**Convergence of the Power Method Documentation**

In the scatter plots, we can see that the matrices need more iterations around the area where trace = 0 when determinant is less than 0. When determinant is larger than 0, we can see the color separate as a shape of parabola. To the right of the parabola, the matrices need more iteration.

**Here is the reason why the graph looks like this:**

We have a 2x2 matrix A

|a b|

|c d|

λ1 is the largest eigenvalue and λ2 is the smallest eigenvalue

(a - λ)(d - λ) – bc = 0

=> λ2 – (a + d) λ + ad – bc = 0

=> λ1 + λ2 = a + d

=> λ1λ2 = ad – bc

1. det(A) < 0

trace(A) = a + d **=>** trace(A) = λ1 + λ2

det(A) < 0 => λ1λ2 < 0 => λ1 = -λ2

We know when |λ1 / λ2| ≈ 1, it converge slowly.

|λ1 / λ2| ≈ 1 & λ1 = -λ2

=> λ1 ≈ -λ2

=> λ1 + λ2 ≈ 0

=> trace(A) ≈ 0

That’s why the graph shows more iteration in that area.

2. det(A) > 0

From above we can have λ1λ2 = ad – bc

det(A) = ad – bc

=> det(A) = λ1λ2

We know when |λ1 / λ2| ≈ 1, it converge slowly.

|λ1 / λ2| ≈ 1 & λ1λ2  > 0

=> det(A) ≈ λ12 & trace(A) ≈ 2λ1

=> 4det(A) ≈ trace2(A)

That’s why the iteration separate like a parabola.