Problem 1: The demand for yak butter is $q = 120 - 4p$ and the supply is $q = 2p - 30$, where p is the price measured in dollars per hundred pounds and q is the quantity measured in hundred pound units.

(a) On one graph, draw the demand curve and the supply curve for yak butter.

(b) Write down the equation that you would solve to find the equilibrium price.

(c) What is the equilibrium price of yak butter? What is the equilibrium quantity? Show the equilibrium price and quantity on the graph and label them p_1 and q_1.

(d) A terrible drought strikes the central Ohio steppes, traditional homeland of the yaks. The supply schedule shifts to $2p - 60$. The demand schedule remains as before. Draw the new supply schedule. Write down the equation that you would solve to find the new equilibrium price of yak butter.

(e) What is the new equilibrium price of yak butter? What is the new equilibrium quantity? Show the equilibrium price and quantity on the graph and label them p_2 and q_2.

Problem 2: Consider the following curves.

Supply: $P = 4Q$

Demand: $P = 150 - Q$

(a) Give a definition of a competitive equilibrium.

(b) Calculate competitive equilibrium.

(c) Calculate producer surplus, consumer surplus and total surplus.

(d) Suppose now there is no price floor, but the government impose taxes \$5 per unit sold. Calculate consumer surplus, producer surplus, government revenue, total surplus and deadweight loss.

(e) Illustrate the situation in (d) graphically. Does it matter whether the tax is imposed on the producers or the consumers? Explain.

Problem 3: Consider the following story from the Second World War. There are two prisoners of war in a German camp: British (consumer A) and French (consumer B). Both of them have a right to get some weekly amount of tea (good 1) and coffee (good 2). British prisoner has the endowment $\omega_A = (1, 4)$ and French prisoner, being privileged, has the endowment $\omega_B = (5, 4)$. The two prisoners are totally separated and the direct exchange is not possible, but they succeeded to persuade a German prisoners' priest to transfer coffee and tee between them. The prisoners' preferences are given by the following utility functions:

$$u^A(x_1^A, x_2^A) = 2 \ln x_1^A + x_2^A$$
$$u^B(x_1^B, x_2^B) = 4 \ln x_1^B + x_2^B$$

where x_1^i is the amount of good 1 consumer i consumes and x_2^i the amount of good 2. Suppose that the price of good 1 is p_1 and the price of good 2 is p_2.

(a) Sketch the corresponding Edgeworth box. In the Edgeworth box draw several indifference curves of both agents and mark their initial endowment. Find Pareto efficient (Pareto optimal) allocations.

(b) Find the market demand functions x_1^A, x_1^B.

(c) Find the competitive equilibrium (prices and allocations) for this prisoners' economy.