Math 1160 – Finite Math
Test #1 Review Guide
Summer II, 2008

Students - To prepare for the test, please study from your homework, quizzes, and take the practice test. The answers to the practice test are at the end of this document.

SECTION	CONCEPTS REVIEWED AND HINTS
1.1	**STANDARD FORM OF AN EQUATION** Be able to convert an equation to the standard form y = mx + b
1.1	**GRAPHING AND INTERPRETING** Be able to graph a linear equation and to interpret the slope and y-intercept.
1.1	**X-INTERCEPT and Y-INTERCEPT** x-intercept → The value of x when y = 0 (x, 0) y-intercept→ The value of y when x = 0 (0, y)
1.2	**IS A POINT IN THE FEASIBLE SET OF SOLUTIONS?** Plug the coordinates of the point into every inequality. For the point to be in the feasible set, it must make *all* inequalities true.
1.2	**STANDARD FORM OF A LINEAR INEQUALITY** *Make sure that if you multiply or divide the inequality by a negative number, you reverse the direction of the inequality sign.
1.2	**GRAPHING A LINEAR INEQUALITY or a SYSTEM OF LINEAR INEQUALITIES** 1. Graph the dividing line (the equation part of the inequality) 2. "Cross out" the area (or points) which are NOT feasible solutions.
1.3	**FIND A POINT OF INTERSECTION OF A PAIR OF LINES** 1. Substitution method 2. Addition/Elimination method 3. Graphing and using the calculator to find a point of intersection
1.4	**SLOPE OF A LINE → when given points (x_1, y_1) and (x_2, y_2)** $\frac{y_2 - y_1}{x_2 - x_1}$ Remember the Parallel and Perpendicular Properties as relating to slope. 1. Parallel lines have the <u>same</u> slope. 2. The slopes of perpendicular lines are <u>negative reciprocals</u> of each other.
1.4	**SLOPE AND Y-INTERCEPT IN FINANCIAL EQUATIONS** $y = mx + b$ m (slope) → Represents the variable cost (cost per unit). b (y-intercept) → Represents the fixed cost.

SECTION	CONCEPTS REVIEWED AND HINTS
1.4	**POINT-SLOPE FORMULA** $y - y_1 = m(x - x_1)$ Use the point-slope formula to solve for the equation of a line, where *m* is the slope of the line and (x_1, y_1) is the point given.
1.5	**LINEAR REGRESSION (least squares line or best fit line)** 1. Enter the x (column 1) and y (column 2) values into your calculator utilizing the "STAT" key. 2. To calculate the regression line, enter "STAT", "CALC", "4:LinReg(ax+b)". 3. The slope will be displayed (a) and y-intercept (b).
3.1	**LINEAR PROGRAMMING** 1. Be able to determine an objective function (usually financial) 2. Translate data given into inequalities $\leq$ (look for key words "maximum" , "available", "at most") $\geq$ (look for key words "order" , "minimum", "at least") Don't forget $x \geq 0$ and $y \geq 0$ 3. Be able to determine if a point is in a feasible set by plugging the coordinates of the point into all inequalities.
3.2	**LINEAR PROGRAMMING II** 1. Be able to find the coordinates of all vertices of a feasible set. 2. Determine the optimal point by plugging the coordinates of all vertices into the objective function and finding the optimal value.
2.1	**ROW OPERATIONS ON MATRICES** Elementary Row Operation #1 → Change the order of the equations (rows) Elementary Row Operation #2 → Change an equation (row of matrix) by multiplying the row by a nonzero number. Elementary Row Operation #3 → Change an equation (row of matrix) by adding to it a multiple of another equation (row of matrix).
2.1	**SOLVE A SYSTEM OF LINEAR EQUATIONS USING CALCULATOR (1 unique solution)** Utilize the "matrix" function on the calculator to enter the entries of your matrix. Use the "rref" function to convert the matrix to "diagonal" form.
2.2	**SOLVE A SYSTEM OF LINEAR EQUATION USING CALCULATOR ("No Solutions" OR "Infinite Number of Solutions")** Utilize the "matrix" function on the calculator to enter the entries of your matrix. Use the "rref" function to convert the matrix to "diagonal" form. Convert matrix rows to equation format. 1. **0 = a number other than zero** → No Solutions 2. **0 = 0** → Infinite Number of Solutions (define each variable) 3.

SECTION	CONCEPTS REVIEWED AND HINTS
2.3	**ADDITION AND SUBTRACTION OF MATRICES** The matrices must be the same dimension in order to be added or subtracted. If they are the same dimension, add/subtract the corresponding entries.
2.3	**MULTIPLICATION OF MATRICES** You can multiply 2 matrices when the number of columns of the 1st matrix equals the number of rows of the 2nd matrix. Example: [4 x **2**] x [**3** x 4] → Can Not Multiply [2 x **4**] x [**4** x 2] → Can Multiply
2.3	**MATRIX EQUATIONS** Convert a system of equations to an equation consisting of a coefficient matrix (A), variable matrix (X), and a solution matrix (B).
2.4	**SOLVING MATRIX EQUATIONS** $AX = B$ — A = Coefficient Matrix $X = A^{-1}B$ — X = Variable Matrix B = Constant Matrix
2.4	**FINDING THE INVERSE OF A MATRIX** Enter the matrix into your calculator. Pull up the matrix on your main screen, and press the x^{-1} key to get the inverse.
2.6	**INPUT-OUTPUT ANALYSIS** Solve for matrix X (how much to produce) using the formula → $X = (I – A)^{-1}D$ A is the input-output matrix (internal consumption of products) D is the demand matrix (outside demand for products) I is the identity matrix (needs to be the same dimensions as matrix A)

Practice Test

_______1. The standard form of the inequality $3x - 2y \geq 12$ is

A. $y \geq (3/2)x - 6$
B. $y \leq (3/2)x - 6$
C. $y \leq (-3/2)x + 6$
D. $y \geq (3/2)x + 6$
E. $y \geq (-3/2)x + 6$

_______2. Determine which of the following points is in the feasible set of the system of inequalities:

$$\begin{cases} x + y \geq 3 \\ 3x - y \geq 1 \\ x \leq 3 \end{cases}$$

A. (1, 4)
B. (-1, 2)
C. (1, 6)
D. (0, 0)
E. (2, 4)

_______3. The equation of the line passing through the point (-1, 2) and parallel to the line $y = -3x + 3$ is

A. $y = 3x - 1$
B. $y = -3x + 5$
C. $y = -3x -1$
D. $y = 3x + 5$
E. $y = -3x - 5$

_______4. The manager of the purchasing department of a large banking organization would like to develop a model to predict the completion time, *y* (in hours), that it takes to process a number of invoices, *x*. A sample of 6 days were randomly selected and the following table was constructed with the data:

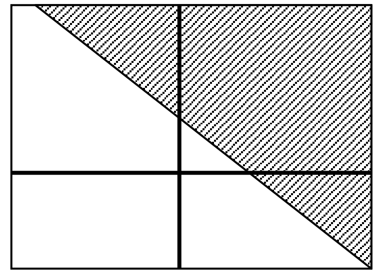
Invoices Processed (*x*)	Completion Time (*y*)
149	2.1
60	1.8
188	2.3
19	0.3
201	2.7
58	1.0

Using the calculator, find the best fitting line for the data.

A. $y = 0.503x + 0.011$
B. $y = 0.011x + 0.503$
C. $y = 78.442x - 20.852$
D. $y = -20.852x + 78.442$
E. $y = 0.048x + 3.762$

______5. Consider the following graph:

Recalling that we shade (cross out) the region containing the points that are NOT solutions to the linear inequality, which linear inequality best describes this graph?



A. $y \geq -2x + 3$
B. $y \leq 2x - 3$
C. $y \geq 2x + 3$
D. $y \leq -2x - 3$
E. $y \leq -2x + 3$

______6. Consider a linear programming problem in which the objective function is –3x + 6y. If the vertices of the feasible set are {(1, 1), (1, 3), (5, 1), (6, 3), (4, 5)}, which vertex minimizes the objective function?

A. (4, 5)
B. (6, 3)
C. (1, 1)
D. (5, 1)
E. (1, 3)

Problems 7 and 8: North American Housing is a builder of two types of modular homes, the Basic and the Deluxe. The Basic requires 400 worker-days of carpentry, 10 worker-days of painting and sells for a profit of $3,000. The Deluxe requires 300 worker-days of carpentry, 20 worker-days of painting and sells for a profit of $4,000. The North American Housing has available at most 48,000 worker-days of carpentry and 1,600 worker days of painting.

Let *x* represent the number of Basic models produced and *y* represent the number of Deluxe models produced. North American Housing builds modular homes in order to <u>maximize its profits</u>.

______7. In this situation, what is the objective function?

A. $400x + 300y$
B. $10x + 20y$
C. $3000x + 4000y$
D. $48{,}000x + 1600y$
E. $4000x + 3000y$

______8. In this situation, which inequality states the restriction on *x* and *y* due to carpentry?

A. $400x + 300y \geq 48{,}000$
B. $400x + 300y \leq 48{,}000$
C. $300x + 400y \leq 48{,}000$
D. $400x + 300x \leq 48{,}000$
E. $300x + 400y \geq 48{,}000$

______9. Suppose that property taxes for Kalamazoo residents follows the given equation $y = 50x + 100$, where x is the assessed value of the home (in thousands of dollars) and y is the property taxes (in dollars). Which of the below statements is the interpretation of the slope?

A. As the assessed value of the house increases by $1000, the property taxes for the house increase by $100.
B. As the assessed value of the house increases by $1, the property taxes for the house increase by $50.
C. As the assessed value of the house increases by $1, the property taxes for the house increase by $100.
D. As the assessed value of the house increases by $1000, the property taxes for the house increase by $50.
E. As the assessed value of the house increases by $50, the property taxes for the house increase by $1000.

For problems 10 and 11, use the following information: In 2000, Acme Business Supply Co. used the previous five years of revenue data to form a linear equation, to predict the revenue, y (in millions of dollars), based on the number of years after 1995, x. The method of least squares resulted in the following equation as the best fitting line through the data: $y = 0.874x + 12.731$.

_____10. What is the predicted revenue for 2003?

A. $18.849 million
B. $12.731 million
C. $20.597 million
D. $1,763.353 million
E. $19.723 million

_____11. If this linear trend continues, predict what year the yearly revenues reach $25.841 million?

A. 2039
B. 2015
C. 2030
D. 2010
E. 2008

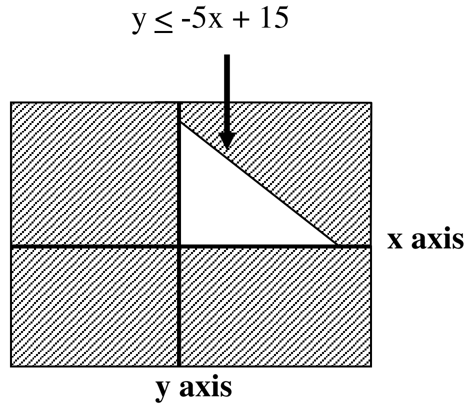
_____12. Find the point of intersection of the following equations.

$$\begin{cases} x - y = 1 \\ x + 2y = 2 \end{cases}$$

A. (4/3, 1/3)
B. (2, 1)
C. (1, 1/2)
D. (4/3, 0)
E. (-1, -2)

_____13. Consider the following graph:

What are the values of the 3 vertices of the feasible region denoted in the diagram?



A. (0,15) (0,0) (-3,0)
B. (15,0) (0,0) (3,0)
C. (0,15) (0,0) (3,0)
D. (15,0) (0,0) (0,-3)
E. (0,3) (0,0) (15,0)

_____14. A coffee merchant sells two blends of coffee. Each pound of blend A contains 80% Mocha Java and 20% Jamaican and sells for $2 a pound. Each pound of blend B contains 35% Mocha Java and 65% Jamaican and sells for $2.25 a pound. The merchant has available 1000 pounds of Mocha Java and 600 pounds of Jamaican. The merchant will try to sell the amount of each blend that maximizes her income. Let x be the number of pounds of blend A and y be the number of pounds of blend B.

In the situation above, the objective function is

A. $0.80x + 0.20y$
B. $2x + 2.25y$
C. $2.25x + 2y$
D. $1000x + 600y$
E. $0.35x + 2y$

_____15. The standard form of the linear equation $4x – 8y = 16$ is

A. $y = (-1/2)x - 2$
B. $8y = -4x + 16$
C. $(1/4)x – (1/2)y = 1$
D. $y = (1/2)x + 2$
E. $y = (1/2)x - 2$

_____16. The x-intercept of the line $y = 9x – 12$ is

A. (0, 4/3)
B. (9, 0)
C. (0, -12)
D. (4/3, 0)
E. (-12, 0)

_____17. Find the slope of the line perpendicular to $5x – 2y + 10 = 0$.

A. 5/2
B. -2
C. –2/5
D. 5
E. 2/5

_____18. Suppose that the cost of making 20 radios is \$2000 and the cost of making 40 radios is \$3600. Letting x represent the number of radios and letting y represent the total cost, which statement is true?

A. The cost to make each radio is \$90.
B. The cost to make each radio is \$80.
C. The cost to make each radio is \$100.
D. The fixed cost of production is \$1600.
E. The fixed cost of production is \$1000.

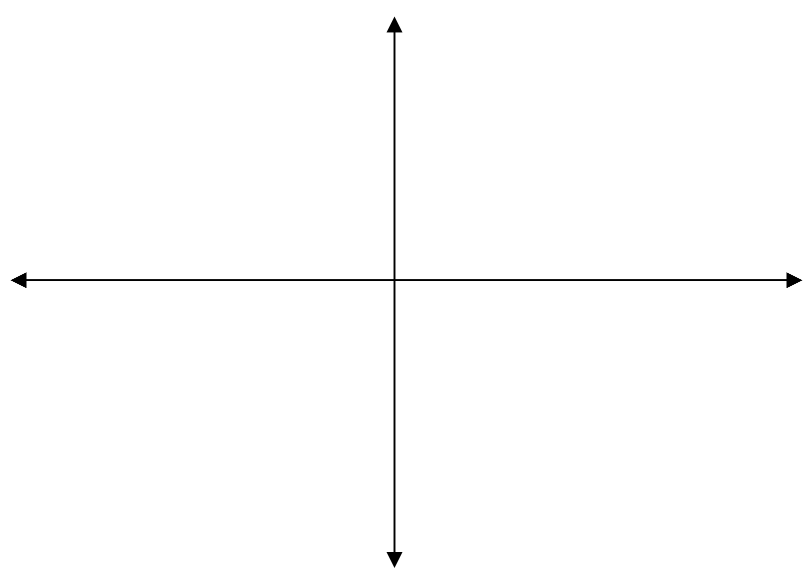
_____19. A person decides to make rice and soybeans part of their staple diet. Let the following table represent the table created that is used to translating the problem into mathematical language:

	Rice	Soybeans	Minimum requirement level per day
Protein (grams/cup)	15	22.5	90
Calories (per cup)	810	270	1620
Riboflavin (milligrams/cup)	1/9	1/3	1
Cost (cents/day)	21	14	

If x represents the number of cups of rice eaten per day and y represents the number of cups of soybeans eaten per day, which of the following inequalities below is due to the restriction placed on the diet by protein?

A. $90x + 1620y \geq 1$
B. $810x + 270y \geq 1620$
C. $15x + 810y \leq 21$
D. $22.5x + 270y \geq 14$
E. $15x + 22.5y \geq 90$

_____20. Graph the following two inequalities: $y \leq 2x + 1$ and $y \geq -3x + 4$.



_____21. If B is a 4 x 2 matrix and A is a 3 x 4 matrix, then the size of AB is

A. 4 x 4
B. 3 x 4
C. 4 x 2
D. 2 x 3
E. 3 x 2

_____22. The system of linear equations that is equivalent to the matrix equation

$$\begin{bmatrix} -2 & 5 \\ 1 & 4 \end{bmatrix}\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 3 \\ 6 \end{bmatrix} \text{ is}$$

A. $\begin{cases} -2x+5y=3 \\ x+4y=6 \end{cases}$

B. $\begin{cases} -2x+y=3 \\ 5y+4y=6 \end{cases}$

C. $\begin{cases} -2x+5x=3 \\ y+4y=6 \end{cases}$

D. $\begin{cases} -2x+y=3 \\ 5x+4y=6 \end{cases}$

E. $\begin{cases} -2y+5x=3 \\ y+4x=6 \end{cases}$

_____23. Given the following matrices:

$$A = \begin{bmatrix} 5 & -5 & -6 \\ -5 & 3 & -2 \end{bmatrix}, \quad B = \begin{bmatrix} 2 & 1 \\ -6 & -7 \end{bmatrix}, \text{ and } \quad C = \begin{bmatrix} 9 & -8 \\ 0 & -5 \\ 9 & 1 \end{bmatrix},$$

Which one of the following matrix product listed below is NOT defined?

A. $A \ x\, C$
B. $A \ x\, B$
C. $B \ x\, A$
D. $C \ x\, B$
E. $C \ x\, A$

_____24. Which is the result of performing the row operation [2] + (– 3)[1] on the following matrix: $\begin{bmatrix} 2 & 8 & 4 \\ 6 & 5 & 10 \end{bmatrix}$?

A. $\begin{bmatrix} 2 & 8 & 4 \\ 0 & -19 & -2 \end{bmatrix}$

B. $\begin{bmatrix} 1 & 0 & \frac{30}{19} \\ 0 & 1 & \frac{2}{19} \end{bmatrix}$

C. $\begin{bmatrix} 1 & \frac{5}{6} & \frac{5}{3} \\ 0 & 1 & \frac{2}{19} \end{bmatrix}$

D. $\begin{bmatrix} 2 & 8 & 4 \\ -24 & -39 & -42 \end{bmatrix}$

E. $\begin{bmatrix} -6 & -24 & -12 \\ 0 & -19 & -2 \end{bmatrix}$

_____25. Using the fact that $X = (I - A)^{-1} D$, find X given that the input-output matrix is $\begin{bmatrix} 0.278 & 0.125 & 0.333 \\ 0.111 & 0.188 & 0.167 \\ 0.167 & 0.125 & 0.167 \end{bmatrix}$ and the demand matrix is $\begin{bmatrix} 60 \\ 110 \\ 60 \end{bmatrix}$.

A. $\begin{bmatrix} 50.41 \\ 37.36 \\ 33.79 \end{bmatrix}$

B. $\begin{bmatrix} 9.59 \\ 72.64 \\ 26.21 \end{bmatrix}$

C. $\begin{bmatrix} 235.56 \\ 584.27 \\ 157.51 \end{bmatrix}$

D. $\begin{bmatrix} 178.33 \\ 187.81 \\ 135.96 \end{bmatrix}$

E. $\begin{bmatrix} 259.56 \\ 474.27 \\ 97.51 \end{bmatrix}$

_____26. Given that $A \, x \, X = B$, $A^{-1} = \begin{bmatrix} 0.4 & 0.05 \\ 0.2 & 0.15 \end{bmatrix}$, and $B = \begin{bmatrix} 3 \\ 4 \end{bmatrix}$, then which matrix below is X equal to?

A. $\begin{bmatrix} 2.4 \\ 3.8 \end{bmatrix}$ B. $\begin{bmatrix} 1.4 \\ 1.2 \end{bmatrix}$

C. $\begin{bmatrix} 3.4 \\ 4.2 \end{bmatrix}$ D. $\begin{bmatrix} 2 \\ 0.75 \end{bmatrix}$

E. $\begin{bmatrix} 5 \\ 20 \end{bmatrix}$

_____27. Use the Gaussian elimination method to solve the following system of linear equations:

$$\begin{cases} 8x + 2y + 4z = 6 \\ 6x + 4y + 3z = 3 \\ 9x + 2y + 6z = 4 \end{cases}$$

A. $x = 4/9$, $y = 1/8$, $z = -29/15$
B. $x = 28/15$, $y = -3/5$, $z = -29/15$
C. $x = 6$, $y = 3$, $z = 4$
D. The system of linear equations has an infinite number of solutions
E. The system of linear equations has no solution

_____28. Let $A = \begin{bmatrix} 1 & 4 \\ 2 & 3 \end{bmatrix}$ and $B = \begin{bmatrix} 3 & -2 \\ 4 & 6 \end{bmatrix}$. The entry in the second row, first column of AB is

A. 8
B. 6
C. 18
D. 22
E. 34

_____29. Consider the following system of linear equations:

$$\begin{cases} 3x + y = 10 \\ -3x - y = k \end{cases}$$

Which of the following is true:

A. If $k = 10$, the system has an infinite number of solutions.
B. If $k = 10$, the system has a unique solution.
C. If $k = -10$, the system has an infinite number of solutions.
D. If $k = -10$, the system has no solution.
E. If $k = -10$, the system has a unique solution.

_____30. Which of the following systems has no solution?

A. $2x + 4y = 10$
$4x + 8y = 20$

B. $2x + 4y = 10$
$2x + 6y = 10$

C. $2x + 4y = 10$
$3x + 6y = 20$

D. $2x + 4y = 10$
$3x + 6y = 15$

E. None of the above

ANSWERS TO SAMPLE TEST QUESTIONS

1. B	11. D	21. E
2. E	12. A	22. A
3. C	13. C	23. B
4. B	14. B	24. A
5. E	15. E	25. D
6. D	16. D	26. B
7. C	17. C	27. B
8. B	18. B	28. C
9. D	19. E	29. C
10. E	20. See below	30. C