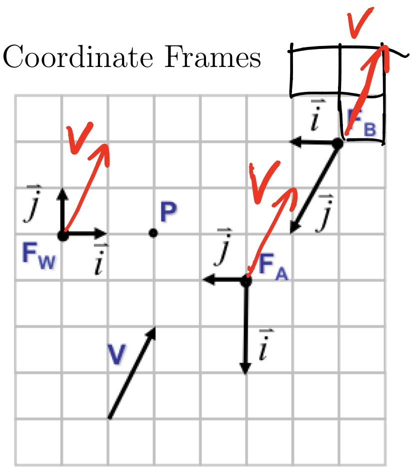
1. Coordinate Frames



$$\begin{bmatrix} x \\ y \\ 1 \end{bmatrix}_W = \begin{bmatrix} 0 & -1 & 4 \\ -2 & 0 & -1 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \\ 1 \end{bmatrix}_A$$

$$\begin{bmatrix} x \\ y \\ 1 \end{bmatrix}_A = \begin{bmatrix} 0 & 1 & -1.5 \\ 1 & 1 & -2 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \\ 1 \end{bmatrix}_B$$

(a) (3 points) Express point P in each of the three coordinate frames.

$P_W\ (2,0)$
$P_A\ (-0.5, 2)$
$P_B\ (3,1)$

(b) (3 points) Express ~~point~~ vector V in each of the three coordinate frames.

$V_W \langle 1,2 \rangle$
$V_A \langle -1,-1 \rangle$
$V_B \langle 0,-1 \rangle$

See the sketches of V in the figure above.

(c) (2 points) Find the 3×3 homogeneous transformation matrix which takes a point from F_A and expresses it in terms of F_W. I.e., determine M, where $P_W = MP_A$.

$$\begin{bmatrix} i_A & j_A & O_A \\ 0 & 0 & 1 \end{bmatrix}$$

i_A, j_A, O_A expressed wrt F_W

(see above)

(d) (2 points) Find the 3×3 homogeneous transformation matrix which takes a point from F_B and expresses it in terms of F_A. I.e., determine M, where $P_A = MP_B$.

$$\begin{bmatrix} i_B & j_B & O_B \\ 0 & 0 & 1 \end{bmatrix}$$

i_B, j_B, O_B expressed wrt F_A

(see above)