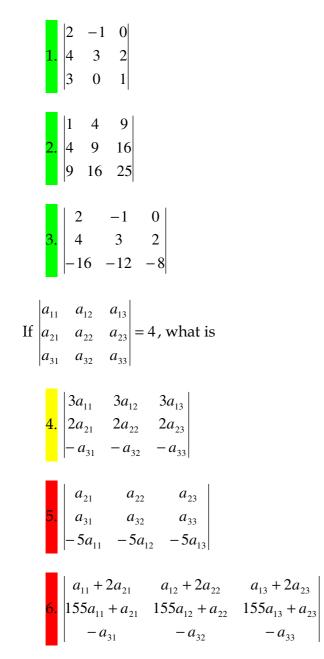# HW. # 3

Homework problems are taken from textbook. The problems are color coded to indicate level of difficulty. The color green indicates an elementary problem, which you should be able to solve effortlessly. Yellow means that the problem is somewhat harder. Red indicates that the problem is hard. You should attempt the hard problems especially.

Evaluate the determinants.

1. $\begin{vmatrix} 2 & -1 & 0 \\ 4 & 3 & 2 \\ 3 & 0 & 1 \end{vmatrix}$

2. $\begin{vmatrix} 1 & 4 & 9 \\ 4 & 9 & 16 \\ 9 & 16 & 25 \end{vmatrix}$

3. $\begin{vmatrix} 2 & -1 & 0 \\ 4 & 3 & 2 \\ -16 & -12 & -8 \end{vmatrix}$

If $\begin{vmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{vmatrix} = 4$, what is

4. $\begin{vmatrix} 3a_{11} & 3a_{12} & 3a_{13} \\ 2a_{21} & 2a_{22} & 2a_{23} \\ -a_{31} & -a_{32} & -a_{33} \end{vmatrix}$

5. $\begin{vmatrix} a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \\ -5a_{11} & -5a_{12} & -5a_{13} \end{vmatrix}$

6. $\begin{vmatrix} a_{11} + 2a_{21} & a_{12} + 2a_{22} & a_{13} + 2a_{23} \\ 155a_{11} + a_{21} & 155a_{12} + a_{22} & 155a_{13} + a_{23} \\ -a_{31} & -a_{32} & -a_{33} \end{vmatrix}$

7. Compute $a \times b$ where $a = i - 2j + k$ and $b = 2i + j + k$

8. Find the area of the parallelogram with sides **a** and **b** given in exercise 7.

9. A triangle has vertices (0, 0, 0), (1, 1, 1), and (0, -2, 3). Find its area.

10. What is the volume of the parallelepiped with sides 2**i** + **j** – **k**, 5**i** –3**k**, and **I** – 2**j** + **k**?

Describe all unit vectors orthogonal to both of the given vectors.

11. **I, j**

12. 2**i** – 4**j** + 3**k**, -4**i** + 8**j** –6**k**

Find an equation for the plane that

13. is perpendicular to **v** = (1, 2, 3) and passes through (1, 1, 1)

14. is perpendicular to the line **l**(t) = (5, 0, 2)t + (3, -1, 1) and passes through (5, -1, 0)

15. passes through (0, 0, 0), (2, 0, -1), and (0, 4, -3)

16. passes through (2, -1, 3), (0, 0, 5), and (5, 7, -1)

17. contains the two (parallel) lines **l**(t) = (0, 1, -2) +t(2, 3, -1) and **S**(t) = (2, -1, 0) + t(2, 3, -1)

18. Find the intersection of the planes x + 2y + z = 0 and x – 3y – z = 0

19. (a) Show that two parallel planes are either identical or they never intersect.
    (b) How do two nonparallel planes intersect?

20. Determine the distance from the plane 12x + 13y + 5z + 2 = 0 to the point (1, 1, -5)

21. Given vectors **a** and **b**, do the equations **x** ×**a** = **b** and **x** • **a** = |**a**| determine a unique vector **x**? Explain.   (This one's really hard!)