

# Key Topics for 8100

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Throughout, I expect you to have a *true* understanding of each topic. Not just to be able to solve problems, but also to interpret the results.

## Midterm

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- Be fluent in dealing with relations.
  - Know and understand the assumptions *Reflexive, Complete, Transitive, Convex (weak/strong), Monotonic (weak/strong), Homothetic*
  - Determine/Prove whether relations meet certain assumptions.
  - Work various types of problems involving relations. (See previous exams for examples).
- Understand the sets associated with relations: upper contour, lower contour, indifference sets.
  - Understand how assumptions about the preference relation affect the geometries of these sets.
    - *For example:* convex preferences have convex upper contour sets and convex indifference curves.
  - Understand how the "slope" of indifference curves measure tradeoffs between goods.
- Understand the basics of the "Choice Function" and when preferences translate into a finitely non-empty and coherent choice function.
- Know and be able to work with important properties of functions:
  - Convex, Concave, Quasi-convex, Quasi-concave, Homogeneous, Homothetic, Monotonic....
- Understand how (and when) utility functions *represent* preferences.
  - Understand how assumptions about the preference relation affect the properties of the utility representation.
    - *For example:* convex preferences have quasi-concave utility representations.
  - Understand that utility functions are *ordinal*, and how many utility functions can represent the same preferences.
- Understand the relationship between a primal and dual optimization problem and leverage duality in the consumer problem.
- Solve choice problems with traditional budgets and non-traditional budgets. (But just one constraint.)
  - Solve utility maximization and cost minimization problems.
  - Interpret results of optimization including interpreting the value of "shadow values"
  - Check for corner solutions where demand for a good is zero.
  - Construct the value and expenditure function and check various properties of these functions (you do not need to memorize them).
- Calculate elasticities of demands and more generic elasticities and be able to interpret these.

## Final

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- Solve optimization problems with *multiple constraints*.
- Be fluent in dealing with preferences over lotteries.
  - Execute simple proofs about these preferences.
- Work with simple and compound gambles.
  - Find the induced simple gamble for a compound gamble.
- Work with *expected utility preferences*.
  - Understand the axioms required for expected utility and how they might fail.
  - Understand risk preferences.
    - Understand how different "shapes" of the utility function for money translate into risk preferences.
    - Calculate certainty equivalents / risk premia.
- Work with production functions.
  - Understand and calculate returns to scale.
  - Understand and find whether production is homogeneous/homothetic.
- Solve firm *cost minimization* problems.
  - Find conditional factor demands and cost functions.
  - Understand how properties of the production function translate into properties of the cost function for *homogeneous/homothetic production*.
  - Leverage *separability* to break-up optimization problems.
- Solve firm profit maximization problems.
  - Price-taking setting.
  - Monopoly setting.
- Understand "Nash equilibrium".
  - Find equilibrium in simple games and by finding fixed points of best response functions.
  - Know what a contraction is and why it is useful.
- Solve Cournot models.
  - Symmetric firm setting.
  - Assymmetric firm setting.
  - Sequential quantity setting.
  - Supporting collusion in a repeated game.