Review of Vectors

Pre-Class Questions:

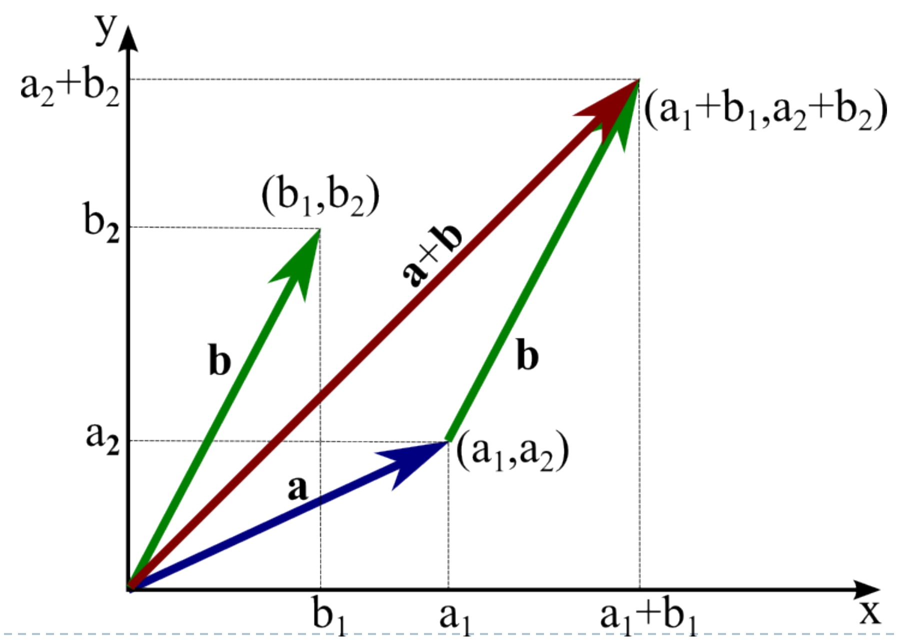
Problem Set #5 (due next time)

Lecture Outline

1. Addition of Scalars Re-envisioned
2. Graphical Addition of Vectors
3. Vector Components
4. Analytical Addition of Vectors
5. Multiplying Vectors

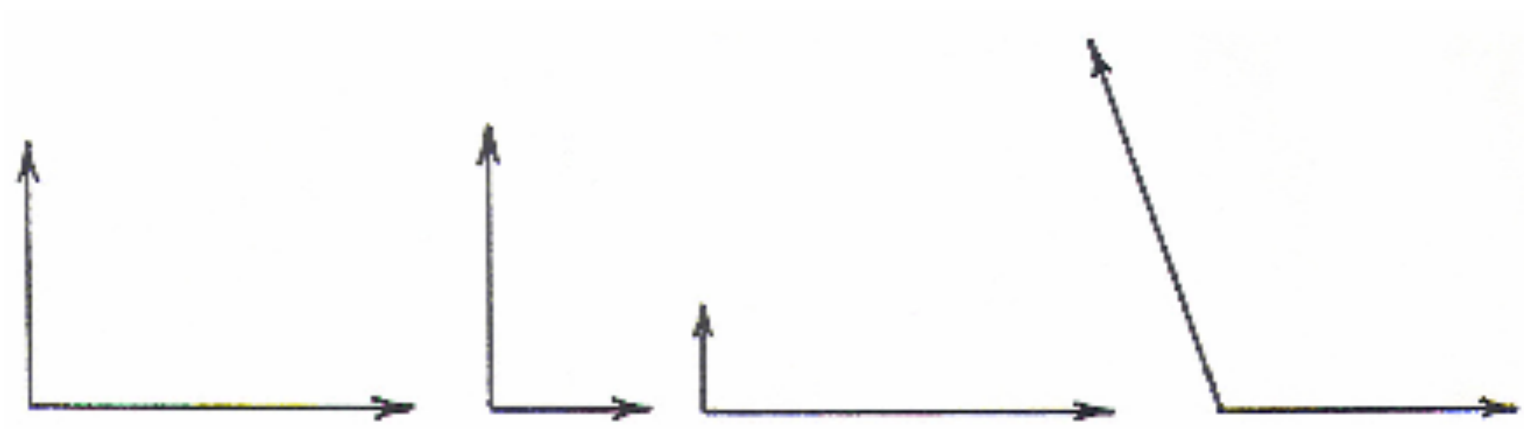
Pre-Class Summary:

1. Vectors have magnitude and direction.
2. Vectors can be broken down into components along each axis.
3. Vectors can be added graphically using the parallelogram rule.
4. Vectors can be added numerically by adding their components.
5. The magnitude can be found by using the Pythagorean Theorem.
6. The direction can be found using the definition of the tangent.
7. Vectors can be multiplied two ways – cross and dot products.

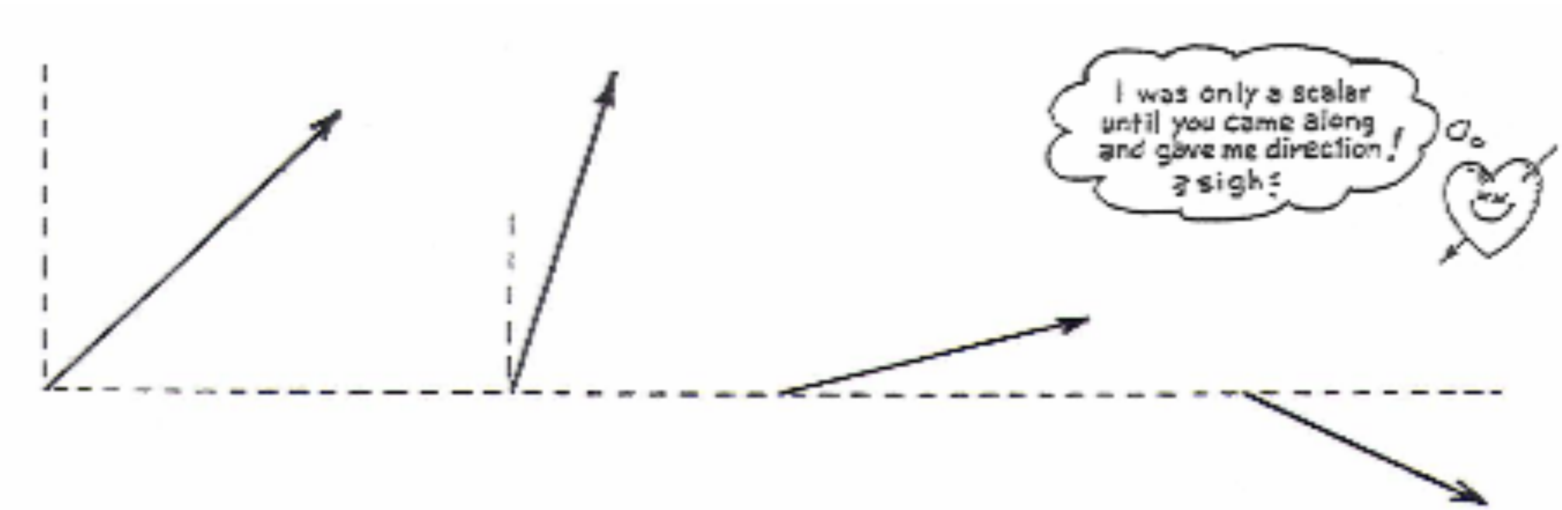


Example 1: Use the number line to represent the equation 1+3=4.

For each pair of vectors shown draw their sum.



For each pair of vectors shown draw their horizontal and vertical components.

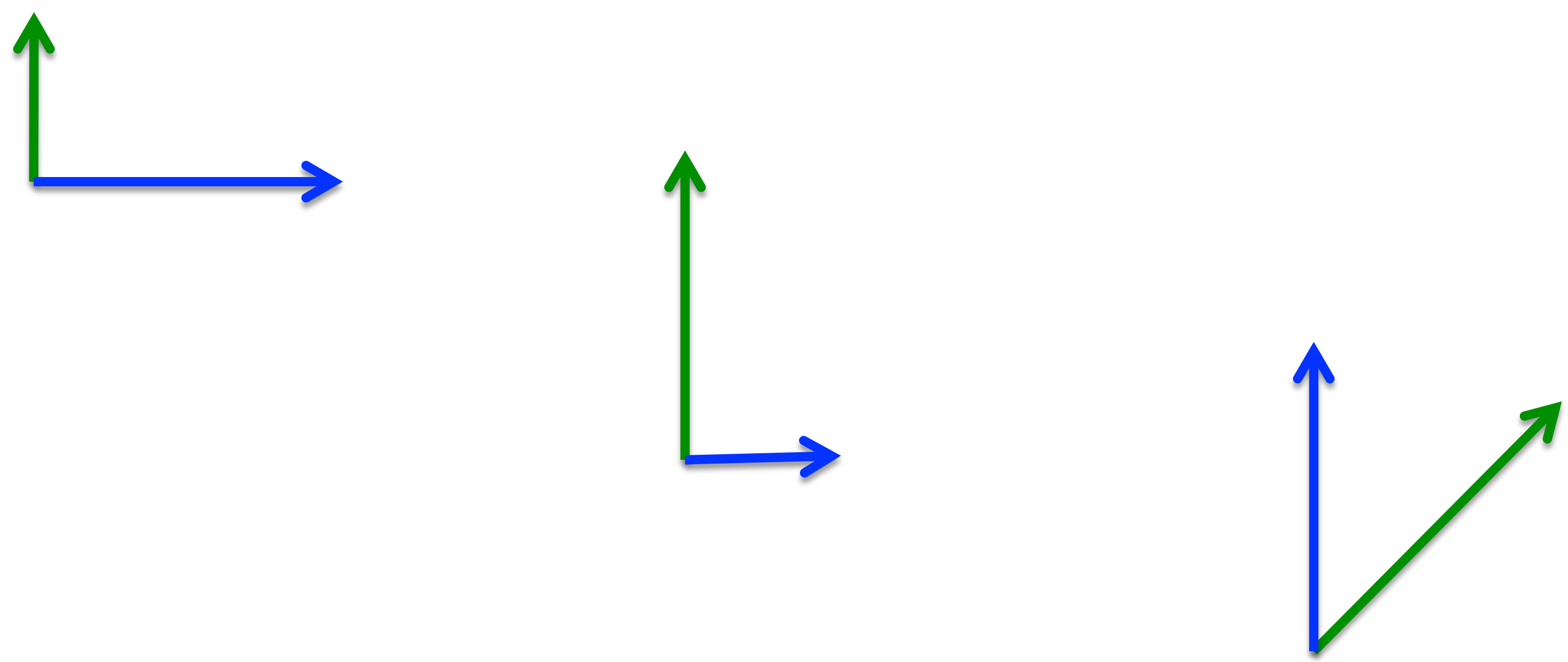


Example 2: Sacramento is 120km northeast of San Francisco. Find (a)the distance you would have to go eastward and (b)the distance you would have to go northward to get from San Francisco to Sacramento.

Example 3: Chico is 135km from Sacramento at 70° north of west. Find the total displacement from San Francisco to Chico.

Example 4: Find the distance and direction from San Francisco to Chico.

For each pair of vectors shown subtract green vector from the blue one.



Example 5: Given the two vectors below, find (a)their dot product and (b)their cross product.

$$\vec{A} = 10\hat{i} + 8\hat{j}$$

$$\vec{B} = 12\hat{i} - 8\hat{j}$$

Lecture 05- Summary

Vector Components $A_x = A\cos\theta$ and $A_y = A\sin\theta$

Unit Vector Notation $\vec{A} = A_x\hat{i} + A_y\hat{j}$

Vector Addition $\vec{R} = \vec{A} + \vec{B}$ where $R_x = A_x + B_x$ and $R_y = A_y + B_y$

Vector Dot Product $\vec{A} \bullet \vec{B} \equiv AB\cos\theta = A_xB_x + A_yB_y + A_zB_z$

Vector Cross Product

$$\vec{A} \times \vec{B} \equiv AB\sin\theta\hat{n} = (A_yB_z - A_zB_y)\hat{i} + (A_zB_x - A_xB_z)\hat{j} + (A_xB_y - A_yB_x)\hat{k}$$

$$\vec{A} \times \vec{B} \equiv AB\sin\theta\hat{n} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ A_x & A_y & A_z \\ B_x & B_y & B_z \end{vmatrix}$$