

Undergraduate mathematics preparation for a PhD in economics

Here is excellent advice from a former William and Mary double major in mathematics and economics. It was written in 2010, just after she had completed her second year in the Harvard PhD program.

To survive the first year economics PhD courses students should be extremely comfortable with calculus (through Math 213) and basic linear algebra (Math 211). I also took the advanced linear algebra course (Math 408), but in retrospect it was not particularly useful. If someone is interested in going into econometrics, however, it might be beneficial. In any case, I would not consider the advanced course a strong priority.

A basic understanding of differential equations (Math 302) is strongly recommended. If someone is considering doing macroeconomics or repeated game theory a follow-up course would be helpful. Math 345, Introduction to Mathematical Biology, might cover useful topics in this area.

A basic understanding of linear and nonlinear programming (Math 328 and 424) is useful for understanding concepts in many field courses and in the first-year sequence, but could be omitted without much harm.

An understanding of probability and mathematical statistics is very helpful (Math 401 and 452), although Harvard offers a very similar course as part of the typical first-year sequence. Many other schools do as well. A solid understanding in these areas is very useful for all areas of economics, including most theory courses that I have taken.

For economic theory, the most important courses to take are in real analysis. I would advise students to take as many real analysis courses as are currently being offered (at least Math 311, which includes measure theory (Math 403) and topology (Math 426). (I've often wished that I had an even stronger background than Math 426 provided.) Functional analysis (Math 428) and complex analysis (Math 405) are not particularly useful, although I would recommend complex analysis as a very useful course for flexing one's mathematical muscles.

Based on my direct experience and my experience teaching a mathematics review course for the incoming graduate class following my first year, analysis is the area in which students tend to be the weakest and require the most time and effort to get up to speed.

In summary: *Recommended Courses*

Highest Priority: Math 211, 213, 302, 311, 401, 403, 424, 426, 452

Lower Priority: Math 307, 323, 405, 408, 417

This is a rather extensive list, but a student going into a Ph.D. program would be well-advised to take as many of these courses as possible. Students who got a late start on developing their mathematical skills should take the minimum number of economics courses required and devote as much schedule space as possible to math courses. The mathematics classes are taught in a manner, and with a rigor, that is more akin to graduate economics courses than most undergraduate economics courses.