LESSON MAKER PRO

Matrix Power Moves

Use determinants and inverses to solve matrix problems.

HIGH SCHOOL · MA.912.NSO.4.4

MA.912.NSO.4.4 "Solve mathematical and real-world problems using the inverse and determinant of matrices."

NAME _____ DATE _____

INVERT IT

For A = [[a, b], [c, d]], det(A) = ad - bc. If det(A) is not 0, then A^{-1} = 1/det(A) [[d, -b], [-c, a]]. To solve A[x, y]^T = b, multiply both sides by A^{-1}.

WORKED EXAMPLE

Find A^{-1} for A = [[11, 13], [17, 19]].

1. det(A) = (11)(19) - (13)(17) = 209 - 221 = -12.
2. Swap 11 and 19, then change the signs of 13 and 17: [[19, -13], [-17, 11]].
3. Multiply each entry by -1/12.

Answer: A^{-1} = [[-19/12, 13/12], [17/12, -11/12]]

PRACTICE 6 problems

1 Find det(A) for A = [[2, 5], [1, 4]].

ANSWER _____

2 Find the inverse of A = [[3, 1], [2, 1]].

ANSWER _____

3 Use an inverse matrix to solve the system: 2x + y = 7 and x + y = 5.

ANSWER _____

4 Is A = [[4, 6], [2, 3]] invertible? Show your determinant.

ANSWER _____

5 Find the inverse of A = [[0, 2], [3, 1]].

ANSWER _____

6 Use an inverse matrix to solve the system: x - y = 1 and 4x + 2y = 14.

ANSWER _____

APPLY IT Show your work

1 At a school concert, student tickets cost $6 and adult tickets cost $10. The box office sold 16 tickets for $128. Use an inverse matrix to find how many student tickets and adult tickets were sold.

WORK SPACE

ANSWER _____

2 A gaming club buys hoodies for $14 each and T-shirts for $8 each. The club buys 15 items for a total of $162. Use an inverse matrix to find how many hoodies and T-shirts the club buys.

WORK SPACE

ANSWER _____

CHALLENGE One step up

For which values of k does the system with coefficient matrix A = [[k, 2], [3, 6]] have a unique solution? Explain using the determinant.

WORK SPACE AND ANSWER

ANSWER KEY # Matrix Power Moves

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Find det(A) for A = [[2, 5], [1, 4]].	**3**
2	Find the inverse of A = [[3, 1], [2, 1]].	**A^{-1} = [[1, -1], [-2, 3]]**
3	Use an inverse matrix to solve the system: 2x + y = 7 and x + y = 5.	**x = 2, y = 3**
4	Is A = [[4, 6], [2, 3]] invertible? Show your determinant.	**No. det(A) = 0, so A is not invertible.**
5	Find the inverse of A = [[0, 2], [3, 1]].	**A^{-1} = [[-1/6, 1/3], [1/2, 0]]**
6	Use an inverse matrix to solve the system: x - y = 1 and 4x + 2y = 14.	**x = 8/3, y = 5/3**

PART 2 · APPLY IT

1. **8 student tickets and 8 adult tickets** Write the system 6s + 10a = 128 and s + a = 16. Invert the coefficient matrix [[6, 10], [1, 1]] to get s = 8 and a = 8.
2. **7 hoodies and 8 T-shirts** Write the system 14h + 8t = 162 and h + t = 15. Invert the coefficient matrix [[14, 8], [1, 1]] to get h = 7 and t = 8.

CHALLENGE

The system has a unique solution when k != 1. det(A) = 6k - 6 = 6(k - 1), which is nonzero only when k != 1.

Accept equivalent simplified inverse entries or an inverse written as a scalar times an adjugate matrix. For system problems, accept the ordered pair form for x and y.