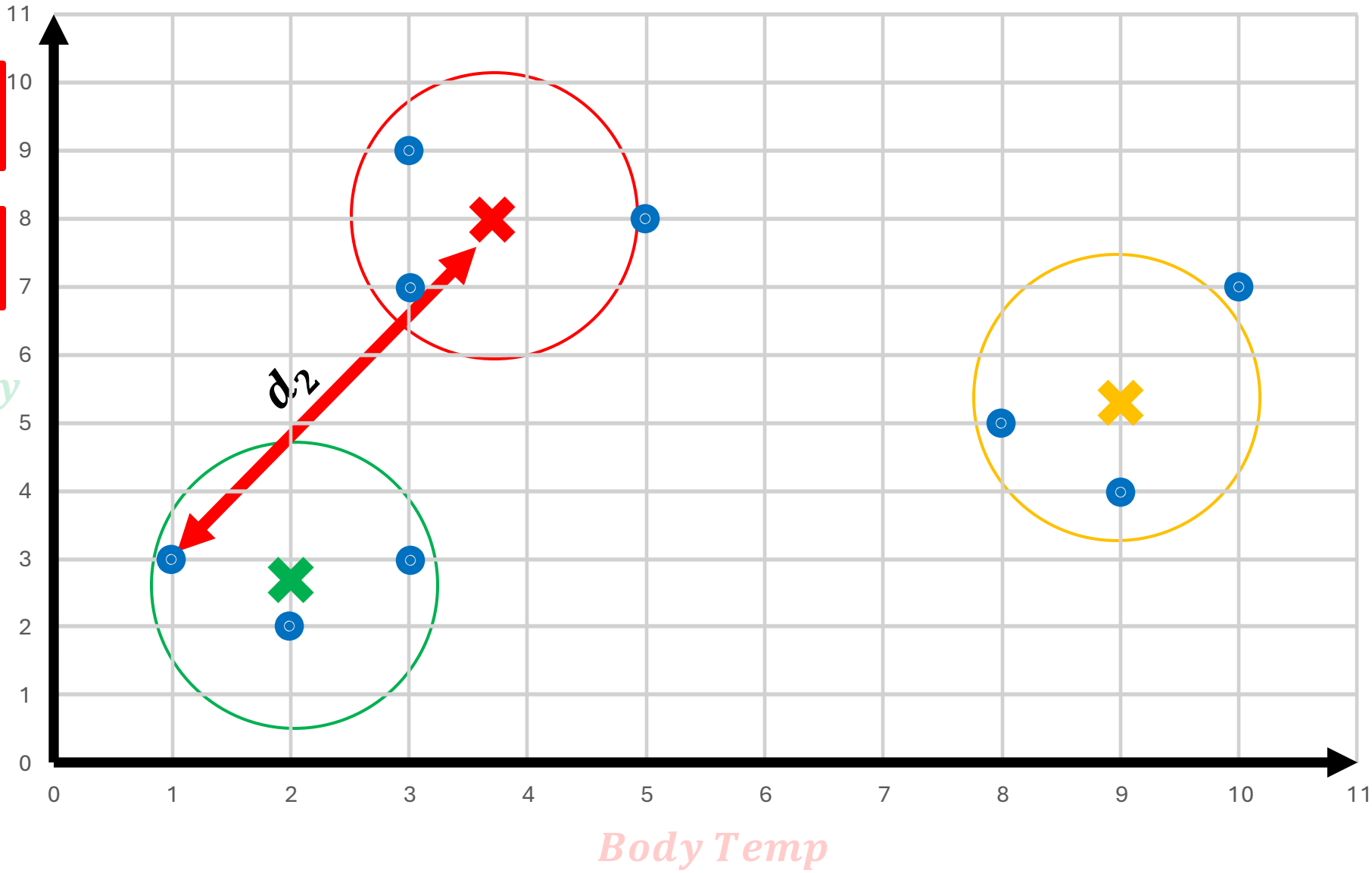


$$d_2 = \sqrt{(x - a_2)^2 + (y - b_2)^2}$$

$$d_2 = \sqrt{(1 - 3.7)^2 + (3 - 8)^2}$$

$$d_2 = \sqrt{32.29}$$

$$d_2 = 4.5$$

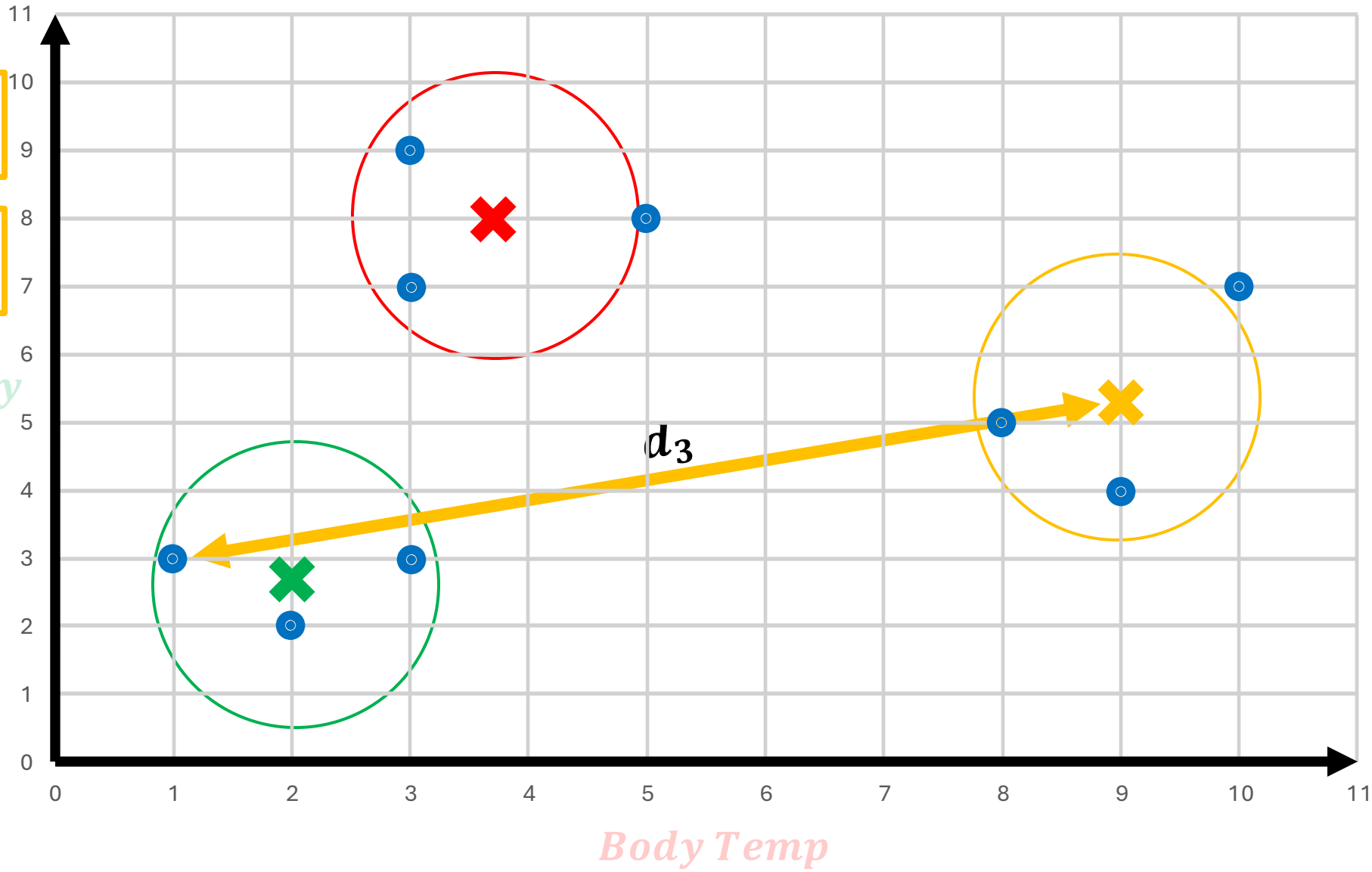


$$d_3 = \sqrt{(x - a_3)^2 + (y - b_3)^2}$$

$$d_3 = \sqrt{(1 - 9)^2 + (3 - 5.3)^2}$$

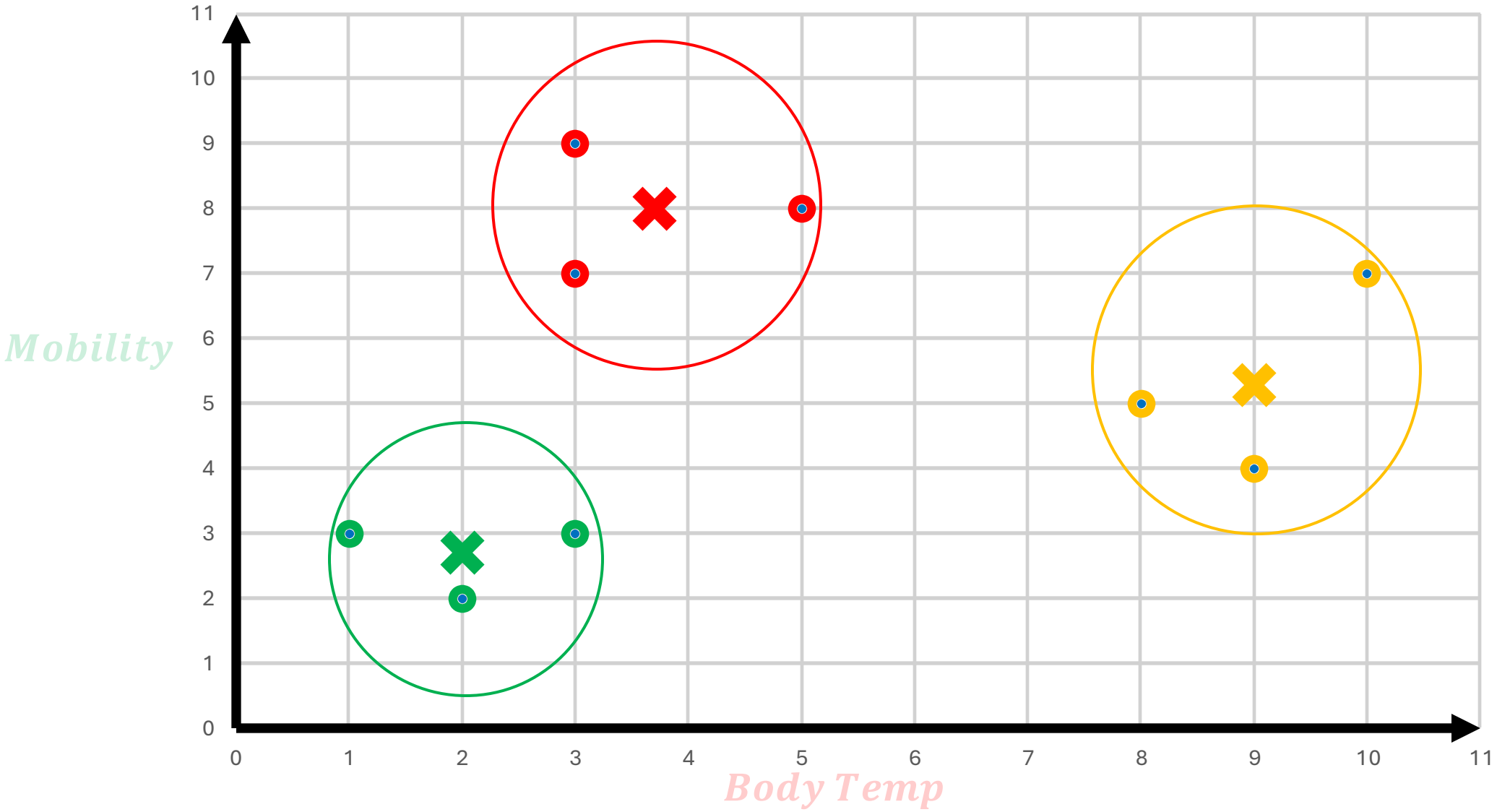
$$d_3 = \sqrt{69.29}$$

$$d_3 = 8.3$$



	$Body\ Temp$	$Mobility$	d_1	d_2	d_3	Cluster
Crocodile	1	3	1	4.5	8.3	**Reptile**
Iguana						
Swan						
Cat						
Duck						
Giraffe						
Turtle						
Kangaroo						
Eagle						

	Body Temp	*Mobility*	d_1	d_2	d_3	Cluster
Crocodile	1	3	1	4.5	8.3	Reptile
Iguana	2	2	0.7	6.2	7.7	Reptile
Swan	5	8	6.1	1.3	4.8	Bird
Cat	8	5	6.4	5.2	1.0	Mammal
Duck	3	9	6.4	1.2	7.0	Bird
Giraffe	10	7	9.1	6.4	1.9	Mammal
Turtle	3	3	1.0	5.0	6.4	Reptile
Kangaroo	9	4	7.1	6.6	1.3	Mammal
Eagle	3	7	4.4	1.2	6.2	Bird


Mobility
Body Temp
0
1
2
3
4
5
6
7
8
9
10
11