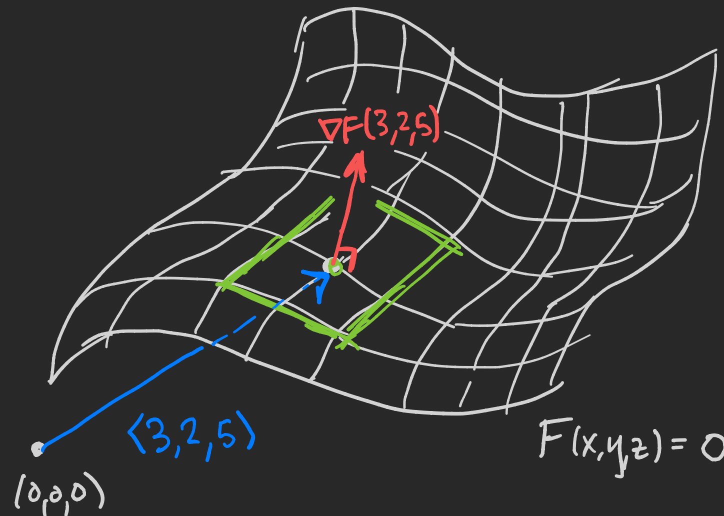
If $(3,2,5)$ is a point on the surface $F(x,y,z)=0$ and $\nabla F(3,2,5)=\langle 1,0,-7\rangle$, how can we characterize the vectors <u>parallel</u> to the tangent plane of the surface @ $(3,2,5)$?

<u>Rmk</u>: The tangent plane eq. is:

$$\underbrace{\langle 1,0,-7\rangle}_{\vec{n}} \cdot \left(\vec{r} - \langle 3,2,5\rangle\right) = 0$$

$$1\cdot(x-3) + 0\cdot(y-2) + (-7)\cdot(z-5) = 0$$



To check if $\vec{u}$ (some vec.) is parallel to the tangent plane (i.e. tangent to the surface @ $(3,2,5)$), need to check

$$\nabla F(3,2,5) \cdot \vec{u} = 0.$$

e.g.

$$\langle 1,0,-7\rangle \cdot \langle 14,-6,2\rangle = 14+0-14 = 0.$$

14.6 #27)

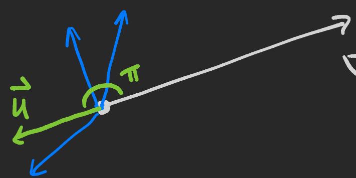
(a) $D_{\vec{u}} f(a,b) = \nabla f(a,b) \cdot \vec{u}$

unit vector.

$= |\nabla f(a,b)|\, \underbrace{|\vec{u}|}_{=1} \cos\theta$

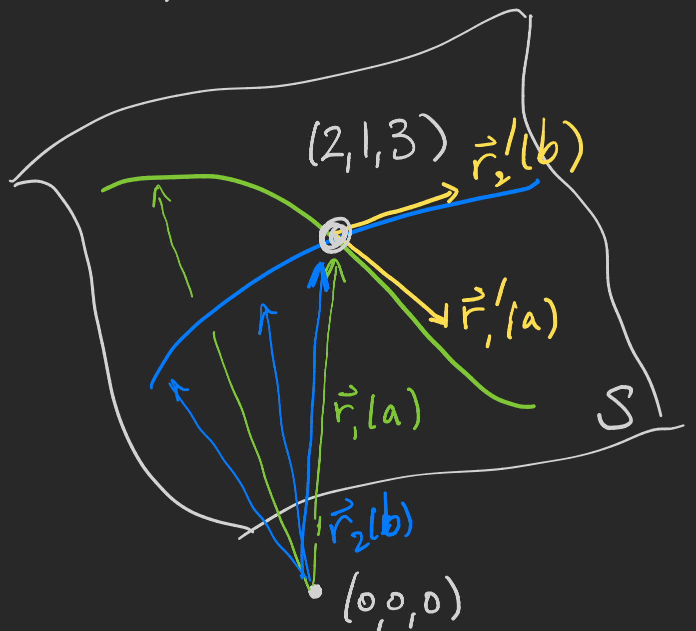
minimized when $\cos\theta = -1$

i.e. $\theta = \pi$.



this choice of $\vec{u}$ minimizes the directional derivative

14.4 #42)



where $\vec{r}_1(a) = \vec{r}_2(b) = \langle 2,1,3 \rangle$

(solve for a and b).