

change condition:

$$v^T c \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix} = 1 \Rightarrow c(1+2+0.01) = 1 \Rightarrow c = \frac{1}{1.11}$$

$$\therefore \text{solution is } \frac{1}{1.11} \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix}$$

### 13) Learning with Rescaling

$$v' = \left( \frac{1}{1.1}, \frac{0.1}{1.11}, \frac{0.01}{1.11} \right)^T = (1, 1, 1)^T$$

$$\nabla_{\theta} f = -2 v' (1 - v'^T \theta') \xrightarrow{\text{set to zero}} \theta' = \frac{v}{v^T v} = \frac{1}{3} \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix}$$

↓ convert back to original coordinate

$$v^T \theta = v'^T \theta'$$

$$v' = \begin{pmatrix} 1 & 0 & 0 \\ 0 & \frac{1}{0.1} & 0 \\ 0 & 0 & \frac{1}{0.01} \end{pmatrix} v = Dv$$

$$v'^T \theta' = (Dv)^T \theta' = v^T \underline{D^T \theta'}$$

$$\theta = D^T \theta' = \begin{pmatrix} 1 & 0 & 0 \\ 0 & \frac{1}{0.1} & 0 \\ 0 & 0 & \frac{1}{0.01} \end{pmatrix} \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix} \cdot \frac{1}{3} = \begin{pmatrix} 1/3 \\ 10/3 \\ 100/3 \end{pmatrix}$$