



**(LIMITS) الغاية**

**Properties of limits**

1- If  $f(x)=k$  then  $\lim_{x \rightarrow a} f(x) = k$

2- If  $\lim_{x \rightarrow a} f_1(x) = L_1$   $\lim_{x \rightarrow a} f_2(x) = L_2$

a) Sum rule:  $\lim_{x \rightarrow a} [f_1(x) + f_2(x)] = L_1 + L_2$

b) Difference rule:  $\lim_{x \rightarrow a} [f_1(x) - f_2(x)] = L_1 - L_2$

c) Product rule :  $\lim_{x \rightarrow a} [f_1(x) * f_2(x)] = L_1 * L_2$

d) Quotient rule:  $\lim_{x \rightarrow a} \left[ \frac{f_1(x)}{f_2(x)} \right] = \frac{L_1}{L_2}$

3- Polynomial  $\lim_{x \rightarrow a} (c_0 + c_1x + c_2x^2 + \dots + c_nx^n) = c_0 + c_1a + c_2a^2 + \dots + c_na^n$

**Example:** Find the limits of the following:

1-  $\lim_{x \rightarrow 2} (x^2 - 4x) = 2^2 - 4 * 2 = -4$

2-  $\lim_{x \rightarrow 1} (x^3 - 2x^2) = 1^3 - 2 * 1^2 = -1$

3-  $\lim_{x \rightarrow 1} \left[ \frac{(3x-1)^2}{(x+1)^3} \right] = \frac{(3*1-1)^2}{(1+1)^3} = \frac{(2)^2}{(2)^3} = \frac{4}{8}$

4-  $\lim_{x \rightarrow 2} \left[ \frac{(x^2-4)}{x-2} \right] = \frac{0}{0}$  (Indeterminate quantities كمية غير محددة)

So  $\lim_{x \rightarrow 2} \left[ \frac{(x-2)(x+2)}{x-2} \right] = \lim_{x \rightarrow 2} (x + 2) = 2 + 2 = 4$

5-  $\lim_{x \rightarrow 2} \left[ \frac{(x^2-4)}{x^2-5x+6} \right] = \frac{0}{0}$  (Indeterminate quantities كمية غير محددة)

So  $\lim_{x \rightarrow 2} \left[ \frac{(x-2)(x+2)}{(x-2)(x-3)} \right] = \lim_{x \rightarrow 2} \left[ \frac{(x+2)}{(x-3)} \right] = \frac{4}{-1} = -4.$