Chapter 9 Practice Exercises (*Optional)

9-01 Matrices and Systems of Equations

What is the order of the given matrix?

1. $\begin{bmatrix} 1 & 2 \end{bmatrix}$

2. $\begin{bmatrix} 1 & 3 & 0 & 7 \\ 0 & 1 & 2 & 5 \end{bmatrix}$

Write the augmented matrix for the system of equations.

3. $\begin{cases} x + 2y = 7 \\ -x - y = -7 \end{cases}$

4. $\begin{cases} 2x + y \quad\quad = 4 \\ \quad\quad y + z = 6 \\ 2x \quad + z = 10 \end{cases}$

Perform the indicated row operations and state what the operation accomplished.

5. Swap row 1 and 2: $\begin{bmatrix} 2 & 1 & 2 \\ 1 & 4 & -3 \end{bmatrix}$

6. Add -2 times 1st row to the 2nd row: $\begin{bmatrix} 1 & 3 & -7 \\ 2 & 6 & 1 \\ 0 & 1 & 1 \end{bmatrix}$

7. Multiply the 2nd row by $\frac{1}{7}$: $\begin{bmatrix} 1 & 3 & 5 \\ 0 & 7 & 21 \end{bmatrix}$

Is the matrix in row-echelon form?

8. $\begin{bmatrix} 1 & 3 & 4 \\ 0 & 0 & 2 \\ 0 & 0 & 0 \end{bmatrix}$

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

Use Gaussian Elimination to solve the system of equations.

10. $\begin{cases} x - y + 3z = 5 \\ 2x + y \quad = 4 \\ \quad\quad y + z = 1 \end{cases}$

11. $\begin{cases} 2x + y - z = 22 \\ \quad\quad y + 2z = -1 \\ x \quad\quad + z = 4 \end{cases}$

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

13. $\begin{cases} 3x + 2y \quad\quad = 6 \\ 2x + y - 3z = 4 \\ \quad x + y + z = 2 \end{cases}$

14. $\begin{cases} \quad 2x - 3y + 2z = -1 \\ -12x + 6y - 42z = 17 \\ \quad 9x + 6y + 3z = 5 \end{cases}$

Problem Solving

15. An arcade uses colored tokens for its game machines. For $20 you can purchase any of the three combinations of tokens: 14 gold, 20 silver, and 24 bronze; 20 gold, 15 silver, or 19 bronze; and 30 gold, 5 silver, and 13 bronze. What is the value of each color of token?

Mixed Review

16. (8-06) Use linear programming to find the maximum of $z = 2x + 3y$ given the constraints $\begin{cases} 1 \le x \le 5 \\ 2 \le y \le 4 \end{cases}$

17. (8-04) Find the partial fractions of $\frac{7x-11}{x^2-4x-5}$

18. (6-05) Find the dot product: $\langle 2, 5 \rangle \cdot \langle -1, 3 \rangle$

19. (5-03) Verify the identity: $\frac{\sin^3 x}{1+\cos x} = \sin x(1 - \cos x)$

20. (2-07) Find the asymptotes of $\frac{2x^2+1}{x^2-1}$

9-02 Gaussian Elimination

1. What is the difference between row echelon form and reduced-row echelon form?

2. Are the following matrices in row echelon form, reduced-row echelon form, or neither?

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

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

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

Use Gauss-Jordan Elimination to put the matrix in reduced-row echelon form.

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

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

5. $\begin{bmatrix} 1 & 2 & -3 & -3 \\ -2 & 3 & 2 & -25 \\ -1 & 2 & -3 & -11 \end{bmatrix}$

Solve using Gauss-Jordan Elimination.

6. $\begin{cases} x + 2y - z = -9 \\ x + y + 3z = 10 \\ x - 2y - z = 3 \end{cases}$

7. $\begin{cases} \quad\quad y - 2z = -4 \\ x + 4y - 3z = 21 \\ -2x + y + z = 13 \end{cases}$

8. $\begin{cases} 3x + y - 5z = 27 \\ -x + 4y + z = -15 \\ \quad\quad x + 2z = -5 \end{cases}$

Use a graphing calculator to put the matrix in reduced-row echelon form.

9. $\begin{bmatrix} 2 & 3 & 1 \\ 1 & -4 & 2 \\ -2 & 0 & 5 \end{bmatrix}$

10. $\begin{bmatrix} 2 & 5 & -3 & -13 \\ 1 & -2 & 4 & 20 \\ -1 & 10 & 9 & 24 \end{bmatrix}$

Mixed Review

11. (9-01) What is the order of $\begin{bmatrix} 4 & 9 & 0 & 3 \\ 2 & 4 & 1 & 2 \end{bmatrix}$?

12. (8-06) Use linear programming to find the maximum of the objective function given the constraints.
    Objective function: $z = x - y$
    Constraints: $\begin{cases} 0 \le x \le 5 \\ y \le x \\ y \ge 1 \end{cases}$

13. (8-04) Find the partial fractions of $\frac{4x+14}{x^2+6x+8}$.

14. (7-09) Write the polar equation of the conic with its focus at the pole and hyperbola with eccentricity $e = 2$ and directrix $x = -2$

15. (7-08) Find the maximums of $r = 2 \cos \theta$.

9-03 Matrix Operations

1. Describe a scalar and give an example.

Add or subtract the matrices.

2. $\begin{bmatrix} 1 & 9 \\ -3 & -2 \end{bmatrix} + \begin{bmatrix} 0 & -4 \\ -1 & -7 \end{bmatrix}$

3. $\begin{bmatrix} -4 & 2 & 4 \\ 1 & -2 & -7 \end{bmatrix} + \begin{bmatrix} 8 & 2 \\ 4 & 5 \end{bmatrix}$

4. $\begin{bmatrix} -2 & -3 \\ 1 & -2 \\ 4 & 7 \end{bmatrix} - \begin{bmatrix} 2 & 1 \\ 0 & 4 \\ -5 & 6 \end{bmatrix}$

Perform the indicated operations.

5. $\begin{bmatrix} 2 & -1 \end{bmatrix} + 2\begin{bmatrix} -5 & 5 \end{bmatrix}$

6. $-1\begin{bmatrix} -3 & 2 & 6 \\ 1 & 4 & -7 \end{bmatrix} + 3\begin{bmatrix} -1 & 2 & -5 \\ 4 & -3 & 0 \end{bmatrix}$

7. $2\begin{bmatrix} 3 \\ 2 \\ 0 \end{bmatrix} - 3\begin{bmatrix} 0 \\ -3 \\ 1 \end{bmatrix} + \begin{bmatrix} 4 \\ -2 \\ -1 \end{bmatrix}$

Multiply the matrices.

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

9. $\begin{bmatrix} 3 & -2 \end{bmatrix}\begin{bmatrix} 7 & 9 \end{bmatrix}$

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

11. $\begin{bmatrix} 5 & 1 \\ -2 & -4 \\ 0 & 3 \end{bmatrix}\begin{bmatrix} -1 \\ 6 \end{bmatrix}$

12. $\begin{bmatrix} 1 & 1 & 0 \\ -2 & 1 & 5 \end{bmatrix}\begin{bmatrix} 2 & 1 \\ 0 & 4 \\ -1 & 0 \end{bmatrix}$

13. Use the matrices $A = \begin{bmatrix} 2 & -1 \\ 0 & -2 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 3 \\ 2 & 0 \end{bmatrix}$ to verify that matrix multiplication has no commutative property by comparing the products AB and BA.

Problem Solving

14. The corners of a figure are at the coordinates $A(0, 0)$, $B(3, 1)$, $C(4, 5)$, and $D(1, 5)$. These can be written as the matrix

$\begin{matrix} A & B & C & D \end{matrix}$
$\begin{bmatrix} 0 & 3 & 4 & 1 \\ 0 & 1 & 5 & 5 \end{bmatrix}$ where each column is a point. Jane wants to enlarge the figure by a factor of 5. Use scalar multiplication to find the coordinates of the enlargement.

15. A student is buying supplies for two different classes at school. Math class requires 20 pencils, 2 paper packs, and 1 textbook. English class requires 15 pencils, 2 paper packs, and 5 textbooks. Pencils are 25¢ each, paper packs are $2 each, and textbooks are $20 each. Write the supply requirements as a matrix and the costs as another matrix. Show how to use matrix multiplication to find the total cost for each class.

Mixed Review

16. (9-02) Use Gauss-Jordan Elimination to solve $\begin{cases} x+3y-2z=-8 \\ y+5z=16 \\ -x+z=8 \end{cases}$

17. (8-02) Use elimination to solve $\begin{cases} 10x+5y=6 \\ 30x+20y=17 \end{cases}$

18. (6-05) Find the dot product $(2\hat{i}-3\hat{j})\cdot(4\hat{i}+\hat{j})$

19. (5-04) Solve $1 = 2\sin(2\theta)$ on the interval $0 \le \theta < 2\pi$.

20. (5-03) Verify the trigonometric identity $\sin\theta = \frac{\sin 2\theta}{2\cos\theta}$

9-04 Inverse Matrices

1. Multiply the matrices and determine if they are inverses. (Hint: The product should be the identity matrix.)
$\begin{bmatrix} 2 & 0 & 1 \\ 0 & 0 & -1 \\ 0 & 2 & 0 \end{bmatrix}$ and $\begin{bmatrix} 0.5 & 0.5 & 0 \\ 0 & 0 & 0.5 \\ 0 & -1 & 0 \end{bmatrix}$

Find the inverse matrix.

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

3. $\begin{bmatrix} 1 & 4 \\ -2 & 5 \end{bmatrix}$

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

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

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

Use inverse matrices to solve the system of equations.

7. $\begin{cases} 2x+2y=-2 \\ x-5y=8 \end{cases}$

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

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

Problem Solving

10. Fred is investing $5000 in two different accounts to stay diversified. One account pays 6% simple interest and the other pays 9% simple interest. Use an inverse matrix to determine how much he should invest in each account to earn an average of 8%.

Mixed Review

11. (9-03) $\begin{bmatrix} 2 & 5 & -7 \end{bmatrix} - 3\begin{bmatrix} -1 & 10 & 3 \end{bmatrix}$

12. (9-03) $\begin{bmatrix} 2 & 1 & -2 \end{bmatrix}\begin{bmatrix} 1 & 0 \\ -1 & -2 \\ 0 & 5 \end{bmatrix}$

13. (9-01) Add 2 times row 1 to row 3 and identify what it accomplished. $\begin{bmatrix} 1 & 3 & 0 & 2 \\ 0 & 3 & -2 & -5 \\ -2 & 8 & -6 & 2 \end{bmatrix}$

14. (6-03) If $\overrightarrow{m} = \langle 2, -1\rangle$ and $\overrightarrow{n} = \langle -3, 1\rangle$, find $2\overrightarrow{m} - \overrightarrow{n}$.

15. (5-04) Solve $2\sin x - \sqrt{2} = 0$ on the interval $0 \le x < 2\pi$.

9-05 Determinants of Matrices

1. Describe what the subscripts on the minors and cofactors mean, i.e. M_{35} or C_{42}.

Evaluate the determinant using the shortcuts.

2. $\begin{vmatrix} 2 & 0 \\ 5 & 1 \end{vmatrix}$

3. $\begin{vmatrix} 3 & -1 \\ 6 & 7 \end{vmatrix}$

4. $\begin{vmatrix} -2 & 6 \\ -5 & -4 \end{vmatrix}$

5. $\begin{vmatrix} 1 & 0 & 2 \\ 3 & 7 & -5 \\ -2 & 4 & 0 \end{vmatrix}$

6. $\begin{vmatrix} -1 & -2 & -3 \\ 3 & 2 & 1 \\ 4 & -4 & 5 \end{vmatrix}$

7. $\begin{vmatrix} 1 & 2 & 1 \\ 0 & 5 & -2 \\ -4 & -1 & 3 \end{vmatrix}$

Find the (a) minor and (b) cofactor of the matrix
$\begin{vmatrix} 2 & 1 & 4 \\ -1 & 5 & -2 \\ 0 & -1 & 3 \end{vmatrix}$

8. a. M_{23} b. C_{23}

9. a. M_{13} b. C_{13}

10. a. M_{32} b. C_{32}

11. a. M_{31} b. C_{31}

Evaluate the determinant using expansion by cofactors.

12. $\begin{vmatrix} 1 & 3 & -2 \\ 0 & 0 & 2 \\ -5 & 1 & 4 \end{vmatrix}$

13. $\begin{vmatrix} -1 & 4 & -2 \\ 1 & 2 & 5 \\ 0 & -3 & 2 \end{vmatrix}$

14. $\begin{vmatrix} 1 & 0 & -2 & 1 \\ 0 & -1 & 2 & -1 \\ 3 & 2 & 0 & -2 \\ 0 & 5 & 1 & 1 \end{vmatrix}$

15. $\begin{vmatrix} -1 & 3 & 5 & 1 & 2 \\ 0 & 2 & 4 & 0 & 0 \\ 0 & 4 & -3 & 0 & 3 \\ 0 & 0 & 2 & 0 & 0 \\ 1 & -4 & -5 & 4 & -2 \end{vmatrix}$

Mixed Review

16. (9-04) Find the inverse of $\begin{bmatrix} 2 & 3 \\ -4 & 1 \end{bmatrix}$.

17. (9-04) Use an inverse matrix to solve the system $\begin{cases} 2x+3y=5 \\ -4x+y=11 \end{cases}$.

18. (9-03) Simplify $\begin{bmatrix} 2 & 1 \\ -3 & 1 \end{bmatrix}\begin{bmatrix} 5 & -3 \\ 2 & 10 \end{bmatrix}$.

19. (9-01) Use Gaussian Elimination to solve $\begin{cases} x+y+z=-1 \\ y-z=9 \\ 2y+z=0 \end{cases}$.

20. (8-05) Solve by graphing $\begin{cases} x-y \ge -2 \\ x+y \le 6 \\ y \ge x^2-6x+9 \end{cases}$.

9-06 Applications of Matrices

Solve the system of equations using Cramer's Rule.

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

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

3. $\begin{cases} x+y=-1 \\ 2x-3z=8 \\ y+3z=-5 \end{cases}$

4. $\begin{cases} x+2y-2z=7 \\ -2x+3y-z=-6 \\ x-y-z=7 \end{cases}$

Use a determinant to find the area of the triangle with the given vertices.

5. (2, 3), (4, 6), (0, 1)

6. (4, 1), (−2, 2), (3, 5)

7. (−1, −1), (3, 1), (4, 6)

Determine if points are collinear.

8. (−2, −5), (1, 1), (3, 5)

9. (−4, 14), (−1, 5), (2, −4)

Use a determinant to find the equation of the line through the given points.

10. (2, −1), (6, 2)

11. (−4, 7), (1, 2)

12. (1, 3), (−8, 2)

Hill Cipher

13. Encode the message MATH FUN using $\begin{bmatrix} 2 & -3 \\ -2 & 1 \end{bmatrix}$.

14. Decode the message 18, −27, 16, −54, 28, −42, −22, −7 using the inverse of $\begin{bmatrix} 2 & -3 \\ -2 & 1 \end{bmatrix}$.

Problem Solving

15. Frankie is designing a new backyard. Part of the landscaping is a triangular garden plot that needs 2 inches of top soil. The coordinates of the vertices of the garden on the diagram of the backyard are (2, 5), (3, 6), and (2.5, 10) where the grid is measured in feet. How much top soil does Frankie need in cubic inches?

Mixed Review

16. (9-05) Evaluate $\begin{vmatrix} 3 & -3 \\ 2 & 1 \end{vmatrix}$.

17. (9-05) Evaluate using expansion by cofactors $\begin{vmatrix} -4 & 2 & 0 \\ 1 & 3 & 0 \\ 4 & 0 & 2 \end{vmatrix}$.

18. (9-04) Use an inverse matrix to solve $\begin{cases} 3x - 2y = 14 \\ 7x + 5y = 23 \end{cases}$.

19. (9-03) $\begin{bmatrix} 2 & 0 & -1 \\ 2 & -3 & 5 \end{bmatrix} \begin{bmatrix} 1 & 1 \\ 0 & 2 \\ -2 & -1 \end{bmatrix}$

20. (9-02) Put the matrix in reduced-row echelon form $\begin{bmatrix} 1 & 3 & -2 & 1 \\ 0 & 1 & -2 & 3 \\ 0 & 0 & 1 & 4 \end{bmatrix}$.

9-Review

Take this test as you would take a test in class. When you are finished, check your work against the answers. On this assignment round your answers to three decimal places unless otherwise directed.

1. Perform the indicated row operations on $\begin{bmatrix} 2 & 4 & -6 \\ -8 & 1 & 2 \\ 0 & 3 & -4 \end{bmatrix}$
   a. Add four time the 1st row to the 2nd row.
   b. Multiply the 1st row by $\frac{1}{2}$.

2. Solve the system with Gaussian Elimination $\begin{cases} x - 3y + 2z = 5 \\ -2x + y = -4 \\ 2y - z = -3 \end{cases}$

3. Is the matrix in reduced-row echelon form? $\begin{bmatrix} 1 & 0 & 0 & 2 \\ 0 & 0 & 1 & 5 \\ 0 & 0 & 0 & 1 \end{bmatrix}$

4. Put the matrix into reduced-row echelon form. $\begin{bmatrix} 1 & -2 & 5 & 2 \\ 1 & 3 & 1 & 5 \\ 2 & -1 & 0 & 1 \end{bmatrix}$

Perform the indicated operations.

5. $\begin{bmatrix} 2 & -1 & 3 \\ 0 & 7 & -3 \end{bmatrix} - \begin{bmatrix} 4 & 0 & -4 \\ 2 & -2 & 3 \end{bmatrix}$

6. $\begin{bmatrix} 1 & 3 \\ -2 & 5 \end{bmatrix} + 2\begin{bmatrix} -1 & 2 \\ 3 & 1 \end{bmatrix}$

7. $\begin{bmatrix} 1 & 2 & -1 & -2 \\ 0 & 3 & 1 & -2 \end{bmatrix} \begin{bmatrix} 3 & 0 \\ -1 & -2 \\ 2 & 5 \\ 1 & 1 \end{bmatrix}$

8. Find the inverse of $\begin{bmatrix} 2 & -1 \\ -2 & 3 \end{bmatrix}$

9. Find the inverse of $\begin{bmatrix} 1 & 0 & 1 \\ -1 & 2 & 4 \\ 2 & 1 & -1 \end{bmatrix}$

10. Use an inverse matrix to solve $\begin{cases} x + z = 5 \\ -x + 2y + 4z = 11 \\ 2x + y - z = -4 \end{cases}$

11. Find $\begin{vmatrix} 2 & -1 \\ 4 & -3 \end{vmatrix}$

12. Find $\begin{vmatrix} 1 & -2 & -1 \\ 0 & -3 & 2 \\ 0 & 2 & 2 \end{vmatrix}$ using the shortcut.

13. Find $\begin{vmatrix} 3 & 1 & -2 \\ 4 & 2 & 0 \\ 1 & -2 & -1 \end{vmatrix}$ using the expansion by cofactors.

14. Use Cramer's Rule to solve $\begin{cases} 2x + 3y - z = 0 \\ y + z = 0 \\ -x + 2y - z = -10 \end{cases}$

15. Find the area of triangle with vertices (−3, 2), (2, −1), (3, 5).

16. Use a determinant to find the equation of the line through (3, 1) and (−2, 4).

17. Use $\begin{bmatrix} 2 & 3 \\ -1 & 1 \end{bmatrix}$ to encode the message I GOT A.

Answers

9-01

1. 1×2
2. 2×4
3. $\left[\begin{array}{ccc:c} 1 & 2 & : & 7 \\ -1 & -1 & : & -7 \end{array}\right]$
4. $\left[\begin{array}{ccc:c} 2 & 1 & 0 & : & 4 \\ 0 & 1 & 1 & : & 6 \\ 2 & 0 & 1 & : & 10 \end{array}\right]$
5. $\begin{bmatrix} 1 & 4 & -3 \\ 2 & 1 & 2 \end{bmatrix}$; Puts a 1 as leading coefficient in 1st row.
6. $\begin{bmatrix} 1 & 3 & -7 \\ 0 & 0 & 15 \\ 0 & 1 & 1 \end{bmatrix}$; Puts a zero in 1st column of 2nd row.
7. $\begin{bmatrix} 1 & 3 & 5 \\ 0 & 1 & 3 \end{bmatrix}$; Makes a leading 1 in 2nd row.
8. No
9. Yes
10. (2, 0, 1)
11. (7, 5, −3)
12. (−2, 4, 1)
13. (2, 0, 0)
14. $\left(\frac{1}{2}, \frac{1}{3}, -\frac{1}{2}\right)$
15. Gold: \$0.50, Silver: \$0.35, Bronze: \$0.25
16. Max: 22 at (5, 4)
17. $\frac{3}{x+1} + \frac{4}{x-5}$
18. 13
19. You have to figure it out.
20. VA: $x = \pm 1$; HA: $y = 2$

9-02

1. reduced-row echelon form is row echelon form with any entries above a leading 1 turned to zeros using elementary row operations.
2. reduced-row echelon form; row echelon form; reduced-row echelon form
3. $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$
4. $\begin{bmatrix} 1 & 0 & -7 & 0 \\ 0 & 1 & 2 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$
5. $\begin{bmatrix} 1 & 0 & 0 & 4 \\ 0 & 1 & 0 & -5 \\ 0 & 0 & 1 & -1 \end{bmatrix}$
6. (1, −3, 4)
7. (2, 10, 7)
8. (3, −2, −4)
9. $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$
10. $\begin{bmatrix} 1 & 0 & 0 & 2 \\ 0 & 1 & 0 & -1 \\ 0 & 0 & 1 & 4 \end{bmatrix}$
11. 2 × 4
12. Maximum is 4 at (5, 1)
13. $\frac{3}{x+2} + \frac{1}{x+4}$
14. $r = \frac{4}{1 - 2\cos\theta}$
15. Maximums occur at $\theta = 0$ and $\theta = \pi$.

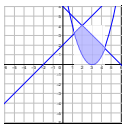
9-03

1. A single number, not a matrix or vector, such as 3.
2. $\begin{bmatrix} 1 & 5 \\ -4 & -9 \end{bmatrix}$
3. Not possible
4. $\begin{bmatrix} -4 & -4 \\ 1 & -6 \\ 9 & 1 \end{bmatrix}$
5. $\begin{bmatrix} -8 & 9 \end{bmatrix}$
6. $\begin{bmatrix} 0 & 4 & -21 \\ 11 & -13 & 7 \end{bmatrix}$
7. $\begin{bmatrix} 10 \\ 11 \\ -4 \end{bmatrix}$
8. $\begin{bmatrix} -1 & -1 \end{bmatrix}$
9. Not possible
10. $\begin{bmatrix} -4 & -3 \\ 12 & 6 \end{bmatrix}$
11. $\begin{bmatrix} 1 \\ -22 \\ 18 \end{bmatrix}$
12. $\begin{bmatrix} 2 & 5 \\ -9 & 2 \end{bmatrix}$
13. $AB = \begin{bmatrix} 0 & 6 \\ -4 & 0 \end{bmatrix}$, $BA = \begin{bmatrix} 2 & -7 \\ 4 & -2 \end{bmatrix}$
14. $A' = (0, 0)$, $B' = (15, 5)$, $C' = (20, 25)$, $D' = (5, 25)$
15. $\begin{array}{c} \\ Math \\ Eng \end{array} \begin{array}{c} \begin{array}{ccc} Pencil & Paper & Book \end{array} \\ \begin{bmatrix} 20 & 2 & 1 \\ 15 & 2 & 5 \end{bmatrix} \end{array} \begin{array}{c} Pencil \\ Paper \\ Book \end{array} \begin{bmatrix} \$0.2 \\ \$2 \\ \$2 \end{bmatrix}$
16. (−5, 1, 3)
17. $\left(\frac{7}{10}, -\frac{1}{5}\right)$
18. 5
19. $\frac{\pi}{12}, \frac{5\pi}{12}, \frac{13\pi}{12}, \frac{17\pi}{12}$
20. Show work

9-04

1. Show work, yes they are inverses
2. $\begin{bmatrix} \frac{1}{5} & \frac{1}{5} \\ -\frac{3}{5} & \frac{2}{5} \end{bmatrix}$
3. $\begin{bmatrix} \frac{5}{13} & -\frac{4}{13} \\ \frac{2}{13} & \frac{1}{13} \end{bmatrix}$
4. $\begin{bmatrix} \frac{1}{2} & \frac{1}{6} & \frac{1}{6} \\ 0 & \frac{1}{3} & \frac{1}{3} \\ 0 & 0 & -1 \end{bmatrix}$
5. $\begin{bmatrix} \frac{2}{7} & \frac{3}{7} & \frac{1}{14} \\ -\frac{1}{7} & -\frac{5}{7} & \frac{3}{14} \\ -\frac{4}{7} & -\frac{6}{7} & \frac{5}{14} \end{bmatrix}$
6. $\begin{bmatrix} -\frac{1}{3} & -\frac{1}{6} & -\frac{2}{3} \\ -\frac{1}{2} & -\frac{1}{2} & -\frac{1}{2} \\ -1 & -\frac{1}{2} & -1 \end{bmatrix}$
7. $\left(\frac{1}{2}, -\frac{3}{2}\right)$
8. (−3, 1)
9. (1, 2, 1)
10. \$1666.67 at 6%, \$3333.33 at 9%
11. $\begin{bmatrix} 5 & -25 & -16 \end{bmatrix}$
12. $\begin{bmatrix} 1 & -12 \end{bmatrix}$
13. $\begin{bmatrix} 1 & 3 & 0 & 2 \\ 0 & 3 & -2 & -5 \\ 0 & 14 & -6 & 6 \end{bmatrix}$; Made a 0 in the 3rd row.
14. (7, −3)
15. $\frac{\pi}{4}, \frac{3\pi}{4}$

9-05

1. The first number is the row and the second number is the column which are crossed out to create the new matrix. Take the determinant of that matrix.
2. 2
3. 27
4. 38
5. 72
6. 68
7. 49
8. −2; 2
9. 1; 1
10. 0; 0
11. −22; −22
12. −32
13. −21
14. −37
15. −60
16. $\begin{bmatrix} \frac{1}{14} & -\frac{3}{14} \\ \frac{2}{7} & \frac{1}{7} \end{bmatrix}$
17. (−2, 3)
18. $\begin{bmatrix} 12 & 4 \\ -13 & 19 \end{bmatrix}$
19. (2, 3, −6)
20. 

9-06

1. $\left(-3, \frac{1}{2}\right)$
2. (2, −1)
3. (4, −5, 0)
4. (3, −1, −3)
5. 1
6. $\frac{23}{2}$
7. 9
8. Yes
9. Yes
10. $3x - 4y = 10$
11. $x + y = 3$
12. $x - 9y = -26$
13. 24, −38, 24, −52, −12, 6, 14, −49
14. I WON IT
15. 648 in^3
16. 9
17. −28
18. (4, −1)
19. $\begin{bmatrix} 4 & 3 \\ -8 & -9 \end{bmatrix}$
20. $\begin{bmatrix} 1 & 0 & 0 & -24 \\ 0 & 1 & 0 & 11 \\ 0 & 0 & 1 & 4 \end{bmatrix}$

9-Review

1. a. $\begin{bmatrix} 2 & 4 & -6 \\ 0 & 17 & -22 \\ 0 & 3 & -4 \end{bmatrix}$

   b. $\begin{bmatrix} 1 & 2 & -3 \\ -8 & 1 & 2 \\ 0 & 3 & -4 \end{bmatrix}$

2. $(1, -2, -1)$

3. No, the 2 and 5 should be zeros.

4. $\begin{bmatrix} 1 & 0 & 0 & \frac{20}{19} \\ 0 & 1 & 0 & \frac{21}{19} \\ 0 & 0 & 1 & \frac{12}{19} \end{bmatrix}$

5. $\begin{bmatrix} -2 & -1 & 7 \\ -2 & 9 & -6 \end{bmatrix}$

6. $\begin{bmatrix} -1 & 7 \\ 4 & 7 \end{bmatrix}$

7. $\begin{bmatrix} -3 & -11 \\ -3 & -3 \end{bmatrix}$

8. $\begin{bmatrix} \frac{3}{4} & \frac{1}{4} \\ \frac{1}{2} & \frac{1}{2} \end{bmatrix}$

9. $\begin{bmatrix} \frac{6}{11} & -\frac{1}{11} & \frac{2}{11} \\ -\frac{7}{11} & \frac{3}{11} & \frac{5}{11} \\ \frac{5}{11} & \frac{1}{11} & -\frac{2}{11} \end{bmatrix}$

10. $(1, -2, 4)$

11. -2

12. -10

13. 18

14. $(4, -2, 2)$

15. $\frac{33}{2}$

16. $3x + 5y = 14$

17. 18, 27, −1, 36, 40, 60, 2, 3