SLIDE 61-62   Calculate partial derivatives of θ

Recall rules: (1) $\frac{\partial}{\partial x}\left(\frac{f}{g}\right) = \frac{f'g - g'f}{g^2}$

(2) $\frac{\partial f(g(x))}{\partial x} = f'g'$

$$\theta = \frac{\bar{R}_p - R_f \cdot 1}{\sigma_p} = \frac{x_A \bar{R}_A + x_B \bar{R}_B - R_f(x_A + x_B)}{\left(x_A^2 \sigma_A^2 + x_B^2 \sigma_B^2 + 2 x_A x_B \sigma_{AB}\right)^{1/2}}$$

rule 1 & 2

$$\frac{\partial \theta}{\partial x_A} = \frac{(\bar{R}_A - R_f)\sigma_p - 1/2\left(x_A \sigma_A^2 + x_B^2 \sigma_B^2 + 2 x_A x_B\right)^{-1/2}\left(2 x_A \sigma_A^2 + 2 x_B \sigma_{AB}\right)(\bar{R}_p - R_f)}{\sigma_p^2}$$

$$= \frac{(R_A - R_f)\sigma_p - \cancel{1/2}\, \sigma_p^{-1}\left(\cancel{2} x_A \sigma_A^2 + \cancel{2} x_B \sigma_{AB}\right)(\bar{R}_p - R_f)}{\sigma_p^2}$$

Let $\frac{\partial \theta}{\partial x_A} = 0$

$$\Rightarrow \frac{(R_A - R_f)\sigma_p - \sigma_p^{-1}\left(x_A \sigma_A^2 + x_B \sigma_{AB}\right)(\bar{R}_p - R_f)}{\sigma_p^2} = 0$$

$$\Rightarrow (R_A - R_f) - \frac{\bar{R}_p - R_f}{\sigma_p^2}\left(x_A \sigma_A^2 + x_B \sigma_{AB}\right) = 0$$

Which is the last eqn at the end of slide 62.