Note that as the post weight approaches 0, the perimeter of the hamster pen approaches 1 meter and the polygon approaches a circle. The upper limit for the area is therefore :

As increases, the number of sides and area decrease.

|  |  |
| --- | --- |
| The area of a regular polygon is: |  |
| The side length in meters is the same as the side weight in kilograms. Given that the total weight is 1 kilogram and each of the posts weigh kilograms, the length of a side is: |
| The apothem can be found from one of the triangles in the regular polygon : |

Substituting yields the following:

There is a weight for each such that the area of a regular *n*-gon and regular *(n+1)*-gon will have the same area.

This yields :

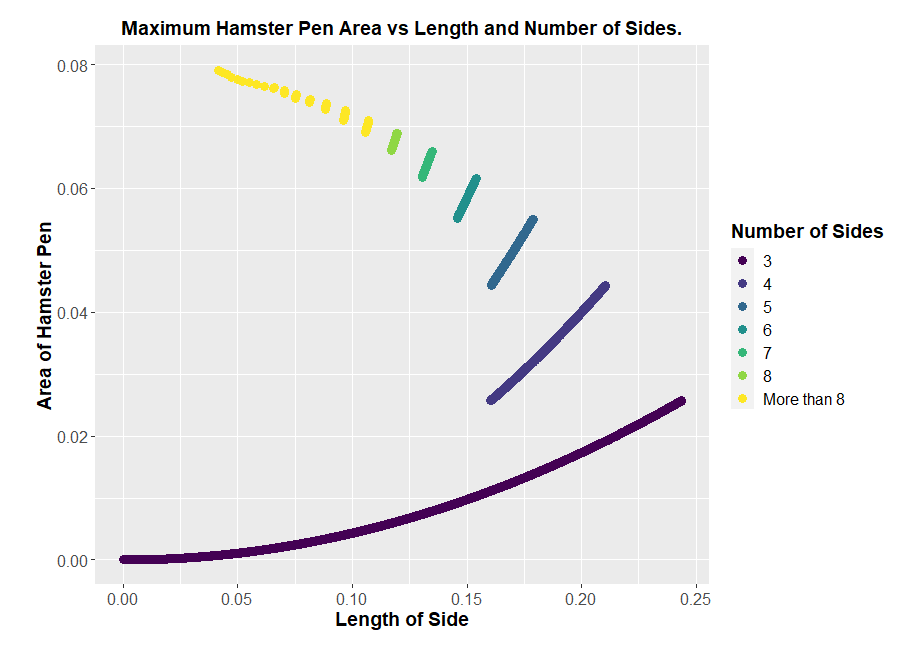
Substituting and yields:

The discriminant, , yields :

Completing the quadratic formula :

The above equation yields the following table that [maximizes the hamster pen area](http://www.codeskulptor.org/#user47_lNrpZTv7xh_3.py) (rounded to 7 decimal places) :

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **For -gon** | **Maximum weight of post (kg)** | **Minimum weight of post (kg)** |  |
|  | 3 | 0.3333333 | 0.0896422 |  |
|  | 4 | 0.0896422 | 0.0395738 |  |
|  | 5 | 0.0395738 | 0.0210155 |  |
|  | 6 | 0.0210155 | 0.0125110 |  |
|  | 7 | 0.0125110 | 0.0080559 |  |
|  | 8 | 0.0080559 | 0.0054941 |  |
|  | 9 | 0.0054941 | 0.0039154 |  |



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2020.08.24