Three ways of looking at a surface

image of a 1 – 1 regular parametrization S(u,v)	**can be flattened locally with a change of coordinates**	**zero set of F(x, y, z) on which grad F is never zero**
more local than global in nature	bridge between the local and global viewpoints	more global than local in nature
related to middle concept via the Inverse Function Theorem and Normal Thickening		related to middle concept via the Implicit and Inverse Function Theorems
space of tangent vectors at point p = span of the two partial derivative vectors $S_u(p)$ and $S_v(p)$	under flattening, the space of tangent vectors corresponds to the xy – plane	space of tangent vectors at point p = all vectors perpendicular to grad F(p)
tangent plane at p = plane through p which is parallel to the space of tangent vectors	under flattening, the tangent plane is horizontal	tangent plane at p = plane through p which is parallel to the space of tangent vectors
normal direction is perpendicular to the tangent plane and the space of tangent vectors and is given by the cross product $S_u \times S_v$		normal direction is perpendicular to the tangent plane and the space of tangent vectors and is given by grad F(p)
First Fundamental Form = $E\,dudu + 2F\,dudv + G\,dvdv$ where E, F, G are the dot products $S_u \cdot S_u$, $S_u \cdot S_v$, $S_v \cdot S_v$		First Fundamental Form = usual inner product on the space of tangent vectors
First Fundamental Form gives the square of the integrand in the formula for arc length		First Fundamental Form gives the square of the integrand in the formula for arc length
Surface area integrand is the square root of $EG - F^2$		No comparable formula for finding surface area