# Parcial 3 - teórico

## Punto 23

d) $h(\alpha) = \phi(x_k + \alpha r_k)$ } función a minimizar

$x_{k+1} = x_k + \alpha_k r_k$ } dirección

Derivamos $h(\alpha)$

$* \ \nabla(\phi(x_k)) = Ax_k - b$

$$h'(\alpha) = \phi'(x_k + \alpha r_k) \cdot (x_k' + (\alpha r_k)')$$

$$h'(\alpha) = \nabla\phi(x_k + \alpha r_k) \cdot (x_k' + (\alpha r_k)')$$

$$h'(\alpha) = [A(x_k + \alpha r_k) - b] \ (0 + r_k)$$

$$h'(\alpha) = [(Ax_k + A\alpha r_k) - b] \ r_k$$

Igualamos $h'(\alpha) = 0$

$$0 = (Ax_k - b + A\alpha r_k) r_k$$

$$0 = (r_k + A\alpha r_k) r_k$$

$$0 = r_k^T \cdot r_k + r_k^T A \alpha r_k$$

Como $\alpha$ es escalar, podemos reorganizarlo:

$$0 = r_k^T r_k + \alpha r_k^T A r_k$$

$$r_k^T \cdot r_k = \alpha \underbrace{r_k^T A r_k}_{\text{como este valor es escalar, podemos pasarlo a dividir}}$$

$$\boxed{-\frac{r_k^T \cdot r_k}{r_k^T A r_k} = \alpha}$$