Mathematics at ICEF Master's programme: What to be prepared for

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About me

- ICEF Master's programme graduate (2012)
- First degree from the Faculty of Mechanics and Mathematics, Lomonosov MSU
- Analytics Team lead at Avito
- Lecturer and class teacher at ICEF BSc programme

Course Review

1. Refresher part
   - **Multivariate Calculus and Optimization**
   - **Linear Algebra**
     - Matrix Algebra
     - Eigenvalues/eigenvectors, diagonalization and Jordan form
     - Quadratic forms
     - Projections
   - **Probability theory and statisticts**
2. Main part
   - **Differential equations**
     - Phase diagrams, stability and Linearization
   - **Dynamic Optimization in Continious and Discrete time**
   - **Stochastic Calculus**
     - Sigma algebras and Filtrations
     - Martingales
     - Ito's calculus
     - Black-Scholes model

Preparation

- **Literature**
  - C. P. Simon, L. Blume, Mathematics for economists, W.W. Norton company Inc., 1994 or latest edition
  - H. Anton, C. Rorres, Elementary linear algebra, 11th edition
  - Newbold P., Carlson W., Thorne B. (2019). Statistics for Business and Economics, 9th edition.
  - Ватутин В.А. Ивченко Г.И., Медведев Ю.И. и др. Теория вероятностей и математическая статистика в задачах
- **Summer Bridge School**

Problem 1.
A monopolist producing a single output has two types of customers. If it produces Q_1 units for customers of type 1, then these customers are willing to pay a price of $50 - 5Q_1$ dollars per unit. If it produces Q_2 units for customers of type 2, then these customers are willing to pay a price of $100 - 10Q_2$ dollars per unit. The monopolist's cost of manufacturing Q units of output is $90 + 20Q$ dollars.
In order to maximize profits, how much should the monopolist produce for each market?

Problem 2.
An economy has three markets. The supply functions for the three gooods are given by

$$q_1^S = -20 - p_1 + 3p_2 + 3p_3$$
$$q_2^S = 50 + 2p_1 - p_2 - p_3$$
$$q_1^S = -50 + 4p_1 + p_2$$

and the demand functions for the three goods are given by

$$q_1^D = 130 - 2p_1 + p_3$$
$$q_2^D = 100 - 2p_1 - 3p_2 + 2p_3$$
$$q_3^D = 100 + p_1 + p_2 - 2p_3.$$

Finf the equlibrium prices using matrix algebra.