**Cost

The total cost of producing a good will normally consist of:

(i) Fixed costs, FC: costs that are fixed irrespective of the level of output, e.g. rent on premises.
(ii) Variable costs, VC: costs, which vary with the level of output, e.g. each extra unit of a good, produced will require additional units of raw materials, and labour.

Total cost, TC, is therefore the sum of fixed costs and variable costs:

$$TC = \mathbf{FC + VC}$$

Remark :- suppose that, T.C=20+4Q , where FC = 20 (the vertical intercept), and VC = 4Q , where 4 = slope of the line.

Ex:- A firm has fixed production costs of £10 and variable production costs of £2 per unit produced.

(a) Write down the equation of the total cost function.

(b) Graph the total cost function.

Sol :-

(a) FC = £10; while VC = £2Q, since to produce

1 unit VC = 2(1)

2 units VC = 2(2)

3 units VC = 2(3)

Q units VC = 2(Q)

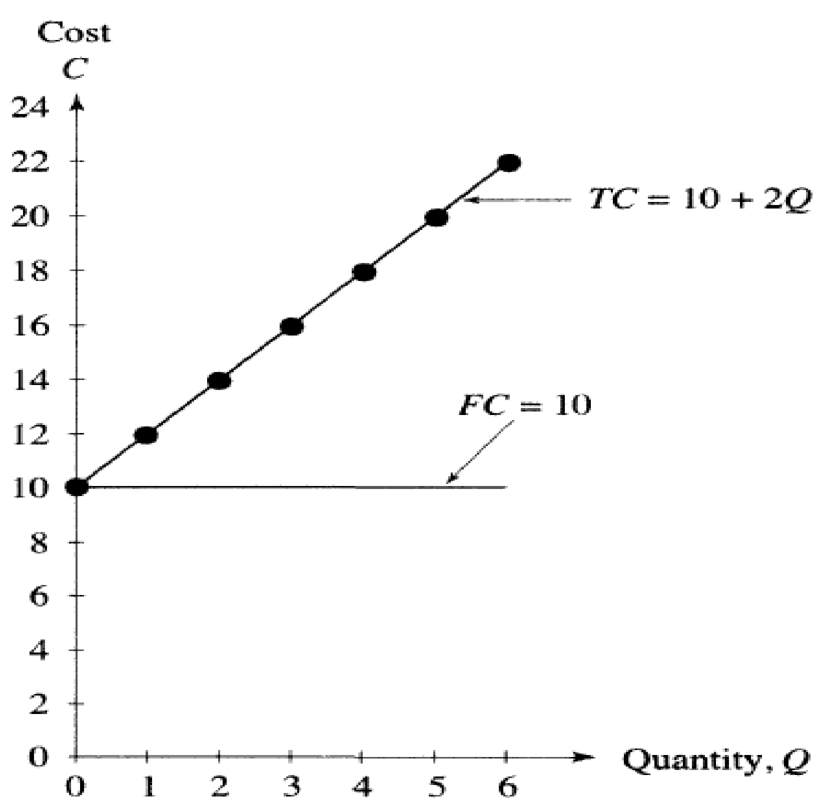
that is, the total variable costs incurred in producing Q units of this good is £2Q. Since TC = FC + VC, the total cost incurred in producing Q units is

TC = 10 + 2Q

This is the same as the line y = 10 + 2x, where y ≡ TC and x ≡ Q.

(b) TC = FC + VC , y = 10 + 2x

Q	Variable costs (at £2 per unit)	$TC = FC + VC$ ($y = 10 + 2Q$)	Point (Q, TC) (x, y)
0	0	$TC = 10 + 0 = 10$	(0, 10)
1	$1(2) = 2$	$TC = 10 + 2 = 12$	(1, 12)
2	$2(2) = 4$	$TC = 10 + 4 = 14$	(2, 14)
3	$3(2) = 6$	$TC = 10 + 6 = 16$	(3, 16)
4	$4(2) = 8$	$TC = 10 + 8 = 18$	(4, 18)
5	$5(2) = 10$	$TC = 10 + 10 = 20$	(5, 20)
6	$6(2) = 12$	$TC = 10 + 12 = 22$	(6, 22)



** **Revenue**

A firm receives revenue when it sells output. The total revenue, TR, received is the price of the good, P, multiplied by the number of units sold, Q, that is,

$$TR = P.Q$$

the total revenue function would take the form $TR = P_0Q$, where P_0 is the constant price per unit of the good and is represented by the vertical intercept of a horizontal demand function. For example, if $P_0 = 10$, then the total revenue function

$$TR = 0 + 10Q = 10Q$$

. . . .

. . . .

. . . .

$$Y = c + mx = mx$$

This is a line through the origin (0, 0) since the vertical intercept, $c = 0$.

E.X:- Suppose that each chicken snack box is sold for £3.50 irrespective of the number of units sold.

(a) Write down the equation of the total revenue function.

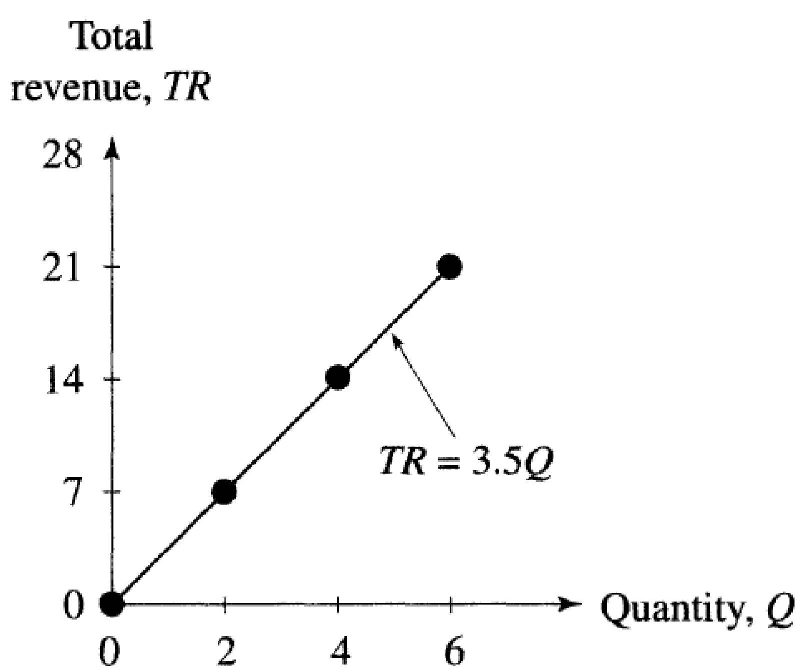
(b) Graph the total revenue function.

Sol:-

(a) Total revenue is price multiplied by the number of units sold, that is, $TR = 3.5Q$

(b) Total revenue is represented graphically by a straight line, with slope = 3.5 and intercept = 0.

Q	$TR = PQ = 3.5Q$	Point (Q, TR)
0	$TR = 3.5(0) = 0$	(0, 0)
2	$TR = 3.5(2) = 7$	(2, 7)
4	$TR = 3.5(4) = 14$	(4, 14)
6	$TR = 3.5(6) = 21$	(6, 21)



Equilibrium in the goods and labour markets

Goods market equilibrium (market equilibrium) occurs when the quantity demanded (Q_d) by consumers and the quantity supplied (Q_s) by producers of a good or service are equal. Equivalently, market equilibrium occurs when the price that a consumer is willing to pay (P_d) is equal to the price that a producer is willing to accept (P_s). The equilibrium condition, therefore, is expressed as :

$$Q_d = Q_s \text{ and } P_d = P_s$$

Note: In equilibrium problems, once the equilibrium condition is stated, Q and P are used to refer to the equilibrium quantity and price respectively.

EX:- The demand and supply functions for a good are given as

Demand function: $P_d = 100 - 0.5Qd$

Supply function: $P_s = 10 + 0.5Qs$

Calculate the equilibrium price and quantity algebraically and graphically.

Sol:- Market equilibrium occurs when $Q_d = Q_s$ and $P_d = P_s$, therefore tr following system is reduced:

$P_d = P_s$

$100 - 0.5Q = 10 + 0.5Q$

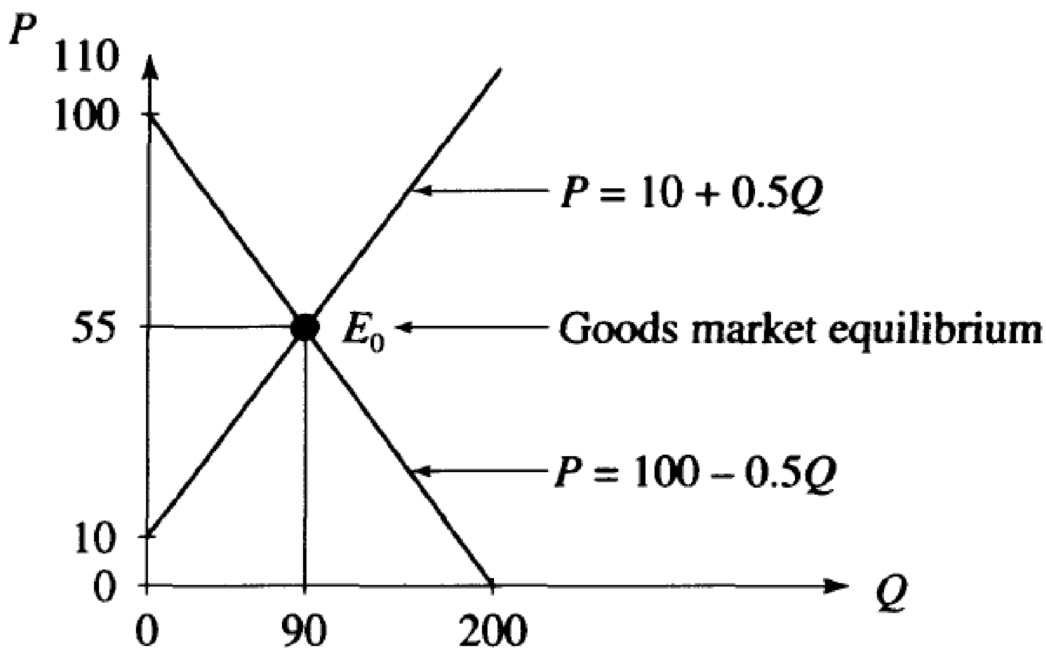
$100 - 10 = 0.5Q + 0.5Q$

$90 = Q$ equilibrium quantity

Now solve for the equilibrium price by substituting Q = 90 into either equation

P = 100 - 0.5(90)   substituting Q = 90 into equation

P = 55



**Price ceilings

Price ceilings are used by governments in cases where they believe that the equilibrium price is too high for the consumer to pay. Thus, price ceilings operate below market equilibrium and are aimed at protecting consumers. Price ceilings are also known as maximum price controls, where the price is not allowed to go above the maximum or 'ceiling' price (for example, rent)

EX:- The demand and supply functions for a good are given by

Demand function: $P_d = 100 - 0.5Q_d$

Supply function: $P_s = 10 + 0.5Q_s$

(a) Analysis the effect of the introduction of a price ceiling of £40 in this market.

(b) Calculate the profit made by black marketeers if a black market operated in this market.

Sol:- (a) The demand and supply functions are the same as those in the previous Example where the equilibrium price and quantity were £55 and 90 units respectively. The price ceiling of £40 is below the equilibrium price of £55. Its effect is analysed by comparing the levels of quantity demanded and supplied at P = £40.

The quantity demanded at $P = 40$ is

$$P_d = 100 - 0.5Q_d$$

$$40 = 100 - 0.5Q_d \quad \text{substituting } P = 40$$

$$0.5Q_d = 100 - 40$$

$$Q_d = 120$$

The quantity supplied at $P = 40$ is

$$P_s = 10 + 0.5Q_s$$

$$40 = 10 + 0.5Q_s \quad \text{substituting } P = 40$$

$$-0.5Q_s = 10 - 40$$

$$-0.5Q_s = -30$$

$$Q_s = 60$$

Since the quantity demanded (Q_d = 120) is greater than the quantity supplied(Q_S = 60), there is an excess demand (XD) of: XD = $Q_d – Q_S$ = 120 – 60 = 60. This is also referred to as a shortage in the market.

(b)) There is a shortage of goods, consumers are willing to pay a higherprice for these 60 units. The price that consumers are willing to pay is calculated from the demand function for Q = 60. Substitute Q = 60 into the demand function:

$P_d = 100 – 0.5\ Q_d$

$P_d = 100 – 0.5\ (60)$

$P_d = 100 – 30 = 70$

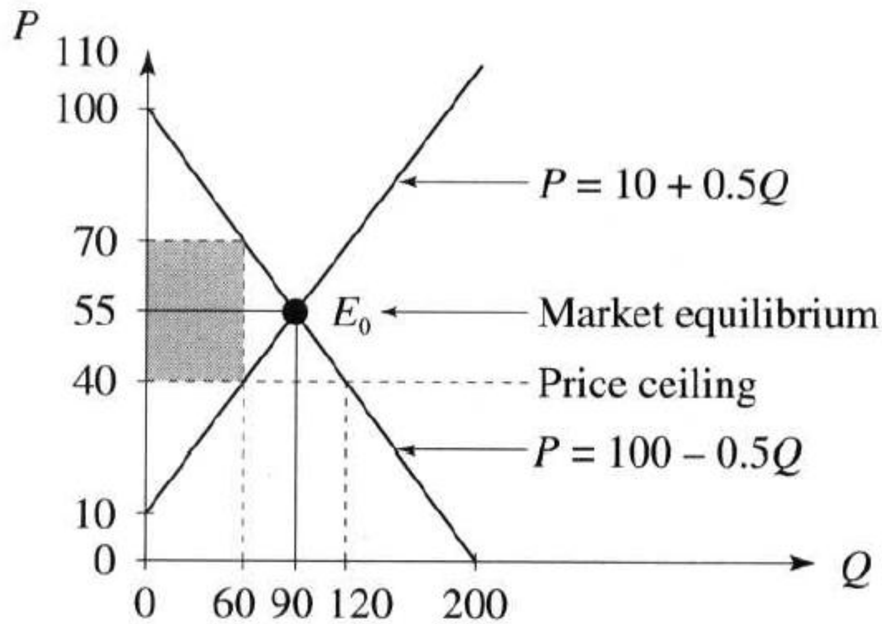
So, P_d = 70 is the price consumers are willing to pay. Therefore, black marketeers buy the 60 units at the maximum price of £40 per unit, costing them 60 x £40 = £2400, and then sell these 60 units at £70 per unit, generating revenue of 60 x £70 = £4200. Their profits (π) is the difference between revenue and costs:

$\Pi = TR - TC$

$= (70 \times 60) - (40 \times 60)$

$= 4200 - 2400$

$= 1800$



**** Market equilibrium for substitute and complementary goods**

Complementary goods are goods that are consumed together (for example, cars and petrol, computer hardware and computer software). One good cannot function without the other. On the other hand, substitute goods are consumed instead of each other (for example, coffee versus tea; bus versus train).

** Remark:- let P_s be a price of substitute goods. Consider two goods, X and Y, The demand function for good X is Q_x. And The demand function for good Y is Q_y.

** If **X and Y are substitutes, then**

$Q_X = a-bP_X + dP_Y$

$Q_X =(a+ dP_Y)-bP_X$

Therefore, as P_Y increases, so does Q_x. Similarly, the demand function for good Y is

$Q_y = \alpha-\beta P_y + bP_x$

Example: if train fares increase, individuals will reduce their demand for train journeys and increase their demand for bus journeys.

** If **X and Y are complements, then**

$Q_x = a-bP_x - dP_Y$

$Q_x =(a- dP_Y) - bP_x$

Therefore, as P_Y increases, Q_x decreases. Similarly, the demand function for good Y is

$Q_y = \alpha-\beta P_y - bP_x$

Example: if car prices increase, individuals will reduce their demand for cars and consequently the demand for petrol decreases.

EX:- Find the equilibrium price and quantity for two substitute goods X and Y given their respective demand and supply equations as.

$Q_{dx} = 82 – 3p_x + p_y$ ……. (1)

$Q_{sx} = -5 + 15p_x$ ……. (2)

$Q_{dy} = 92 + 2p_x - 4p_y$ ……. (3)

$Q_{sy} = -6 + 32p_y$ ……. (4)

Sol:- The equilibrium condition for this two-goods market is

$Q_{dx} = Q_{sx}$ and $Q_{dY} = Q_{SY}$

Therefore, the equilibrium prices and quantities are calculated as follows:

$82 – 3p_x + p_y = -5 + 15p_x$ from (1) and (2)

$-18p_x + p_y = -87$ ……. (5)

And

$92 + 2p_x - 4p_y = -6 + 32p_y$ from (3) and (4)

$2p_x - 36p_y = -98$ ……. (6)

Equations (5) and (6) are two equations in two unknowns, P_x and P_Y. solve these equations

$-18p_x + p_y = -87$ ……. (5)

$2p_x - 36p_y = -98$ ……. (6) multiplied by 9

$- 323p_y = -969$

$p_y = 3$

Solve for P_x by substituting $P_y = 3$ into either equation (5) or equation (6):

$-18p_x + 3 = -87$

$-18p_x = -90$

$p_x = 5$

Now, solve for Q_x and Q_Y

Solve for Qx by substituting $P_x = 5$ and $P_Y = 3$ into either equation (1) or equation (2) as appropriate:

$Q_x = -5 + 15p_x$

$Q_x = -5 + 15(5)$

$Q_x = 70$

Solve for Q_Y by substituting $P_Y = 3$ and $P_x = 5$ into either equation (3) or equation (4) as appropriate:

$Q_y = -6 + 32p_y$

$Q_y = -6 + 32(3)$

$Q_y = 90$

The equilibrium prices and quantities in this two goods market are

$p_x = 5$, $Q_x = 70$, $p_y = 3$, $Q_y = 90$