

Department of Mathematics **Howard University**
College Algebra II (Math-010) - Final Examination
May 3, 2006

Do all questions. Show all work.
The time for the examination is two (2) hours.

1. [15 points]

The function

$$f(x) = \frac{3x+1}{x}, \quad x \neq 0$$

is one-to-one.

(a) Find its inverse.

(b) State the domain of f and find its range.

2. [20 points]

Use transformations to graph the function $f(x) = 2^x + 3$. Determine the domain, range, and horizontal asymptote of f .

3. [15 points]

Solve each equation

(a) $2^{x^2} = 4^{x+4}$

(b) $\log_5(2x) = 3$

4. [15 points]

Jerome will be buying a used car for \$15,000 in 3 years. How much money should he ask his parents for now so that, if he invests it at 5% compounded continuously, he will have enough to buy the car?

5. [15 points]

(a) Write $\log_6(x+1) - 2\log_6 x$, $x > 0$, as a single logarithm.

(b) If $\log_b 2 = 0.69$ and $\log_b 3 = 1.10$ ($b > 0$, $b \neq 1$), find $\log_b 36$.

6. [15 points]

If $A = \begin{bmatrix} 2 & 3 & 1 & 0 \\ 0 & 4 & 0 & 2 \\ 1 & 0 & 1 & 0 \end{bmatrix}$ and $B = \begin{bmatrix} 2 & -1 & 1 \\ 0 & 3 & 0 \end{bmatrix}$, find each of the following if possible:

(i) AB

(ii) BA

7. [15 points]

Use any valid method you wish to solve the system of equations:

$$\begin{cases} 2x - 3y + z = 10 \\ 3x - y - 2z = 1 \\ x + 2y + 4z = 12 \end{cases}$$

8. [15 points]

The matrix

$$A = \begin{bmatrix} 1 & -2 & 1 \\ 2 & -5 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

is nonsingular. Find its inverse.

9. [15 points]

Find x such that the determinant $\begin{vmatrix} x & 3 & 1 \\ 1-x & 2 & 4 \\ 4 & 3 & 2 \end{vmatrix}$ equals 10.

10. [20 points]

(a) Graph the region for the system of inequalities:

$$\begin{cases} x + 3y \leq 9 \\ 2x + 3y \leq 12 \\ x \geq 0 \\ y \geq 0 \end{cases}$$

(b) Maximize and minimize the objective function $P(x, y) = 8x + 15y$ subject to the constraints in part (a).

11. [15 points]

Solve the system of equations and sketch the graph of each equation on the same coordinate plane.

$$\begin{cases} 2x + y + 3 = 0 \\ x^2 + y^2 = 5 \end{cases}$$

12. [15 points]

Find the vertex, focus, and directrix of the parabola given by the equation:

$$x^2 - 4x = 2y$$

Sketch the graph.

13. [10 points]

DO EITHER PROBLEM A OR PROBLEM B, NOT BOTH.

PROBLEM A

Find the center, vertices, foci of the ellipse given by the equation:

$$9(x-3)^2 + (y+2)^2 = 9$$

PROBLEM B

(a) Write down the first six terms of the sequence having general term

$$a_n = \frac{n-1}{n}, \quad n \neq 0.$$

(b) Evaluate $\sum_{k=1}^4 7k$.