Distance formula d (p1,p2)=$\sqrt{(x1-x2)^2+(y1-y2)^2+(z1-z2)^2}$ p1=(x1,y1,z1) p2=(x2,y2,z2) **Circle** $(x-a)^2+(y-b)^2=r^2$ (a,b)=center r=radius **Sphere** $(x-a)^2+(y-b)^2+(z-c)^2=r^2$ (a,b,c)=center r=radius **P=(x1,y1,z1) Q=(x2,y2,z2)** $\vec{v}=\overrightarrow{PQ}=<x2-x1,y2-y1,z2-z1>$ $|\vec{v}|=d(P,Q)$ $\overrightarrow{\boldsymbol{w}}(\boldsymbol{unit\ vector})=\frac{1}{|\vec{v}|}*\vec{v}$ **Dot Product** $\vec{v}=<x1,y1>$ $\vec{w}=<x2,y2>$ $\vec{v}\cdot\vec{w}=x1*x2+y1*y2$ **Angle between 2 vectors** $\vec{v}\cdot\vec{w}=|\vec{v}|\cdot|\vec{w}|\cos\theta$ /// parallel if 0 or 180 degrees, perpendicular if 90, Pi/2 or –Pi/2 **Component** of $\vec{w}$ on $\vec{v}$ = $\frac{\vec{v}\cdot\vec{w}}{|\vec{v}|}$ **Scalar projection** of $\vec{w}$ on $\vec{v}$ = component of $\vec{w}$ on $\vec{v}$ * $\frac{\vec{v}}{|\vec{v}|}$ **Cross product** $\vec{v}=(x1,y1,z1)$ $\vec{w}=(x2,y2,z2)$ $\vec{v}\times\vec{w}$ = (y1*z2-y2*z1) $\vec{\imath}$ – (x1*z2-x2*z1) $\vec{\jmath}$ + (x1*y2-x2*y1) $\vec{k}$ **Triple product** of $\vec{u},\vec{v},\vec{w}=\vec{u}\cdot(\vec{v}\times\vec{w})$ **Parametric equations** x-x1=t(x2-x1) y-y1=t(y2-y1) z-z1=t(z2-z1) $1\le t\le 0$ **Length of a portion of a graph** $L(a,b)=\int_a^b\left|\overrightarrow{r^1}(t)\right|dt=$ $\int_a^b\sqrt{(x^1(t))^\wedge 2+(y^1(t))^\wedge 2+(z^1(t))^\wedge 2}$ dt **Tangent vector** $\vec{T}(t)=\frac{\vec{r}(t)}{|\vec{r}^1(t)|}$ **Normal vector** $\vec{N}(t)=\frac{\overrightarrow{r^{11}}(t)}{\left|\overrightarrow{r^{11}(t)}\right|}$ $\vec{\boldsymbol{B}}(\boldsymbol{t})=\vec{\boldsymbol{T}}(\boldsymbol{t})*\vec{\boldsymbol{N}}(\boldsymbol{t})$ **Curvature** $K(t)=\left|\vec{r}^1(t)*\overrightarrow{r^{11}}(t)\right|/|\vec{r}^1(t)|^\wedge 3$ $K=(x)=\frac{|f^{11}(x)|}{(1+f^1(x)^2)^\wedge(\frac{3}{2})}$ **Unit Circle** (0°, 0 radians, sin=0,cos=1,tan=0) (30°, $\pi/6$, sin=1/2, cos=$\frac{\sqrt{3}}{2}$,tan=$\frac{\sqrt{3}}{3}$) (45°, $\pi/4$,sin=$\frac{\sqrt{2}}{2}$=, cos=$\frac{\sqrt{2}}{2}$, tan=1) (60°, $\pi/3$, cos=$\frac{\sqrt{3}}{2}$,sin=1/2, tan=$\sqrt{3}$) (90°, $\pi/2$, sin=1, cos=0, tan=--) **Ellipsoid** $\frac{(x-x0)^\wedge 2}{a^\wedge 2}+\frac{(y-y0)^\wedge 2}{b^\wedge 2}+\frac{(z-z0)^\wedge 2}{c^\wedge 2}=1$ **Elliptic paraboloid** $\frac{(z-z0)^\wedge 2}{c}=\frac{(x-x0)^\wedge 2}{a^\wedge 2}+\frac{(y-y0)^\wedge 2}{b^\wedge 2}$ **Cone** $\frac{(z-z0)^2}{c^\wedge 2}=\frac{(x-x0)^2}{a^2}+\frac{(y-y0)^2}{b^2}$ **Hyperboloid (one sheet)** $\frac{(x-x0)^2}{a^2}+\frac{(y-y0)^2}{b^2}-\frac{(z-z0)^2}{c^2}=1$ **Hyperboloid (two sheets)** $-\frac{(x-x0)^2}{a^2}-\frac{(y-y0)^2}{b^2}+\frac{(z-z0)^2}{c^2}$**=1** **Hyperbolic paraboloid** $\frac{(z-z0)^2}{c}=\frac{(x-x0)^\wedge 2}{a^\wedge 2}-\frac{(y-y0)^\wedge 2}{b^\wedge 2}$ **Double angle formulas** sin(2x)=2sin(x)cos(x) : cos(2x)=cos^2(x)-sin^2(x)=2cos^2(x) -1=1-2sin^2(x) : tan(2x)=(2tan(x))/(1-tan^2(x)) **Half angle formulas** sin^2(x)=(1-cos(2x))/2 : cos^2(x)=(1+cos(2x))/2 **Equation of a line through** P(x0,y0,z0) with direction vector <a,b,c> $\frac{x-x0}{a}=\frac{y-y0}{b}=\frac{z-z0}{c}$ **Equation of a line** with perpendicular vector $\vec{v}=<a,b,c>$ ax+by+cz=d **Direction cosines** $\boldsymbol{cos\alpha}=\frac{\vec{v}\cdot\vec{\imath}}{|\vec{v}|}$ $\boldsymbol{cos\beta}=\frac{\vec{v}\cdot\vec{\jmath}}{|\vec{v}|}$ $\boldsymbol{cos}\Gamma=\frac{\vec{v}\cdot\vec{k}}{|\vec{v}|}$