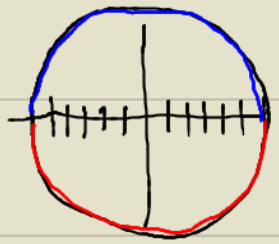
2. $\iint_S (x-4y+z)\,dS$ $\quad S: z=4 \quad x^2+y^2 \le 36$

$g(x,y)=4$

$g_x=0$

$g_y=0$



$$\int_{x=-6}^{x=6}\int_{y=-\sqrt{36-x^2}}^{y=\sqrt{36-x^2}} (x-4y+4)\sqrt{1+0^2+0^2}\,dy\,dx$$

$x^2+y^2=36$

$y^2=36-x^2$

$y=\pm\sqrt{36-x^2}$

$y=-\sqrt{36-x^2}$ $\quad y=\sqrt{36-x^2}$

$x=r\cos\theta$

$y=r\sin\theta$

$$=\int_{\theta=0}^{\theta=2\pi}\int_{r=0}^{r=6} (r\cos\theta-4r\sin\theta+4)\,r\,dr\,d\theta$$

$$=\int_{\theta=0}^{\theta=2\pi}\int_{r=0}^{r=6} (r^2\cos\theta-4r^2\sin\theta+4r)\,dr\,d\theta$$

$$=\int_{\theta=0}^{\theta=2\pi}\left[\frac{1}{3}r^3\cos\theta-\frac{4}{3}r^3\sin\theta+\frac{4}{2}r^2\right]_{r=0}^{r=6} d\theta$$

$$=\int_{\theta=0}^{\theta=2\pi}\left[\frac{1}{3}(6)^3\cos\theta-\frac{4}{3}(6)^3\sin\theta+2(6)^2\right] d\theta$$

$$=\int_{\theta=0}^{\theta=2\pi}\left[\frac{216}{3}\cos\theta-\frac{864}{3}\sin\theta+72\right] d\theta$$

$$=\left[\frac{216}{3}\sin\theta+\frac{864}{3}\cos\theta+72\theta\right]_{\theta=0}^{\theta=2\pi}$$

$$=\frac{216}{3}\sin 2\pi+\frac{864}{3}\cos 2\pi+72(2\pi)-\left(\frac{216}{3}\sin 0+\frac{864}{3}\cos 0+72(0)\right)$$

$$=\frac{864}{3}+144\pi-\left(\frac{864}{3}\right)$$

$$=144\pi$$