LESSON MAKER PRO

Matrix Identity Moves

Use zero, identity, and determinants to test matrix behavior.

HIGH SCHOOL · HSN-VM.C.10

CCSS.Math.Content.HSN-VM.C.10 "(+) Understand that the zero and identity matrices play a role in matrix addition and multiplication similar to the role of 0 and 1 in the real numbers..."

NAME _____ **DATE** _____

MATRIX RULES

For matrices of the same size, adding the zero matrix changes nothing: A + 0 = A. For a square matrix, multiplying by the matching identity matrix changes nothing: AI = IA = A. A square matrix has a multiplicative inverse exactly when its determinant is not 0.

WORKED EXAMPLE

The figure shows the four entry positions of square matrix B. Let B = [[11, 0], [0, 13]]. Find B + 0, find BI, and decide whether B has an inverse.



1. B + 0 = [[11, 0], [0, 13]] + [[0, 0], [0, 0]].
2. B + 0 = [[11, 0], [0, 13]], and BI = [[11, 0], [0, 13]].
3. det B = 11(13) - 0(0) = 143.
4. Because 143 is not 0, B has an inverse.

Answer: B + 0 = B, BI = B, and B has an inverse.

PRACTICE 6 problems

1 The four shaded cells in the figure are the entry positions of matrix A = [[-3, 7], [8, -2]]. Find A + 0.



ANSWER _____

2 The nine shaded cells in the figure are the entry positions of matrix C = [[7, -8, 9], [0, 7, -9], [8, 0, -7]]. Find CI_3.



ANSWER _____

3 Find det D for D = [[4, 1], [7, 2]]. Then state whether D has an inverse.

ANSWER _____

4 Find det E for E = [[3, 6], [1, 2]]. Then state whether E has an inverse.

ANSWER _____

5 Let F = [[-2, 5], [3, -7]]. Find I_2F and FI_2.

ANSWER _____

6 A square matrix has determinant -12. Does it have a multiplicative inverse? Explain using the determinant.

ANSWER _____

APPLY IT Show your work

1 A coding club uses the square code matrix M shown in the table to transform a two-part game score. Find det M and decide whether the club can undo the transformation with an inverse matrix.

CODE MATRIX M

	Column 1	Column 2
Row 1	3	2
Row 2	5	4

ANSWER _____

2 A student records two sound settings in a music app with matrix H = [[-1, 4], [6, 0]]. The app first multiplies H by I_2, then adds the 2 by 2 zero matrix. What matrix is left after both steps?

WORK SPACE

ANSWER _____

CHALLENGE One step up

Let G = [[x, 4], [3, 6]]. For which values of x does G have a multiplicative inverse? Explain using the determinant.

WORK SPACE AND ANSWER

ANSWER KEY

Matrix Identity Moves

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	The four shaded cells in the figure are the entry positions of matrix A = [[-3, 7], [8, -2]]. Find A + 0.	**[[-3, 7], [8, -2]]**
2	The nine shaded cells in the figure are the entry positions of matrix C = [[7, -8, 9], [0, 7, -9], [8, 0, -7]]. Find CI_3.	**[[7, -8, 9], [0, 7, -9], [8, 0, -7]]**
3	Find det D for D = [[4, 1], [7, 2]]. Then state whether D has an inverse.	**det D = 1; yes, D has an inverse.**
4	Find det E for E = [[3, 6], [1, 2]]. Then state whether E has an inverse.	**det E = 0; no, E does not have an inverse.**
5	Let F = [[-2, 5], [3, -7]]. Find I_2F and FI_2.	**I_2F = [[-2, 5], [3, -7]]; FI_2 = [[-2, 5], [3, -7]]**
6	A square matrix has determinant -12. Does it have a multiplicative inverse? Explain using the determinant.	**Yes. Its determinant is not 0, so it has a multiplicative inverse.**

PART 2 · APPLY IT

1. **det M = 2, so M has a multiplicative inverse.** Compute 3(4) - 2(5) = 2. Since the determinant is not 0, the matrix is invertible.
2. **[[-1, 4], [6, 0]]** Multiplying by I_2 leaves H unchanged. Adding the zero matrix also leaves H unchanged.

CHALLENGE

G has a multiplicative inverse for all x except x = 2, because det G = 6x - 12 = 6(x - 2), which is nonzero when x is not 2.

Accept equivalent matrix formatting and any correct statement that a nonzero determinant means an inverse exists. For the challenge, accept x ≠ 2 or "all real numbers except 2."