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Application of straight line to Business and Economics

Solving Models with Graphs

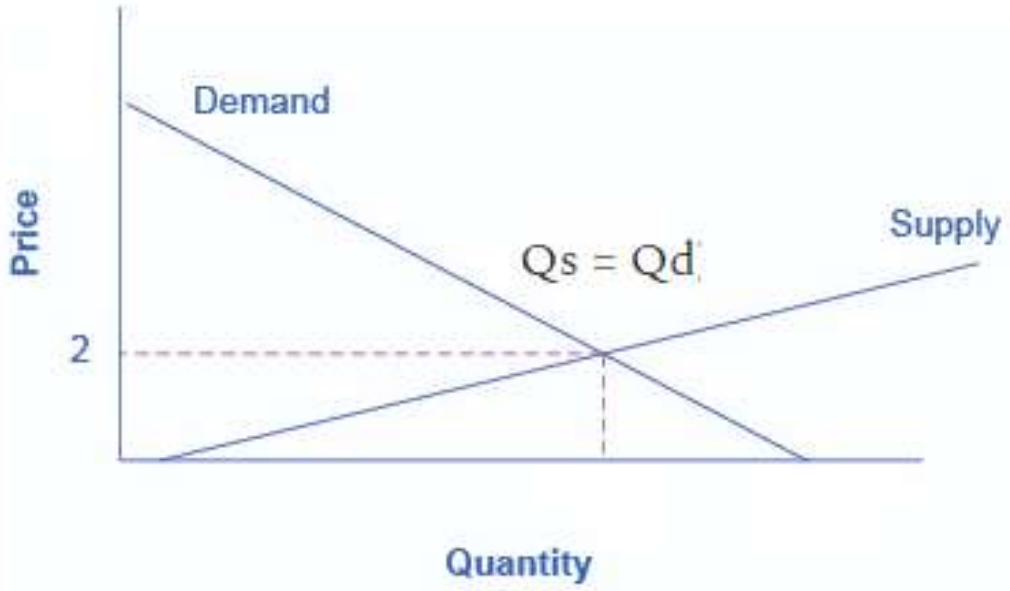

Figure. Supply and Demand Graph. The equations for Qd and Qs are displayed graphically by the sloped lines.

Demand curve:

Example 1

Let us assume that the demand curve is described by the following line $q = mp + b$. Find its equation given the following information: a promoter discovers that the demand for theater tickets is 1200 when the price is \$60, but decreases to 900 when the price is raised to \$75.

Solution :

The form of the equation $q = mp + b$ indicates that the price p, is the independent variable (like x), and the quantity q, is the dependent variable (like y). The problem allows us to deduce two points of the demand line: the points (60\$, 1200) and (75\$, 900). We must identify the slope and the y –intercept of the line.

Slope :

$$m = \frac{\Delta q}{\Delta p} = \frac{q_2 - q_1}{p_2 - p_1} = \frac{900 - 1200}{75 - 60} = \frac{-300}{15} = -20$$

The equation must therefore take on the following form: $q = -20p + b$. It is necessary to find the y -intercept using one of the two points.

y-intercept :

since $(60\$, 1200)$ is a point on the demand curve, it must satisfy the following equation : $q = -20p + b$. By substitution, we obtain

$$1200 = -20(60) + b$$

$$1200 = -1200 + b$$

$$b = 2400$$

As a result, since $m = -20$ and $b = 2400$, the equation of the demand line is

$$q = -20p + 2400$$

It is interesting to note that once this line is found, we can evaluate what the demand is whatever the price. For example, the demand when the price is at \$40 would be obtained by calculating the variable $\boldsymbol{q}$:

$$q = -20(40) + 2400$$

$$q = -800 + 2400$$

$$q = 1600$$

We could also obtain the price needed for a demand of 1000 tickets.

$$1000 = -20\,p + 2400$$

$$20\,p = 2400 - 1000$$

$$20\,p = 1400$$

$$p = 70\,\$$$

Example 2

The equilibrium quantity and the equilibrium price of a product are determined by the point where the supply and demand curves intersect. For a given product, the supply is determined by the line

$$q_{supply} = 30p - 45$$

and for the same product, the demand is determined by the line

$$q_{demand} = -15p + 855.$$

Determine the price and the equilibrium quantity and trace the supply and demand curves on the same graph.

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Solution :

We must determine the coordinates of point (q,p), situated at the intersection of the two lines. This point must therefore satisfy both the supply and the demand equations. The solution to this problem is to solve :

$$\begin{aligned} q &= 30p - 45 \\ q &= -15p + 855 \end{aligned}$$

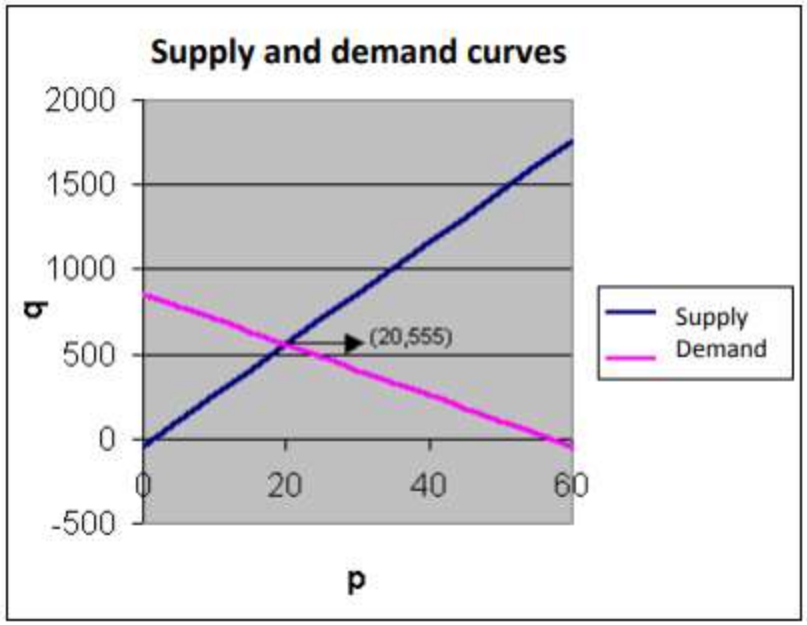
Thus,

$$\begin{aligned} 30p - 45 &= -15p + 855 \\ 45\,p &= 900 \\ p &= 20 \end{aligned}$$

and

$$q = 30(20) - 45 = 555$$

The equilibrium price and quantity are therefore \$20 and 555.



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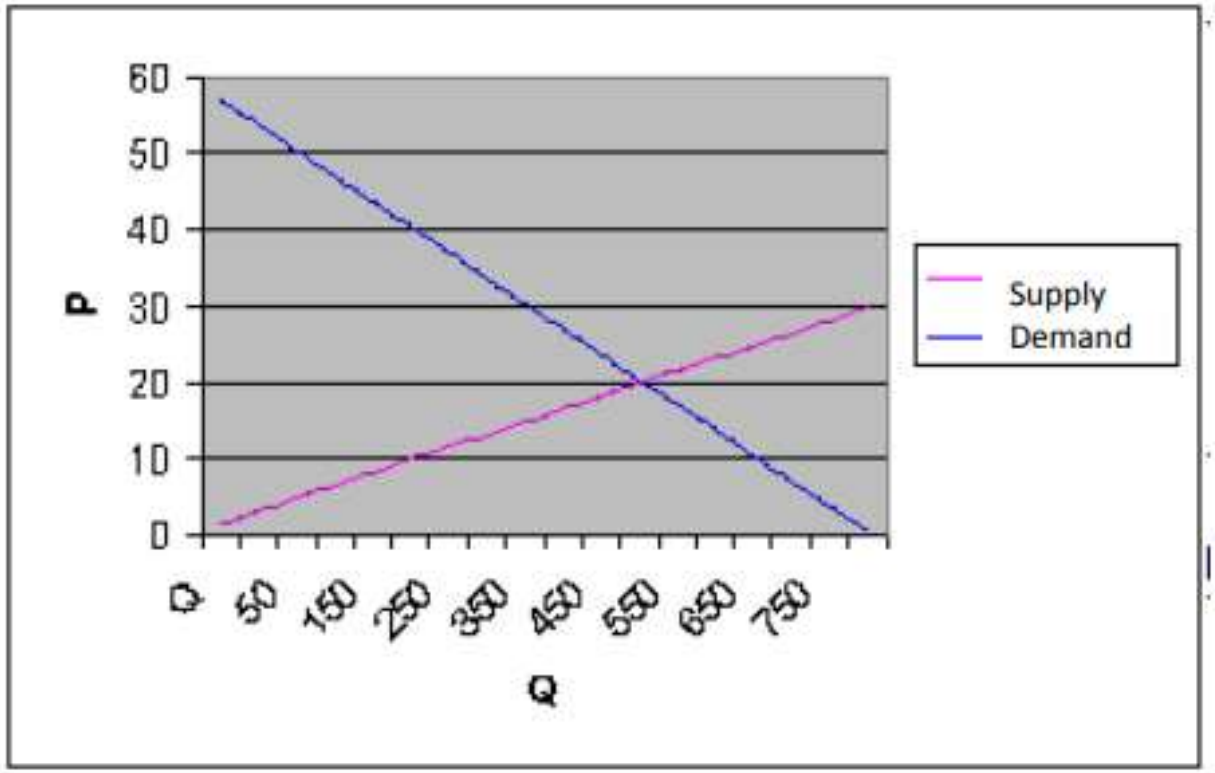


Problem 1 :

*A company produces shoes. When 30 shoes are produced, the total cost of production is $325. When 50 shoes are produced, the costs increase to $485. What is the cost equation (**C**) if it varies linearly in function to the number of shoes produced (**q**) ?*

Problem 2 :

Consider a market characterised by the following supply and demand curves :

$$q_{demand} = -10p + 1000$$
$$q_{supply} = 0{,}2p + 298{,}6$$

Find the equilibrium price and quantity.

Problem 3 :

Find the demand function if the price-elasticity is -0.2 and the equilibrium price and quantity are $100 and 2500 units, respectively. Supposing that the quantity depends linearly on the price.

Straight line (linear) demand curve

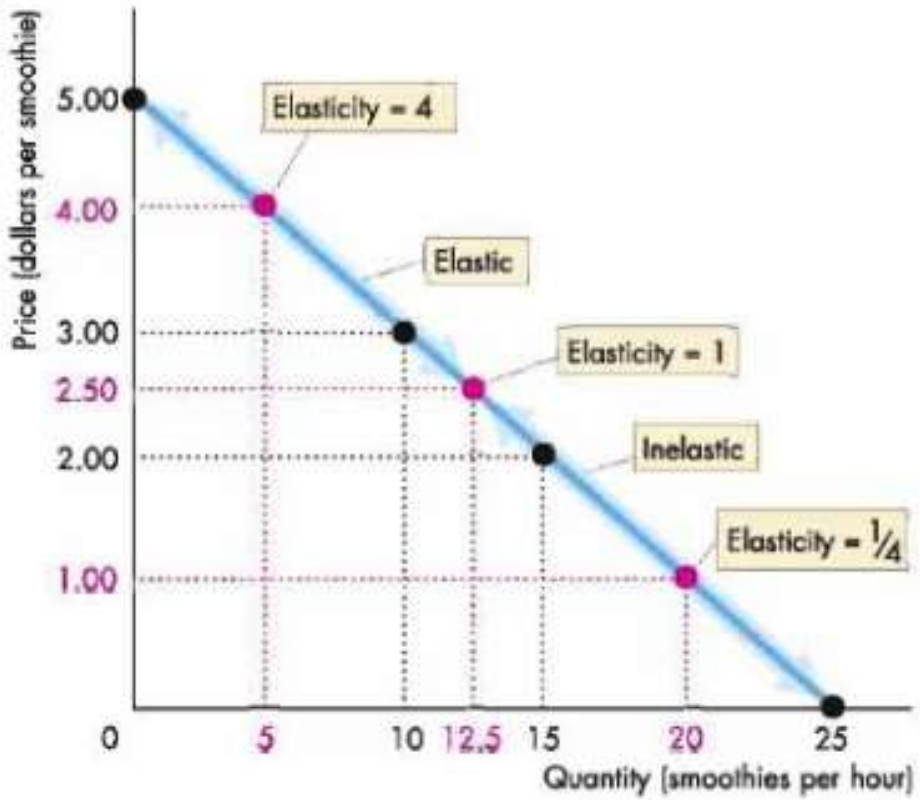
A straight line demand curve will have a different elasticity at each point on it.

The price elasticity of demand can also be measured at any point on the demand curve.

If the demand curve is linear (straight line), it has a unitary elasticity at the midpoint. The total revenue is maximum at this point. Any point above the midpoint has elasticity greater than 1, (Ed > 1).

Here, price reduction leads to an increase in the total revenue (expenditure). Below the midpoint elasticity is less than 1. (Ed < 1). Price reduction leads to reduction in the total revenue of the firm. Now the question arises, why does a straight line demand curve have different elasticity at each point? The value of PED falls as price falls.

The reason is that low priced products have a more inelastic demand than high priced products, because consumers are not that price sensitive when the product is inexpensive, Similarly the value of PED is higher when the prices increase because consumers are more sensitive to price change when the good is expensive. A mathematical explanation can be given as follows. As we seen in diagram below



On a linear demand curve, elasticity decreases as the price falls and the quantity demanded increases. Demand is unit elastic at the midpoint of the demand curve (elasticity is 1). At prices above the midpoint, demand is elastic; at prices below the midpoint, demand is inelastic.

What the Slope Means

The concept of slope is very useful in economics, because it measures the relationship between two variables. A **positive slope** means that two variables are positively related—that is, when *x* increases, so does *y*, and when *x* decreases, *y* decreases also. Graphically, a positive slope means that as a line on the line graph moves from left to right, the line rises. We will learn in other sections that "price" and "quantity supplied" have a positive relationship; that is, firms will supply more when the price is higher.

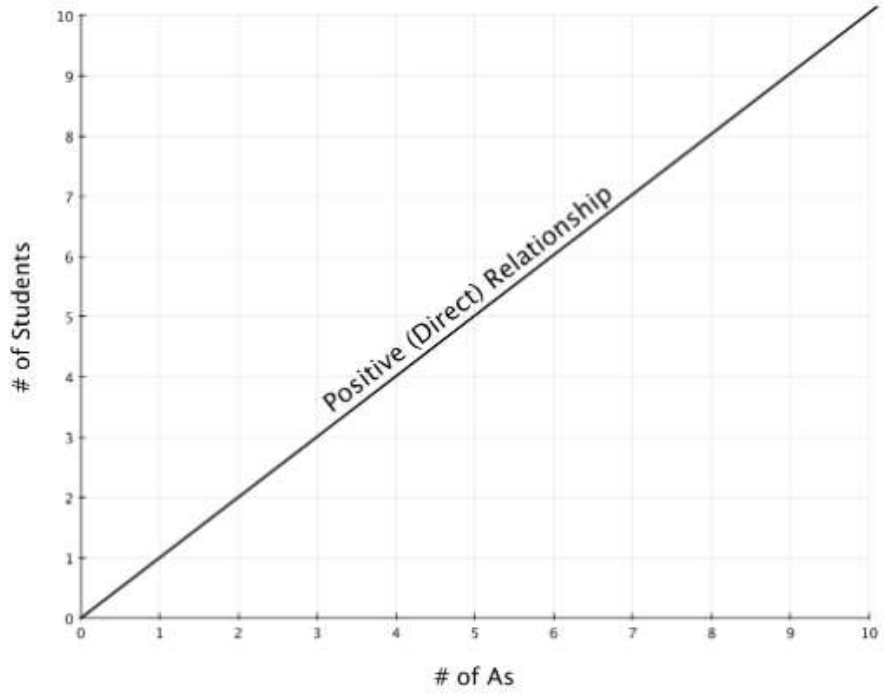


Figure 1. Positive Slope

A **negative slope** means that two variables are negatively related; that is, when *x* increases, *y* decreases, and when *x* decreases, *y* increases. Graphically, a negative slope means that as the line on the line graph moves from left to right, the line falls. We will learn that "price" and "quantity demanded" have a negative relationship; that is, consumers will purchase less when the price is higher.

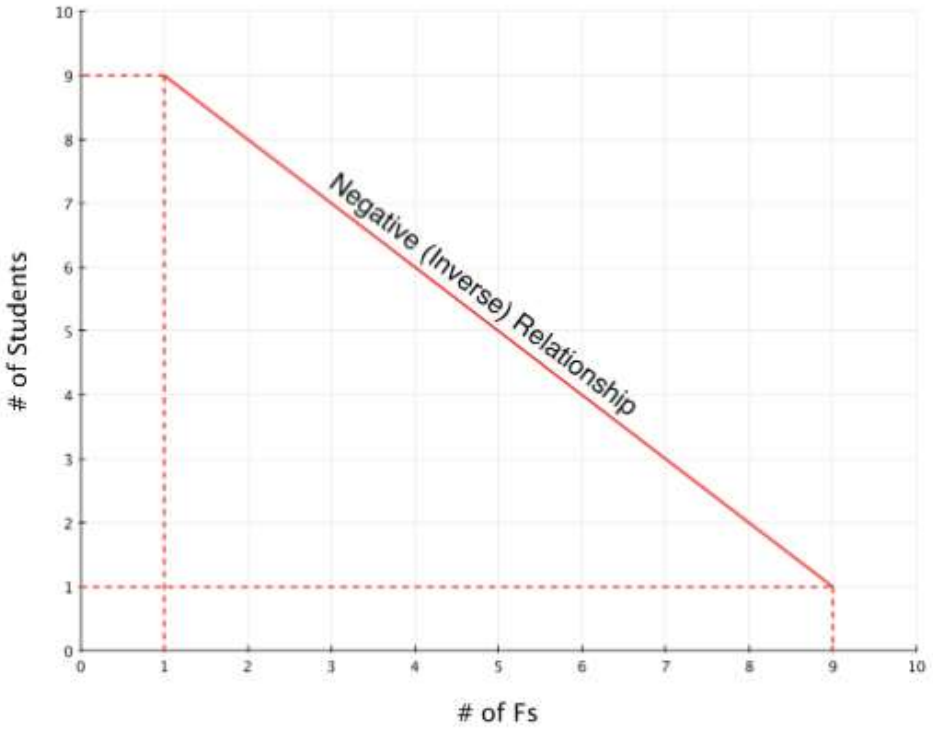


Figure 2. Negative slope

A **slope of zero** means that there is a constant relationship between *x* and *y*. Graphically, the line is flat; the rise over run is zero.

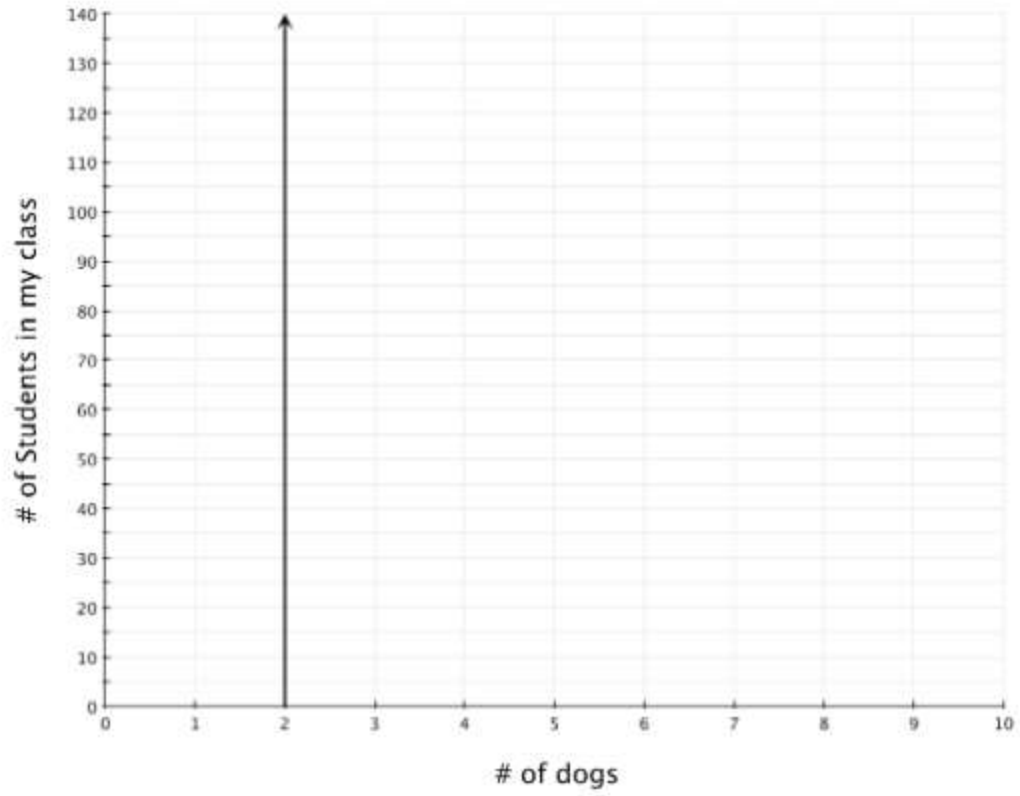


Figure 3. Slope of Zero