1. Suppose the short-run production function (capital, $K$, is fixed) is $f(L|K) = 10L^{0.5}$. Capital costs $10$.

(a) Find the short-run cost function as a function of $y$ and the wage of labor, $w$.

(b) If the price is $p = 20$ and labor costs $5$, how much will be produced? How much labor will be hired?

(c) How low would the price have to be for the firm to shut down?

(d) How high would the wage have to be for the firm to shut down?

2. Suppose there are two oil-producing regions in the world, and in each one there are perfectly competitive producers. The factor price for extraction equipment is $w$, and the long-run average costs of one of these firms are

$$AC(y) = \sqrt{w(1 + y^2)}$$

There are 20 firms in the Middle East, and for them extraction equipment costs 400. There are 10 firms in Alberta who must pay 900 for extraction equipment.

(a) Suppose the world needs an amount of oil equal to $\hat{y}$. What value of $\hat{y}$ would result in a price of oil of $25$?

(b) What value of $\hat{y}$ would result in a price of oil of $32$?

(c) What is the market supply curve for oil?

3. Suppose the daily demand curve for flounder at Cape May is given by

$$X(p) = 1600 - 600p$$

Suppose the supply of flounder is 1000 pounds, no matter what the price.

(a) What is the equilibrium price? The equilibrium quantity?

(b) Suppose the demand rises to $X'(p) = 2200 - 600p$. What is the equilibrium price? The equilibrium quantity?

(c) Suppose demand is back to $X(p) = 1600 - 600p$ but now supply becomes variable with $S(p) = 800 + 200p$. What is the equilibrium price? The equilibrium quantity?

(d) Again, suppose the demand rises to $X'(p) = 2200 - 600p$ but now with the new supply curve from part (c). What is the equilibrium price? The equilibrium quantity?

(e) The change from (a) to (b) is different from the change from (c) to (d). Explain the difference with reference to the elasticity of supply.
4. Let demand be $X(p) = Ap^\epsilon$. Let supply be $S(p + g) = d(1 + g)p$, where $g$ represents a government subsidy to producers. (I.e. the total amount the government pays out is $gpX(p)$.)

(a) What is the equilibrium price and quantity?
(b) What is the government payout in equilibrium?
(c) Using derivatives, show the change in the equilibrium government payout for a change in $g$. Show that it is always positive for all $\epsilon < 0$ and $g > 0$. 