AP Precalc

4.13A Matrices as Functions

4.13A Notes

Write your questions and thoughts here!

General Form of a Linear Transformation of a Vector in a Plane:

$\langle x,y\rangle$ to $\langle a_{11}x + a_{12}y,\ \ a_{21}x + a_{22}y\rangle$
is associated with the matrix

$$\begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix}$$

Why?

Ex 1: Given the linear transformation T, that maps <x, y> to <3x - y, 4x + 2y>, find the associated matrix with T.

Ex 2: Find the linear transformation associated with the given matrix.

$$\begin{bmatrix} 4 & 7 \\ -2 & -1 \end{bmatrix}$$

Counterclockwise Rotation Matrix

Maps a rotation that is an angle counterclockwise rotation about the origin from the original vector

$$\begin{bmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{bmatrix}$$

Suppose you have vector $\vec{u} = \langle 3, 4\rangle$

Ex 3: What is the result rotating $\frac{\pi}{2}$ radians counterclockwise about the origin?

Ex 4: What is the result rotating $\frac{\pi}{4}$ radians counterclockwise about the origin?

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Write your questions

Ex 5: Consider the transformation, what is the image of $\vec{u} = \langle 2, 4 \rangle$ under each transformation?

a. The x-coordinate triples and the y-coordinate doubles.

b. $\langle x,y \rangle$ to $\langle 2x + 3y,\ -2x + y \rangle$

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4.13A Practice

Directions: Given the linear transformation, find the associated matrix with that transformation.		
1) <x, y> to <x - y, x + y>	2) <x, y> to <2x + 3y, 3x + 9y>	3) <x, y> to <-y, 4x + 5y>
Directions: Find the linear transformation given the associated matrix.		
4) $\begin{bmatrix} 2 & 0 \\ 0 & 2 \end{bmatrix}$	5) $\begin{bmatrix} 3 & 4 \\ 1 & -3 \end{bmatrix}$	6) $\begin{bmatrix} 5 & 0 \\ -3 & -2 \end{bmatrix}$

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Directions: Find the resulting vector from rotating the given vector by the given angle.	
7) $\vec{u} = \langle 2,-3 \rangle$ rotated $\frac{\pi}{2}$ radians counterclockwise.	8) $\vec{v} = \langle -4,8 \rangle$ rotated $\frac{\pi}{4}$ radians counterclockwise.
9) $\vec{v} = \langle 4,1 \rangle$ rotated $\frac{\pi}{6}$ radians counterclockwise.	10) $\vec{u} = \langle -6,-4 \rangle$ rotated π radians counterclockwise.
Directions: Considering the given transformation, what is the image of the given vector under the transformation.	
11) The x- and y-coordinates are dilated by a factor of 4 and $\vec{u} = \langle 3,-2 \rangle$	12) $\langle x,y \rangle$ to $\langle x + 2y,\ -2x - y \rangle$ and $\vec{u} = \langle 4,6 \rangle$
13) The x-coordinate doubles, the y-coordinate quadruples and $\vec{u} = \langle -1,-5 \rangle$	14) $\langle x,y \rangle$ to $\langle 3x - y,\ -x + 7y \rangle$ and $\vec{u} = \langle -3,3 \rangle$

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4.13A Test Prep

15. (3.2B) An angle is in standard position in the xy-plane. Which of the following is true about θ on the interval $0 \leq \theta \leq 2\pi$ if $\cos\theta < 0$?

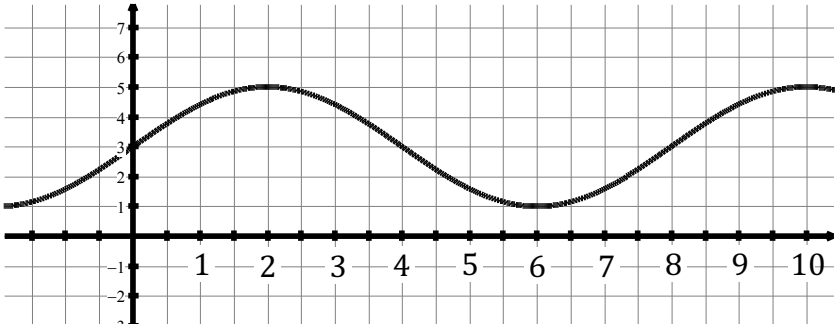
(A) There is no value of θ on $0 \leq \theta \leq 2\pi$ for which $\cos < 0$.

(B) There are values of θ on $0 \leq \theta \leq 2\pi$ for which $\cos < 0$ in all four Quadrants.

(C) There is a value of θ on $0 \leq \theta \leq 2\pi$ for which $\cos < 0$ in Quadrant II only.

(D) There are values of θ on $0 \leq \theta \leq 2\pi$ for which $\cos < 0$ in Quadrants II and III only.

16. (3.5) The figure shows the graph of a periodic function f in the xy-plane. What is the frequency of f?



Graph of f

(A) $\frac{1}{8}$ (B) $\frac{\pi}{8}$ (C) $\frac{\pi}{4}$ (D) 8

17. (3.6A) The table gives ordered pairs for seven points from a larger data set. The larger data set can be modeled by a sinusoidal function f with a period of 6. The minimum values of the data set occur at x-values that are multiples of 6.

x	0	1	2	3	4	5	6
$f(x)$	-4	-1	3	6	3	-1	-4

Which of the following best defines $f(x)$ for the larger data set?

(A) $-4\cos(12\pi x) + 1$

(B) $-4\cos\left(\frac{\pi}{3}x\right) + 1$

(C) $-5\cos(12\pi x) + 1$

(D) $-5\cos\left(\frac{\pi}{3}x\right) + 1$

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