Standard matrix stuff

$(AB)^T = B^T A^T$	**Symmetric:** $A^T = A$	**Skew-symmetric:** $A^T = -A$	**Orthogonal:** $A \times A^T = I; A^T = A^{-1}$
Reduced Row Echelon Form: Each leading 1 is the only one in its <u>column</u>			
Rank: Number of unique column/row		$Minor(A) = M_{ij} = \lvert A_{\cancel{ij}} \rvert$	$Cofactor(A) = C_{ij} = (-1)^{i+j} M_{ij}$
$\begin{vmatrix} R_1 \\ R_2 \\ R_3 \end{vmatrix} = -\begin{vmatrix} R_1 \\ R_3 \\ R_2 \end{vmatrix}$	$\begin{vmatrix} R_1 \\ k(R_2) \\ R_3 \end{vmatrix} = k \begin{vmatrix} R_1 \\ R_2 \\ R_3 \end{vmatrix}$	$\begin{vmatrix} R_1 \\ R_{2a} + R_{2b} \\ R_3 \end{vmatrix} = \begin{vmatrix} R_1 \\ R_{2a} \\ R_3 \end{vmatrix} + \begin{vmatrix} R_1 \\ R_{2b} \\ R_3 \end{vmatrix}$	
$\lvert AB \rvert = \lvert A \rvert \lvert B \rvert$	$\lvert RREF(A) \rvert = \prod A_{ii}$	$[A \vert I] \sim [I \vert A^{-1}]$	$A^{-1} = \frac{(C_A)^T}{\lvert A \rvert}$
$adj(A)\, A = A\, adj(A) = \lvert A \rvert\, I$		☺	

Vector & Space stuff

Linear Independence: $(c_1 \;\; c_2 \;\; c_3)\begin{pmatrix} \vec{a} \\ \vec{b} \\ \vec{c} \end{pmatrix} \neq \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix}$; $\begin{vmatrix} \vec{a} \\ \vec{b} \\ \vec{c} \end{vmatrix} \neq 0$		
Span: (Basis vectors: v_n) $\{\alpha\overrightarrow{v_1} + \beta\overrightarrow{v_2} + \cdots : \alpha, \beta, \ldots \in \mathbb{R}\} = \{(\alpha v_{1x} + \beta v_{2x} + \cdots, \alpha v_{1y} + \beta v_{2y} + \cdots, \ldots) : \alpha, \beta, \ldots \in \mathbb{R}\}$		
Orthogonalisation: (Basis: $\overrightarrow{w_n}$) $\overrightarrow{v_n} = \overrightarrow{w_n} - \left(\frac{\overrightarrow{w_n} \cdot \overrightarrow{v_1}}{\overrightarrow{v_1} \cdot \overrightarrow{v_1}}\right)\overrightarrow{v_1} - \left(\frac{\overrightarrow{w_n} \cdot \overrightarrow{v_2}}{\overrightarrow{v_2} \cdot \overrightarrow{v_2}}\right)\overrightarrow{v_2} - \cdots - \left(\frac{\overrightarrow{w_n} \cdot \overrightarrow{v_{n-1}}}{\overrightarrow{v_{n-1}} \cdot \overrightarrow{v_{n-1}}}\right)\overrightarrow{v_{n-1}}$		
$\vec{u} = \left(\frac{\vec{u} \cdot \overrightarrow{v_1}}{\overrightarrow{v_1} \cdot \overrightarrow{v_1}}\right)\overrightarrow{v_1} + \left(\frac{\vec{u} \cdot \overrightarrow{v_2}}{\overrightarrow{v_2} \cdot \overrightarrow{v_2}}\right)\overrightarrow{v_2} + \cdots$	**Subspace:** $0 \in S; (\overrightarrow{S_1} + \overrightarrow{S_2}) \in S; k\vec{S} \in S$	
$\vec{b} \in col(A)$: $(A \vert \vec{b})$ is consistent	$Nul(A) = \{\vec{x} : A\vec{x} = 0\}$	$rank(A) + N(A) = n_A$
Linear transformation: $t(\vec{u} + \vec{v}) = t(\vec{u}) + t(\vec{v}); t(k\vec{u}) = k \cdot t(\vec{u})$	$A\vec{x} = t(\vec{x}) : A = \left(t\begin{pmatrix} 1 \\ 0 \\ \vdots \\ 0 \end{pmatrix} \;\; t\begin{pmatrix} 0 \\ 1 \\ \vdots \\ 0 \end{pmatrix} \;\; \ldots \;\; t\begin{pmatrix} 0 \\ 0 \\ \vdots \\ 1 \end{pmatrix} \right)$	

Eigen stuff

$A\vec{x} = \lambda\vec{x} : \vec{x} \neq 0$	$(A - \lambda I)\vec{x} = 0$	**Eigenvalue:** $\lvert A - \lambda I \rvert = 0$	$S(\lambda) = \{k\overrightarrow{x_\lambda}\} + \vec{0}$
Multiplicity: Root repeatedness/ Number of eigenvectors per λ			
Diagonalisation: $P = (\overrightarrow{x_{\lambda_1}} \;\; \overrightarrow{x_{\lambda_2}} \;\; \cdots)$: $\overrightarrow{x_{\lambda_n}}$ are orthogonal $D = P^{-1}AP; D = P^TAP$: P is orthonormal			

Mathematics fundamentals

Dot product	$\vec{a} \cdot \vec{b} = \lvert\vec{a}\rvert \lvert\vec{b}\rvert \cos\theta = i_a i_b + j_a j_b + k_a k_b$
Cross product	$\vec{a} \times \vec{b} = \hat{n}\, \lvert\vec{a}\rvert \lvert\vec{b}\rvert \sin\theta = \begin{vmatrix} \hat{\imath} & \hat{\jmath} & \hat{k} \\ i_a & j_a & k_a \\ i_b & j_b & k_b \end{vmatrix}$
Vector projection	$\vec{a} \xrightarrow[proj.]{} \vec{b} = (\vec{a} \cdot \hat{b})\, \hat{b}$