

Exam 1 Basic Fact Sheet

Basic Vector Facts

$ \mathbf{v} = \sqrt{v_1^2 + v_2^2 + v_3^2}$	$c\mathbf{v} = \langle cv_1, cv_2, cv_3 \rangle$	$\frac{1}{ \mathbf{v} }\mathbf{v}$ = 'unit vector in direction of \mathbf{v} '
$\mathbf{u} + \mathbf{v} = \langle u_1 + v_1, u_2 + v_2, u_3 + v_3 \rangle$	$\mathbf{u} \cdot \mathbf{v} = u_1v_1 + u_2v_2 + u_3v_3$	$\mathbf{u} \times \mathbf{v} = \begin{vmatrix} \mathbf{i} & \mathbf{j} & \mathbf{k} \\ a_1 & a_2 & a_3 \\ b_1 & b_2 & b_3 \end{vmatrix}$
$\mathbf{u} \cdot \mathbf{v} = \mathbf{u} \mathbf{v} \cos(\theta)$	$\mathbf{u} \cdot \mathbf{v} = 0$ means orthogonal	θ is the angle if drawn tail to tail
$\mathbf{u} \times \mathbf{v} = \mathbf{u} \mathbf{v} \sin(\theta)$	$\mathbf{u} \times \mathbf{v}$ is orthogonal to both	$ \mathbf{u} \times \mathbf{v} $ = parallelogram area
$\text{comp}_{\mathbf{a}}(\mathbf{b}) = \frac{\mathbf{a} \cdot \mathbf{b}}{ \mathbf{a} }$	$\text{proj}_{\mathbf{a}}(\mathbf{b}) = \frac{\mathbf{a} \cdot \mathbf{b}}{ \mathbf{a} ^2} \mathbf{a}$	

Basic Lines, Planes and Surfaces (assume all constants a , b and c are positive)

Lines: $x = x_0 + at, y = y_0 + bt, z = z_0 + ct$	(x_0, y_0, z_0) = a point on the line $\langle a, b, c \rangle$ = a direction vector
Planes: $a(x - x_0) + b(y - y_0) + c(z - z_0) = 0$	(x_0, y_0, z_0) = a point on the plane $\langle a, b, c \rangle$ = a normal vector
Cylinder: One variable 'missing'	Know basics of traces
Elliptical/Circular Paraboloid: $z = ax^2 + by^2$	Hyperbolic Paraboloid: $z = ax^2 - by^2$
Ellipsoid/Sphere: $ax^2 + by^2 + cz^2 = 1$	Elliptical/Circular Cone: $z^2 = ax^2 + by^2$
Hyperboloid of One Sheet: $ax^2 + by^2 - cz^2 = 1$	Hyperboloid of Two Sheets: $ax^2 + by^2 - cz^2 = -1$