

Homework due Jul 13, 2021 22:00 +06

## Exercise 2

Consider a circle inscribed in a square. The ratio of their areas (the ratio of the area of the circle to the area of the square) is  $\frac{\pi}{4}$ . In this six-part exercise, we will find a way to approximate this value.

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### Exercise 2a

1/1 point (graded)

Using the `math` library, calculate and print the value of  $\frac{\pi}{4}$ .

What is the value of  $\frac{\pi}{4}$ ?

Report your answer to 6 decimal places.

0.7853981633974483



0.7853981633974483

Submit

You have used 1 of 10 attempts

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✓ Correct (1/1 point)

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### Exercise 2b

1/1 point (graded)

Using `random.uniform()`, create a function `rand()` that generates a single float between  $-1$  and  $1$ .

Call `rand()` once. For us to be able to check your solution, we will use `random.seed()` to fix the seed value of the random number generator.

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We include some sample code to get you started:

```
import random

random.seed(1) # Fixes the seed of the random number generator.

def rand():
    # define `rand` here!

rand()
```

What is the value you get from calling `rand()` ?

-0.7312715117751976



**-0.7312715117751976**

Submit

You have used 1 of 10  
attempts

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✓ Correct (1/1 point)

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## Exercise 2d

1/1 point (graded)

Write a function `in_circle(x, origin)` that determines whether a point in a two dimensional plane falls within a unit circle surrounding a given origin.

Your function should return a boolean `True` if the distance between `x` and `origin` is less than 1 and `False` otherwise.

Use `distance(x, y)` as defined in Exercise 2c.

Use your function to determine whether the point (1,1) lies within the unit circle centered at (0,0):

```
def in_circle(x, origin = [0,0]):
    # Define your function here!
```

Does the point (1,1) lie within the unit circle centered at (0,0)?

☐ Yes

☒ No



Submit

You have used 1 of 1 attempt

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✓ Correct (1/1 point)

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## Exercise 2e

1/1 point (graded)

Create a list `inside` of `R=10000` booleans that determines whether or not a point falls within the unit circle centered at `(0,0)`.

Set the seed to 1 using `random.seed(1)`.

Use the `rand` function from Exercise 2b to generate `R` randomly located points.

Use the function `in_circle` to test whether or not a given point falls within the unit circle.

Find the proportion of points that fall within the circle by summing all `True` values in the `inside` list; then divide the answer by `R` to obtain a proportion.

Print your answer. This proportion is an estimate of the ratio of the two areas!

What is the proportion of points within the unit circle?

0.779



0.779

Submit

You have used 1 of 10 attempts

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✓ Correct (1/1 point)

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## Exercise 2f

1/1 point (graded)

Calculate the difference between your estimate from Exercise 2e and

`math.pi / 4`. Note: `inside` and `R` are defined as in Exercise 2e.

What is the difference between our estimate from 2e and the true value of  $\frac{\pi}{4}$ ?

0.006398163397448253



**0.006398163397448253**

Submit

You have used 1 of 10 attempts

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✓ Correct (1/1 point)