Supply and Demand Examples

1) Sales figures show that your company sold 1960 pen sets each week when they were priced at \$1/pen set, and 1800 pen sets each week when they were priced at \$5/pen set. What is the linear demand function for your pen sets?

   Solution: Recall that a linear demand function has the form $q = mp + b$. We need to find m and b. We are given two values for p and two values for q. This gives two points in the form (p, q), where $(p_1, q_1) = (1, 1960)$ and $(p_2, q_2) = (5, 1800)$. We can find the slope m using the formula

   $$m = \frac{q_2 - q_1}{p_2 - p_1} = \frac{1800 - 1960}{5 - 1} = -40$$

   Now we have $q = -40p + b$. We can use this to find b (the q-intercept), by choosing one of the given points, plugging in the values for p and q, and solving for b:

   $$1960 = -40(1) + b$$

   Solving gives $b = 2000$. Thus, the linear demand equation is

   $$q = -40p + 2000$$

   Note that the slope $m = -40$ can be written as $m = \frac{-40}{1}$, which is the change in q over the change in p. This can be interpreted to mean that for every \$1 increase in the price of a pen set, we can expect that sales will decrease by 40.

2) The following table shows worldwide sales of Nokia cell phones and their average wholesale prices in 2004.

Quarter	*Second*	*Fourth*
Wholesale Price ($)	111	105
Sales (millions)	45.4	51.4

a) Use the data to obtain a linear demand function for (Nokia) cell phones, and use your demand equation to predict sales if Nokia lowered the price further to $103.

b) Fill in the blanks: For every ______ increase in price, sales of cell phones decrease by ______ units.

Solution for (a): Here the quantity q is the number of sales. We want to find a linear demand function, which has the form $q = mp + b$. We can find m by finding the slope of the line between the points $(p_1, q_1) = (111, 45.4)$ and $(p_2, q_2) = (105, 51.4)$:

$$m = \frac{51.4 - 45.4}{105 - 111} = -1$$

This means that $q = -p + b$. We can now use one of the points to find b:

$$45.4 = -111 + b$$

This gives $b = 156.4$, so the linear demand equation is

$$q = -p + 156.4$$

We can now use this equation to predict what the sales would be if the price were lowered to $103, by plugging in $p = 103$ into the demand equation:

$$q = -103 + 156.4 = 53.4$$

Taking units into account from the table, this means that if the price were lowered to $103, we could expect sales of about 53.4 million phones. This is of course consistent with the Law of Demand which states that lower prices lead to higher demand.

Solution for (b): The slope can be written as $m = \frac{-1}{1}$, which is the change in q over the change is p. Considering that sales are given in millions on the table, this can be interpreted to mean that for each increase of $1 in the price of a phone, we can expect sales to decrease by 1 million phones.

3) You can sell 90 pet chias per week if they are marked at \$1 each, but only 30 each week if they are marked at \$2 per chia. Your chia supplier is prepared to sell you 20 chias each week if they are marked at \$1/chia, and 100 each week if they are marked at \$2 per chia.

   a) Write down the associated linear demand and supply functions.

   b) At what price should the chias be marked so that there is neither a surplus nor a shortage of chias?

Solution for (a): We need to find both the supply and demand equations. Both have the same form, $q = mp + b$, but the slope on the demand equation is negative while the slope on the supply equation is positive. To find the demand equation, we use the two price/quantity pairs $(1, 90)$ and $(2, 30)$. We can find m using the usual equation:

$$m = \frac{q_2 - q_1}{p_2 - p_1} = \frac{30 - 90}{2 - 1} = -60$$

This means $q = -60p + b$. We can find b by choosing one of the two price/quantity pairs, plugging them into the demand equation, and solving for b:

$$90 = -60(1) + b$$

Solving gives $b = 150$. Thus the demand equation is $q = -60p + 150$.

We can find the supply equation in the same way – first finding the slope and then the q-intercept. Here we use the price quantity pairs $(1, 20)$ and $(2, 100)$. We find m in the usual way:

$$m = \frac{q_2 - q_1}{p_2 - p_1} = \frac{100 - 20}{2 - 1} = 80$$

This means $q = 80p + b$. We can find b by choosing one of the two price/quantity pairs for supply, plugging them into the supply equation, and solving for b:

$$20 = 80(1) + b$$

Solving gives $b = -60$. Thus the supply equation is $q = 80p - 60$.

Solution for (b): To find the equilibrium price, we set supply equal to demand and then solve for p:

$$-60p + 150 = 80p - 60$$

Solving for p gives $p = 1.5$. Thus the equilibrium price is \$1.50 per chia. If they are sold for this price, there will be neither a surplus nor a shortage.