

9.7.16

For what points  $P=(x,y,z)$  does  $\nabla f$  with  $f=25x^2+9y^2+16z^2$  have the direction from  $P$  to the origin?

$$\nabla f = \begin{bmatrix} 50x \\ 18y \\ 32z \end{bmatrix}$$

find  $x$  such that

$$k \nabla f(P) = \vec{0} \quad \text{where } k \in \mathbb{R}$$

$$k(50x) = 0$$

$$k(18y) = 0$$

$$k(32z) = 0$$

$$\text{let } k=0 \quad x, y, z = 0$$

$$k=1$$

$$P = \begin{bmatrix} 1/50 \\ 1/18 \\ 1/32 \end{bmatrix}$$

$$k=2$$

$$P = \begin{bmatrix} 1/25 \\ 1/9 \\ 1/16 \end{bmatrix}$$

any point on the line

$$P(k) = \begin{bmatrix} 1/50k \\ 1/18k \\ 1/32k \end{bmatrix}$$

will point towards the origin

$$\text{let } c = 1/k$$

$$P(c) = \begin{bmatrix} c/50 \\ c/18 \\ c/32 \end{bmatrix}$$