

1. For the matrices given, find: $A + B$, $A - B$, $3A$ and $2A - 3B$.

$$\text{a. } A = \begin{bmatrix} 2 & 3 \\ -1 & 5 \end{bmatrix}, B = \begin{bmatrix} 1 & -3 \\ -2 & -4 \end{bmatrix}$$

$$\text{b. } A = \begin{bmatrix} -3 & 1 \\ 0 & -1 \\ 2 & 1 \end{bmatrix}, B = \begin{bmatrix} 4 & 0 \\ -2 & 1 \\ -3 & -1 \end{bmatrix}$$

2. Given matrices A and B , find AB , BA or state whether the product is undefined.

$$\text{a. } A = \begin{bmatrix} 2 & 1 & -3 \\ 0 & 1 & 2 \end{bmatrix}, B = \begin{bmatrix} 1 & -4 \\ 0 & 2 \\ 1 & 0 \end{bmatrix} \quad \text{b. } A = \begin{bmatrix} 1 & 3 & 5 \\ 4 & -2 & 0 \end{bmatrix}, B = \begin{bmatrix} 3 & -4 \\ 2 & 1 \end{bmatrix}$$

3. Determine if each 2×2 matrix has an inverse. If so, find it.

$$\text{a. } \begin{bmatrix} 2 & 1 \\ 3 & 4 \end{bmatrix}$$

$$\text{b. } \begin{bmatrix} 2 & 3 \\ 2 & 2 \end{bmatrix}$$

$$\text{c. } \begin{bmatrix} 6 & 3 \\ 10 & 5 \end{bmatrix}$$

4. Find the determinants of each 3×3 matrix using cofactors.

$$\text{a. } \begin{bmatrix} 1 & 2 & -1 \\ 2 & -1 & 3 \\ -1 & 0 & 1 \end{bmatrix}$$

$$\text{b. } \begin{bmatrix} 2 & 3 & -1 \\ -1 & 0 & 4 \\ 0 & 1 & 1 \end{bmatrix}$$

5. Find the determinant of each matrix using the diagonal method.

a.
$$\begin{bmatrix} 1 & 2 & -1 \\ 2 & -1 & 3 \\ -1 & 0 & 1 \end{bmatrix}$$

b.
$$\begin{bmatrix} 1 & 2 & -1 \\ 2 & -1 & 3 \\ 3 & 1 & 2 \end{bmatrix}$$

6. Solve the system of equations by using linear combinations

a.
$$\begin{cases} x + 2y - z = 3 \\ 3x + 7y - 3z = 12 \\ -2x - 4y + 3z = -5 \end{cases}$$

b.
$$\begin{cases} x - 2y + z = -2 \\ 2x - 3y + 2z = 2 \\ 4x - 8y + 5z = -5 \end{cases}$$

Extra Problems: Section 7.3

Name _____

1. A fertilizer processing plant produces three grades of fertilizer. A bag of grade *A* contains 30 lb of component I, 20 lb of component II, and 50 lb of component III. A bag of grade *B* contains 20 lb of component I, 20 lb of component II, and 60 lb of component III. A bag of grade *C* contains 50 lb of component II and 50 lb of component III. Given that the plant has 980 lb of component I, 1800 lb of component II, and 3220 lb of component III, how many bags of each grade should be packaged to use all the available supplier?
2. Assembly lines *A*, *B*, and *C* can produce 8400 TV dinners per day. Lines *A* and *B* together can produce 4900 TV dinners, while *B* and *C* can produce 5600 TV dinners. By using the augmented matrix method of solving a system of linear equations, find the number of TV dinners each assembly line can produce.
3. Determine the equation of the circle that passes through the three given points: $(-2, -2)$, $(10, -8)$, $(7, 1)$.
4. Determine the equation of the parabola with equation $y = ax^2 + bx + c$ that passes through the three given points: $(1, -1)$, $(2, 8)$, $(-2, -4)$.
5. Determine the equation of the circle circumscribing the triangle whose vertices are given: $(0, 3)$, $(6, 1)$, $(3, -3)$
6. Find three numbers whose sum is 50, if the first is 2 more than the second, and the third is two-thirds of the second. Solve this problem by using an augmented matrix for a system of three linear equations.

7. How could you show that the points $(-1, 3)$, $(1, 0)$, $(4, -2)$, and $(14, 13)$ all lie on the same circle?

8. A cookie manufacturer mixes vanilla, chocolate, and vanilla/chocolate cookies to create an assortment for sale. The cookies are packaged in three different sizes according to the following proportions.

Package size I	7 lb chocolate,	5 lb vanilla,	1 lb mixed
Package size II	3 lb chocolate,	2 lb vanilla,	2 lb mixed
Package size III	4 lb chocolate,	3 lb vanilla,	3 lb mixed

If 67 lb of chocolate, 48 lb of vanilla, and 32 lb of mixed are available, how much of each size package may be produced?

9. Meredith has a total of 264 on three tests. The sum of the scores on her first and third tests exceeds her second score by 30. Her first score exceeds her third by 7. Find the three scores.

10. Jan invests \$5,000 in three ways. With one part, she buys mutual funds which offer a return of 10% per year. The second part, which amounts to three times the first, is used to buy government bonds at 8% per year. She puts the rest in the bank at 6% annual interest. The first year her investments bring a return of \$420. How much did she invest each way?

11. Three pumps X , Y , Z are used to pump water from a flooded underpass. When all three pumps are used, 4200 gal/h may be pumped. When only A and B are running, 3000 gal/h may be pumped. When A and C are running, 2800 gal/h can be pumped. What is the pumping capacity of each pump?

12. Three pipes supply an oil storage tank. The tank can be filled by pipes A and B running for 10 h, by pipes B and C running for 15 h, or by pipes A and C running for 20 h. How long does it take to fill the tank if all three pipes run?

7.4 Worksheet

Decompose the following fractions:

1. $\frac{7x+2}{x(x+1)}$

2. $\frac{7x+9}{(x+3)(x-1)}$

3. $\frac{11x+25}{x^2+9x+8}$

4. $\frac{3x+7}{x^2-1}$

5. $\frac{2x^2+15x+25}{x^2+5x}$

6. $\frac{3x^3+3x^2}{x^2+x-2}$

$$7. \frac{6x^2 + 9x - 15}{x(x+5)(x-1)}$$

$$8. \frac{6x^2 - x - 1}{x^3 - x}$$

$$9. \frac{8x^2 - x + 3}{x^3 + x}$$

$$10. \frac{9x^2 + 13x + 15}{x^3 + 2x^2 - 3x}$$

$$11. \frac{11x^2 + 23x + 7}{x^2(x+2)}$$

$$12. \frac{6x^2 + 14x - 9}{x(x+3)^2}$$

Include **objective statement**, **all inequalities**, an **accurate graph**, **all corner points** and their **substitution** into the objective statement, and the **final answer** written with words.

1. Suppose a company produces plywood by using a press to glue veneers together. The veneers come in two grades, A and B, and two kinds of plywood are made, interior and exterior. One panel of exterior plywood requires two panels of grade A veneer, two panels of grade B veneer, and 10 minutes on the press. One panel of interior plywood requires 4 panels of grade B veneers; no grade A veneers and 5 minutes on the press. On a certain day there are 1000 panels of grade A veneer available and 3000 panels of grade B. There are 12 presses and each press can be run for 500 minutes each day. The profit per panel is \$5 for interior plywood and \$6 for exterior plywood. How much of each product should be produced that day to maximize profit? What will be the profit?

2. A refinery mixes high-octane and low-octane fuels to produce regular and premium gasoline. The profits per gallon on the two gasolines are 30 and 40 cents, respectively. One gallon of premium is produced by mixing $\frac{1}{2}$ gallon of each of the fuels. One gallon of the regular gasoline is produced by mixing $\frac{1}{4}$ gallon of the high-octane and $\frac{3}{4}$ gallon of low-octane. If there are 500 gallons of high-octane and 600 gallons of low-octane, how many of each gasoline should the refinery make?

3. In a certain medical office, a routine visit requires 10 minutes of nurses' time, 5 minutes of doctors' time, and 5 minutes of lab time. The comprehensive office visit requires 5 minutes of nurses' time, 25 minutes of doctors' time, and 10 minutes of lab time. In a typical week there are 6150 minutes of nurses' time, 11,000 minutes of doctors' time and 5000 minutes of lab time available. If the medical office clears \$30 from a routine visit and \$50 from a comprehensive visit, how many of each should be scheduled each week?

4. An owner of a fruit orchard hires a crew of workers to prune at least 25 of his 50 fruit trees. Each newer tree requires 1 hour of pruning, while each older tree needs 1.5 hours. The crew contracts to work for at least 30 hours and charge \$15 for each new tree and \$20 for each older tree. To minimize his cost, how many of each kind of tree will the orchard owner have pruned? What will be the cost?

5. Bottled water and medical supplies are to be shipped to victims of an earthquake by plane. Each container of bottled water will serve 10 people and each medical kit will aid 6 people. Each plane can carry no more than 80,000 pounds. The bottled water weighs 20 pounds per container and each medical kit weighs 10 pounds. The total volume of supplies that a plane carries cannot exceed 6000 cubic feet. Each water bottle is 1 cubic foot and each medical kit also has a volume of 1 cubic foot. Determine how many bottles of water and how many medical kits should be sent on each plane to maximize the number of earthquake victims who can be helped.

6. A student earns \$10 per hour for tutoring and \$7 per hour as a teacher's aid. To have enough time for studies, the student can work no more than 20 hours per week. The tutoring center requires that each tutor spend at least 3 hours per week, but no more than 8 hours per week, tutoring. How many hours of each job should the student work to maximize earnings? What will be the student's earnings?
7. You are about to take a test that contains computation problems worth 6 points each and word problems worth 10 points each. You can do a computation problem in 2 minutes and a word problem in 4 minutes. You have 40 minutes to take the test and may answer no more than 12 problems. Assuming you answer all the problems attempted correctly, how many of each type of problem must you do to maximize your score? What is the maximum score?
8. A bottler uses three pure juices – pineapple, orange and grapefruit – to make two juice mixtures, pineapple-orange and pineapple-grapefruit, sold in 1-quart bottles. The profit is 50 cents per bottle of pineapple-orange and 40 cents per bottle of pineapple-grapefruit. Each mixture is made by using equal proportions of the two juices in its name. The amounts of juice on hand are 100 quarts of pineapple juice, 70 quarts of grapefruit juice and 40 quarts of orange juice. How many of each juice mixture should be produced to maximize profit?
9. A certain diet requires at least 60 units of carbohydrates, 45 units of protein, and 30 units of fat each day. Each ounce of Supplement A provides 5 units of carbohydrates, 3 units of protein, and 4 units of fat. Each ounces of Supplement B provides 2 units of carbohydrates, 2 units of protein, and 1 unit of fat. If Supplement A costs \$1.50 per ounce and Supplement B costs \$1.00 per ounce, how many ounces of each supplement should be taken to minimize the cost?
10. A manufacturer of stereo speakers makes two kinds of speakers, an economy model costing \$50 and a deluxe model costing \$200. The deluxe model uses 1 woofer (a low frequency range speaker), 2 tweeters (high frequency range speakers) and 1 mid-frequency range speaker. The economy model uses 1 tweeter, 1 mid-frequency range speaker, and no woofers. How many types of each model should be manufactured to maximize the income from their sales?
11. An entrepreneur is having a design group produce at least six samples of a new kind of fastener that he wants to market. It costs \$9.00 to produce each metal fastener and \$4.00 to produce each plastic fastener. He wants to have at least two of each version of the fastener and needs to have all samples 24 hours from now. It takes 4 hours to produce each metal sample and 2 hours to produce each plastic sample. To minimize the cost of the samples, how many of each kind should the entrepreneur order? What will be the cost of the samples?

HCP PRECALCULUS
Chapter 7 Review

NAME _____

NON-CALCULATOR

1. Solve the system by substitution

$$x - y = 3$$

$$y = x^2 - 5$$

2. Solve the system by elimination.

$$x - y = -2$$

$$x + 2y = 7$$

3. Write the following as a matrix equation ($AX = B$) and then use an inverse matrix to solve

$$2x - 2y = -1$$

$$-2x + y = 5$$

4. WITHOUT SOLVING, write the related system of equations(x, y, z) for the following augmented matrix:

$$\left(\begin{array}{cccc} 2 & 1 & 0 & 3 \\ -1 & 3 & 4 & 0 \\ 0 & -2 & 1 & 5 \end{array} \right)$$

5. WITHOUT SOLVING, write the augmented matrix for the following system of equations:

$$x + 2y + 4z = 16$$

$$3x + 4y + 8z = 1$$

$$2x + 7z = 12$$

6. Find the reduced row echelon form of the following matrix

$$\begin{bmatrix} 1 & 0 & -4 & 1 \\ 3 & 2 & 2 & 10 \\ 2 & 2 & 3 & -3 \end{bmatrix}$$

7. The following matrix is the reduced row echelon form of a system of three equations in three variables. The matrix indicates that there are an infinite number of solutions. Your job is to find *expressions* for x , y , and z that represent all of the solutions.

$$\begin{bmatrix} 1 & 0 & 2 & 10 \\ 0 & 1 & 3 & 25 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

8. Solve for x , y , and z in terms of a using any convenient method:

$$\begin{aligned} x - z &= 2 \\ -2x + y + 3z &= -5 \\ 2x + y - z &= 3 \end{aligned}$$

9. Sketch the graph of the following function whose decomposition is provided for you:

$$f(x) = \frac{5x-1}{x^2-2x-15} = \frac{3}{x+3} + \frac{5}{x-5}$$

CALCULATOR

10. Three pipes supply an oil storage tank. The tank can be filled by pipes A and B running for 10 hours, by pipes B and C running for 15 hours, or by pipes A and C running for 20 hours. How long does it take to fill the tank if all three pipes are running simultaneously?

11. Determine the equation of the circle passing through points $(0, 3)$, $(6, 1)$ and $(3, -3)$.

12. Find the partial fraction decomposition of each of the following:

a. $\frac{2x^3 + 4x - 1}{x^2 + 1}$

b. $\frac{5x^2 + 7x - 4}{x^3 + 4x^2}$

13. Graph the following system of inequalities: $(x-1)^2 + (y+3)^2 \leq 16$
 $x - 3y < 3$

14. a. Graph the following system of linear inequalities and label the corner points and give their coordinates

$$5x + 2y \geq 60$$

$$5x + 8y \geq 120$$

$$x \geq 0$$

$$y \geq 0$$

b. Find the coordinates of the point that minimizes f given that $f = 11x + 5y$

15. Set up, and solve the system of equations you would use to solve the following problem (don't forget to label your variables!!)

A bottler uses three pure juices – pineapple, orange, and grapefruit – to make two juice mixtures, pineapple-orange and pineapple-grapefruit, sold in 1-qt. bottles. The profit is 50 cents per bottle of pineapple-orange and 40 cents per bottle of pineapple-grapefruit. Each mixture is made by using equal portions of the two juices in its name. The amounts of juice on hand are 100 quarts of pineapple juice, 70 quarts of grapefruit juice, and 40 quarts of orange juice. How many of each mixture should be produced?