

Exam

Name \_\_\_\_\_

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

Provide an appropriate response.

1) Use matrix multiplication to represent the system:  $\begin{cases} 3x + 2y = 2 \\ 4x + y = 5 \end{cases}$  1) \_\_\_\_\_

2) Use matrix multiplication to represent the system:  $\begin{cases} 4x + 6z = 3 \\ x - y + z = 4 \\ 3x + y - z = 5 \end{cases}$  2) \_\_\_\_\_

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

- 3) If the orders of the matrices Q, R, and S are  $4 \times 5$ ,  $3 \times 2$ , and  $5 \times 3$ , respectively, then the order of QRS is 3) \_\_\_\_\_
- A)  $3 \times 3$ .  
B)  $2 \times 4$ .  
C)  $3 \times 5$ .  
D)  $4 \times 5$ .  
E) none of the above

4)  $\begin{bmatrix} 1 & -1 \\ 3 & 4 \end{bmatrix} \begin{bmatrix} 0 & 2 \\ 5 & -3 \end{bmatrix} =$  4) \_\_\_\_\_

A)  $\begin{bmatrix} -2 & 8 \\ 3 & 8 \end{bmatrix}$       B)  $\begin{bmatrix} 4 & -1 \\ 0 & 6 \end{bmatrix}$       C)  $\begin{bmatrix} 6 & 8 \\ -4 & -17 \end{bmatrix}$       D)  $\begin{bmatrix} 0 & -2 \\ 15 & -12 \end{bmatrix}$       E)  $\begin{bmatrix} -5 & 5 \\ 20 & -6 \end{bmatrix}$

5)  $\begin{bmatrix} 1 & -1 & 2 \end{bmatrix} \left( \begin{bmatrix} 4 \\ -1 \\ 0 \end{bmatrix} \begin{bmatrix} 2 & 3 \end{bmatrix} + \begin{bmatrix} 1 & 0 \\ 0 & 1 \\ -1 & -1 \end{bmatrix} \right) =$  5) \_\_\_\_\_

A)  $\begin{bmatrix} 2 & 9 & -3 \end{bmatrix}$   
B)  $\begin{bmatrix} 5 \\ -7 \end{bmatrix}$   
C)  $\begin{bmatrix} 2 & -3 \\ 4 & 8 \\ 1 & 0 \end{bmatrix}$   
D)  $\begin{bmatrix} 9 & 12 \end{bmatrix}$   
E) none of the above

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

6) Let  $A = \begin{bmatrix} 1 & 2 \\ 2 & -1 \end{bmatrix}$ . Find  $A^2$ . 6) \_\_\_\_\_

- 7) If A is a  $3 \times 5$  matrix, B is a  $5 \times 7$  matrix, C is a  $7 \times 11$  matrix, D is a  $5 \times 7$  matrix, which of the following matrix products are defined? Give the size of each answer if it is defined.
- (a)  $A \times B \times C$
  - (b)  $B \times C \times D$
  - (c)  $A \times D \times C$
  - (d)  $A \times B \times D$

7) \_\_\_\_\_

8) Let  $A = \begin{bmatrix} 1 & 1 \\ 2 & -1 \end{bmatrix}$ ;  $B = \begin{bmatrix} 3 & -5 \\ -9 & 2 \end{bmatrix}$ ;  $C = \begin{bmatrix} -2 & 2 \\ 4 & -1 \end{bmatrix}$ . Find  $A[B + 2C]$

8) \_\_\_\_\_

9) Give an example of 2 matrices A and B where  $A \times B \neq B \times A$ .

9) \_\_\_\_\_

10) The price charged for 2 different CDs at two different stores can be represented by the matrix  $P = \begin{bmatrix} 14 & 16 \\ 13 & 15 \end{bmatrix}$  Store A. The quantities of each CD sold at each store can be represented by the matrix  $Q = \begin{bmatrix} 20 & 30 \\ 25 & 40 \end{bmatrix}$ . Show that the transpose of the income generated  $(PQ)^T$  is equal to the product of the transposes of P and Q in reverse order,  $Q^T P^T$ .

10) \_\_\_\_\_

Set up a matrix equation with integer values that is equivalent to the system of equations.

11) 
$$\begin{cases} y = -\frac{3}{4}x + 3 \\ y = -\frac{1}{5}x + \frac{9}{5} \end{cases}$$

11) \_\_\_\_\_

Provide an appropriate response.

12) If  $A = \begin{bmatrix} 5 & -2 \\ -4 & 3 \\ 1 & 4 \end{bmatrix}$  and  $C = \begin{bmatrix} 6 & 8 \\ 2 & -1 \end{bmatrix}$ , find AC.

12) \_\_\_\_\_

13) If  $B = \begin{bmatrix} 7 & 5 & 0 \\ -2 & 1 & 1 \\ 1 & -3 & -5 \end{bmatrix}$  and  $C = \begin{bmatrix} 6 & 8 \\ 2 & -1 \end{bmatrix}$ , find BC.

13) \_\_\_\_\_

14) If  $A = \begin{bmatrix} 5 & -2 \\ -4 & 3 \\ 1 & 4 \end{bmatrix}$ ,  $B = \begin{bmatrix} 7 & 5 & 0 \\ -2 & 1 & 1 \\ 1 & -3 & -5 \end{bmatrix}$ , and  $C = \begin{bmatrix} 2 & -4 \\ 5 & 7 \\ -4 & 9 \end{bmatrix}$ , find  $BA - C$ .

14) \_\_\_\_\_

15) Reduce the matrix:  $\begin{bmatrix} 1 & 2 & 0 \\ 3 & -5 & 2 \end{bmatrix}$

15) \_\_\_\_\_

16) Reduce the matrix:  $\begin{bmatrix} 2 & 1 & -1 \\ 4 & 0 & 1 \end{bmatrix}$

16) \_\_\_\_\_

17) Using the method of reduction, solve the system: 
$$\begin{cases} 2x - y - 4z = 0 \\ 4x + y - 2z = 0 \\ x - y - 3z = 0 \end{cases}$$

17) \_\_\_\_\_

18)

18) \_\_\_\_\_

Using the method of reduction, solve the system: 
$$\begin{cases} 3x - 2y + z = -1 \\ 2x - y - z = 5 \\ 2x + 3z = 4 \end{cases}$$

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

19)

19) \_\_\_\_\_

Reducing  $\begin{bmatrix} 2 & 2 & 4 \\ 1 & 1 & 2 \\ 1 & 0 & 1 \end{bmatrix}$  gives

A)  $\begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 1 \\ 0 & 0 & 0 \end{bmatrix}$

B)  $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$

C)  $\begin{bmatrix} 1 & 1 & 2 \\ 0 & 0 & 0 \\ 1 & 0 & 1 \end{bmatrix}$

D)  $\begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 2 \\ 0 & 0 & 0 \end{bmatrix}$

E)  $\begin{bmatrix} 1 & 0 & 3 \\ 0 & 0 & 1 \\ 0 & 0 & 0 \end{bmatrix}$

20)

20) \_\_\_\_\_

If  $\begin{cases} x + y - 3z = 5 \\ x - 3y + z = -7, \text{ then} \\ 2x - y - 3z = 2 \end{cases}$

A)  $x = 5 - 3z, y = 3 + 4z, \text{ and } z = t.$

B)  $x = 5, y = -8, \text{ and } z = 12.$

C)  $x = 2 - 4z, y = -5 + 2z, \text{ and } z = t.$

D)  $x = 3, y = -1, \text{ and } z = 4.$

E) none of the above

21)

21) \_\_\_\_\_

If  $\begin{cases} x - 2y - 4z = 4 \\ 2x + y + z = 9, \text{ then} \\ x + y - z = 1 \end{cases}$

A)  $x = 5, y = -\frac{5}{2}, \text{ and } z = \frac{3}{2}$

B)  $x = 4 - \frac{13}{2}z, y = \frac{11}{2} - \frac{1}{6}z, \text{ and } z = t$

C)  $x = 2z, y = 3 - 4z, \text{ and } z = t$

D)  $x = \frac{22}{5}, y = \frac{1}{5}, \text{ and } z = 0$

E) none of the above

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

22) Solve the following system of equations by reducing the matrix:

22) \_\_\_\_\_

$$\begin{cases} 2x + y = 11 \\ 9x + 5y = 7 \end{cases}$$

23) Solve the following system of equations by reducing the matrix:

23) \_\_\_\_\_

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

24) For what values of  $a$  will the following system of equations have a solution?

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

24) \_\_\_\_\_

25) Solve by the method of reduction:

$$\begin{cases} 2x - 9y = 10 \\ x - 6y = 14 \end{cases}$$

25) \_\_\_\_\_

26) Solve by the method of reduction:

$$\begin{cases} 3x - 5y = 2 \\ 18x - 30y = 14 \end{cases}$$

26) \_\_\_\_\_

27) Solve by the method of reduction:

$$\begin{cases} 5x + 3y + z = 2 \\ 2x - y + 2z = 10 \\ 4x - 2y + 3z = 17 \end{cases}$$

27) \_\_\_\_\_

28) Solve by the method of reduction:

$$\begin{cases} 3x - 2y + 5z = 7 \\ x + y - z = 2 \\ 5x + 3z = 11 \end{cases}$$

28) \_\_\_\_\_

29) Solve by the method of reduction:

$$\begin{cases} x + 2y - 5z = 1 \\ 3x - 4y - 11z = 6 \\ -2x - 6y - 16z = -5 \end{cases}$$

29) \_\_\_\_\_

# Answer Key

Testname: UNTITLED2

$$1) \begin{bmatrix} 3 & 2 \\ 4 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 2 \\ 5 \end{bmatrix}$$

$$2) \begin{bmatrix} 4 & 0 & 6 \\ 1 & -1 & 1 \\ 3 & 1 & -1 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 3 \\ 4 \\ 5 \end{bmatrix}$$

3) E

4) E

5) D

$$6) \begin{bmatrix} 5 & 0 \\ 0 & 5 \end{bmatrix}$$

7) (a)  $3 \times 11$

(b) not defined

(c)  $3 \times 11$

(d) not defined

$$8) \begin{bmatrix} -2 & -1 \\ -1 & -2 \end{bmatrix}$$

9)  $\begin{bmatrix} 0 & 1 \\ 2 & 0 \end{bmatrix}; \begin{bmatrix} 1 & 2 \\ 2 & 1 \end{bmatrix};$  many possible answers

$$10) (PQ)^T = \left( \begin{bmatrix} 14 & 16 \\ 13 & 15 \end{bmatrix} \begin{bmatrix} 20 & 30 \\ 25 & 40 \end{bmatrix} \right)^T$$

$$= \begin{bmatrix} 680 & 1060 \\ 635 & 990 \end{bmatrix}^T = \begin{bmatrix} 680 & 635 \\ 1060 & 990 \end{bmatrix}$$

$$Q^T P^T = \begin{bmatrix} 20 & 30 \\ 25 & 40 \end{bmatrix}^T \begin{bmatrix} 14 & 16 \\ 13 & 15 \end{bmatrix}^T$$

$$= \begin{bmatrix} 20 & 25 \\ 30 & 40 \end{bmatrix} \begin{bmatrix} 14 & 13 \\ 16 & 15 \end{bmatrix}$$

$$= \begin{bmatrix} 680 & 635 \\ 1060 & 990 \end{bmatrix}$$

$$11) \begin{bmatrix} 3 & 4 \\ 1 & 5 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 12 \\ 9 \end{bmatrix}$$

$$12) \begin{bmatrix} 26 & 42 \\ -18 & -35 \\ 14 & 4 \end{bmatrix}$$

13) can't be done

$$14) \begin{bmatrix} 13 & 5 \\ -18 & 4 \\ 16 & -40 \end{bmatrix}$$

$$15) \begin{bmatrix} 1 & 0 & \frac{4}{11} \\ 0 & 1 & -\frac{2}{11} \end{bmatrix}$$

$$16) \begin{bmatrix} 1 & 0 & \frac{1}{4} \\ 0 & 1 & -\frac{3}{2} \end{bmatrix}$$

17)  $x = z, y = -2z, z = t$

## Answer Key

Testname: UNTITLED2

18)  $x = 5, y = 7, z = -2$

19) A

20) E

21) A

22)  $x = 48; y = -85$

23)  $x = \frac{1}{2}; y = 0; z = -\frac{1}{2}$

24)  $a = \frac{7}{2}$

25)  $x = -22, y = -6$

26) no solution

27)  $x = 1, y = -2, z = 3$

28)  $x = \frac{11}{5} - \frac{3}{5}r, y = \frac{-1}{5} + \frac{8}{5}r, z = r$ , where  $r$  is any real number

29)  $x = \frac{41}{26}, y = 0, z = \frac{3}{26}$