

BRONX COMMUNITY COLLEGE
of the City University of New York

DEPARTMENT OF MATHEMATICS AND COMPUTER SCIENCE

MATH 31
Nikos Apostolakis

Exam 2
November 14, 2011

Name: _____

Directions: Write your answers in the provided booklets. Make sure to indicate which answer belongs to which question. To get full credit you *must* show all your work. Simplify your answers whenever possible. Be certain to indicate your final answer clearly. This exam has a total of 1000 points. The perfect score for this exam is 1000 points.

1. (150 points) Prove that the equation

$$2x^3 + 9x^2 + 42x - 5 = 0$$

has exactly one real solution.

2. Let $f(x) = 3x^4 + 4x^3 - 12x^2 - 10$.
- (a) (100 points) Find the (absolute) extremum values of f in the interval $[-3, 2]$.
- (b) (100 points) How many real solutions does the equation $f(x) = 0$ have?
3. (200 points) Sketch a graph of the function

$$f(x) = |x^3 - 2x^2 + x|$$

The graph should correctly indicate x and y intercepts, local extrema, points of inflection, the intervals where f is increasing or decreasing, and the intervals where f is concave upwards or downwards.

4. (250 points) Sketch a graph of the function

$$f(x) = \cos x - \sin x$$

The graph should correctly indicate x and y intercepts, local extrema, points of inflection, the intervals where f is increasing or decreasing, and the intervals where f is concave upwards or downwards.

5. (200 points) Sketch a graph of the function

$$f(x) = \frac{x^2 - 4}{x^2 - 1}$$

The graph should correctly indicate x and y intercepts, local extrema, points of inflection, the intervals where f is increasing or decreasing, the intervals where f is concave upwards or downwards, and any horizontal or vertical asymptotes.