

Matrix Operations, Determinants and Inverses

Grade 12 – Precalculus math · Worksheet · Standards: N-VM.C.6, N-VM.C.7, N-VM.C.8, N-VM.C.9, N-VM.C.10

Name: _____ Date: _____ Class: _____

These problems build matrix fluency for standards N-VM.C.6 through N-VM.C.10: data matrices, sums and scalar multiples, products of 2×2 and 3×3 matrices, identity and zero matrices, determinants and inverses.

The last problems use matrices for sales, population moves and a secret code. Show every row-by-column step.

Standards: N-VM.C.6, N-VM.C.7, N-VM.C.8, N-VM.C.9, N-VM.C.10 · **Level:** Grade 12 Precalculus

Problem 1 Data in a Matrix (easy)

A bakery logged these weekend sales.

Day	Muffins	Scones	Bagels
Saturday	48	30	25
Sunday	36	41	52

Write the data as a matrix with days as rows. State its dimensions, then name the number found in the second row and third column and tell what it counts.

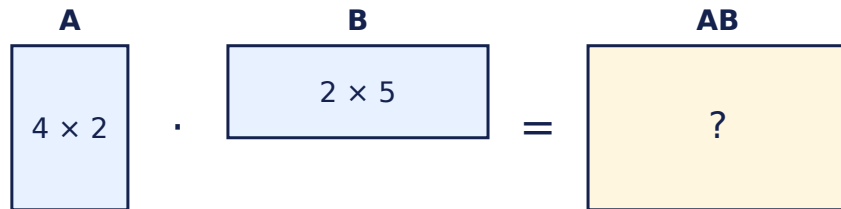
Problem 2 Adding and Subtracting (easy)

Let A have rows $(3, -2)$ and $(5, 0)$, and B have rows $(-4, 7)$ and $(1, 6)$. Find $A + B$ and $A - B$.

Problem 3 Scalar Multiple (easy)

Find $-3A$ for A with rows $(2, -1, 4)$ and $(0, 5, -2)$.

Problem 4 Can the Product Be Found? (easy)

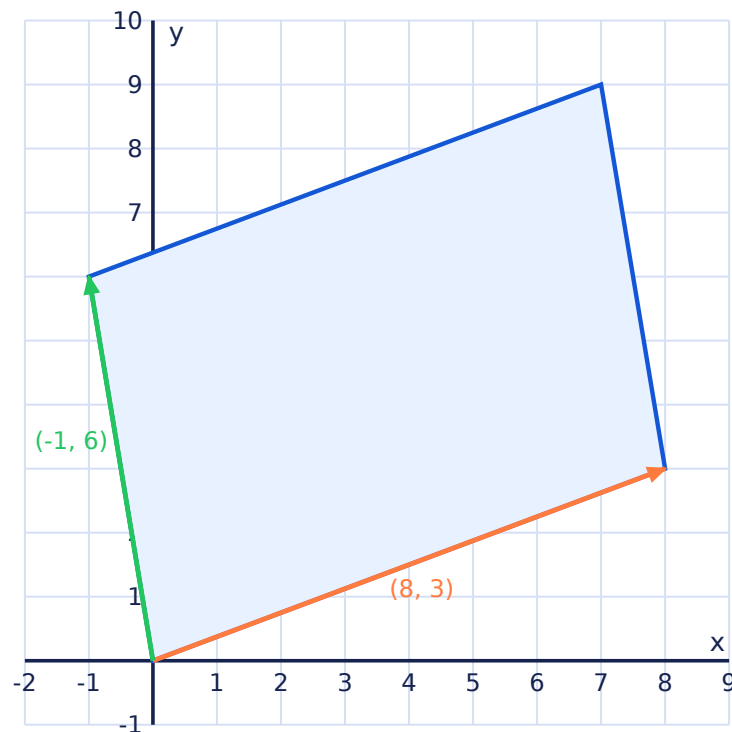


inner numbers must match

Sizes in the diagram: 4 by 2 and 2 by 5.

Suppose A has 4 rows and 2 columns, while B has 2 rows and 5 columns. (a) Can AB be formed? If so, how big is it? (b) Can BA be formed?

Problem 5 A Determinant and Its Area (easy)



The columns of the matrix drawn as vectors.

The figure shows the two columns of the matrix with rows $(8, -1)$ and $(3, 6)$. Find its determinant and state the area of the parallelogram.

Problem 6 Identity and Zero (easy)

For A with rows $(7, -3)$ and $(2, 9)$, compute IA and $A + O$, where I and O are the identity and zero matrices of matching size.

Problem 7 A 2×2 Product (medium)

Multiply A by B , where A has rows $(2, -1)$ and $(3, 4)$, and B has rows $(5, 0)$ and $(-2, 1)$.

Problem 8 Order Matters (medium)

Let A have rows $(1, 2)$ and $(0, 3)$, and B have rows $(4, -1)$ and $(2, 5)$. Find AB and BA . Are they equal?

Problem 9 A 2×3 Times a 3×2 (medium)

Let A have rows $(1, 0, 2)$ and $(-1, 3, 1)$, and B have rows $(2, 1)$, $(0, -3)$ and $(4, 5)$. Find AB and give its size.

Problem 10 Finding an Inverse (medium)

Find the inverse of A with rows $(4, 1)$ and $(6, 3)$, then verify by computing AA^{-1} .

Problem 11 A 3×3 Product (medium)

Let A have rows $(1, 0, 2)$, $(0, 1, -1)$ and $(3, 2, 0)$, and B have rows $(2, 1, 0)$, $(1, 0, 3)$ and $(-1, 2, 1)$. Find AB .

Problem 12 No Inverse (medium)

Find the value of k that makes the matrix with rows $(2, k)$ and $(3, 6)$ singular. Show the work.

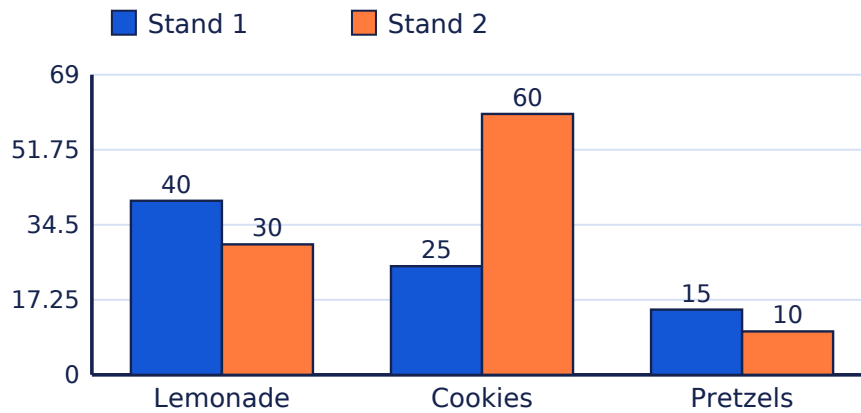
Problem 13 A Matrix Equation (medium)

Solve $2X + A = B$ for X , where A has rows $(1, 3)$ and $(-5, 7)$, and B has rows $(9, -1)$ and $(3, 11)$.

Problem 14 Powers of a Matrix (medium)

Let A have rows $(0, -1)$ and $(1, 0)$. Find A^2 , A^4 and A^{10} .

Problem 15 Fundraiser Stands (hard)



Items sold at each stand.

Two stands at a school fundraiser sold the items shown. Lemonade costs \$1.50, a cookie costs \$0.75 and a pretzel costs \$2.00. Write the sales as a 2×3 matrix Q and the prices as a 3×1 matrix P , find QP , and explain what each entry means.

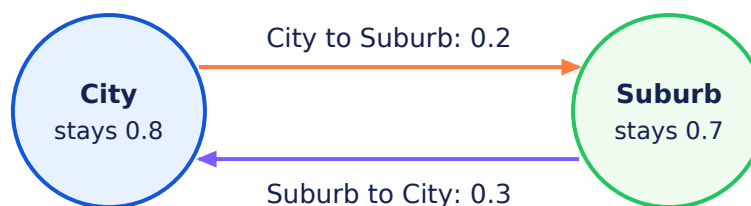
Problem 16 Camp Enrollment (hard)

Summer camp enrollment is recorded with rows for three camps (Lake, Forest, Ridge) and columns for ages 8-10 and ages 11-13. Week 1 has rows (12, 20), (16, 8) and (24, 28). Week 2 has rows (8, 12), (20, 16) and (16, 32). (a) Find the total enrollment matrix for both weeks. (b) Next summer, enrollment is projected to grow by 25%. Find the projected matrix.

Problem 17 Secret Number Code (hard)

A robotics club encodes a pair of numbers (p, q) by multiplying the column matrix with entries p and q by the key K with rows (2, 3) and (1, 4). (a) Encode the pair (7, 4). (b) Find K^{-1} . (c) Decode the received pair (27, 26).

Problem 18 City and Suburb Moves (hard)



Each year, residents either stay or move to the other area.

The matrix P with rows (0.8, 0.3) and (0.2, 0.7) describes yearly moves, as in the diagram.

Columns are the starting place (City, Suburb) and rows are the ending place. This year, 50,000 people live in the City and 30,000 in the Suburb. Find the populations after one year and after two years.

Problem 19 Solving $AX = B$ (hard)

Matrix A has rows $(3, 2)$ and $(4, 5)$, and B has rows $(9, -6)$ and $(19, -8)$. Find the matrix X that satisfies $AX = B$.

Problem 20 Inverse of a Product (hard)

Let A have rows $(1, 2)$ and $(0, 1)$, and B have rows $(3, 0)$ and $(1, 2)$. Show that $(AB)^{-1} = B^{-1}A^{-1}$ by computing both sides.