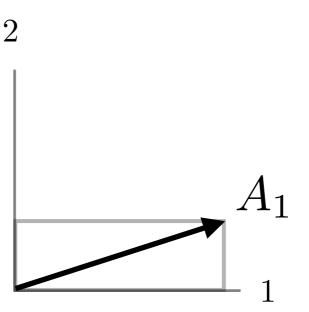
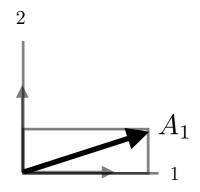
Matrix Multiplication

Column Geometry

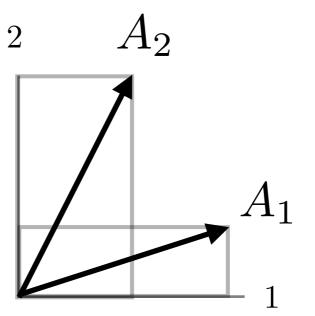
Dan Calderone



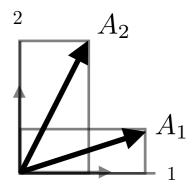
$$\left[egin{array}{c} A \end{array}
ight] = \left[egin{array}{c} dash \ A_1 \ dash \end{array}
ight]$$



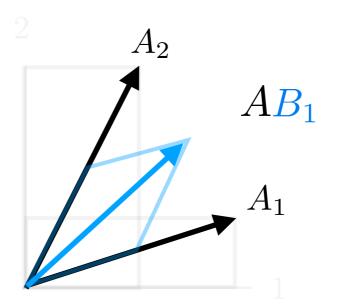
$$A = \begin{bmatrix} | \\ A_1 \\ | \end{bmatrix}$$



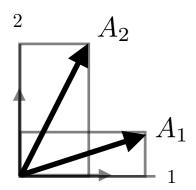
$$\left[egin{array}{c} A \end{array}
ight] = \left[egin{array}{c} ert \ A_1 \ A_2 \ ert \end{array}
ight]$$

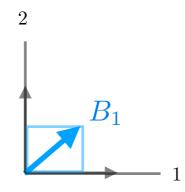


$$A = \begin{bmatrix} | & | & | \\ A_1 & A_2 & | & | \\ | & & | & | \end{bmatrix}$$



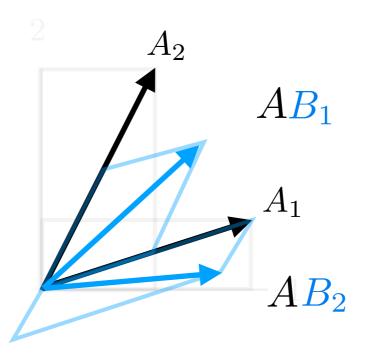
$$\left[egin{array}{c} A \end{array}
ight] \left[egin{array}{c} | \ A_1 \ A_2 \ | \ | \end{array}
ight] \left[egin{array}{c} | \ B_1 \ | \ | \end{array}
ight]$$

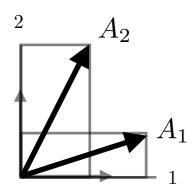


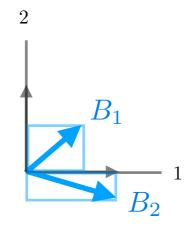


$$A = \begin{bmatrix} | & | & | \\ A_1 & A_2 & | & | \\ | & | & | \end{bmatrix} \qquad B = \begin{bmatrix} | & | & | \\ B_1 & | & | \\ | & | & | \end{bmatrix}$$

$$B = \begin{vmatrix} | & | \\ B_1 & | \\ | & | \end{vmatrix}$$

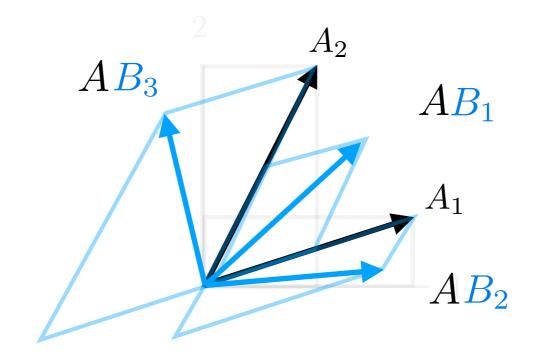




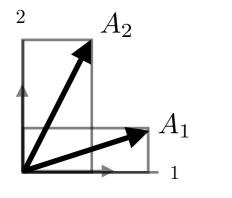


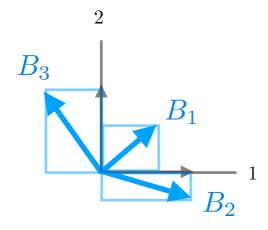
$$A = \begin{bmatrix} | & | & | \\ A_1 & A_2 & | & B = \begin{bmatrix} | & | & | \\ B_1 & B_2 & | & | \\ | & & | & \end{bmatrix}$$

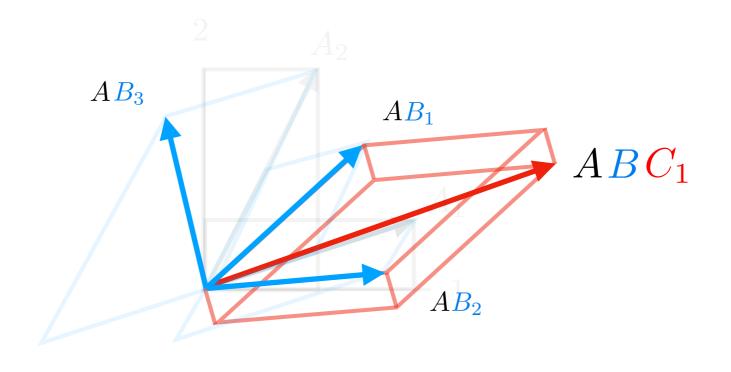
$$B = \begin{vmatrix} | & | & | \\ B_1 & B_2 & | \\ | & | & | \end{vmatrix}$$



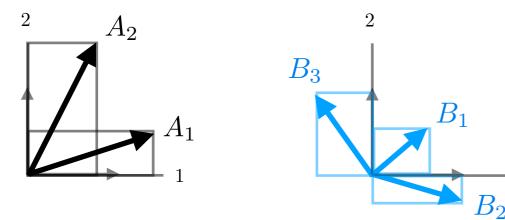
$$\left[egin{array}{c} A \end{array}
ight] \left[egin{array}{c} | \ A_1 \ A_2 \ | \ | \end{array}
ight] \left[egin{array}{c} | \ B_1 \ B_2 \ B_3 \ | \ | \end{array}
ight]$$



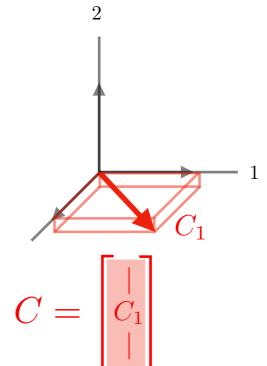


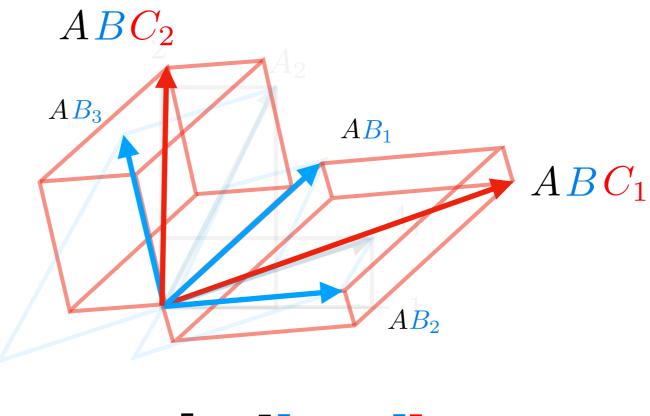


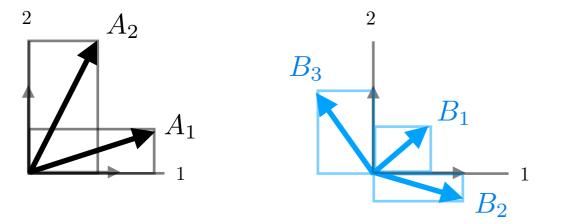
$$\left[egin{array}{c} A \end{array}
ight] \left[egin{array}{c} B \end{array}
ight] \left[egin{array}{c} A_1 & A_2 \ A_1 & A_2 \ A_2 & A_3 \end{array}
ight] \left[egin{array}{c} B_1 & B_2 & B_3 \ A_1 & A_2 & A_3 \end{array}
ight] \left[egin{array}{c} C_1 \ A_1 & A_2 \end{array}
ight]$$



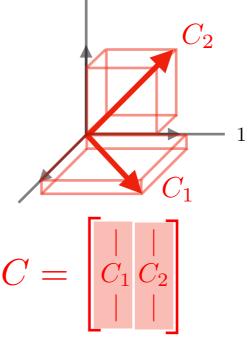
$$A = \begin{bmatrix} | & | & | \\ A_1 & A_2 & | & | \\ | & | & | \end{bmatrix} \qquad B = \begin{bmatrix} | & | & | & | \\ B_1 & B_2 & B_3 & | & | \\ | & | & | & | & | \end{bmatrix}$$

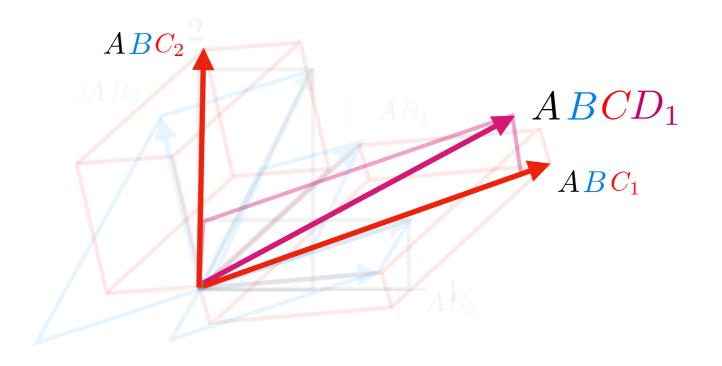




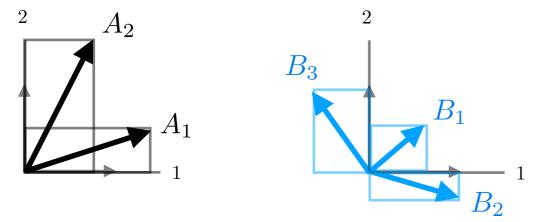


$$A = \begin{bmatrix} \begin{vmatrix} 1 & 1 \\ A_1 & A_2 \\ | & | \end{bmatrix} \qquad B = \begin{bmatrix} \begin{vmatrix} 1 & 1 & 1 \\ B_1 & B_2 & B_3 \\ | & | & | \end{bmatrix} \qquad C = \begin{bmatrix} \begin{vmatrix} 1 & 1 \\ C_1 & C_2 \\ | & | & | \end{bmatrix}$$





$$\left[egin{array}{c|c} A \end{array}
ight] \left[egin{array}{c|c} B \end{array}
ight] \left[egin{array}{c|c} D \end{array}
ight] = \left[egin{array}{c|c} |A_1 \ A_2 \ | \end{array}
ight] \left[egin{array}{c|c} |A_1 \ B_2 \ B_3 \ | \end{array}
ight] \left[egin{array}{c|c} |A_1 \ C_2 \ | \end{array}
ight] \left[egin{array}{c|c} |D_1 \ | \end{array}
ight]$$

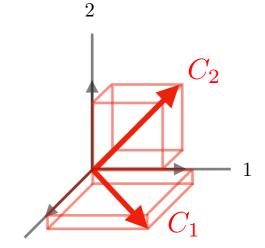


$$A = \begin{bmatrix} \begin{vmatrix} 1 \\ A_1 \\ A_2 \\ \end{vmatrix}$$

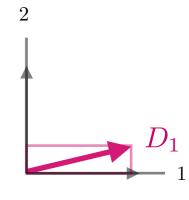
$$B = \begin{bmatrix} \begin{vmatrix} 1 \\ B_1 \\ B_2 \\ \end{vmatrix}$$

$$C = \begin{bmatrix} \begin{vmatrix} 1 \\ C_1 \\ C_2 \\ \end{vmatrix}$$

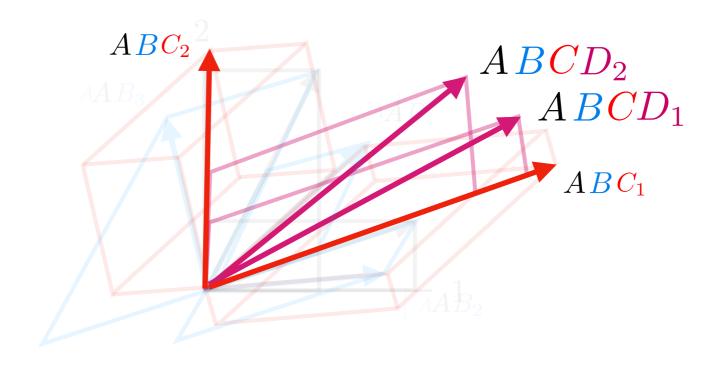
$$D = \begin{bmatrix} \begin{vmatrix} 1 \\ D_1 \\ \end{vmatrix}$$



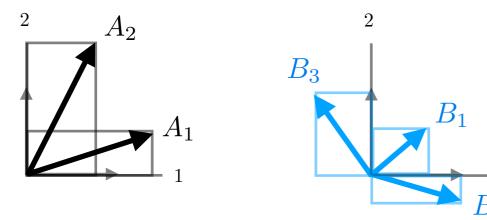
$$C = \begin{bmatrix} | & | \\ C_1 & C_2 \\ | & | \end{bmatrix}$$

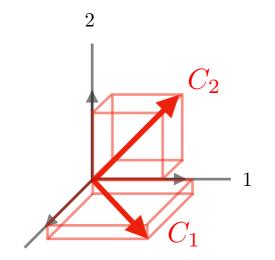


$$D = \begin{bmatrix} 1 \\ D_1 \\ 1 \end{bmatrix}$$

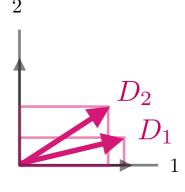


$$egin{bmatrix} A & egin{bmatrix} B & C & D \end{bmatrix} = & egin{bmatrix} ig| A_1 & A_2 \ ig| & ig| B_1 & B_2 & B_3 \ ig| & ig| &$$

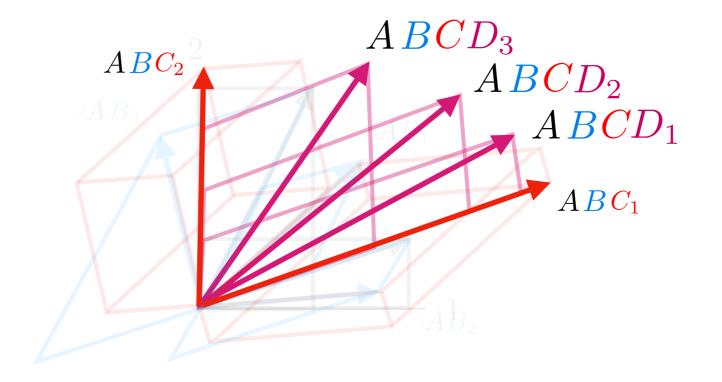




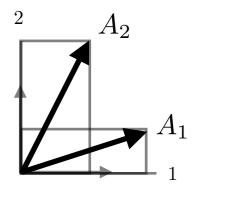


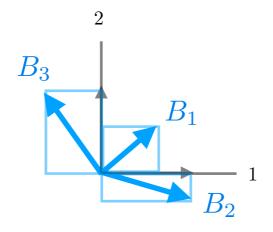


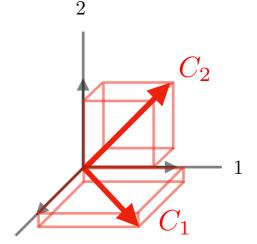
$$D = \begin{vmatrix} \begin{vmatrix} | & | & | \\ | & | & | \\ | & | & | \end{vmatrix}$$

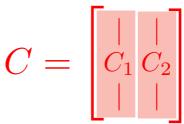


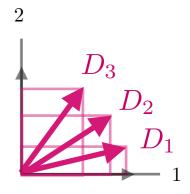
$$\left[egin{array}{c|c} A \end{array}
ight] \left[egin{array}{c|c} B \end{array}
ight] \left[egin{array}{c|c} D \end{array}
ight] = \left[egin{array}{c|c} |A_1 & A_2 \ |A_2 & |A_3 \ |A_4 & |A_4 \ |A_4 & |$$

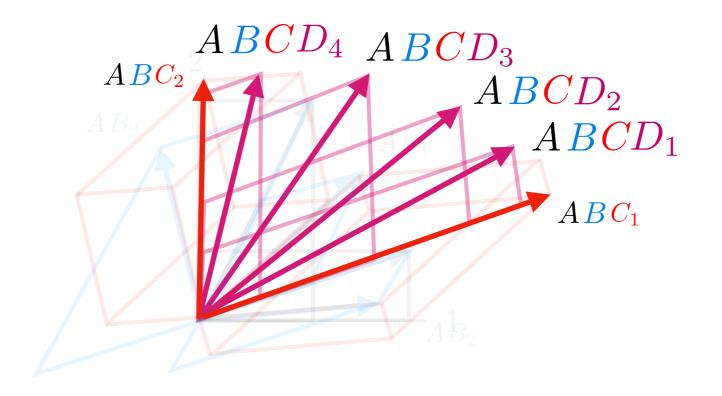




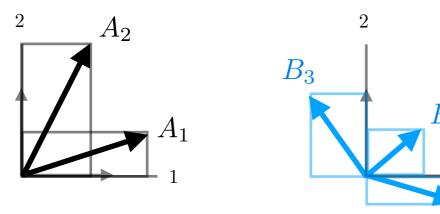


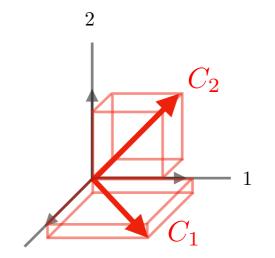






$$egin{bmatrix} A & egin{bmatrix} B & C \end{bmatrix} \begin{bmatrix} D \end{bmatrix} = egin{bmatrix} ig| A_1 & A_2 \ ig| & ig| B_1 & B_2 & B_3 \ ig| & ig| B_1 & C_1 & C_2 \ ig| & ig| & ig| B_1 & B_2 & B_3 \ ig| & ig| & ig| & ig| B_1 & B_2 & B_3 \ ig| & ig| &$$





$$C = \begin{bmatrix} | & | \\ C_1 & C_2 \\ | & | \end{bmatrix}$$

