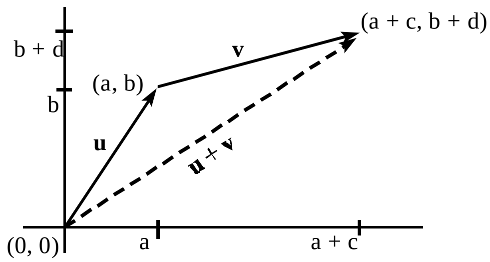
MTH 3331 Practice Test #2 - Answers

Summer 2013

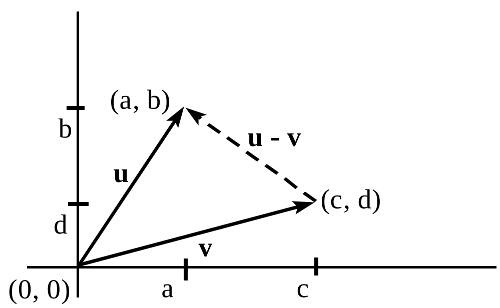
Pat Rossi Name ____________________

1. ~

   (a) $\mathbf{u}+\mathbf{v}$



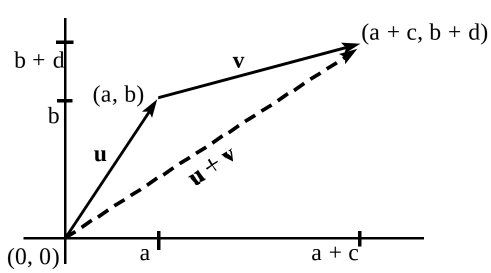
   (b) $\mathbf{u}-\mathbf{v}$



2. $||\mathbf{u}|| = 13$; $||\mathbf{v}|| = \sqrt{61}$

3. **Cauchy-Schwarz Inequality**: If $\mathbf{u}$ and $\mathbf{v}$ are vectors in $\Re^n$, then $|\mathbf{u}\circ\mathbf{v}| \leq ||\mathbf{u}||\,||\mathbf{v}||$. Equality holds exactly when $\mathbf{u} = k\mathbf{v}$.

4. **Triangle Inequality**: If $\mathbf{u}$ and $\mathbf{v}$ are vectors in $\Re^n$, then $||\mathbf{u}+\mathbf{v}|| \leq ||\mathbf{u}|| + ||\mathbf{v}||$. Equality holds exactly when $\mathbf{u} = k\mathbf{v}$. and give its geometric interpretation. Geometrically, this means that no one side of a triangle has length greater than the sum of the lengths of the other two sides.



5. $\mathbf{u}\circ\mathbf{v} = 15$

6. ~

   (a) $||\mathbf{u}|| = 1$

   (b) $\mathbf{u}$ is a unit vector.

7. $\cos(\theta) = 0$

8. $\cos(\theta) = \frac{2}{7\sqrt{10}} = \frac{\sqrt{10}}{35}$

9. $\begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 5 \\ -1 \\ 0 \end{bmatrix} + k \begin{bmatrix} 2 \\ -1 \\ 1 \end{bmatrix}$

10. Assume that each of the following matrices is the matrix of coefficients of a homogeneous system of equations. Decide whether has any solution other than the trivial solution. If so, give the solution.

    (a) The matrix $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 1 \\ 0 & 0 & 1 \end{bmatrix}$ is row equivalent to the identity matrix and therefore has only the trivial solution. Alternately, the matrix has rank 3 and therefore has only the trivial solution.

    (b) $\begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = k \begin{bmatrix} 1 \\ -1 \\ 1 \end{bmatrix}$

    (c) $\begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \end{bmatrix} = k_1 \begin{bmatrix} -2 \\ 1 \\ 0 \\ 0 \end{bmatrix} + k_2 \begin{bmatrix} 0 \\ 0 \\ -1 \\ 1 \end{bmatrix}$

    (d) $\begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = k \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}$

11. $A\mathbf{x} = \mathbf{0}$ has only the trivial solution, $\mathbf{x} = \mathbf{0}$.

12. $\begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} -\frac{1}{2} \\ 1 \\ 0 \end{bmatrix} + k \begin{bmatrix} \frac{17}{2} \\ -7 \\ 1 \end{bmatrix}$

13. See solutions.

14. See solutions.

15. The $\begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \\ x_5 \\ x_6 \end{bmatrix} = \begin{bmatrix} 6 \\ 0 \\ -1 \\ 0 \\ 2 \\ 0 \end{bmatrix} + k_1 \begin{bmatrix} -2 \\ 1 \\ 0 \\ 0 \\ 0 \\ 0 \end{bmatrix} + k_2 \begin{bmatrix} -1 \\ 0 \\ -4 \\ 1 \\ 0 \\ 0 \end{bmatrix} + k_3 \begin{bmatrix} 1 \\ 0 \\ -2 \\ 0 \\ -2 \\ 1 \end{bmatrix}$

16. $\mathbf{x}_1 + \mathbf{y}_1$ is also a particular solution of the system $A\mathbf{x} = \mathbf{b}$.

17. $$\begin{aligned} x - 1 &= 2k \\ y - 4 &= 2k \end{aligned}$$

18. $x + 3y + 4z = 16$

19. $2x + 2y - 3z = 1$

20. $$\begin{aligned} x - 2 &= -k \\ y - 1 &= 3k \\ z - 2 &= 3k \end{aligned}$$

21. $A^{-1} = \begin{bmatrix} 3 & -12 & 5 \\ -1 & 5 & -2 \\ -2 & 8 & -3 \end{bmatrix}$

22. $\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} -17 \\ 8 \\ 11 \end{bmatrix}$

23. $2x + 3y + 4z = 9$

24. $4x - 4y + 3z = 10$

25. ~

(a) $$\begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 2 \\ 3 \\ 0 \end{bmatrix} + k \begin{bmatrix} -1 \\ -2 \\ 1 \end{bmatrix}$$

(b) $$\begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \end{bmatrix} = \begin{bmatrix} 5 \\ 0 \\ 3 \\ 1 \end{bmatrix} + k \begin{bmatrix} -2 \\ 1 \\ 0 \\ 0 \end{bmatrix}$$

(c) $$\begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \\ x_5 \end{bmatrix} = k_1 \begin{bmatrix} -2 \\ 1 \\ 0 \\ 0 \\ 0 \end{bmatrix} + k_2 \begin{bmatrix} -4 \\ 0 \\ -2 \\ -3 \\ 1 \end{bmatrix}$$