

Math 135 - Final Exam

Please do the following:

- a.) read each problem and its directions CAREFULLY;
- b.) write neatly and legibly in the space provided, making sure that your final answer is clearly indicated;
- c.) show all work.

A. Simplifying Expressions

1. Perform the operation and reduce to lowest terms.

$$\frac{r^2 + 5r + 6}{r^2 + r - 12} \cdot \frac{r^2 + 5r + 4}{r^2 + 4r + 3}$$

2. Rationalize the denominator.

$$\frac{7}{3 - \sqrt{5}}$$

For 3 and 4, remove as many factors as possible from under the radical, and combine any like-terms. Assume that all variables represent positive real numbers.

3. $\sqrt[4]{243a^8b^7c^{17}}$

4. $4\sqrt{63} - 3\sqrt{28}$

For 5 and 6, write answers with positive exponents only. Assume that all variables represent positive real numbers

5. $\frac{4q^{-7}(4q^2)^{-2}}{q^{-5}}$

6. $\frac{x^{\frac{7}{3}}y^{-\frac{2}{7}}z^{\frac{3}{5}}}{x^{-\frac{2}{3}}y^{\frac{5}{7}}z^{-\frac{7}{5}}}$

B. Solving Equations

For 7, 8, and 9, solve each equation. Write all possible values for the given variable. If the solution is irrational, make sure it is simplified.

7. $t(2t - 13) = 7$

8. $5x^2 + 2 = 8x$

9. $\frac{2y + 3}{y + 1} - \frac{y - 2}{y - 1} = \frac{2}{y^2 - 1}$

10. Solve the inequality for the given variable. Give EACH of the following:

- a.) a number line expression,
- b.) an inequality, and
- c.) a representation in interval notation.

$$\frac{4}{k} - \frac{5}{k-3} \geq -1$$

C. Linear Functions

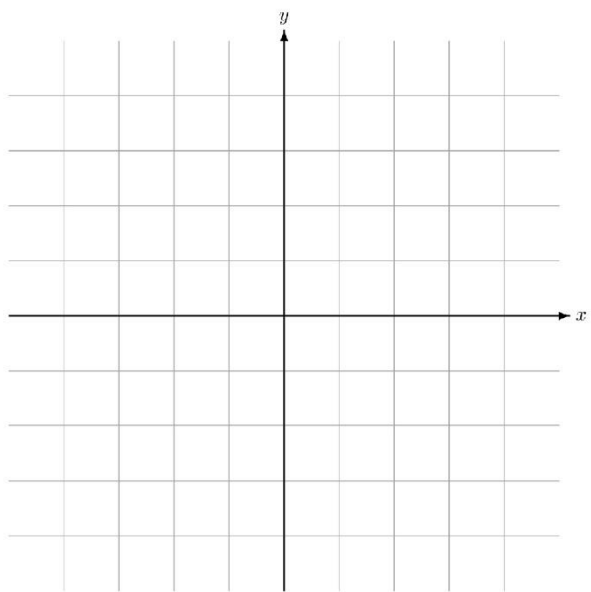
11. Give an equation for the line parallel to the line

$$2x - 3y = 6$$

that goes through the point $(3, 5)$.

12. a.) Give an equation for the horizontal line that goes through the point $(4, -2)$.

- b.) Graph that line on the provided grid, and label any intercepts.



13. A firm that manufactures laptop computers charges \$450 each for its M1 model. The marginal cost to the firm of producing one more M1 is \$150. The firm's fixed costs pertaining to production of the M1 are \$12,000 per month.

Let x be the number of M1's produced and sold in a month's time.

Assume that the firm's monthly cost of production of any of its models is a LINEAR function of the quantity produced of that model.

a.) What is $C(x)$, the firm's total monthly cost function in dollars for production of the M1?

b.) What is $P(x)$, the firm's monthly profit function in dollars for production and sales of the M1?

c.) What is the monthly profit to the firm in dollars from the production and sale of 70 M1's?

14. The relationship between temperature measurement from Fahrenheit to Celsius is a LINEAR relationship. It is known that water freezes at 0° Celsius (32° Fahrenheit), and that water boils at 100° Celsius (212° Fahrenheit).

Let the variable C stand for temperature in degrees Celsius, and F stand for temperature in degrees Fahrenheit.

Temperature	C	F
Water freezes	0°	32°
Water boils	100°	212°

- a.) Give an equation in C and F that models the relationship between degrees Fahrenheit and degrees Celsius.

(Hint: Your answer should be of the form $F = mC + b$.)

- b.) The temperature must be much lower to freeze alcohol than to freeze water. Ethyl alcohol, for example, freezes at -114° Celsius. What temperature is this in degrees Fahrenheit?

15. The following table gives information about ten students. It tells each student's study time in hours in preparation for the math portion of the SAT, and it gives each student's corresponding score on the test.

Hours Spent Studying	Math SAT Score
9	580
14	730
8	590
4	410
7	530
1	350
3	400
8	560
5	450
6	520

a.) Let the variable x stand for students' study time in hours, and let y be students' corresponding scores on the math SAT.

Using a linear regression application/calculator, give an equation in x and y for the line of best fit that relates study times in hours to scores.

b.) Using this equation, what score would you expect to achieve if you studied for 12 hours?

D. Systems of Equations

For questions 16 to 18, solve each system of equations, and express your answer as an ordered pair (e.g. if the solution is $x=9$ and $y=1$, write " $(x,y) = (9,1)$ ".)

If there is no solution, write "No solution."

If there is an infinite number of solutions, then express a parametrized solution (i.e. express the solution as the ordered pair $(t, f(t))$).

16. $14x - 10y = 20$

$$y = \frac{7}{5}x - 2$$

17. $9x + 3y = 4$

$$y = -3x + 8$$

18. $2x - 3y = -2$

$$4x + y = 24$$

19. Using the Gauss/Jordan row reduction method, reduce the following system to solve for at least ONE variable (you may choose which variable).

Before each reduction, describe the row operation for that specific reduction.

$$x - 2y + 3z = 7$$

$$x + z = 3$$

$$-2x + z = -3$$

(Hint: The solution has only integer values. If you get any value other than an integer, you've made a mistake.)

20. Using a matrix operations calculator/application, solve the following system for EACH given variable. Express your answer as an ordered quadruplet (e.g. if your solution is "w=8, x=7, y=6, z=5", write "(w,x,y,z) = (8,7,6,5)").

$$2w - x + 5y + z = -3$$

$$3w + 2x + 2y - 6z = -32$$

$$w + 3x + 3y - z = -47$$

$$5w - 2x - 3y + 3z = 49$$

(Hint: The solution has only integer values. If you get any value other than an integer, you've made a mistake.)

Bonus: (1pt each)

For each of the following intervals, classify each as one of the following:

CLOSED, OPEN, NEITHER, or BOTH.

(Hint: For any that you aren't sure of, I wouldn't mind terribly if you took a minute to look the answer up somewhere.)

(i) $(-1, 5) \cup (15, 20)$

(ii) $[0, 5]$

(iii) $[0, \infty)$

(iv) $(-\infty, 5)$

(v) $(0, 5]$

(vi) $(-1, 5) \cup [15, 20]$

(vii) $(-\infty, 5) \cup (9, \infty)$

(viii) $(-\infty, \infty)$