LESSON MAKER PRO

Matrix Moves

Use zero, identity, and inverses to work with matrices.

HIGH SCHOOL · A2S.NQ.B.5

A2S.NQ.B.5 "Describe the roles that zero and identity matrices play in matrix addition and multiplication, recognizing that they are similar to the roles of 0 and 1 in the real numbers. a..."

NAME _____ DATE _____

THE BIG IDEA

Adding a zero matrix or multiplying by an identity matrix leaves a matrix unchanged. To find a matrix's additive inverse, change the sign of each entry. For A = [[a,b],[c,d]], det(A) = ad - bc. If the determinant is not 0, A^{-1} = 1/det(A) [[d,-b],[-c,a]]; if it is 0, no multiplicative inverse exists.

WORKED EXAMPLE

Find the multiplicative inverse of A = [[7,9],[3,4]].

1. Find the determinant: 7(4) - 9(3) = 1.
2. Swap the diagonal entries and change the signs of the other entries: [[4,-9],[-3,7]].
3. Multiply by 1/det(A) = 1.

Answer: A^{-1} = [[4,-9],[-3,7]]

PRACTICE 6 problems

1 Find [[2,-1],[6,0]] + [[0,0],[0,0]].

ANSWER _____

2 Let I_2 = [[1,0],[0,1]]. Find [[-2,6],[1,10]]I_2.

ANSWER _____

3 Find the additive inverse of [[-6,2],[1,-10]].

ANSWER _____

4 Find the determinant of [[2,10],[1,5]]. Does this matrix have a multiplicative inverse?

ANSWER _____

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5 Find the multiplicative inverse of [[2,1],[1,1]].

ANSWER _____

6 Find the determinant and the multiplicative inverse of [[2,0],[0,-1]].

ANSWER _____

_____

APPLY IT Show your work

1 A school store records hoodie and T-shirt preorders in a matrix. The rows show grades 11 and 12, in that order. The columns show hoodies and T-shirts, in that order. Its current report is [[12,8],[8,12]]. The store accidentally added [[2,-1],[0,6]] to the original counts. Find the additive inverse of the added matrix, then use it to find the original counts.

WORK SPACE

ANSWER _____

2 At a school concert, x people bought one ticket each, and y people bought bundles of two tickets. The sales record uses [[1,1],[1,2]][[x],[y]] = [[70],[100]], where 70 is the number of purchases and 100 is the number of tickets sold. Find the inverse of [[1,1],[1,2]], then find x and y.

WORK SPACE

ANSWER _____

CHALLENGE One step up

For A = [[x,2],[2,x]], find every real value of x for which A has no multiplicative inverse. Explain using the determinant.

WORK SPACE AND ANSWER

Matrix Moves

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Find [[2,-1],[6,0]] + [[0,0],[0,0]].	**[[2,-1],[6,0]]**
2	Let I_2 = [[1,0],[0,1]]. Find [[-2,6],[1,10]]I_2.	**[[-2,6],[1,10]]**
3	Find the additive inverse of [[-6,2],[1,-10]].	**[[6,-2],[-1,10]]**
4	Find the determinant of [[2,10],[1,5]]. Does this matrix have a multiplicative inverse?	**The determinant is 0. No, the matrix has no multiplicative inverse.**
5	Find the multiplicative inverse of [[2,1],[1,1]].	**[[1,-1],[-1,2]]**
6	Find the determinant and the multiplicative inverse of [[2,0],[0,-1]].	**The determinant is -2. The multiplicative inverse is [[1/2,0],[0,-1]].**

PART 2 · APPLY IT

1. **Additive inverse: [[-2,1],[0,-6]]. Original counts: [[10,9],[8,6]].** Change the sign of each entry in the added matrix. Add the result to the current report to undo the error.
2. **Inverse: [[2,-1],[-1,1]]. There were 40 one-ticket purchases and 30 two-ticket bundles.** The determinant is 1, so the inverse is [[2,-1],[-1,1]]. Multiplying it by [[70],[100]] gives [[40],[30]].

CHALLENGE

det(A) = x^2 - 4. This equals 0 when x = 2 or x = -2, so A has no multiplicative inverse at those values.

Accept equivalent matrix notation. In the challenge, accept a factored determinant of (x - 2)(x + 2) with both values identified.