3.

a). sphere of radius R at $C=(C_x, C_y, C_z)$

$$obs = \left\{ \begin{bmatrix} x \\ y \\ z \end{bmatrix} \;\middle|\; (x-C_x)^2 + (y-C_y)^2 + (z-C_z)^2 \le R^2 \right\}$$

$$b(O_i) = \begin{cases} \dfrac{R}{\|O_i - C_i\|} \begin{vmatrix} O_x - C_x \\ O_y - C_y \\ O_z - C_z \end{vmatrix}, & \text{if } \|O_i\| \ge R \\ \begin{bmatrix} O_x - C_x \\ O_y - C_y \\ O_z - C_z \end{bmatrix}, & \text{if } \|O_i\| < R \end{cases}$$

use above for $\|o_i(q_j) - b\|$ & $o_i(q_j) - b$.

b). cylinder with infinite height:

$$obs = \left\{ \begin{bmatrix} x \\ y \\ z \end{bmatrix} \;\middle|\; x^2 + y^2 \le R^2 \right\}$$

$$\overset{\downarrow}{\longmapsto} \bar{V}$$

$$b(O_i) = \begin{cases} \dfrac{R}{\|\bar{V}\|} \begin{bmatrix} O_x \\ O_y \\ 0 \end{bmatrix} + \begin{bmatrix} 0 \\ 0 \\ O_z \end{bmatrix}, & \text{if } \sqrt{O_x^2 + O_y^2} \ge R \\ \begin{bmatrix} O_x \\ O_y \\ O_z \end{bmatrix}, & \text{if } \sqrt{O_x^2 + O_y^2} < R \end{cases}$$

use above for $\|o_i(q_j) - b\|$ & $o_i(q_j) - b$.