

Suggestions on Math Preparation for the MA and MAEP Programs in Economics at Boston University

Many of the courses in the MA and MAEP programs in economics at Boston University use algebra and some calculus. This sheet is intended to offer guidelines with respect to the kind of math preparation that would be particularly useful before starting these courses. Some students will possess these skills already. For those who are less familiar with some, or all, of these mathematical concepts this sheet also describes how you might prepare yourselves either before arriving at Boston University or during your time in Boston.

During orientation at the start of the new academic year, the level of math preparation for all new students entering the MA and MAEP programs in economics will be ascertained.

This sheet contains a set of sample problems. Please take the time to look over these. If these questions look very familiar to you, then you do not need to read further.

If, on the other hand, most or part of these sample problems contain material that you have never covered before, or that you have forgotten, you could study a little on your own prior to arrival. Where possible, we urge you to undertake a little preparation prior to arrival. This can be particularly helpful if you have not used some part of this math for a while, or if there are a couple of topics which appear unfamiliar.

An alternative, which may be open to a few students, is to take a preparatory course in mathematics before starting the MA or MAEP program. In general this route should only be taken if a significant part of the material in the sample questions is unfamiliar. Such courses may be taken in your home area, at Boston University's Summer School, or elsewhere. The courses that would be most useful to students in economics are: One variable calculus, multivariable calculus, linear algebra and differential equations, introduction to probability theory, introduction to statistics. Of course, you might only have time for a subset of these courses; but in any case you should take them in sequence as listed above.

Sample Problems

Please remember that these sample questions are intended only as guidelines.
You are not necessarily expected to be able to answer every single question.

General Mathematics

1. Firm A had 300 employees, but 20% of these workers move to firm B. As a result, the number of workers in firm B increases by 100%. How many workers are now employed in each firm?
2. When a machine is first switched on in the morning, the electricity required to warm up the machine costs \$20. The electricity required to process each unit of output on this machine then costs an additional \$1.50. Let C represent the cost of electricity and Q be the quantity of units processed. Write down an algebraic equation showing the relationship between C and Q .
3. A banker invests \$1000. Her investment grows at 10% each year. After three years, what is this investment worth?
4. Given $Q = a - bP$, find P in terms of Q .
5. You are given two equations that relate P and Q as follows:

$$Q = 7 - P$$

$$Q = 1 + 0.5P$$

Find values of Q and P that satisfy both equations.

6. The total cost C of producing Q units of a good behaves as follows:

$$C = a_0 Q^3 - a_1 Q^2 + a_2 Q$$

Write down an algebraic expression for the average cost of producing each unit (i.e. C/Q).

7. Which (if any) of the following equations are correct?

$$\text{a. } \sum_{i=1}^{i=N} (ax_i + by_i) = a \sum_{i=1}^{i=N} x_i + b \sum_{i=1}^{i=N} y_i$$

$$\text{b. } \sum_{i=1}^{i=N} (ax_i + by_i)^2 = a \sum_{i=1}^{i=N} x_i^2 + b \sum_{i=1}^{i=N} y_i^2$$

$$\text{c. } \sum_{i=1}^{i=N} (ax_i y_i) = a \sum_{i=1}^{i=N} x_i \sum_{i=1}^{i=N} y_i$$

8. When (if any) of the following equations are correct:

a. $x^a + x^b = x^{a+b}$

b. $x^{-0.5} = \sqrt{x}$

c. $x^{2a} = x^2 x^a$

9. In the following statements, " $\ln(x)$ " represents the natural logarithm of x . Which (if any) of the following equations are correct?

a. $\ln(e^{bx}) = bx$

b. $\ln(x/y) = \ln(x)/\ln(y)$

c. If $x = y^a z^b$ then $\ln(x) = a \ln(y) + b \ln(z)$

Calculus

10. Find dy/dx for each of the following expressions:

a. $y = a + bx + cx^2$

b. $y = x/(a+bx)$

c. $y = a \ln(x^b)$ where \ln again indicates a natural logarithm

d. $y = a(b+z)^c$ and $z = 3/x$

11. Suppose $y = x^{0.3} z^{0.6}$

a. Write down the partial derivative of y with respect to x .

b. Write down the total differential of y .

12. Write down the $\int (a+bx+cx^2) dx$

13. Find the area under the curve given by $y = 4 + 3x^2$ from $x = 1$ to $x = 3$.