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Task 2.2

Birthday - 29

***a* = 2**

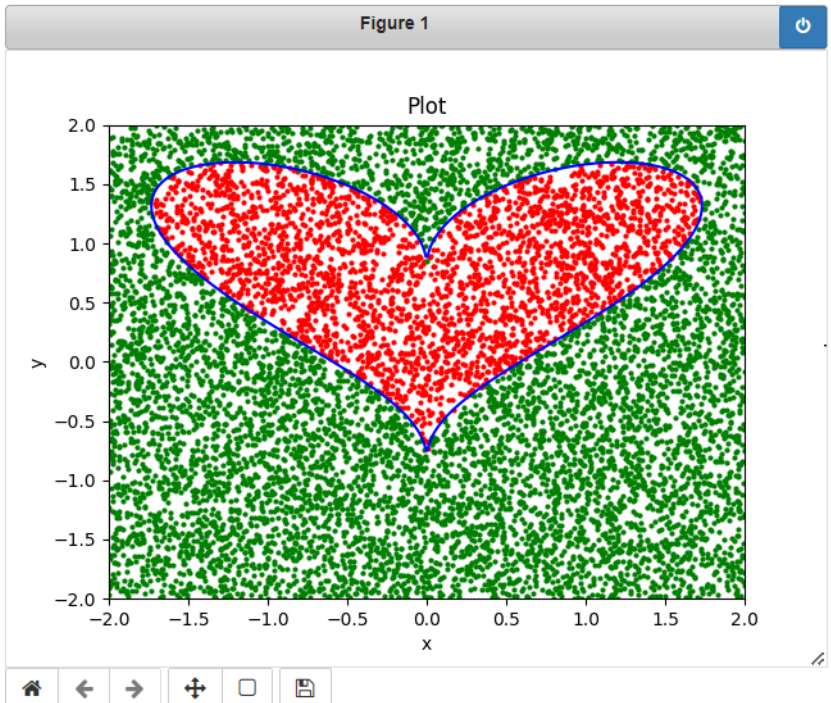
***b* = 9**

$$ax^2 + b\left(y - \sqrt{|x|}\right)^2 = 1$$

In [1]:
```
import matplotlib.pyplot as plt
import numpy as np
%matplotlib notebook
```

In [2]:
```
n = 10000
x = np.linspace(-2, 2, 400)
y = np.linspace(-2, 2, 400)
X, Y = np.meshgrid(x, y)

Z = 2 * X**2 + 9 * (Y - np.sqrt(np.abs(X)))**2 - 1
square = []
for i in range(10):
    x_val = np.random.uniform(-2,2,n)
    y_val = np.random.uniform(-2,2,n)
    points = list(zip(x_val,y_val))
    count = 0
    for x,y in points:

        if 2 * x**2 + 9 * (y - np.sqrt(np.abs(x)))**2 - 1 <= 5:
            count += 1
            if i == 9:
                plt.plot(x,y,marker='o', color='red', markersize=2)
        else:
            if i == 9:
                plt.plot(x,y,marker='o', color='green', markersize=2)
    square.append(count/n * 16)
plt.contour(X, Y, Z, levels=[5], colors='b')
plt.title('Plot')
plt.text(2.5, 0, "The plot shows dots for the last 10 iteration", fontsize=12)
plt.xlabel('x')
plt.ylabel('y')
plt.show()

print(f"Square of heart = {np.mean(square)}")
print(f"Squares per iteration - {square}")
```

```
<IPython.core.display.Javascript object>
```




```
Square of heart = 4.4152000000000005
Squares per iteration - [4.4352, 4.3648, 4.3744, 4.392, 4.3904, 4.4368, 4.4512, 4.3696, 4.496, 4.4416]
```

Task 2.1

My number in 1st group - 3

$$\begin{cases} -\frac{x}{k} \le y \le \frac{x}{k} \\ 2(k+1)x \le x^2 + y^2 \le 4(k+1)x \end{cases}$$

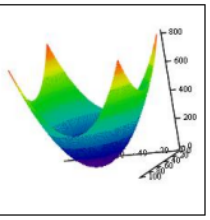
де k - номер студента списку групи.

The graph is located inside the cube : x = [0,16], y = [-8,8] in my case

In [3]:
```
N = 10000
T = 100

squares = []

for _ in range(T):
    count = 0

    for _ in range(N):
        x_value = np.random.uniform(0, 16)
        y_value = np.random.uniform(-8, 8)

        if (-x_value / 3 <= y_value <= x_value / 3) and (8 * x_value <= x_value**2 + y_value**2 <= 16 * x_value):
            count += 1

    square_estimate = count / N * 16 * 16
    squares.append(square_estimate)

print(f"Estimated area of plot: {np.mean(squares)}")
```

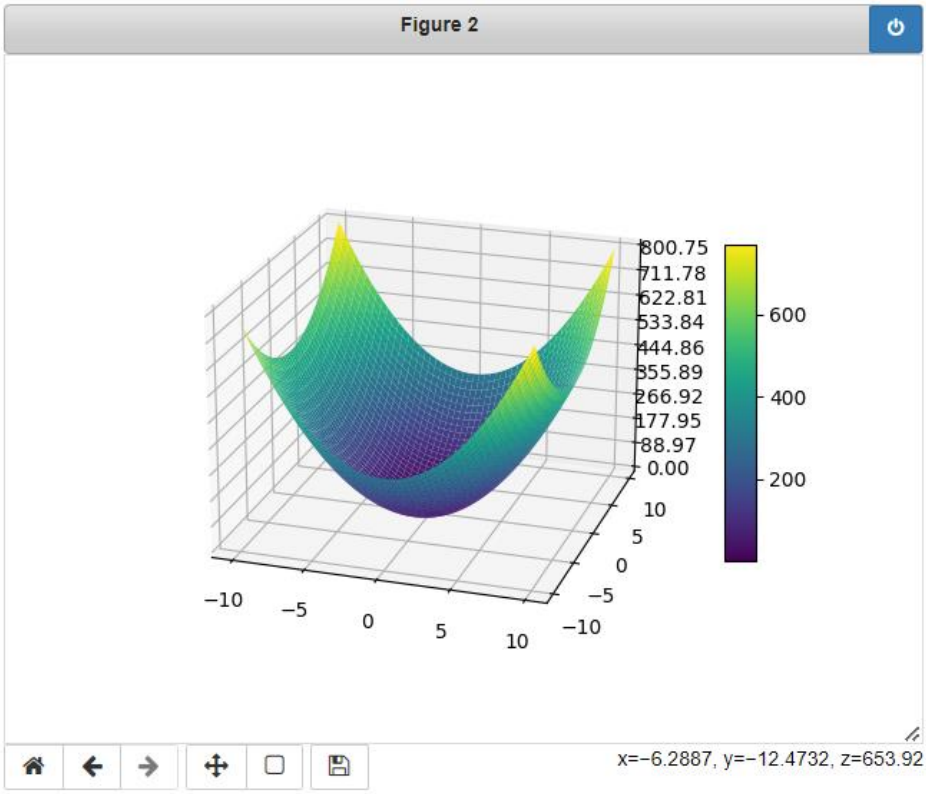
```
Estimated area of plot: 59.627008000000004
```

3 Task

3.	$f(x_1,x_2) = 5x_1^2 + 3x_2^2 - \cos\left(\frac{x_1}{2}\right)\cos\left(\frac{x_2}{\sqrt{3}}\right) + 1,$ $x_i \in [-10,10]$	

In [4]:
```
from matplotlib import cm
from matplotlib.ticker import LinearLocator


fig = plt.figure()
ax = fig.add_subplot(111, projection='3d')

# Make data.
X = np.linspace(-10, 10, 1000)
Y = np.linspace(-10, 10, 1000)
X, Y = np.meshgrid(X, Y)

Z = 5*X*X + 3*Y*Y - np.cos(X/2)*np.cos(Y/(np.sqrt(3))) + 1



surf = ax.plot_surface(X, Y, Z, cmap=cm.viridis, linewidth=0)


ax.zaxis.set_major_locator(LinearLocator(10))
ax.zaxis.set_major_formatter('{x:.02f}')


fig.colorbar(surf, shrink=0.6, aspect=10)

plt.show()
print(f"Function minimum  = {np.min(Z)}")
print(f"Function maximum  = {np.max(Z)}")
```

```
<IPython.core.display.Javascript object>
```




```
Function minimum  = 0.0008308272090252755
Function maximum  = 800.7523914474617
```