Chapter 2 - Matrices

1. If possible, find $A - B$.

$A = \begin{bmatrix} 8 & -5 \\ 8 & -8 \end{bmatrix}, B = \begin{bmatrix} -5 & 9 \\ -2 & 5 \end{bmatrix}$

a. $\begin{bmatrix} 13 & -14 \\ 10 & -13 \end{bmatrix}$

b. $\begin{bmatrix} 3 & 4 \\ 6 & -3 \end{bmatrix}$

c. $\begin{bmatrix} 13 & -5 \\ 8 & -13 \end{bmatrix}$

d. $\begin{bmatrix} -50 & 97 \\ -56 & 112 \end{bmatrix}$

e. not possible

ANSWER: a
POINTS: 1
QUESTION TYPE: Multiple Choice
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2. Use the following matrices to perform the indicated matrix operations, if possible.

$3C - 2D$

$C = \begin{bmatrix} 5 & 3 \\ 1 & 2 \end{bmatrix}, D = \begin{bmatrix} 4 & 2 \\ 3 & 5 \end{bmatrix}$

a. $3C - 2D = \begin{bmatrix} 7 & 5 \\ 9 & 16 \end{bmatrix}$

b. $3C - 2D = \begin{bmatrix} -2 & 0 \\ -7 & -11 \end{bmatrix}$

c. $3C - 2D = \begin{bmatrix} 7 & 5 \\ -3 & -4 \end{bmatrix}$

d. $3C - 2D = \begin{bmatrix} -7 & -5 \\ 3 & 6 \end{bmatrix}$

e. $3C - 2D = \begin{bmatrix} 11 & 7 \\ 0 & 1 \end{bmatrix}$

ANSWER: c
POINTS: 1

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3. Find $A+B$.

$$A=\begin{bmatrix}1 & 4\\ -3 & 9\\ 2 & -2\end{bmatrix}, B=\begin{bmatrix}-8 & 2\\ -5 & -8\\ 3 & 9\end{bmatrix}$$

a. $\begin{bmatrix}9 & 2\\ 2 & 17\\ -1 & -11\end{bmatrix}$

b. $\begin{bmatrix}6 & -3\\ 5 & -5\\ -5 & -3\end{bmatrix}$

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

d. $\begin{bmatrix}-7 & \#\#d2\#\#\\ -8 & 1\\ 5 & 7\end{bmatrix}$

e. $\begin{bmatrix}17 & 6\\ -5 & 9\\ -11 & -3\end{bmatrix}$

ANSWER: d
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4. If possible, find $5A-4B$.

$$A=\begin{bmatrix}-9 & -7 & 7\\ 5 & -1 & 7\end{bmatrix}, B=\begin{bmatrix}-7 & 7 & 6\\ -1 & 7 & 6\end{bmatrix}$$

a. $\begin{bmatrix}-73 & -7 & 59\\ 21 & 23 & 59\end{bmatrix}$

b. $\begin{bmatrix}-16 & 0 & 13\\ 4 & 6 & 13\end{bmatrix}$

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

d. $\begin{bmatrix} -17 & -63 & 11 \\ 29 & -33 & 11 \end{bmatrix}$

e. not possible

ANSWER: d
POINTS: 1
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5. Use the following matrices to perform the indicated matrix operations, if possible.
$A + F$

$$A = \begin{bmatrix} 1 & 0 & 2 \\ 3 & 2 & 1 \\ 4 & 1 & 4 \end{bmatrix}, F = \begin{bmatrix} 1 & 3 & 4 \\ -1 & 1 & 1 \\ 3 & 3 & -4 \end{bmatrix}$$

a. $A + F = \begin{bmatrix} 0 & -3 & -2 \\ 4 & 1 & 2 \\ 1 & -2 & 8 \end{bmatrix}$

b. $A + F = \begin{bmatrix} 2 & -3 & 8 \\ -3 & 3 & 2 \\ 1 & 4 & -16 \end{bmatrix}$

c. $A + F = \begin{bmatrix} 1 & 0 & 8 \\ -3 & 2 & 1 \\ 12 & 3 & -16 \end{bmatrix}$

d. $A + F = \begin{bmatrix} 1 & -2 & 3 \\ 0 & -2 & 1 \\ 3 & 6 & 3 \end{bmatrix}$

e. $A + F = \begin{bmatrix} 2 & 3 & 6 \\ 2 & 3 & 2 \\ 7 & 4 & 0 \end{bmatrix}$

ANSWER: e
POINTS: 1
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6. Use the following matrices to perform the indicated matrix operations, if possible.

$A - F$

$$A = \begin{bmatrix} -5 & 3 & 1 \\ -1 & 4 & 2 \\ 5 & -4 & 4 \end{bmatrix}, F = \begin{bmatrix} -3 & -1 & -2 \\ -3 & 5 & -5 \\ 2 & 1 & 2 \end{bmatrix}$$

a. $A - F = \begin{bmatrix} -8 & 2 & -1 \\ -4 & 9 & 2 \\ 7 & -3 & 6 \end{bmatrix}$

b. $A - F = \begin{bmatrix} -2 & 4 & 3 \\ 2 & -1 & 7 \\ 3 & -5 & 2 \end{bmatrix}$

c. $A - F = \begin{bmatrix} 15 & -3 & -2 \\ 3 & 20 & -10 \\ 10 & -4 & 8 \end{bmatrix}$

d. $A - F = \begin{bmatrix} -8 & 2 & -1 \\ 2 & -1 & 7 \\ 10 & -4 & 8 \end{bmatrix}$

e. $A - F = \begin{bmatrix} -8 & 4 & -2 \\ 2 & 9 & -10 \\ 3 & -4 & 6 \end{bmatrix}$

ANSWER: b
POINTS: 1
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7. Use the matrices to find *CD*, if possible.

$$C = \begin{bmatrix} 5 & -4 \\ 4 & -3 \end{bmatrix}, D = \begin{bmatrix} 5 & 3 \\ -1 & -2 \end{bmatrix}$$

a. $\begin{bmatrix} 20 & -4 \\ 16 & -3 \end{bmatrix}$

b. $\begin{bmatrix} 13 \\ 2 \end{bmatrix}$

c. $\begin{bmatrix} 29 & 23 \\ 23 & 18 \end{bmatrix}$

d. $\begin{bmatrix} 29 & 23 \\ 23 & 18 \end{bmatrix}$

e. $\begin{bmatrix} 13 & 2 \end{bmatrix}$

ANSWER: d
POINTS: 1
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8. Use the matrices below. Perform the indicated operation.

AB

$$A = \begin{bmatrix} -5 & 5 & -3 \\ 1 & -2 & 3 \\ -3 & -3 & 3 \end{bmatrix}, B = \begin{bmatrix} -1 & 2 & 1 \\ -5 & 8 & -5 \\ -7 & -5 & -3 \end{bmatrix}$$

a. $\begin{bmatrix} 5 & 10 & -3 \\ -5 & -16 & -15 \\ 21 & 15 & -9 \end{bmatrix}$

b. $\begin{bmatrix} -51 & 45 & -39 \\ 32 & -29 & 20 \\ 3 & 3 & -9 \end{bmatrix}$

c. $\begin{bmatrix} 1 & 45 & -21 \\ -12 & -29 & 2 \\ -3 & -45 & 3 \end{bmatrix}$

d. $\begin{bmatrix} 5 & 10 & -3 \\ 32 & -29 & 20 \\ -3 & -45 & 3 \end{bmatrix}$

e. $\begin{bmatrix} 1 & 10 & -3 \\ -5 & -29 & 2 \\ -3 & 15 & -9 \end{bmatrix}$

ANSWER: c
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9. Use the matrices below. Perform the indicated operations.

BA

$$A = \begin{bmatrix} -3 & 5 & 2 \\ 1 & 5 & 3 \\ 3 & -3 & 4 \end{bmatrix}, B = \begin{bmatrix} -1 & 2 & 1 \\ -2 & 8 & 5 \\ -7 & -2 & -3 \end{bmatrix}$$

a. $\begin{bmatrix} 3 & 10 & 2 \\ -2 & 40 & 15 \\ -21 & 6 & -12 \end{bmatrix}$

b. $\begin{bmatrix} 2 & 18 & 12 \\ 29 & 45 & 40 \\ -14 & 34 & 20 \end{bmatrix}$

c. $\begin{bmatrix} 3 & 10 & 2 \\ 29 & 45 & 40 \\ 10 & -36 & -32 \end{bmatrix}$

d. $\begin{bmatrix} 8 & 2 & 8 \\ 29 & 15 & 40 \\ 10 & -36 & -32 \end{bmatrix}$

e. $\begin{bmatrix} 8 & 18 & 2 \\ -2 & 15 & 40 \\ -14 & 6 & -32 \end{bmatrix}$

ANSWER: d
POINTS: 1
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10. Multiply the matrices.

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

a. $\begin{bmatrix} -3 & 4 & 20 \end{bmatrix}$

b. $\begin{bmatrix} -19 \end{bmatrix}$

c. $\begin{bmatrix} -240 \end{bmatrix}$

d. $\begin{bmatrix} -3 \\ 4 \\ 20 \end{bmatrix}$

e. $\begin{bmatrix} 21 \end{bmatrix}$

ANSWER: e
POINTS: 1

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11. Indicate whether the statement "If A is a 3×1 matrix and B is a 1×4 matrix, then the product BA is a 1×1 matrix." is true or false.

a. True
b. False

ANSWER: b
POINTS: 1
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12. Solve $5X + 2A = B$ for X when $A = \begin{bmatrix} -2 & 0 \\ 2 & -5 \\ -2 & 14 \end{bmatrix}$ and $B = \begin{bmatrix} 16 & 8 \\ -12 & 1 \\ 28 & 28 \end{bmatrix}$

a. $X = \begin{bmatrix} 4 & \frac{8}{5} \\ \frac{16}{5} & \frac{13}{5} \\ \frac{32}{5} & 5 \end{bmatrix}$

b. $X = \begin{bmatrix} 0 & \frac{8}{5} \\ \frac{16}{5} & -\frac{11}{5} \\ \frac{32}{5} & 4 \end{bmatrix}$

c. $X = \begin{bmatrix} 5 & \frac{8}{5} \\ \frac{16}{5} & -\frac{13}{5} \\ \frac{32}{5} & 1 \end{bmatrix}$

d. $X = \begin{bmatrix} 1 & -\frac{8}{5} \\ -\frac{16}{5} & \frac{11}{5} \\ \frac{32}{5} & 0 \end{bmatrix}$

e. $X = \begin{bmatrix} 4 & \frac{8}{5} \\ -\frac{16}{5} & \frac{11}{5} \\ \frac{32}{5} & 0 \end{bmatrix}$

ANSWER: e
POINTS: 1
QUESTION TYPE: Multiple Choice
HAS VARIABLES: True

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13. Find $B(CA)$, provided that $A = \begin{bmatrix} 3 & 2 & 4 \\ 0 & 3 & -3 \end{bmatrix}$, $B = \begin{bmatrix} 3 & 4 \\ -3 & 2 \end{bmatrix}$, $C = \begin{bmatrix} 0 & 3 \\ -3 & 0 \end{bmatrix}$

a. $B(CA) = \begin{bmatrix} -9 & 51 & 21 \\ -9 & -15 & 51 \end{bmatrix}$

b. $B(CA) = \begin{bmatrix} 36 & 3 & -21 \\ 18 & -39 & -51 \end{bmatrix}$

c. $B(CA) = \begin{bmatrix} -36 & 3 & -75 \\ -18 & -39 & 3 \end{bmatrix}$

d. $B(CA) = \begin{bmatrix} 9 & 3 & -75 \\ 9 & -39 & 3 \end{bmatrix}$

e. $B(CA) = \begin{bmatrix} 3 & 3 & 2 \\ 18 & -15 & 3 \end{bmatrix}$

ANSWER: c
POINTS: 1
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14. Find $(B+C)A$, provided that $A = \begin{bmatrix} 3 & 4 & 9 \\ 0 & 3 & -3 \end{bmatrix}$, $B = \begin{bmatrix} 3 & 4 \\ -3 & 2 \end{bmatrix}$, $C = \begin{bmatrix} 0 & 3 \\ -3 & 0 \end{bmatrix}$

a. $(B+C)A = \begin{bmatrix} 9 & 27 & 9 \\ -18 & -6 & -30 \end{bmatrix}$

b. $(B+C)A = \begin{bmatrix} 9 & 27 & 9 \\ 9 & 5 & 18 \end{bmatrix}$

c. $(B+C)A = \begin{bmatrix} 9 & 27 & 9 \\ 18 & 6 & 30 \end{bmatrix}$

d. $(B+C)A = \begin{bmatrix} 9 & 27 & 9 \\ -18 & 5 & 30 \end{bmatrix}$

e. $(B+C)A = \begin{bmatrix} 9 & 27 & 9 \\ 18 & -6 & 18 \end{bmatrix}$

ANSWER: a
POINTS: 1
QUESTION TYPE: Multiple Choice

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15. Find A^2. (Note: $A^2 = AA$.)

$$A = \begin{bmatrix} -3 & -4 \\ 4 & 5 \end{bmatrix}$$

a. $\begin{bmatrix} -7 & -8 \\ 8 & 9 \end{bmatrix}$

b. $\begin{bmatrix} 9 & 16 \\ 16 & 25 \end{bmatrix}$

c. $\begin{bmatrix} -7 & 8 \\ -8 & 9 \end{bmatrix}$

d. $\begin{bmatrix} -3 & -8 \\ 8 & 25 \end{bmatrix}$

e. not possible

ANSWER: a
POINTS: 1
QUESTION TYPE: Multiple Choice
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16. Find A^TA if $A = \begin{bmatrix} 2 & -2 \\ 5 & 6 \\ 0 & -3 \end{bmatrix}$

a. $A^TA = \begin{bmatrix} 29 & -26 \\ 34 & 49 \end{bmatrix}$

b. $A^TA = \begin{bmatrix} 29 & 26 \\ -34 & 49 \end{bmatrix}$

c. $A^TA = \begin{bmatrix} 34 & 29 \\ 49 & -26 \end{bmatrix}$

d. $A^TA = \begin{bmatrix} 29 & 26 \\ 26 & 49 \end{bmatrix}$

e. $A^TA = \begin{bmatrix} 29 & 26 \\ -34 & 49 \end{bmatrix}$

ANSWER: d
POINTS: 1
QUESTION TYPE: Multiple Choice
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17. Write the transpose of matrix A.

$$A = \begin{bmatrix} 2 & 1 & 3 \\ 3 & 2 & 1 \\ 3 & 1 & 4 \end{bmatrix}$$

a. $A^T = \begin{bmatrix} 3 & 1 & 4 \\ 3 & 2 & 1 \\ 2 & 1 & 3 \end{bmatrix}$

b. $A^T = \begin{bmatrix} 3 & 1 & 2 \\ 1 & 2 & 3 \\ 4 & 1 & 3 \end{bmatrix}$

c. $A^T = \begin{bmatrix} -2 & -1 & -3 \\ -3 & -2 & -1 \\ -3 & -1 & -4 \end{bmatrix}$

d. $A^T = \begin{bmatrix} 2 & 3 & 3 \\ 1 & 2 & 1 \\ 3 & 1 & 4 \end{bmatrix}$

e. $A^T = \begin{bmatrix} 4 & 1 & 3 \\ 1 & 2 & 3 \\ 3 & 1 & 2 \end{bmatrix}$

ANSWER: d
POINTS: 1
QUESTION TYPE: Multiple Choice
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18. Find (AB) if $A = \begin{bmatrix} 4 & 1 \\ 0 & 1 \\ -4 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 4 & 5 & 1 \\ 0 & 7 & -1 \end{bmatrix}$

a. $(AB)^T = \begin{bmatrix} 16 & 4 & 16 \\ 27 & 7 & 27 \\ 3 & 1 & 3 \end{bmatrix}$

b. $(AB)^T = \begin{bmatrix} 16 & 0 & -16 \\ 27 & 7 & -13 \\ 3 & -1 & -5 \end{bmatrix}$

c. $(AB)^T = \begin{bmatrix} 16 & 4 & 16 \\ 27 & 7 & -13 \\ 3 & 1 & -3 \end{bmatrix}$

d. $(AB)^T = \begin{bmatrix} 16 & 0 & 16 \\ 27 & 7 & -13 \\ 3 & -1 & -3 \end{bmatrix}$

e. $(AB)^T = \begin{bmatrix} 16 & 0 & 16 \\ 27 & 7 & -13 \\ 3 & 1 & 3 \end{bmatrix}$

ANSWER: b
POINTS: 1
QUESTION TYPE: Multiple Choice
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19. Consider the matrices $X = \begin{bmatrix} 4 \\ 0 \\ 4 \end{bmatrix}$, $Y = \begin{bmatrix} 4 \\ 4 \\ 0 \end{bmatrix}$, $Z = \begin{bmatrix} -12 \\ -24 \\ 12 \end{bmatrix}$. Find scalars *a* and *b* such that $Z = aX + bY$.

a. $a = 2;\ b = 4$
b. $a = 4;\ b = -12$
c. $a = -6;\ b = -3$
d. $a = 12;\ b = -6$
e. $a = 3;\ b = -6$

ANSWER: e
POINTS: 1
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20. Use the provided definition to find *f*(*A*): If *f* is the polynomial function, $f(x) = a_0 + a_1x + a_2x^2 + \ldots + a_nx^n$, then for an $n \times n$ matrix *A*, *f*(*A*) is defined to be $f(A) = a_0I_n + a_1A + a_2A^2 + \ldots + a_nA^n$. Given that $f(x) = x^2 - 3x + 3$, $A = \begin{bmatrix} 4 & 0 \\ 5 & 7 \end{bmatrix}$.

a. $f(A) = \begin{bmatrix} 31 & 0 \\ 0 & 25 \end{bmatrix}$

b. $f(A) = \begin{bmatrix} 25 & 40 \\ 0 & 73 \end{bmatrix}$

c. $f(A) = \begin{bmatrix} 7 & 0 \\ 40 & 31 \end{bmatrix}$

d. $f(A) = \begin{bmatrix} 31 & 40 \\ 0 & 31 \end{bmatrix}$

e. $f(A) = \begin{bmatrix} 25 & 0 \\ 40 & 25 \end{bmatrix}$

ANSWER: c
POINTS: 1
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21. If $C = \begin{bmatrix} 2 & -1 & 12 \\ 3 & 6 & -9 \\ 1 & 1 & 3 \end{bmatrix}$ and $D = \begin{bmatrix} 9 & 5 & -21 \\ -6 & -2 & 18 \\ -1 & -1 & 5 \end{bmatrix}$, are C and D inverse matrices?

a. Yes
b. No

ANSWER: a
POINTS: 1
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22. Find the inverse matrix, if one exists.

$\begin{bmatrix} 5 & 3 \\ 13 & 8 \end{bmatrix}$

a. $\begin{bmatrix} 5 & 3 \\ -13 & -8 \end{bmatrix}$

b. $\begin{bmatrix} -3 & 8 \\ -5 & 13 \end{bmatrix}$

c. $\begin{bmatrix} -5 & 13 \\ 3 & -8 \end{bmatrix}$

d. $\begin{bmatrix} 8 & -3 \\ -13 & 5 \end{bmatrix}$

e. no inverse exists

ANSWER: d
POINTS: 1
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23. Find the inverse of the matrix $\begin{bmatrix} 8 & 16 \\ -24 & -40 \end{bmatrix}$

a. $\frac{1}{7}\begin{bmatrix} 8 & 16 \\ -24 & -40 \end{bmatrix}$

b. $\frac{1}{8}\begin{bmatrix} -5 & -2 \\ 3 & 1 \end{bmatrix}$

c. $\begin{bmatrix} 8 & -16 \\ 40 & 24 \end{bmatrix}$

d. $\begin{bmatrix} -8 & -16 \\ -24 & 40 \end{bmatrix}$

e. $\frac{1}{13}\begin{bmatrix} -8 & -16 \\ -24 & 40 \end{bmatrix}$

ANSWER: b
POINTS: 1
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24. Given matrix $A = \begin{bmatrix} 7 & 3 \\ -14 & 1 \end{bmatrix}$. Find A^{-1} the inverse matrix.

a. $A^{-1} = \begin{bmatrix} \frac{1}{7} & \frac{1}{3} \\ \frac{1}{-14} & \frac{1}{1} \end{bmatrix}$

b. $A^{-1} = \begin{bmatrix} \frac{1}{35} & -\frac{3}{49} \\ \frac{1}{7} & \frac{1}{5} \end{bmatrix}$

c. $A^{-1} = \begin{bmatrix} \frac{1}{49} & -\frac{3}{49} \\ \frac{2}{7} & \frac{1}{7} \end{bmatrix}$

d. $A^{-1} = \begin{bmatrix} \frac{1}{49} & -\frac{1}{49} \\ \frac{1}{7} & \frac{1}{7} \end{bmatrix}$

e. $A^{-1} = \begin{bmatrix} -\frac{1}{49} & \frac{3}{49} \\ \frac{1}{7} & \frac{1}{7} \end{bmatrix}$

ANSWER: c
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25. $\lim_{h \to 0} \frac{\sin\left(\frac{\pi}{2} + h\right) - \frac{3}{4}}{h} =$

a. –1
b. 0
c. $\frac{\pi}{2}$
d. $\frac{\sqrt{\#\#d1\#\#}}{2}$

ANSWER: d
POINTS: 1
QUESTION TYPE: Multiple Choice
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26. Find the inverse of the matrix $\begin{bmatrix} 5 & 5 & 5 \\ 15 & 25 & 20 \\ 15 & 30 & 25 \end{bmatrix}$.

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

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

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

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

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

ANSWER: a
POINTS: 1
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27. Given that matrix $A = \begin{bmatrix} -4 & 12 & 4 \\ 8 & 20 & 0 \\ 12 & 4 & -8 \end{bmatrix}$. Find the inverse matrix.

a. $A^{-1} = \frac{1}{36}\begin{bmatrix} -10 & 7 & -5 \\ 4 & 1 & 2 \\ -13 & 10 & -11 \end{bmatrix}$

b. $A^{-1} = \frac{1}{28}\begin{bmatrix} -10 & 7 & -5 \\ 4 & -1 & 2 \\ -13 & 10 & -11 \end{bmatrix}$

c. $A^{-1} = \frac{1}{36}\begin{bmatrix} 10 & -7 & 5 \\ -4 & 1 & -2 \\ 13 & -10 & 11 \end{bmatrix}$

d. $A^{-1} = \frac{1}{36}\begin{bmatrix} -10 & 7 & -5 \\ 4 & -1 & 2 \\ -13 & 10 & -11 \end{bmatrix}$

e. $A^{-1} = \frac{1}{28}\begin{bmatrix} -10 & 7 & 5 \\ 4 & 1 & 2 \\ -13 & 10 & -11 \end{bmatrix}$

ANSWER: d
POINTS: 1
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28. Use inverse matrices to solve the system of linear equations.

$$\begin{cases} x + 2y = 2 \\ 3x + 4y = 16 \end{cases}$$

a. $x = 34, y = 70$
b. $x = 20, y = 11$
c. $x = 12, y = -5$
d. $x = -2, y = 16$
e. $x = 20, y = -6$

ANSWER: c
POINTS: 1
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29. Use inverse matrices to solve the system of linear equations.

$$\begin{cases} 3x - 4y = 15 \\ 2x + 3y = -7 \end{cases}$$

a. $x = \frac{105}{17}, y = -\frac{7}{17}$

b. $x = 1, y = -3$

c. $x = 73, y = 9$

d. $x = 17, y = 51$

e. $x = \frac{59}{17}, y = \frac{39}{17}$

ANSWER: b
POINTS: 1
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30. Use inverse matrices and the graphing calculator to find the solution of the system of equations.

$$\begin{cases} 2x_1 + 3x_2 + x_4 + 3x_5 = 0 \\ x_1 + 2x_3 + 3x_4 + x_5 = 27 \\ x_2 + 2x_4 + 3x_5 = -15 \\ x_1 + 2x_3 + 2x_4 + x_5 = 24 \\ x_1 + 3x_5 = -24 \end{cases}$$

a. $\begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \\ x_5 \end{bmatrix} = \begin{bmatrix} -33 \\ -18 \\ 51 \\ 6 \\ 72 \end{bmatrix}$

b. $\begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \\ x_5 \end{bmatrix} = \begin{bmatrix} -6 \\ -3 \\ -3 \\ 9 \\ -12 \end{bmatrix}$

c. $\begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \\ x_5 \end{bmatrix} = \begin{bmatrix} -33 \\ -3 \\ 12 \\ 9 \\ 72 \end{bmatrix}$

d. $\begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \\ x_5 \end{bmatrix} = \begin{bmatrix} 3 \\ -3 \\ 51 \\ 9 \\ -9 \end{bmatrix}$

e. $\begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \\ x_5 \end{bmatrix} = \begin{bmatrix} 3 \\ 6 \\ 12 \\ 3 \\ -9 \end{bmatrix}$

ANSWER: e
POINTS: 1
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31. Let $A = \begin{bmatrix} 1 & 6 & -2 \\ 0 & 1 & 6 \\ -1 & 6 & 0 \end{bmatrix}$, $B = \begin{bmatrix} -1 & 6 & 0 \\ 0 & 1 & 6 \\ 1 & 6 & -2 \end{bmatrix}$. Find an elementary matrix E such that $EA = B$.

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

b. $E = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$

c. $E = \begin{bmatrix} -3 & 0 & 40 \\ 6 & 37 & -6 \\ 1 & 0 & 36 \end{bmatrix}$

d. $E = \begin{bmatrix} 0 & 0 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \end{bmatrix}$

e. $E = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 1 & 0 & 0 \end{bmatrix}$

ANSWER: a
POINTS: 1
QUESTION TYPE: Multiple Choice
HAS VARIABLES: True
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32. Let $A = \begin{bmatrix} 1 & 2 & -3 \\ 0 & 1 & 2 \\ -1 & 2 & 0 \end{bmatrix}$, $C = \begin{bmatrix} 0 & 4 & -3 \\ 0 & 1 & 2 \\ 0 & 4 & -3 \end{bmatrix}$. Find an elementary matrix E such that $EA = C$.

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

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

c. $E = \begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 1 \\ 0 & 0 & 1 \end{bmatrix}$

d. $E = \begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 0 \\ 1 & 0 & 1 \end{bmatrix}$

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

ANSWER: d
POINTS: 1
QUESTION TYPE: Multiple Choice
HAS VARIABLES: True
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33. Find the inverse of the elementary matrix $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & -14 & 1 \end{bmatrix}$

a. $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & \frac{1}{14} & 1 \end{bmatrix}$

b. $\begin{bmatrix} 0 & -14 & 1 \\ 0 & 1 & 0 \\ 1 & 0 & 0 \end{bmatrix}$

c. $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & -\frac{1}{14} & 1 \end{bmatrix}$

d. $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & -14 & 1 \end{bmatrix}$

e. $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 14 & 1 \end{bmatrix}$

ANSWER: e
POINTS: 1
QUESTION TYPE: Multiple Choice
HAS VARIABLES: True
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34. Find the inverse of the matrix $\begin{bmatrix} 0 & 1 & 1 \\ 1 & 1 & 0 \\ 0 & 1 & 0 \end{bmatrix}$

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

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

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

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

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

ANSWER: b
POINTS: 1
QUESTION TYPE: Multiple Choice
HAS VARIABLES: True
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35. Find the inverse of the matrix $\begin{bmatrix} 9 & -5 \\ 1 & 0 \end{bmatrix}$ using elementary matrices.

a. $\begin{bmatrix} 0 & 1 \\ -\frac{1}{5} & \frac{9}{5} \end{bmatrix}$

b. $\begin{bmatrix} 0 & 1 \\ \frac{1}{9} & -\frac{5}{9} \end{bmatrix}$

c. $\begin{bmatrix} 1 & 0 \\ \frac{1}{5} & -\frac{9}{5} \end{bmatrix}$

d. $\begin{bmatrix} 1 & 0 \\ -\frac{1}{9} & \frac{5}{9} \end{bmatrix}$

e. $\begin{bmatrix} 0 & 1 \\ \frac{1}{5} & -\frac{5}{9} \end{bmatrix}$

ANSWER: a
POINTS: 1
QUESTION TYPE: Multiple Choice
HAS VARIABLES: True
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36. Which of the following is a product of elementary matrices for the matrix $A = \begin{bmatrix} -3 & 1 \\ 2 & -1 \end{bmatrix}$?

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

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

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

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

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

ANSWER: c
POINTS: 1
QUESTION TYPE: Multiple Choice
HAS VARIABLES: True
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37. Which of the following is a product of elementary matrices for the matrix $A = \begin{bmatrix} 1 & -4 & 0 \\ -1 & 5 & 0 \\ 0 & 0 & 1 \end{bmatrix}$?

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

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

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

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

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

ANSWER: e
POINTS: 1
QUESTION TYPE: Multiple Choice
HAS VARIABLES: True
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38. Which of the following is the LU-factorization of the matrix $\begin{bmatrix} 1 & 0 \\ 9 & 1 \end{bmatrix}$?

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

b. $\begin{bmatrix} 1 & \frac{1}{9} \\ 0 & 1 \end{bmatrix}\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

c. $\begin{bmatrix} 1 & 0 \\ -\frac{1}{9} & 1 \end{bmatrix}\begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix}$

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

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

ANSWER: d

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POINTS: 1
QUESTION TYPE: Multiple Choice
HAS VARIABLES: True
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39. Which of the following is the LU-factorization of the matrix $\begin{bmatrix} 6 & 0 & 1 \\ 18 & 1 & 1 \\ -6 & 1 & 0 \end{bmatrix}$?

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

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

c. $\begin{bmatrix} 1 & 0 & 0 \\ 18 & 1 & 0 \\ -1 & 1 & 1 \end{bmatrix}\begin{bmatrix} 6 & 0 & 1 \\ 0 & 1 & 4 \\ 0 & 0 & 6 \end{bmatrix}$

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

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

ANSWER: a
POINTS: 1
QUESTION TYPE: Multiple Choice
HAS VARIABLES: True
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40. The market research department at a manufacturing plant determines that 30% of the people who purchase the plant's product during any month will not purchase it the next month. On the other hand, 40% of the people who do not purchase the product during any month will purchase it the next month. In a population of 1000 people, 100 people purchased the product this month. How many will purchase the product next month?

a. 510 people
b. 570 people
c. 430 people

d. 400 people
e. 370 people

ANSWER: c
POINTS: 1
QUESTION TYPE: Multiple Choice
HAS VARIABLES: True
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41. The market research department at a manufacturing plant determines that 30% of the people who purchase the plant's product during any month will not purchase it the next month. On the other hand, 60% of the people who do not purchase the product during any month will purchase it the next month. In a population of 1000 people, 200 people purchased the product this month. How many will purchase the product in 2 months?

a. 638 people
b. 830 people
c. 744 people
d. 812 people
e. 662 people

ANSWER: e
POINTS: 1
QUESTION TYPE: Multiple Choice
HAS VARIABLES: True
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42. A population of 10,000 is grouped as follows: 5,000 nonsmokers, 3,500 smokers of one pack or less per day, and 1,500 smokers of more than one pack per day. During any month there is a 5% probability that a nonsmoker will begin smoking a pack or less per day, and a 4% probability that a nonsmoker will begin smoking more than a pack per day. For smokers who smoke a pack or less per day, there is a 10% probability of quitting and a 10% probability of increasing to more than a pack per day. For smokers who smoke more than a pack per day, there is a 5% probability of quitting and a 20% probability of dropping to a pack or less per day. How many people will be in each of the three groups in 1 month?

a. The number of people in each group is as follows: 5,475 nonsmokers, 3,150 smokers of one pack or less per day, and 1,375 smokers of more than one pack per day.
b. The number of people in each group is as follows: 4,975 nonsmokers, 3,350 smokers of one pack or less per day, and 1,675 smokers of more than one pack per day.
c. The number of people in each group is as follows: 5,475 nonsmokers, 3,350 smokers of one pack or less per day, and 1,175 mokers of more than one pack per day.
d. The number of people in each group is as follows: 4,975 nonsmokers, 3,150 smokers of one pack or less per day, and 1,875 mokers of more than one pack per day.
e. The number of people in each group is as follows: 4,775 nonsmokers, 1,875 smokers of one pack or less per day, and 3,350 smokers of more than one pack per day.

ANSWER: b
POINTS: 1
QUESTION TYPE: Multiple Choice
HAS VARIABLES: True

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43. A population of 100,000 consumers is grouped as follows: 20,000 users of Brand A, 30,000 users of Brand B, and 50,000 who use neither brand. During any month a Brand A user has a 20% probability of switching to Brand B and a 10% probability of not using either brand. A Brand B user has a 15% probability of switching to Brand A and a 20% probability of not using either brand. A nonuser has a 20% probability of purchasing Brand A and a 25% probability of purchasing Brand B. How many people will be in each group in 1 month?

a. The number of people in each group is as follows: 30,300 users of Brand A, 36,000 users of Brand B, and 33,700 who use neither brand.
b. The number of people in each group is as follows: 41,700 users of Brand A, 28,500 users of Brand B, and 29,800 who use neither brand.
c. The number of people in each group is as follows: 35,500 users of Brand A, 30,300 users of Brand B, and 34,200 who use neither brand.
d. The number of people in each group is as follows: 28,500 users of Brand A, 36,000 users of Brand B, and 35,500 who use neither brand.
e. The number of people in each group is as follows: 30,300 users of Brand A, 41,700 users of Brand B, and 28,000 who use neither brand.

ANSWER: d
POINTS: 1
QUESTION TYPE: Multiple Choice
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44. Find the uncoded row matrices of the size for the message: SELL CONSOLIDATED. Then encode the message using the matrix

$$A = \begin{bmatrix} 1 & -1 & 0 \\ 1 & 0 & -1 \\ -12 & 5 & 3 \end{bmatrix}$$

a. $-120, 41, 31, -24, 3, 9, -199, 80, 43, -81,$
$30, 15, -235, 96, 59, 9, -5, -4$
b. $-120, 41, 55, -24, 3, 36, -199, 80, 43, -81,$
$93, 15, -235, 56, 239, -9, -5, -4$
c. $-36, 41, 31, -24, -3, 15, -28, 80, 43, -81,$
$30, 15, -95, 236, 59, -9, 5, -4$
d. $-36, 41, 31, -24, 3, 36, -199, 80, 43, -81,$
$30, 15, -95, 96, 239, 9, -5, 4$
e. $-120, 41, 31, -24, -3, 9, -199, 42, 43, -81,$
$93, 15, -235, 56, 59, -9, -5, -4$

ANSWER: a
POINTS: 1
QUESTION TYPE: Multiple Choice
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45. Find A^{-1} of the matrix $A = \begin{bmatrix} 1 & 2 \\ 3 & 5 \end{bmatrix}$ to decode the cryptogram.

11 21 64 112 25 50 29 49 78 136 20 36 76 127

a. HAPPY_NEW_YEAR
b. MEET_ME_FRIDAY
c. MEET_ME_SUNDAY
d. MEET_ME_MONDAY
e. HAPPY_BIRTHDAY

ANSWER: e
POINTS: 1
QUESTION TYPE: Multiple Choice
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46. A system composed of two industries, coal and steel, has the inputs as seen below.
(a) To produce 1 dollar's worth of output, the coal industry requires \$0.30 of its own product and \$0.70 of steel. (b) To produce 1 dollar's worth of output, the steel industry requires \$0.30 of its own product and \$0.10 of coal. Find *D*, the input-output matrix for this system. Then solve for the output matrix *X* in the equation $X = DX + E$ where the external demand is $E = \begin{bmatrix} 10{,}000 \\ 14{,}000 \end{bmatrix}$. Round all the entries of the matrix to two decimal places, where applicable.

a. $A = \begin{bmatrix} 0.30 & 0.70 \\ 0.30 & 0.10 \end{bmatrix}; X = \begin{bmatrix} 40{,}000 \\ 20{,}000 \end{bmatrix}$
b. $A = \begin{bmatrix} 0.30 & 0.70 \\ 0.10 & 0.30 \end{bmatrix}; X = \begin{bmatrix} 20{,}000 \\ 30{,}000 \end{bmatrix}$
c. $A = \begin{bmatrix} 0.30 & 0.10 \\ 0.70 & 0.30 \end{bmatrix}; X = \begin{bmatrix} 20{,}000 \\ 40{,}000 \end{bmatrix}$
d. $A = \begin{bmatrix} 0.70 & 0.30 \\ 0.30 & 0.10 \end{bmatrix}; X = \begin{bmatrix} 20{,}000 \\ 30{,}000 \end{bmatrix}$
e. $A = \begin{bmatrix} 0.70 & 0.30 \\ 0.10 & 0.30 \end{bmatrix}; X = \begin{bmatrix} 30{,}000 \\ 20{,}000 \end{bmatrix}$

ANSWER: c

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47. A small community includes a farmer, a baker, and a grocer and has the input-output matrix $D = \begin{bmatrix} 0.60 & 0.40 & 0.50 \\ 0.20 & 0.30 & 0.40 \\ 0.40 & 0.40 & 0.20 \end{bmatrix}$ and external demand matrix $E = \begin{bmatrix} -320 \\ 440 \\ -2{,}200 \end{bmatrix}$. Solve for the output matrix X in the equation $X = DX + E$.

a. $X = \begin{bmatrix} 4{,}200 \\ 2{,}800 \\ 6{,}900 \end{bmatrix}$

b. $X = \begin{bmatrix} 6{,}900 \\ 4{,}200 \\ 2{,}800 \end{bmatrix}$

c. $X = \begin{bmatrix} 2{,}800 \\ 6{,}900 \\ 4{,}200 \end{bmatrix}$

d. $X = \begin{bmatrix} 2{,}800 \\ 4{,}200 \\ 6{,}900 \end{bmatrix}$

e. $X = \begin{bmatrix} 6{,}900 \\ 2{,}800 \\ 4{,}200 \end{bmatrix}$

ANSWER: b
POINTS: 1
QUESTION TYPE: Multiple Choice
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48. Suppose that the table shows the numbers y of motor vehicle registrations (in millions) in the United States for the years 2000 through 2004. Use the method of least squares to find the least squares regression line for the data. Let t represent the year, with corresponding to 2000. Round the coefficient and constant of the equation to two decimal places.

Year	2000	2001	2002	2003	2004
Number(y)	220.5	231.4	231.6	236.4	237.2

a. $y = -2.00t + 224.00$

b. $y = 3.00t + 230.00$

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c. $y = 2.00t - 230.00$
d. $y = 4.00t + 224.00$
e. $y = -3.00t - 224.00$

ANSWER: d
POINTS: 1
QUESTION TYPE: Multiple Choice
HAS VARIABLES: True
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