Brandeis University
Department of Economics
Sample Math Placement Test

Part I: System of equations.

Solve for x and y:

1. $x - y = 3$
   $x + y = 2$

2. $x^2 - 4y^2 = 5$
   $xy = 3$

3. $x^2 + y^2 = 4$
   $x^2 - 2y^2 = 1$

Part II: Equations of lines.

Find the equation of the line:

1. Through the points (1, 2) and (4, 5).

2. Through point (4, 5), with slope 1/3.

3. Through point (b, -2b), with slope 2/b.

Part III. Graphing functions.

Graph the following functions:

1. $y = - 4x + 5$

2. $y = 2e^x$ (this may be approximate.)

3. $x^{1/2}y^{1/2} = 10$ for x and $y \geq 0$

Part IV. Differentiation

Find f'(x) for each of the following functions:

1. $f(x) = 7x + 5$

2. $f(x) = (x^2 - 3x + 8)^3$

3. $f(x) = (8x - 7)^{-5}$

4. $f(x) = (x^2 - (1/x)^2)^3$

Part V. Natural logs and the exponential function.

Use the rules of natural logs and exponents to simplify (or re-write) the following expressions:

1. $(e^{2x})^3$

2. $(e^{2x})(e^{4x})$

3. $\ln(x/y)$

4. $\ln[(xy)^4]$

Find f'(x) for the following functions:

5. $f(x) = 3xe^x$

6. $f(x) = 4 \ln(x)$

Part VI. Implicit differentiation

Assuming that each of the equations below determines a function f such that y = f(x), find y'(x) in terms of y and x:

1. $x^2 + y^2 - 16 = 0$

2. $2x^3 + x^2y + y^3 = 1$

Part VII. Maxima, minima, and inflection points.

For the following functions, use the second derivative test to find the local maxima and minima of f. Describe the intervals over which f is increasing or decreasing. Find the x-coordinates of points of inflection.

1. $f(x) = x^3 - 2x^2 + x + 1$

2. $f(x) = 3x - 4x^3 + 6$

3. $f(x) = (x^2 - 1)^2$

Part VIII. Slopes, tangencies, and equations of lines.

Find the slope of the equation at the point P. Then find the tangent line to the given equation at that point.

1. $xy + 16 = -0$, P(-2, 8)

2. $y^2 - 4x^2 = 5$, P(-1, 3)

Part IX. Limits.

Find the limits for the following functions:

1. $\lim_{x \to \infty} \frac{(5x^2 - 3x + 1)}{2x^2 + 4x - 7}$

2. $\lim_{x \to -\infty} \frac{4 - 7x^2}{2 + 3x}$