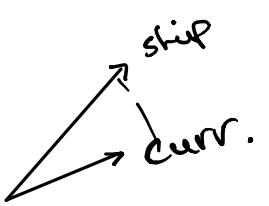

Velocity is $\vec{v}$ (i.e the vector projection of ship onto current)

$$s = \begin{bmatrix} 1 \\ 2 \end{bmatrix} \quad c = \begin{bmatrix} 1 \\ 1 \end{bmatrix}$$

$$s \text{ onto } c = \frac{c}{|c|} \times \frac{s \cdot c}{|c|}$$

$$= \begin{bmatrix} 1 \\ 1 \end{bmatrix} \frac{((1)(1)+(2)(1))}{(\sqrt{2})^2}$$

$$= \frac{3}{2}[1 \ 1]^T$$

PROBLEM #2.

ball has velocity $[2\,1]^T$, wind has direction $[3\,-4]^T$. What is the magnitude of velocity of ball in direction of the wind? (i.e scalar projection)

$$b = [2\ 1]^T, \quad w = [3\ -4]^T$$

$$\text{scalar proj } b \text{ onto } w = \frac{b \cdot w}{|w|}$$

$$= \frac{((2)(3)+(1)(-4))}{\sqrt{(3^2)+(-4)^2}}$$

$$= \frac{2}{5}$$

PROBLEM #3.

$v = [-4\ -3\ 8]$, $a = [1\ 2\ 3]$, $b = [-2\ 1\ 0]$, $b_3 = [-3\ -6\ 5]$.

b is pairwise orthogonal.

v onto a $= \frac{a}{|a|} \times \frac{v \cdot a}{|a|}$

$= a \times \frac{v \cdot a}{a \cdot a}$

$= \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix} \frac{((-4)(1) + (-3)(2) + (8)(3))}{((1)^2 + (2)^2 + 3^2)}$

$= 1$

v onto b $= b \times \frac{b \cdot v}{b \cdot b}$

$= \begin{bmatrix} -2 \\ 1 \\ 0 \end{bmatrix} \frac{((-4)(-2) + (-3)(1) + (8)(0))}{(-2)^2 + 1^2 + (0)^2}$

$= \begin{bmatrix} -2 \\ 1 \\ 0 \end{bmatrix} (1) = \frac{b \cdot v}{|b|}$

v onto c $= \frac{c \cdot v}{|c|} = \frac{(-4)(-3) + (-3)(-6) + 8(5)}{(-3)^2 + (-6)^2 + 5^2}$

$= 1$

PROBLEM # 4

Is $[1\ 2\ -1]^T$, $[3\ -4\ 5]^T$, $[1\ -8\ 7]^T$ independent?

$M = \begin{bmatrix} 1 & 3 & 1 \\ 2 & -4 & -8 \\ -1 & 5 & 7 \end{bmatrix} = \begin{bmatrix} 1 & 3 & 1 \\ 2 & -4 & -8 \\ 0 & 8 & 8 \end{bmatrix}$, adding Row# 1

$= \begin{bmatrix} 1 & 3 & 1 \\ 0 & -10 & -10 \\ 0 & 8 & 8 \end{bmatrix}$, adding $-2 \times$ Row#1

$\longrightarrow$ Row #2 & #3 are dependent.

PROBLEM #5.

Obj. moving w- velocity $[-1 \ 2 \ -3]^T$ km/h, starting at $[3 \ 2 \ 4]^T$. Where after 2 hours?

$$d = \begin{bmatrix} 3 \\ 2 \\ 4 \end{bmatrix} + \begin{bmatrix} -1 \\ 2 \\ -3 \end{bmatrix} 2$$

$$= \begin{bmatrix} 1 \\ 6 \\ -2 \end{bmatrix}$$, where the ship ended up after 2 hours.