# Formularium PoEfS

Let $p(x)$ be your willingness to pay, $u(x)$ your utility, then $u'(x) = p(x)$
Consumer Surplus: $CS = u(x) - p(x) = \int_0^{x*} p(x) - p_x dx$. Maximising this gives: $\frac{\partial CS}{\partial x} = u'(x) - p = 0$.
Deadweight loss: $\Delta = \int_{x'}^{x*} v'(x) - c'(x) dx$
Let $c(x)$ be the cost of producing x goods, $\pi(x)$ be the profit. Then $\pi(x) = px - c(x)$.
Let $GFT$ be the Gains From Trade, then $GFT = CS + \pi$. In perfect competition: $\pi = CS$.
Let $\epsilon$ be the price elasticity of demand. Then $\varepsilon = -\frac{p}{X_D(p)} X'_D(p)$.
⇒ Measures by how many percent demand decreases if the price increases by one percent.
Avg product of capital: $\frac{x}{K} = \frac{f(K,L)}{K}$, avg product of labour: $\frac{x}{L} = \frac{f(K,L)}{L}$
Marginal product of capital, labour respectively: $\frac{\partial f(K,L)}{\partial K}$, $\frac{\partial f(K,L)}{\partial L}$
Elasticity of output with respect to capital, labour: $\eta_K = \frac{K}{x}\frac{\partial f(K,L)}{\partial K}$, $\eta_L = \frac{L}{x}\frac{\partial f(K,L)}{\partial L}$
Cobb-Douglas Production Function: $x = AK^\alpha L^\beta$
The expression $-\frac{dL}{dk}$ is called the marginal rate of substitution of labour for capital
Let the price of capital $K$ be $r$ and the price of labour $L$ be $w$ then $\pi(x) = f(K,L)p - rK - wL$.
Let $A$ be the value today, $V$ the value in one period from now, then $A = \frac{V}{(1+r)^t}$ (Present Value Analysis)
Suppose an asset pays $M$ in each of the next T periods. The Present Discounted Value (PDV) is given by $\frac{M}{r}[1 - \frac{1}{(1+r)^{T+1}}]$.
Marginal rate of substitution: $-\frac{\frac{\partial u(x,y)}{\partial x}}{\frac{\partial u(x,y)}{\partial y}}$
Let M be the budget. The Lagrangian for utitility maximisation: $L(x, y, \lambda) = u(x, y) - \lambda(xp_x + yp_y - M)$
Markup of a monopolistic firm (Lerner index): $\frac{1}{\varepsilon} = \frac{p^m - c'(x^m)}{p^m}$

**Monopoly**: $p(x) + xp'(x) = c'(x)$ (Marginal Revenue = Marginal Costs)
**Perfect Competition**: $p = c'(x)$ (Price = Marginal Costs)
**Oligopolistic competition (Cournot)**: derive based on quantity ($Q = q_1 + q_2$). Equal MC implies equal quantities produced.
**Oligopolistic competition (Bertrand)**: $\pi(x) = 0$ (Bertrand trap), Marginal Revenue still equal to Marginal Costs.
⇒ Set price just below Marginal Cost of the other firm and get entire market