

# hw1\_app\_stat

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2022-03-23

$$y = 2|x| - \pi, x \in [-\frac{\pi}{2}, \frac{\pi}{2}], y \geq -\pi$$

$$y = |\sin(2x)|, x \in [-\frac{\pi}{2}, \frac{\pi}{2}], y \in [0, 1]$$

Range for x and y in total:

$$x \in [-\frac{\pi}{2}, \frac{\pi}{2}], y \in [-\pi, 1]$$

## Generate points

Use uniform distribution to generate points between y and x range separately

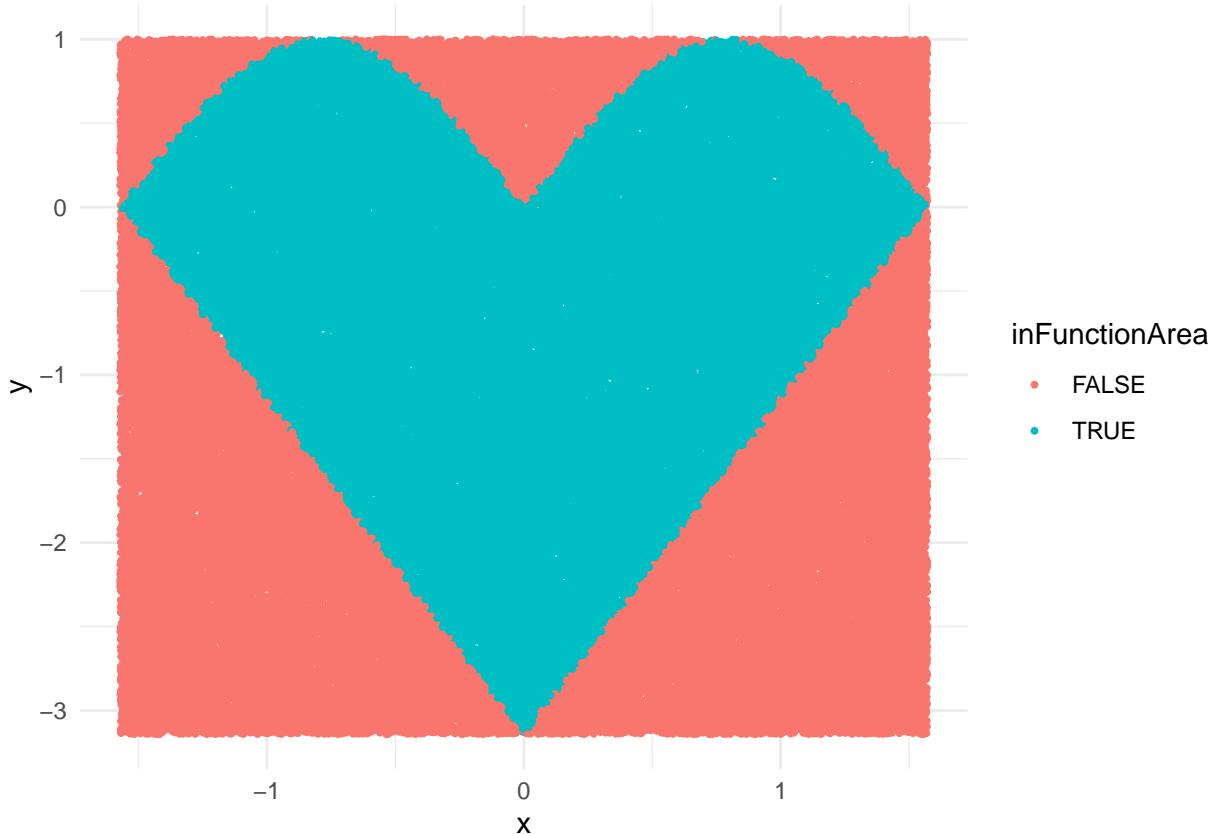
```
numTrials = 100000
x = runif(numTrials, min = -pi/2, max = pi/2)
y = runif(numTrials, min = -pi, max = 1)
points <- data.frame(
  x,
  y)

inFunctionArea <- y >= 2*x-pi & y >= -2*x-pi &
  y <= sqrt(sin(2*x)^2)
```

## Plot of generated points

Blue points are inside area defined by functions Red are not inside this area

```
ggplot(points) +
  geom_point(aes(x = x, y = y, color = inFunctionArea), size = 0.7) +
  theme_minimal()
```



To calculate blue we can use next formula:

$$S_{approx} = \frac{n_{inside} * S_{rectangle}}{n_{total}}$$

where  $S_{rectangle}$  - is area of rectangle (from  $-\pi$  to  $1$  on  $y$  and from  $-\pi/2$  to  $\pi/2$  on  $x$ )

$S_{approx}$  - is approximated blue area

$n_{inside}$  - is count of generated points that is inside blue area

$n_{total}$  - is total count of generated points

This is result

```
ratio <- sum(inFunctionArea) / numTrials
area_rect <- (1 + pi) * (pi/2 + pi/2)
area = ratio * area_rect
area

## [1] 6.936009
```