Derivative

- $f'(x) = \lim\limits_{\Delta x \to 0} \frac{f(x+\Delta x)-f(x)}{\Delta x}$
- $(ax^n)' = anx^{n-1}$
- $f'(x) = f'(t) \cdot t'(x)$
- $(f(x)+g(x))' = f'(x)+g'(x)$
- $(f(x) \cdot g(x))' = f'(x) \cdot g(x) + f(x) \cdot g'(x)$
- $\left(\frac{f(x)}{g(x)}\right)' = \frac{f'(x) \cdot g(x) - f(x) \cdot g'(x)}{g^2(x)}$
- $\left(e^{x^n}\right)' = n \cdot e^{x^n} \cdot x^{n-1}$
- $(\ln(x))' = \frac{1}{x}$

f(x,y) optimization

- Never use this method!
- $(x_0; y_0)$ is one of the solutions of $\begin{cases} f'_x(x, y) = 0, \\ f'_y(x, y) = 0. \end{cases}$
- $A = f''_{xx}(x_0; y_0)$. $B = f''_{xy}(x_0; y_0)$. $C = f''_{yy}(x_0; y_0)$.
- If $A < 0$, $AC - B^2 > 0$, here is the maximum
- If $A > 0$, $AC - B^2 > 0$, here is the minimum
- If $AC - B^2 < 0$, here is no extremum
- If $AC - B^2 = 0$, God only knows

Macroeconomics

- $M \cdot V = P \cdot Y$
- $Y = C + I + G + Xn + A$
- $Y_r = \frac{Y_n}{P}$
- $\frac{Y - Y^*}{Y^*} = -\beta(u - u^*)$

Elasticity

- $E_x^y = \frac{\Delta y}{\Delta x} \cdot \frac{x}{y}$
- $E_x^y = y'(x) \cdot \frac{x}{y}$
- $E_x^{\text{arc}y} = \frac{\Delta y}{\Delta x} \cdot \frac{x_0+x_1}{y_0+y_1}$
- $E_P^S = \frac{P}{P_{max}-P} = \frac{Q_{max}-Q}{Q}$

Math

- $d = a_n - a_{n-1}$
- $a_n = a_1 + d(n-1)$
- $\sum\limits_{i=1}^{n} a_i = \frac{a_1+a_n}{2} \cdot n = \frac{2a_1+d(n-1)}{2} \cdot n = \frac{a_1+a_n}{2} \cdot \left(\frac{a_n-a_1}{a_2-a_1} + 1\right)$ (Alpeev's formula)
- Let $F'(x) = f(x)$. $\int_a^b f(x)\,dx = F(b) - F(a)$

Math

- $b_n = q \cdot b_{n-1}$
- $\prod\limits_{i=k}^{n} b_i = \frac{\prod\limits_{j=1}^{n} b_j}{\prod\limits_{l=1}^{k-1} b_l}$
- $\prod\limits_{i=1}^{n} b_i = (b_1 \cdot b_n)^{\frac{n}{2}}$
- $\sum\limits_{i=1}^{n} b_i = \frac{b_1(1-q^n)}{1-q}$
- $\log_{1+x}(2) = \frac{70}{100x}$.

Firm

- Never use $MR = MC$ in monopoly
- $(TR - TC) \to$ max is much better
- $Q_s = BR(p \cdot q - TC(q))$ if $\pi \geq -FC$
- $Q_s = MC(Q)$ if $MC(Q) \geq AVC(Q)$
- $L = \frac{P-MC}{P}$
- $tg\,\alpha = \frac{TR(Q)}{Q} = AR(Q) = P(Q)$
- Leave if $\pi(0) > \pi(Q^*)$ (Taxation)

Stackelberg model

- Two agents form quantity
- Price forms by the demand
- Leader forms its quantity first
- $Q_{St} > Q_{Co}$
- St is better for society

Forchheimer model

- One dominant firm
- It forms price
- For other firms the price does not change
- Dominant firm knows everything
- $MC_{else} = P$

Lindahl tax

- Two agents
- Creating public goods
- $\alpha \cdot \frac{P_{public}}{P_{else}} = MRS_{person1}$
- $(1-\alpha) \cdot \frac{P_{public}}{P_{else}} = MRS_{person2}$
- $\frac{MC_{public}}{MC_{else}} = \frac{P_{public}}{P_{else}} = MRT = AC$

Hints for kachestvennye problems

- Marginal resourses ("Green Belt", seats in airports)
- Asymmetrical information (lemon market)
- The agent who owns the information is able to find the transmission method which will make the other agent believe him (Michael Spence) (banks use big buildings)
- The agent who does not own information is able to get the one from the other agets who owns it (price targeting)
- There are three market failtures: asymmetrical information, externality and imperfect competition
- Stimuli analysis
- CBA
- The theorem of starting advantage
- Random walk
- Uber-like optimization

Goods

- Private goods (R, E; food, clothing, cars, parking places)
- Club goods (NR, E; cinemas, private parks, satellite TV)
- Common-pool resourses (R, NE; fish stocks, timber, coal)
- Pubpic goods (NR, NE; free-to-air TV, air, national defence)

Brainy phrases

- *Monopoly rent* means the profit got by using monopoly advantage
- *Rent-seeking* means competitors' eliminations and using the one

Nice words

- Everybody believes in you
- Do not panic
- Check everything you can check
- Vseros is not so hard

Goods

- Free goods ($P = 0$)
- Ordinary goods ($P \uparrow Q \downarrow$, $E_P^D < 0$)
- Giffen goods ($P \uparrow Q \uparrow$, $E_P^D > 0$)
- Normal goods ($I \uparrow Q \uparrow$, $E_I^D > 0$)
- Inferior goods ($I \uparrow Q \downarrow$, $E_I^D < 0$)
- Necessary goods ($0 < E_I^D < 1$)
- Luxury/Superior goods ($E_I^D > 1$)
- Using a rival good prevents its use by other possible users
- A good is called excludable if it is possible to prevent people who have not paid for it from having access to it