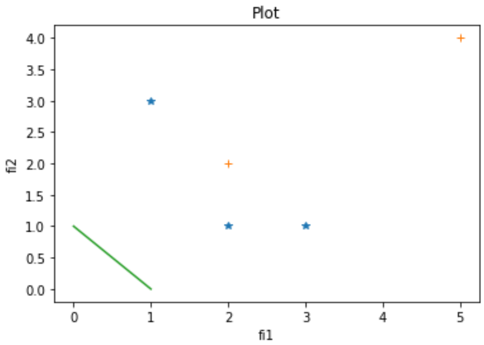
```python
import numpy as np
import matplotlib.pyplot as plt

fi01 = np.array([1., 2., 3.])
fi02 = np.array([3., 1., 1.])

fi11 = np.array([2., 5.])
fi12 = np.array([2., 4.])

x1 = np.array([1., 2., 2., 3., 5.])
x2 = np.array([3., 2., 1., 1., 4.])

xt = np.linspace(0, 1, 2)

print("1a)")

plt.plot(fi01, fi02, '*')
plt.plot(fi11, fi12, '+')
plt.plot(-xt+1.)
plt.title("Plot")
plt.xlabel("fi1")
plt.ylabel("fi2")
plt.show()

print("No it's not linearly separable, because it's not possible to isolate the two patterns with a single line.")
print("It doesn't classify the points properly since all of them would be classified as class 1 (a = 1).")
```

```
1a)
```




```
No it's not linearly separable, because it's not possible to isolate the two patterns with a single line.
It doesn't classify the points properly since all of them would be classified as class 1 (a = 1).
```

1b) $\beta \leftarrow \beta - \alpha \nabla L(D)$

$\beta_i = [0,0,0]$

$$\beta = \underset{0}{\beta_i} - \underset{1}{\alpha} \nabla L(D) \Leftrightarrow \beta = -\nabla L(D)$$

$$\nabla L(D)_{\beta_0} = \sum_{m=1}^{N} \Big(\overbrace{\pi(1|x_m)}^{=\frac{1}{2}} - a_m\Big)$$

$$\pi(1|x_m) = \frac{1}{1 + e^{-\underbrace{(\omega^T \Phi(x) - \omega_0)}_{0}}} = \frac{1}{2}$$

$$\nabla L(D)_{\beta_0} = \left(\tfrac{1}{2}-0\right) + \left(\tfrac{1}{2}-1\right) + \left(\tfrac{1}{2}-0\right) + \left(\tfrac{1}{2}-0\right) + \left(\tfrac{1}{2}-1\right) = \frac{0,5}{5}$$

$$= 0,1$$

$$\nabla L(D)_{\beta_1} = \left(\tfrac{1}{2}-0\right).1 + \left(\tfrac{1}{2}-1\right).2 + \left(\tfrac{1}{2}-0\right).2 + \left(\tfrac{1}{2}-0\right).3 + \left(\tfrac{1}{2}-1\right).5 =$$

$$= \frac{-0,5}{5} = -0,1$$

$$\nabla L(D)_{\beta_2} = -0,1$$

$$\boxed{\beta = [0,1; -0,1; -0,1]}$$

1c) $y = mx + b$

$b = \omega_0$

$m = [\omega_1, \omega_2]^T$

$$y = \omega_1 \Phi_1 + \omega_2 \Phi_2 + \omega_0$$

$$\Rightarrow 0 = \omega_1 \Phi_1 + \omega_2 \Phi_2 + \omega_0$$

$$0,1 + 0,1\,\Phi_1(x) + 0,1\,\Phi_2(x) = 0$$

$$\Leftrightarrow -\Phi_1(x) + 1 = \Phi_2(x)$$

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