(5 pts) Print Your Name

Show all work. Do your own work. Work down the page. The right half of the page is for scratch work. Show all scratch work. Circle final answers. Leave plenty of space.

Paper will be provided. Do not take anything from the test with you when you leave. We'll sell your car keys back to you. Don't worry.

Turn in your test sheets, your work, and your cheat sheet.

The main difference between this test and your Written Assignments is that you don't have to write out the question on a test. No annoying "Context" deductions. That doesn't relieve you of the need for a lexicon for all word problems that defines all variables in words, and the units in which the variables are measured.

Draw Pictures! Fare well!

1. (10 pts) Sketch the system of linear inequalities

$$x - 3y \le 15$$
$$2x + 9y < 36$$
$$x > -2$$

Find and label all x- and y-intercepts with ordered-pair labels, such as (-2, 0). Don't waste time on tick marks. Eyeball it and label things. Use the intercept method. The last inequality only has an x- intercept on its boundary.

- 2. (5 pts) Find the corner points of the feasible region. For full credit, give exact answers as fractions.
- 3. Solve the absolute-value inequalities.
  - a. (5 pts)  $|-3x-9| \ge 6$
  - b. (5 pts) |-3x-9| < 6
  - c. (5 pts) |-3x-9| < -6

4. Let 
$$f(x) = \frac{1}{x-6}$$
,  $g(x) = \sqrt{x-15}$ , and  $h(x) = x^2 - 2x$ 

- a. (5 pts) Find the domain of f, g, and h.
- b. (5 pts) Find f + g and state its domain.
- c. (5 pts) Find  $g \circ h$  and state its domain.

- d. (Bonus 5 pts) Find  $f \circ g \circ h$  and state its domain.
- 5. Let A = (-3, 4) and B = (8, 17). If you mastered point-slope as instructed, this is easy. If you always go back to slope-intercept, this is a lot of work.
  - a. (5 pts) Find an equation  $y = m(x x_1) + y_1$  of the line passing through A and B.
  - b. (5 pts) Find an equation of the line  $y = m(x x_1) + y_1$  passing through  $\left(\frac{3}{13}, \frac{5}{117}\right)$  that is parallel to the line from part a.
  - c. (5 pts) Find an equation of the line  $y = m(x x_1) + y_1$  passing through  $\left(\frac{3}{13}, \frac{5}{117}\right)$  that is perpendicular to the line from part a.
- 6. Consider the quadratic function  $f(x) = x^2 3x 1$ .
  - a. (5 pts) Solve the equation f(x) = 0 using the Quadratic Formula. For full credit, evaluate the discriminant and its square root, first. I'm looking for exact answers, not decimal approximations.
  - b. (5 pts) Solve the equation f(x) = 0 by completing the square. Find the exact solution. Do not use a calculator.
  - c. (5 pts) Write f(x) in standard form  $f(x) = a(x-h)^2 + k$  and sketch its graph. Include the x- and y-interepts, as well as the vertex in your graph.
  - d. (5 pts) What is the domain of f? What is the range of f?
- 7. (5 pts) Solve the equation  $\frac{5x+25}{x+3} = \frac{4x+20}{x+2}$  for x.
- 8. (5 pts) Solve the inequality  $\frac{5x+25}{x+3} \ge \frac{4x+20}{x+2}$  for x.
- 9. Let  $f(x) = x^4 2x^3 + x^2 + 8x 20$ .
  - a. (5 pts) List all possible rational zeros of f.
  - b. (5 pts) Use synthetic division and the rational zeros of f to split f into the product of 2 linear factors and one irreducible quadratic factor.

- c. (Bonus 5 pts) Find the nonreal zeros of f, using your work from part b.
- d. (Bonus 5 pts) Split f into the product of 4 linear factors.
- e. (5 pts) Sketch a graph of f, showing all intercepts.

10. (5 pts) Sketch the graph of  $R(x) = \frac{x-2}{x+4}$ . Show all intercepts and asymptotes.

11. (Bonus 5 pts) Sketch the graph of  $T(x) = \frac{x^2 + 3x - 28}{x + 5}$ . Show all intercepts and asymptotes.

12. (Bonus 5 pts) Let 
$$U(x) = \frac{(x+3)^2 (x-5)^3 (x-8)}{(x+5)^2 (x-7)}$$
 = What is the domain of  $V(x) = \sqrt{U(x)}$ ?

- 13. (5 pts) Sketch the graph of  $g(x) = 4 \cdot 3^{2x-10}$  in 4 steps, counting the graph of  $f(x) = 3^x$  as the first step. Label the key points  $\left(-1, \frac{1}{3}\right), (0,1)$ , and (1,3) in the first graph, and track their movements through each step. For instance,  $\left(-1, \frac{1}{3}\right)$  will move to  $\left(-1, \frac{4}{3}\right)$  in the 2<sup>nd</sup> graph. Then  $\left(-1, \frac{4}{3}\right)$  will move to another point in the 3<sup>rd</sup> graph, etc.
- 14. (Bonus 5 pts) Find the inverse of g(x) from the previous question.
- 15. (Bonus 5 pts) Sketch the graph of  $g^{-1}(x)$  from the previous question in 4 steps, counting the graph of the basic graph underlying it. Trace the movements of the points  $(\frac{1}{3}, -1)$ , (1,0), and (3,1) in the basic function graph through each step.
- 16. (5 pts) Sketch the graph of the parabola  $y-5 = -\frac{1}{20}(x-2)^2$ . Label the center, focus, and endpoints of the *latus rectum*. Also label the *x* and *y*-intercepts.
- 17. (5 pts) Graph the hyperbola given by the equation  $\frac{x^2}{64} \frac{y^2}{36} = 1$ . Label the center, foci, vertices and asymptotes. I don't need to see the equations of the asymptotes, if you make "the box" and show its *x* and *y*-intercepts, that should suffice.
- 18. (Bonus 5 pts) Show that the equation  $36x^2 + 25y^2 + 144x 350y = -469$  represents an ellipse, by completing the square, and write the ellipse's equation in standard form.

- 19. (Bonus 5 pts) Sketch the graph of the ellipse, showing the center, the endpoints of its major and minor axes, and both of its foci.
- 20. (Bonus 5 pts) Label the endpoints of the *latera recti* of the ellipse in #19.
- 21. (5 pts) Use Pascal's triangle to expand  $(x-2y)^5$
- 22. (5 pts) What is the coefficient of  $x^5 y^7$  in the expansion of  $(x-2y)^{12}$ ?
- 23. (5 pts) How many ways can you pick 4 volunteers from a group of 12 volunteers?
- 24. (5 pts) How many ways can a president, vice-president, treasurer and secretary be chosen from a club with 30 members?
- 25. (5 pts) Solve the following system of equations by elimination method. If no solution, state why. If infinitely many solutions, state the general solution.

3x + 2y - 7z = 112y - 5z = 124y - 10z = 20