2009 Matricies and Vectors (Alpha)

1.Which of the following vectors is perpendicular to the vectors $\langle -2,3,1\rangle$ and $\langle 4,1,-3\rangle$?

A. $\langle -10,2,-14\rangle$ b. $\langle 3,2,4\rangle$ c. $\langle -9,-10,12\rangle$ d. $\langle 5,1,7\rangle$

2. Simplify. $\begin{vmatrix} \sin\theta & -\sin\theta & 1-\sin\theta \\ \sin\theta & 1 & \cos\theta \\ -1 & 1 & 1 \end{vmatrix}$

a. $1+\sin\theta$ b. $1-2\sin^2\theta-\sin 2\theta+\sin\theta$ c. $\cos^2\theta$ d. $2\sin\theta-\sin\theta\cos\theta$

3. If a triangle with coordinates at $(3,2),(5,7)$, and $(11,2)$ is transformed by the matrix $\begin{bmatrix} -2 & -1 \\ 4 & 3 \end{bmatrix}$ to a triangle with coordinates $(-8,18),(-17,41)$, and $(-24,50)$, then the difference of area of the new triangle to the old triangle is:

A. 20 b. 30 c. 40 d. 50

4.what is the angle between the vectors $\langle 3,7,-9\rangle$ and $\langle 11,12,13\rangle$?

A. 60° b. 90° c. 120° d. 135°

5. Find the resultant of the two vectors of length 30 and 36 which form an angle of 60°.

A. $6\sqrt{91}$ b. $18\sqrt{17}$ c. $66\sqrt{3}$ d. $56\sqrt{37}$

6. Find the sum of the squares of $\begin{vmatrix} 3 & -1 & 1 \\ x & x & 6 \\ x & 1 & -2 \end{vmatrix} = 6$.

A. 217 b. 169 c. 194 d. 121

7. Let $a=\langle 5,12\rangle, b=\langle 3,-4\rangle, c=\langle -15,8\rangle$. If d is equal to $(a\bullet c)b$, then what is the magnitude of d?

A. 105 b. 561 c. 819 d. – 561

8. Let $M=\begin{bmatrix} 2 & 3 \\ -1 & -2 \end{bmatrix}$. Find the sum of the elements in $M^4+M^3+M^2-M+I+M^{-1}$, where I is the 2×2 identity matrix.

A. 8 b. 9 c. 10 d. 18

9. When solving a system of three variables $x, y,$ and z, kevin used cramer's rule and found the following for x: $\dfrac{\begin{vmatrix} -4 & 2 & -1 \\ 3 & 1 & 1 \\ 5 & 1 & 2 \end{vmatrix}}{\begin{vmatrix} 3 & 2 & -1 \\ 2 & 1 & 1 \\ 1 & 1 & 2 \end{vmatrix}}$. Find the value of z.

A. – 2 b. 0 c. 1 d. 3

10. Let $u = \langle 1, -1 \rangle, v = \langle 3, -2 \rangle,$ and $w = \langle 1, 2 \rangle$. If $w = Au + Bv$, where A and B are scalars, find $(A+B)^2$.

A. 13 b. 17 c. 21 d. 25

11. If A is a 2×2 matrix such that $\det(A) = 8$, then find the value of $\det(A^{-1})$.

A. 8 b. 1 c. $\frac{1}{8}$ d. $\frac{1}{64}$

12. Find the equation of the plane normal to $v = 3i - 2j + k$ and containing the point. (-1, 4, 2)

a. $3x + 3y + z = 7$ b. $3x - 2y + z = 9$ c. $3x - 2y + z = -9$ d. $-x + 4y + 2x = 15$

13. If $A = \begin{bmatrix} 1 & 3 \\ -2 & 4 \end{bmatrix}$ and $B = \begin{bmatrix} 2 & 4 \\ 1 & 0 \end{bmatrix}$, find BA^2.

A. $\begin{bmatrix} 14 & 20 \\ -8 & 0 \end{bmatrix}$ b. $\begin{bmatrix} -50 & 70 \\ -5 & 15 \end{bmatrix}$ c. $\begin{bmatrix} 58 & -66 \\ -3 & 31 \end{bmatrix}$ d. $\begin{bmatrix} 25 & -12 \\ 0 & 64 \end{bmatrix}$

14. Find $v \times w$ if $v = i - 2j + k$ and $w = 2i + 3j - k$.

A. $-i + 3j + 7k$ b. $i - 3j - 7k$ c. -5 d. $2\sqrt{21}$

15. Mark pulls on a box with a rope at an angle of 30° with a force of 50 newtons. If the box is moved 10 meters, how much work did mark do?

A. 500 b. $250\sqrt{2}$ c. $250\sqrt{3}$ d. 250

16. If $A=\begin{bmatrix}-3 & 1 & 0\\ 0 & 1 & -2\\ -1 & 0 & 3\end{bmatrix}$, then what is the entry in $A^{-1}_{(3,2)}$?

A. $\frac{1}{7}$ b. $-\frac{1}{7}$ c. $\frac{6}{7}$ d. $-\frac{6}{7}$

17. If $\begin{bmatrix}-3 & 4\\ -2 & 5\end{bmatrix}$ transforms the vector $\begin{bmatrix}-3 & 4\\ -2 & 5\end{bmatrix}$ to the vector $\langle x, y\rangle$, then find $x^2-2xy+y^2$.

A. 81 b. 64 c. 144 d. 289

18. Find the equation of the line which is the image of $y=2x-3$ under a with vector $\langle -3, 2\rangle$.

A. $y=x-3$ b. $y=2x+5$ c. $y=2x$ d. $y=-3x+2$

19. Find the image under a rotation of 45° for $\begin{bmatrix}-\sqrt{2}\\ \sqrt{2}\end{bmatrix}$.

A. $\begin{bmatrix}\sqrt{2}\\ -\sqrt{2}\end{bmatrix}$ b. $\begin{bmatrix}2\\ -2\end{bmatrix}$ c. $\begin{bmatrix}-2\\ 0\end{bmatrix}$ d. $\begin{bmatrix}-2\sqrt{2}\\ 2\sqrt{2}\end{bmatrix}$

20. Which of the following is the reduced row echelon form matrix to $\left[\begin{array}{ccc|c}1 & 2 & 3 & 6\\ 2 & -4 & 2 & 16\\ 3 & 1 & -1 & -2\end{array}\right]$?

A. $\left[\begin{array}{ccc|c}1 & 2 & 3 & 6\\ 0 & 1 & 2 & 4\\ 0 & 0 & 1 & -3\end{array}\right]$ b. $\left[\begin{array}{ccc|c}1 & 0 & 0 & -5\\ 0 & 1 & 0 & -2\\ 0 & 0 & 1 & 3\end{array}\right]$ c. $\left[\begin{array}{ccc|c}1 & 0 & 0 & 1\\ 0 & 1 & 0 & -2\\ 0 & 0 & 1 & 3\end{array}\right]$ d. $\left[\begin{array}{ccc|c}1 & 0 & 0 & 15\\ 0 & 1 & 0 & 10\\ 0 & 0 & 1 & -3\end{array}\right]$

21. What is the trace of $\begin{bmatrix}-3 & -3 & 6 & 9\\ -4 & 5 & 8 & -12\\ 12 & 0 & 2 & 0\\ 24 & 3 & 9 & -8\end{bmatrix}$?

A. 18 b. 16 c. -1 d. – 4

22. What is sine of the angle between $\langle 4,-2\rangle$ and $\langle 3,3\rangle$?

A. $\frac{3\sqrt{10}}{20}$ b. $\frac{3\sqrt{10}}{20}$ c. $\frac{3\sqrt{5}}{20}$ d. $\frac{3\sqrt{5}}{20}$

23. Let $A=\begin{bmatrix}2 & -1\\ x & 0\end{bmatrix}$ and B is the inverse of A. If $B_{(2,2)}$ is $\frac{2}{5}$, find x.

A. 5 b. $\frac{3}{2}$ c. $-\frac{5}{2}$ d. $\frac{7}{3}$

24. If $a=\langle 1,-2,3\rangle$, $b=\langle 4,3,-5\rangle$, and $c=\langle -2,1,3\rangle$, find $3a-2b+c$.

A. $\langle 1,1,1\rangle$ b. $\langle -7,-11,22\rangle$ c. $\langle -7,-11,22\rangle$ d. $\langle -5,-4,5\rangle$

25. What is the rank of $\begin{bmatrix}5 & -2 & 1 & 3 & 4\\ 0 & -1 & 2 & 6 & -3\end{bmatrix}$?

A. 2 b. 3 c. 4 d. 5

26. Find the eigenvalue(s) of $\begin{bmatrix}2 & 1\\ 1 & 2\end{bmatrix}$.

A. 1 b. 1, 3 c. – 1, - 3 d. – 3

27. Find the volume of the tetrahedron with vertices $A(2,1,-3), B(1,0,2), C(3,-1,1)$, and $D(0,1,3)$.

A. $\frac{1}{6}$ b. 1 c. 3 d. 6

28. When $\begin{vmatrix}\cos A & \sin B\\ \sin A & \cos B\end{vmatrix}$ is simplified it is

A. $\cos(A+B)$ b. $\cos(A-B)$ c. $\cos(AB)$ d. 1

29. Find the difference of $\begin{bmatrix}1 & 2 & 3\\ 4 & 5 & 6\end{bmatrix}-\begin{bmatrix}7 & 8\\ 9 & 10\end{bmatrix}$.

A. $\begin{bmatrix}8 & 10 & 3\\ 13 & 14 & 4\end{bmatrix}$ b. $\begin{bmatrix}-6 & -6 & -3\\ -5 & -4 & -6\end{bmatrix}$ c. $\begin{bmatrix}-6 & -6 & 3\\ -5 & -4 & 6\end{bmatrix}$ d. Not possible

30. Which of the following is skewed?

A. $\begin{bmatrix} 0 & 8 \\ -8 & 0 \end{bmatrix}$ b. $\begin{bmatrix} 0 & 8 \\ 8 & 0 \end{bmatrix}$ c. $\begin{bmatrix} 8 & 0 \\ 8 & 0 \end{bmatrix}$ d. $\begin{bmatrix} 0 & -8 \\ -8 & 0 \end{bmatrix}$

Tiebreakers:

1. $\begin{vmatrix} 3 & 4 & -2 & 3 \\ 0 & 1 & 5 & 0 \\ 2 & 0 & 4 & 7 \\ 6 & 8 & -4 & 6 \end{vmatrix} =$

2. If all the entries in a 3×3 matrix is 3, the what is the trace of the matrix?

3. What is the equation of the plane containing the points $(1,-4,7),(1,-4,2)$, and $(-8,3,5)$?