

# Supply and Demand

## **Preliminary Mathematical Note:**

The equation of the line that most of you are familiar with is given by:

$$y = mx + c$$

We can find the slope of the line when given two sets of points:

$$m = \frac{\Delta y}{\Delta x} = \frac{y_1 - y_0}{x_1 - x_0}$$

The intercept can be recovered by using the fact that:

$$c = y - mx$$

## **Practice Problems**

- For each of the following demand or supply functions, state what will happen to quantity demanded/supplied if price increase from  $p = 3$  to  $p = 5$ . Moreover, state what will happen to quantity demanded/supplied if price increase by £4.
  - $2Q_d = 50 - 2p$
  - $3Q_s = 3 + 9p$
- Given the quantity demanded and quantity supplied functions, find the equilibrium price and quantity:
  - $Q_s = -5 + 3p$  and  $Q_d = 10 - 2p$
  - $Q_s = -20 + 3p$  and  $Q_d = 220 - 5p$
  - $Q_s = -45 + 8p$  and  $Q_d = 125 - 2p$
  - $Q_s = -32 + 7p$  and  $Q_d = 128 - 9p$
  - $Q_s = -27 + 13p$  and  $Q_d = 24 - 4p$
- Supply and demand functions may also be quadratic. Find the equilibrium price and quantity when  $p + Q_d^2 + 3Q_d = 20$  and  $p - 3Q_s^2 + 10Q_s = 5$
- Suppose that the demand and supply functions are linear. Suppose that when  $p = 4$ , quantity demanded is  $Q_d = 31$ , and when  $p = 8$ , quantity demanded is  $Q_d = 11$ . Suppose further that when  $p = 8$ , quantity supplied is  $Q_s = 3$ , and when  $p = 12$ , quantity supplied is  $Q_s = 15$ .
  - Find the equation for quantity demanded.
  - Find the equation for quantity supplied.
  - Find the equilibrium price and quantity.
- Suppose that  $Q_s = -5 + 2p$  and  $Q_d = 10 - p$ . Find the equilibrium price and quantity. Suppose now that the government imposes a price ceiling of £2 below the equilibrium. What

is the quantity demanded and quantity supplied at this new price. What is the size of the shortage/surplus? Suppose instead that the government imposed a minimum price that is £1 above the original equilibrium. What is quantity demanded and quantity supplied? How large is the shortage/surplus?

6. For the following demand and supply equations (taken from Q2 above) work out the effect of a specific tax of £3 per unit levied on producers:
  - a.  $Q_s = -5 + 3p$  and  $Q_d = 10 - 2p$
  - b.  $Q_s = -20 + 3p$  and  $Q_d = 220 - 5p$
  - c.  $Q_s = -45 + 8p$  and  $Q_d = 125 - 2p$
  
7. (**Challenge**) Suppose that  $Q_d = 34 - p$  and  $p = 1 + Q_s$ . Find the equilibrium price and quantity. Suppose that a specific tax of £1 per unit is levied on producers.
  - a. What will be the new equilibrium price and quantity?
  - b. How much tax revenue will be collected by the government in this new equilibrium?
  - c. Let's define the consumer burden of the tax as  $P_{new} - P_{old}$ , and the producer burden of the tax as  $\tau - (P_{new} - P_{old})$ . Who has the bigger tax burden?
  - d. Suppose that the quantity demanded equation changes to  $Q_d = 17 - \frac{1}{2}p$ . Work out original equilibrium, the post-tax equilibrium, the tax revenue, and the consumer and producer tax burdens.
  - e. Comment on how the tax burdens have changed. Why do you think this has happened?