

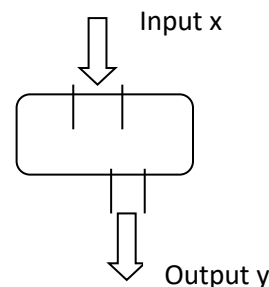
**Handout # 1: Prepared by Mohammad Madiah**

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**Review**

A function **f** is a rule from a set **A** to a set **B** that assigns to each point **x** in A a unique element **y = f(x)** in B.

- ❖ x is called the independent variable – input –
- ❖ y is called the dependent variable – output –
- ❖ The set of all values of inputs is called the **domain**.
- ❖ The set of all values of outputs is called the **range**.
- ❖ A function may be defined as a set of ordered pairs (x, f(x)).



**Linear Functions**

A function of the form  $y = f(x) = mx + b$  is called a **linear function**, m and b are constants.

- ❖ m is called the slope ( $m = \frac{\text{change in } y}{\text{change in } x}$ ),
- ❖ b is called the y – intercept.
- ❖ **Intercepts:** To graph a linear function find x and y – intercepts then join both points.
  - x – Intercept : ( x, 0)  
Solve for x,  $f(x) = 0$
  - y – Intercept : ( 0, f(x)) = (0, b).  
Find f (0)
- ❖ **Graphs:** The graph of a linear function is called a **straight line**.
- ❖ **Forms of Linear Equations**
  - General form  
 $ax + by + c = 0$   
a, b, and c are constants (not both a and b are zero)
  - Point-slope form: Given a point  $P(x_1, y_1)$  and a slope m, the equation is  
 $y - y_1 = m(x - x_1)$ .
  - y – intercept–slope equation: Given y intercept b and slope m, the equation is  
 $y = f(x) = mx + b$ .
  - Vertical line:  $x = a$
  - Horizontal line:  $y = b$

## Linear Models

$$\begin{aligned} \diamond \text{ Total Costs} &= \text{Variable costs} + \text{Fixed costs} \\ \text{VC} &= (\text{cost per unit}) (\text{number of units}) \end{aligned}$$

If,  $m$  is the cost per unit,  $b$  is the fixed cost, and  $C(x)$  is the total cost of producing  $x$  units of the product, then the cost equation is

$$C(x) = mx + b$$

- Revenue results from the sale of items. If  $R(x)$  is the revenue from selling  $x$  items at a price of  $p$  each, then  $R(x)$  will be the linear function;

$$\begin{aligned} \text{Total Revenue} &= (\text{selling price per unit}) (\text{total number of units sold}) \\ R(x) &= p \cdot x \end{aligned}$$

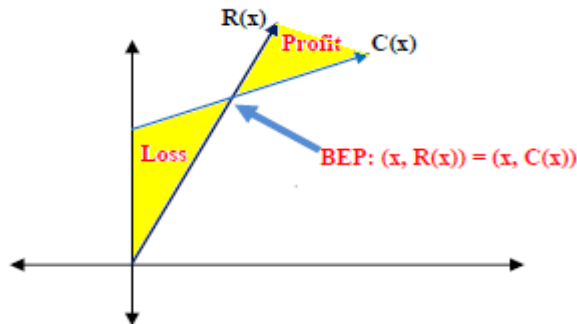
- The profit is the net proceeds, or what remains of the revenue when costs are subtracted. If the profit depends linearly on the number of items, its slope is called the **marginal profit**. Profit, revenue, and cost are related by the following formula.

$$\begin{aligned} \text{Profit} &= \text{Revenue} - \text{cost} \\ P(x) &= R(x) - C(x). \end{aligned}$$

To **break even** means to make **neither a profit nor a loss**. Thus, break-even occurs when the profit is **ZERO** (That is;  $P(x) = 0$ , or  $R(x) = C(x)$ ).

**The break-even point (BEP) is the number of items  $x$  at which break-even occurs.**

If  $P(x) = 0$  at  $x = a$  units, then the BEP is  $(a, C(a)) = (a, R(a))$ .



### Remarks

- The slope  $m$  is also called the marginal cost  $\overline{MC}$  (The **marginal cost** is the cost of producing one **additional unit** at any level of production).
- The fixed cost  $b$  is  $C(0)$
- The selling price  $p$  also called the **marginal revenue** (the revenue of producing and selling one **additional unit** at any level of production).
- If the profit is negative, say  $-\$1000$ , we refer to a loss (of  $\$1000$ ) in this case.