Algebra II / Mr. Hansen
5/17/2016

Name: KEY

. . .

# Quiz (40 pts.) on Ineq/Lin Sys/Lin Prog

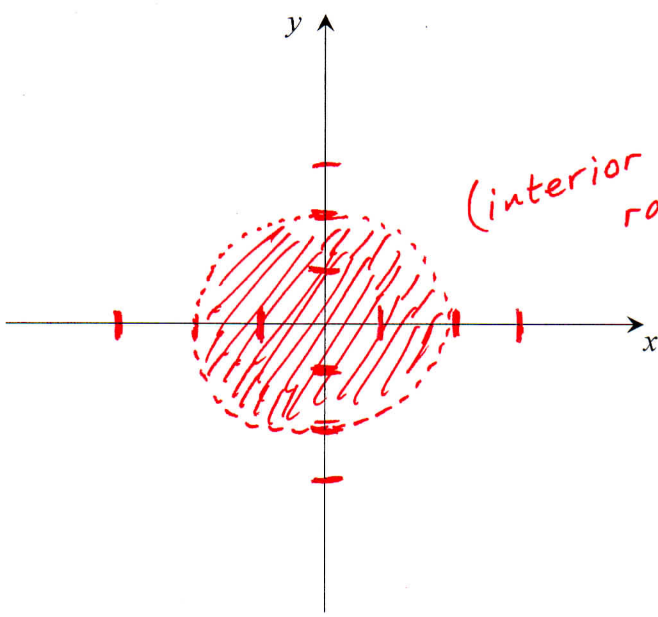
**Instructions:** Graphing calculator and PENCIL are required . If you need more room for rough scratch work, use the reverse sides, which will not be graded (unless you need more room for work that is to be graded, in which case you should write OVER and continue on the back side). Circle all answers in problems involving work (no need to circle if the answer is a graph or a fill-in without any work).

**Note:** For this test, please round all approximate answers to 4 decimal places after the decimal point unless otherwise stated. All graphs must include some tick marks for full credit.

**Part I: Inequalities (14 pts.)**

1. The first step in graphing any inequality is to consider the related __equation__ and graph it first. Then, use the "bug method" or the "test point method" to determine what region needs to be __shaded__ . *Hint:* Blanks represent words starting with the letters E and S, respectively.

2. On the axes provided below, sketch the solution set of the nonlinear inequality $x^2 + y^2 < 4$.




(interior of circle of radius 2, centered at the origin)

**Part II: Linear Systems (16 pts.)**

3. Write the solution set of the system given below. Your answer must be in the form of a solution set in order to receive full credit. No work is required.

$$\left[\begin{array}{rcrcrcrcr} 4w & - & 2x & + & 3y & - & z & = & -4 \\ & & 3x & + & 11y & & & = & 48 \\ -w & + & 4x & - & 3y & - & 2z & = & \frac{19}{2} \\ w & + & x & - & y & + & \frac{z}{4} & = & 1.75 \end{array}\right.$$

$\{(-\frac{1}{2}, 5, 3, 1)\}$

4. Write the solution set of the system given below. Your answer must be in the form of a solution set in order to receive full credit. No work is required.

$$\begin{cases} x - y - z = 2 \\ x + y + 3z = 6 \\ 2x + 2z = 8 \end{cases}$$

Reduced row-echelon form is $\begin{bmatrix} 1 & 0 & 1 & 4 \\ 0 & 1 & 2 & 2 \\ 0 & 0 & 0 & 0 \end{bmatrix}$,

which means $\boxed{\{(x,y,z) : z \in \mathbb{R}, x = 4 - z, y = 2 - 2z\}}$

5. Circle the letter of the best choice:

The system of equations in #4 . . .

(A) is underdetermined (infinitely many solutions)
(B) is overdetermined
(C) has a unique solution

6. Creative work: Make up a linear system of equations in 2 variables such that the system is overdetermined (i.e., has no solution). Be sure to include the square bracket at the left of your system.

$$\begin{cases} x + y = 8 \\ x - y = 3 \\ 2x + 2y = 15 \end{cases}$$

**Part III: Linear Programming (10 pts.)**

7. We have two sugar solutions, 100 ml of each. The first solution is 5% sugar and costs 5 cents per liter. The second solution is 20% sugar and costs 8 cents per liter. Our task is to find the appropriate quantities of each to use in order to obtain a 15% (or more) sugar solution having minimum cost. However, we need at least 120 ml of the blended solution.

**Step 1:** Let $x$ denote quantity of 5% solution used (in ml), and let $y$ denote quantity of 20% solution used (in ml)

**Step 2:** Minimize $C(x, y) =$ cost $= 0.05\left(\frac{x}{1000}\right) + 0.08\left(\frac{y}{1000}\right)$ subject to these constraints:

[List all constraints as inequalities.]

$$\begin{cases} 0.05x + 0.2y \geq 0.15(x+y) \\ x + y \geq 120 \\ x \leq 100 \\ y \leq 100 \\ x \geq 0 \\ y \geq 0 \end{cases}$$

**Step 3:** We now graph all the inequalities. The feasible region is the intersection of the regions defined by the solutions of the individual inequalities listed in step 2. (Assume step 3 has been done, and now skip ahead to step 4.)

**Step 4:** We compute the cost function $C(x, y)$ for each corner point of the feasible region found in step 3. The solution to the linear programming exercise is then the point whose cost function is the least.