The world supply of crude oil is described by the following formula:

\[ P = 30.0 + 0.5Q, \]

where \( Q \) is the quantity supplied, measured in units of millions of barrels per day (bbl./d.), and \( P \) is the price, in units of dollars per barrel ($/bbl.). (Notice that I have given you the supply formula in "inverse form," with supply price as a function of quantity supplied rather than the other way around.) The short-run and long-run demands for crude oil are given by the following formulas (again, in inverse form):

Short-run demand: \[ P = 210.0 - 1.5Q \]

Long-run demand: \[ P = 120.0 - 0.5Q \]

\( a. \) Construct a table giving the supply prices and the short-run and long-run demand prices for quantities \( Q = 0, 10, 20, 30, \ldots, 100, 110, 120 \) million bbl./d. (Rows of the table should correspond to quantities 0, 10, 20, etc. Three separate columns will give the corresponding supply, short-run demand, and long-run demand prices.) Carefully graph the supply curve, and the short- and long-run demand curves over this range of quantities.

\( b. \) Solve algebraically for the short-run equilibrium price and quantity in the world market for crude oil. Verify that this is also a long-run equilibrium. Identify the equilibrium point in your graph.

\( c. \) Now suppose that terrorist attacks in Saudi Arabia disrupt oil production and lead to a decrease (or leftward shift) in supply, with the new world supply relation described by

\[ P = 50.0 + 0.5Q. \]

Add a column to the table you did for part \( a \) listing the new supply prices for quantities \( Q = 0, 10, 20, 30, \ldots, 100, 110, 120 \) million bbl./d. Graph the new supply curve.

(continued on back)
d. Immediately following the supply shift, the new equilibrium will occur where the new supply curve intersects short-run demand. Solve algebraically for the new short-run equilibrium price and quantity and identify the equilibrium point in your graph.

e. Suppose that the disruption of Saudi crude oil supplies lasts for an extended period, so the new supply curve for oil remains in effect for at least a few years. After sufficient time has passed to allow the world's oil consumers to fully adjust to the change in market conditions, a new long-run equilibrium will be reached at the intersection of the new supply curve and the long-run demand curve. Solve algebraically for the new long-run equilibrium price and quantity and identify the equilibrium point in your graph. Is the price response to the supply shift greater in the short-run or the long-run? Is the quantity response to the supply shift greater in the short-run or the long-run?

f. What was the value of total sales revenue in the world oil market (in millions of $/day) before the supply shift? What is the value of total sales revenue in the new short-run equilibrium? . . . in the new long-run equilibrium?

g. Calculate the elasticity of short-run demand between the original equilibrium and the new short-run equilibrium. Calculate the elasticity of long-run demand between the original equilibrium and the new long-run equilibrium. (Use the "mid-point method" in both calculations.) Relate the results from your elasticity calculations to the changes in total revenue calculated in part f.