College of Staten Island
Mathematics Department
Math 130 Section 8962 A. Carter
Final Examination Fall 2006

Answer questions in the space provided below.

Part I : Answer all ten questions worth 6 points each.

1. If $f(x) = 3x^2 - 2x + 1$ and $g(x) = 3x + 1$, compute and simplify $(f \circ g)$.

2. If $f(x) = \frac{x-1}{x+2}$, find and simplify $f^{-1}(x)$.

3. **Sketch** the **graph** of $f(x) = 1 - \sqrt{2-x}$. State **domain** and **range** of f.

4. Find an **equation** of the graph obtained by reflecting the graph of $f(x) = x^2$ upside down and then shifting it 15 units up and 9 units to the right. Do not graph.

5. **Solve** the inequality $\frac{x-4}{x+3} - \frac{x+2}{x-1} \leq 0$. Write your answer in **interval notation**.

6. **Prove** the identity: $\tan\Theta + \cot\Theta = \sec\Theta \bullet \csc\Theta$

7. **Sketch the graph** of $y = 3 \sin (2x + \frac{\pi}{2}) + 1$. Find the amplitude, the period, and the phase shift.

8. A triangle has the following sides : a = 25.4, b = 73.8 and c = 51.2. Find the **measure** of the **smallest angle**.

9. If $\tan \Theta = -\frac{15}{8}$, Θ in quadrant II. Use a suitable identity to find the **exact value** of $\cos 2\Theta$. Write your answer as a simple fraction.

10. Evaluate: $\sin\left(\cot^{-1}\frac{x}{2}\right)$

Part II. Answer any five questions (worth 8 points each). Cross out the three questions you choose not to answer.

11. If $f(x) = \frac{2x+3}{3x^2+7x-6}$ find:

(if any item does not exist, write "NONE")

(a) the **coordinates** of the **x-intercept(s)**: _____

(b) the **coordinates** of the **y-intercept(s)**: _____

(c) the **equation** of the **vertical asymptote(s)**: _____

(d) the **equation** of the **horizontal asymptote(s)**: _____

(e) **sketch** the **graph** of f together with all the points and lines found above

12. Find all **solutions** x (in **radians**) in the interval $[0,2\pi)$:

$$\cos 2x - \sin x = 1$$

13. If $f(x) = x^3 - 7x^2 + 11x + 3$

(a) Give a complete list of **all** possible **rational zeros**:

(b)Use synthetic division to **check** that $x = 3$ is a rational zero:

(c) Find **all** remaining zeros:

(d) Write f as a product of **linear factors**:

$f(x) =$ _____

14. Use algebra to find **all solutions** of the system:

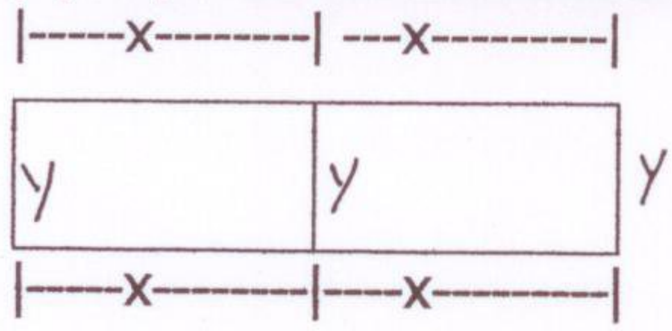
$x^2 + 4y^2 = 25$

$x + 2y = 7$

15. Find the center, the vertices, and the foci of :
$9x^2 + 4y^2 + 18x - 16y = 11$. Then draw the graph. Label all points found.

16. A farmer has 160 feet of fencing to enclose two adjacent rectangular pig pens.

(a) Express the enclosed area as a function of x only:



(b) What dimensions should be used so that the enclosed area will be a maximum?

17. Given complex number: $z = 6(\cos 60^0 + i \sin 60^0)$, compute z^4 in trigonometric form, then convert your answer to standard form.

18. Prove the following identity:

$$1^2 + 2^2 + 3^2 + \ldots + n^2 = \frac{n\,(n+1)\,(2n+1)}{6}$$