Supervised Learning Exercise

You start a new job in a car dealership and have access to a database with data about cars that other employees have bought in order to resell. You want to make decisions that match this training data:

Car Age (years)	Kilometres Driven (km)	Bought?
8	20000	Yes
16	160000	No
3.2	120000	Yes
20	60000	No
14	100000	No
10	80000	Yes

You want to use a linear classifier, so that you can make decisions on the cars that people might want to sell to the dealership

1. Plot out the data.
2. Use the perceptron learning algorithm to find a linear classifier, i.e. find the weight vector and the intercept term.
3. Identify the support vectors in your plot of the data.
4. Use a SVM in order to find a linear classifier.
   (Hint: There are multiple ways to solve this problem. You can solve the primal or dual problem. Also remember that the decision boundary depends only on the support points you have identified and at those points $y^{(i)}\left(\mathbf{w}^t\mathbf{x}^{(i)} + b\right) = 1$. Therefore, the primal problem is a quadratic problem subject to equality constraints (just the support vectors) and we saw how to solve this in the convex optimisation lecture (slide 39)).
5. Plot the decision boundary for the SVM and compare it to the boundary you found using PLA

You have just found out that a colleague refused to buy a car that was 10 years old and had driven 140000km.

6. What are the support vectors now and how many are there?
7. Repeat the process of finding a decision boundary using a SVM