

**BRONX COMMUNITY COLLEGE**  
of the City University of New York

**DEPARTMENT OF MATHEMATICS AND COMPUTER SCIENCE**

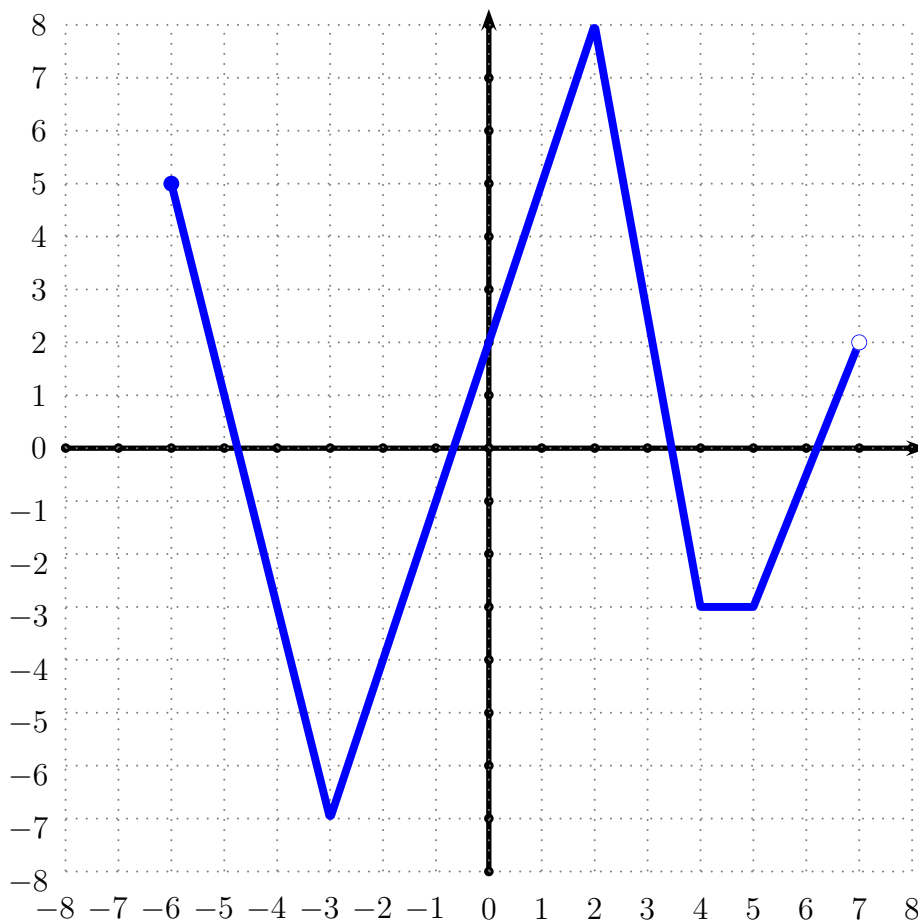
MATH 30  
Nikos Apostolakis

Exam 1  
March 10, 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 1200 points. The perfect score for this exam is 1000 points.

1. For the function  $f$  whose graph is shown bellow, find:
  - (a) (25 points) The domain of  $f$ .
  - (b) (25 points) The range of  $f$ .
  - (c) (25 points) The intervals where  $f$  is increasing.
  - (d) (25 points) The intervals where  $f$  is decreasing.



2. Find the domain for each of the following functions:
  - (a) (35 points)  $g(x) = \sqrt{3 - 6x}$
  - (b) (75 points)  $f(x) = \frac{2x - 1}{x^2 - x - 12}$
3. For the function  $f(x) = \frac{-x + 3}{4x - 7}$  find
  - (a) (100 points) The formula for the inverse function  $f^{-1}$ .
  - (b) (20 points) The domain of  $f^{-1}$ .

(c) (20 points) The range of  $f^{-1}$ .

4. (125 points) Find the difference quotient

$$\frac{f(x+h) - f(x)}{h}$$

where  $f(x) = x^2 - 3x + 21$

5. (100 points) What is the remainder of the division:

$$\frac{60x^{52} - 20x^{31} + 9x - 7}{x - 1}$$

6. Let  $f(x) = \frac{2x - 3}{5x + 2}$  and  $g(x) = \frac{1}{x}$ . Find:

(a) (100 points) The formula for  $f \circ g$ .

(b) (35 points) The domain of  $f \circ g$ .

7. (100 points) Let  $f(x) = x^2 + 6x + 9$  with domain  $(-\infty, -3]$  and  $g(x) = -3 - \sqrt{x}$ . Verify that  $f$  and  $g$  are a pair of inverse functions.

8. (100 points) Find a fourth degree polynomial with integer coefficients that has roots only at  $x = 1$ ,  $x = -1$ , and  $x = 3$ .

9. (40 points) List all possible rational roots of the following polynomial, according to the "Rational Root Theorem".

$$p(x) = 6x^5 - 3x^4 + 7x^3 - 2x^2 + 8x - 12$$

10. (150 points) Solve the following equation:

$$x^5 - 5x^4 - x^3 + 11x^2 - 6 = 0$$

11. (100 points) Prove that  $\sqrt[7]{4}$  is irrational.