Q1) Would you expect the following pairs of random variables to be uncorrelated, positively correlated, or negatively correlated?

(a) The weight of a new car and its price.

(b) The weight of a car and the number of seats in it.

(c) The age in years of a second-hand car and its current market value.

Solution:

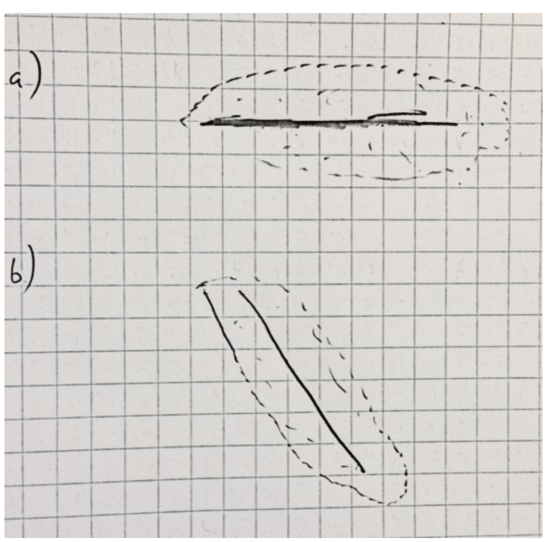
a) The weight of a new car and its price. (**Uncorrelated**).
b) The weight of a car and the number of seats in it. (**positively correlated).**
c) The age in years of a second-hand car and its current market value. (**negatively correlated)**

Q2) Roughly sketch the shapes of the following Gaussians N (μ; Σ). For each, you only need to show a representative contour line which is qualitatively accurate (has approximately the right orientation, for instance).

a) $\mu = \begin{pmatrix} 0 \\ 0 \end{pmatrix}$ and $\Sigma = \begin{pmatrix} 9 & 0 \\ 0 & 1 \end{pmatrix}$

b) $\mu = \begin{pmatrix} 0 \\ 0 \end{pmatrix}$ and $\Sigma = \begin{pmatrix} 1 & -0.75 \\ -0.75 & 1 \end{pmatrix}$

Solution:



Q3) Consider the linear classifier $\omega . x \geq \theta$, where

$$\omega = \binom{-3}{4} \; and \; \theta = 12$$

Sketch the decision boundary in $\mathbb{R}^2$. Make sure to label precisely where the boundary intersects the coordinate axes, and also indicate which side of the boundary is the positive side.

<u>Solution:</u>

<u>Python code:</u>

```
x = np.linspace(-10, 4, 10, endpoint=True)
y = (3 * x + 12) / 4

fig = plt.figure()
ax = fig.add_subplot(111)
ax.plot(x, y)

ax.spines['right'].set_color('none')
ax.spines['top'].set_color('none')
ax.xaxis.set_ticks_position('bottom')
ax.spines['bottom'].set_position(('data',0))
ax.yaxis.set_ticks_position('left')

plt.annotate(r'positive',
         xy=(-6, 2), xycoords='data',
         xytext=(+50, +30), textcoords='offset points', fontsize=20)

plt.show()
```