

Math Sheet

Name _____ Score _____ Teacher _____ Date _____

Gaussian Elimination and RREF

Row-reduce each augmented matrix to RREF, classify the system, and give its exact solution or parametric form.

1. Row-reduce the augmented matrix $[[1,1,0|-1],[2,3,2|5],[1,-1,1|5]]$. Classify and solve the system.

2. Row-reduce the augmented matrix $[[1,2,2|8],[0,1,-1|4],[1,0,4|0]]$. Classify and solve the system.

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3. Row-reduce the augmented matrix $[[1, -1, 1|4], [0, 1, 1|4], [-2, 1, -3|10]]$. Classify and solve the system.

4. Row-reduce the augmented matrix $[[1, -1, 0|-1], [2, -1, 1|3], [1, 1, 1|7]]$. Classify and solve the system.

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5. Row-reduce the augmented matrix $[[1, -2, 1|6], [0, 1, -2|-3], [2, -2, -2|6]]$. Classify and solve the system.

6. Row-reduce the augmented matrix $[[1, 2, -1|9], [0, 1, -2|10], [-1, 0, -3|13]]$. Classify and solve the system.

Gaussian Elimination and RREF

Worked Answer Key

Row-reduce each augmented matrix to RREF, classify the system, and give its exact solution or parametric form.

1. Row-reduce the augmented matrix $[[1,1,0|-1],[2,3,2|5],[1,-1,1|5]]$. Classify and solve the system.

RREF = $[[1,0,0|0],[0,1,0|-1],[0,0,1|4]]$; unique; $(x,y,z) = (0,-1,4)$.

1. $R2 \leftarrow R2 - (2)R1$.
2. $R3 \leftarrow R3 - (1)R1$.
3. $R1 \leftarrow R1 - (1)R2$.
4. $R3 \leftarrow R3 - (-2)R2$.
5. Scale $R3$ by $1/5$.
6. $R1 \leftarrow R1 - (-2)R3$.
7. $R2 \leftarrow R2 - (2)R3$.
8. Every variable column is a pivot column, so read the unique solution.

Gaussian Elimination and RREF

Worked Answer Key

Row-reduce each augmented matrix to RREF, classify the system, and give its exact solution or parametric form.

2. Row-reduce the augmented matrix $[[1,2,2|8],[0,1,-1|4],[1,0,4|0]]$. Classify and solve the system.

RREF = $[[1,0,4|0],[0,1,-1|4],[0,0,0|0]]$; infinite; $x=0 - 4s$, $y=4 + s$, $z=s$; s real.

1. $R3 \leftarrow R3 - (1)R1$.
2. $R1 \leftarrow R1 - (2)R2$.
3. $R3 \leftarrow R3 - (-2)R2$.
4. Nonpivot variable columns are free; assign parameters and solve the pivot variables.

Gaussian Elimination and RREF

Worked Answer Key

Row-reduce each augmented matrix to RREF, classify the system, and give its exact solution or parametric form.

3. Row-reduce the augmented matrix $[[1,-1,1|4],[0,1,1|4],[-2,1,-3|-10]]$. Classify and solve the system.

RREF = $[[1,0,2|0],[0,1,1|0],[0,0,0|1]]$; inconsistent; no solution.

1. $R3 \leftarrow R3 - (-2)R1$.
2. $R1 \leftarrow R1 - (-1)R2$.
3. $R3 \leftarrow R3 - (-1)R2$.
4. Scale $R3$ by $1/2$.
5. $R1 \leftarrow R1 - (8)R3$.
6. $R2 \leftarrow R2 - (4)R3$.
7. A row $[0,0,0|c]$ with c nonzero is a contradiction.

Gaussian Elimination and RREF

Worked Answer Key

Row-reduce each augmented matrix to RREF, classify the system, and give its exact solution or parametric form.

4. Row-reduce the augmented matrix $[[1,-1,0|-1],[2,-1,1|3],[1,1,1|7]]$. Classify and solve the system.

RREF = $[[1,0,0|2],[0,1,0|3],[0,0,1|2]]$; unique; $(x,y,z) = (2,3,2)$.

1. $R2 \leftarrow R2 - (2)R1$.
2. $R3 \leftarrow R3 - (1)R1$.
3. $R1 \leftarrow R1 - (-1)R2$.
4. $R3 \leftarrow R3 - (2)R2$.
5. Scale R3 by -1.
6. $R1 \leftarrow R1 - (1)R3$.
7. $R2 \leftarrow R2 - (1)R3$.
8. Every variable column is a pivot column, so read the unique solution.

Gaussian Elimination and RREF

Worked Answer Key

Row-reduce each augmented matrix to RREF, classify the system, and give its exact solution or parametric form.

5. Row-reduce the augmented matrix $\begin{bmatrix} 1 & -2 & 1 & 6 \\ 0 & 1 & -2 & -3 \\ 2 & -2 & -2 & 6 \end{bmatrix}$. Classify and solve the system.

RREF = $\begin{bmatrix} 1 & 0 & -3 & 0 \\ 0 & 1 & -2 & -3 \\ 0 & 0 & 0 & 0 \end{bmatrix}$; infinite; $x=0 + 3s$, $y=-3 + 2s$, $z=s$; s real.

1. $R3 \leftarrow R3 - (2)R1$.
2. $R1 \leftarrow R1 - (-2)R2$.
3. $R3 \leftarrow R3 - (2)R2$.
4. Nonpivot variable columns are free; assign parameters and solve the pivot variables.

Gaussian Elimination and RREF

Worked Answer Key

Row-reduce each augmented matrix to RREF, classify the system, and give its exact solution or parametric form.

6. Row-reduce the augmented matrix $[[1,2,-1|9],[0,1,-2|10],[-1,0,-3|13]]$. Classify and solve the system.

RREF = $[[1,0,3|0],[0,1,-2|0],[0,0,0|1]]$; inconsistent; no solution.

1. $R3 \leftarrow R3 - (-1)R1$.
2. $R1 \leftarrow R1 - (2)R2$.
3. $R3 \leftarrow R3 - (2)R2$.
4. Scale $R3$ by $1/2$.
5. $R1 \leftarrow R1 - (-11)R3$.
6. $R2 \leftarrow R2 - (10)R3$.
7. A row $[0,0,0|c]$ with c nonzero is a contradiction.