AP Precalc

4.11 The Inverse and Determinant of a Matrix

4.11 Notes

Write your questions and thoughts here!

Identity Matrix: A square matrix with 1's down its diagonal and 0's everywhere else. When multiplying by the identity matrix it results in the original matrix.

$$A = \begin{bmatrix} 2 & -4 \\ -2 & 3 \end{bmatrix}, B = \begin{bmatrix} 2 & -4 \\ 5 & 3 \\ 2 & -1 \end{bmatrix}, C = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

1) $A \; x \; C$

2) $B \; x \; C$

Inverse of a Matrix: a new matrix that when multiplied by the given matrix results in the identity matrix.

In other words: $A \cdot A^{-1} = I$

In order for a Matrix to have an inverse then, it must be a square matrix!

For 2x2 Matrices to have an inverse the determinant must not equal zero!

$$determinant\ of\ \begin{bmatrix} a & b \\ c & d \end{bmatrix} = ad = bc$$

3) Find det(A).

Inverse of a 2x2 Matrix

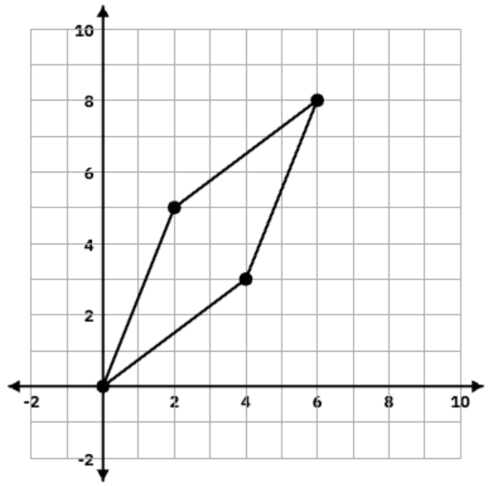
$$Given\ A\ is\ invertible, and\ A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}, then$$

$$A^{-1} = \frac{1}{ad - bc} \begin{bmatrix} d & -b \\ -c & a \end{bmatrix}$$

4) Find the inverse of the following matrix A, then multiply them together.

Write your questions

Finding the area of a parallelogram formed by two vectors with matrices.



The area is equal to the absolute value of the determinant of a 2x2 matrix, where the vectors are the rows or columns.

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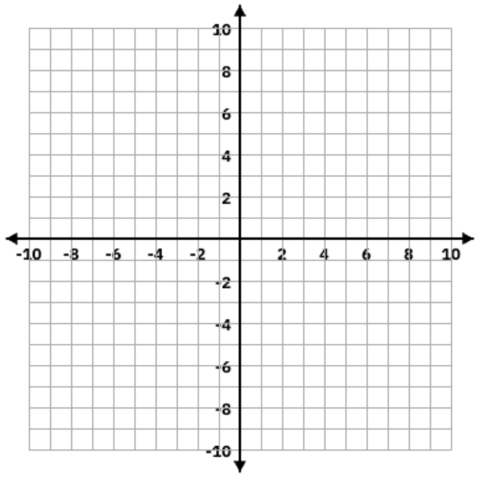
4.11 Practice

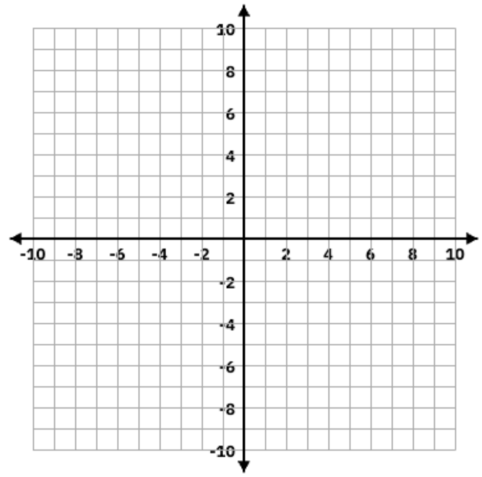
Directions: Find the determinant of each matrix. Tell whether or not the matrix will have an inverse.		
1) $\begin{bmatrix} 5 & 7 \\ -5 & 9 \end{bmatrix}$	2) $\begin{bmatrix} -\frac{1}{2} & 3 \\ \frac{5}{6} & \frac{4}{3} \end{bmatrix}$	3) $\begin{bmatrix} -4.5 & -9 \\ -3 & -6 \end{bmatrix}$
Directions: Find the inverse of each matrix if possible.		
4) $\begin{bmatrix} 2 & 8 \\ 0 & 3 \end{bmatrix}$	5) $\begin{bmatrix} -3 & -6 \\ -2 & 4 \end{bmatrix}$	6) $\begin{bmatrix} -5 & 4 \\ 8 & -8 \end{bmatrix}$
CALCULATOR ACTIVE: Directions: Multiply the matrices and determine if they are inverses.		
7) $\begin{bmatrix} 5 & 8 \\ 3 & 4 \end{bmatrix} \cdot \begin{bmatrix} -1 & 2 \\ \frac{3}{4} & -\frac{5}{4} \end{bmatrix}$	8) $\begin{bmatrix} -\frac{17}{18} & -\frac{5}{18} & \frac{2}{9} \\ \frac{23}{9} & \frac{11}{9} & -\frac{7}{9} \\ -\frac{11}{6} & -\frac{5}{6} & \frac{2}{3} \end{bmatrix} \cdot \begin{bmatrix} -3 & 0 & 1 \\ 5 & 4 & 3 \\ -2 & 5 & 8 \end{bmatrix}$	9) $\begin{bmatrix} 0 & 0 & 1 \\ 0 & 1 & 0 \\ 1 & 0 & 0 \end{bmatrix} \cdot \begin{bmatrix} 2 & -1 & -2 \\ 2 & 1 & 2 \\ 1 & 0 & 1 \end{bmatrix}$

Directions: Plot the parallelogram formed by the vectors and then find the area.

10) $\langle -3, 4\rangle$ and $\langle 2, 5\rangle$



11) $\langle 4, 2\rangle and \langle 3, -6\rangle$



4.11 The Inverse and Determinant of a Matrix

4.11 Test Prep

12) (2.3)

x	0	1	2	3	4
$f(x)$	40	20	10	5	$\frac{5}{2}$

The exponential function f is defined by $f(x) = ab^x$, where a and b are positive constants. The table gives values of $f(x)$ at selected values of x. Which of the following statements is true?

(A) f demonstrates exponential decay because $a > 0$ and $0 < b < 1$.

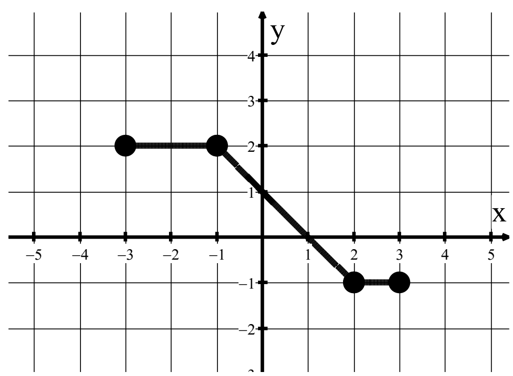
(B) f demonstrates exponential decay because $a > 0$ and $b > 1$.

(C) f demonstrates exponential growth because $a > 0$ and $0 < b < 1$.

(D) f demonstrates exponential growth because $a > 0$ and $b > 1$.

13) (2.5A) **Calculator active.** In the xy-plane, the graphs of the linear function L and the exponential function E both pass through the points $(0, 4)$ and $(1, 8)$. The exponential function E is in the form $E(x) = ab^x$. The function f is given by $f(x) = E(x) - L(x)$. What is the minimum value of f.

13) (2.7B) The piecewise-linear function f, defined on $-3 \leq x \leq 3$, is shown in the graph. The function g is given by $g(x) = x - 2$. Sketch a graph of $y = f(g(x))$.



Graph of *f*