# #1

a) Siden ikke short-salg av fondene er mulig, er $\underline{\underline{\alpha \in [0,1]}}$.

b) $E[r_p] = \alpha E[r_S] + (1-\alpha) E[r_R]$

$$= \alpha \mu_S + (1-\alpha)\mu_R$$

$$= \alpha \cdot 0{,}1 + (1-\alpha) \cdot 0{,}08$$

$$= \underline{\underline{0{,}08 + 0{,}02\alpha}}$$

c) $\dfrac{d E[r_p]}{d\alpha} = 0{,}02$

↳ jo høyere $\alpha$, jo høyere $E[r_p]$.

Siden $\alpha \in [0,1]$, gir $\underline{\underline{\alpha = 1}}$ høyest $E[r_p]$.

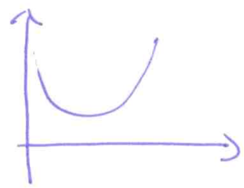
d) $\sigma_p^2 = \alpha^2 \sigma_S^2 + 2\alpha(1-\alpha)\sigma_{S,R} + (1-\alpha)^2 \sigma_R^2$

$$= \alpha^2 \cdot 0{,}3^2 + 2\alpha(1-\alpha)(-0{,}06) + (1-\alpha)^2 \cdot 0{,}2^2$$

$$= 0{,}09\alpha^2 + 0{,}12\alpha^2 - 0{,}12\alpha + 0{,}04 - 0{,}08\alpha + 0{,}04\alpha^2$$

$$= \underline{\underline{0{,}25\alpha^2 - 0{,}2\alpha + 0{,}04}}$$

(2

e) Vi ser at $\sigma_p^2$ er en konveks funksjon på formen  Det betyr at $\max \sigma_p^2$ er for enten $\alpha = 0$ eller $\alpha = 1$.

$$\left.\begin{aligned} \sigma_p^2(\alpha=0) &= \sigma_p^2 = 0{,}04 \\ \sigma_p^2(\alpha=1) &= \sigma_S^2 = 0{,}09 \end{aligned}\right\} \underline{\underline{\alpha = 1 \text{ gir høyast risiko}}}$$

f) $$\frac{d\sigma_p^2}{d\alpha} = 0{,}5\alpha - 0{,}2 = 0 \Leftrightarrow \underline{\underline{\alpha = 0{,}4}}$$

g) $$\sigma_p^2(\alpha = 0{,}4) = 0{,}25 \cdot 0{,}4^2 - 0{,}2 \cdot 0{,}4 + 0{,}04$$
$$= 0{,}04 - 0{,}08 + 0{,}04 = \underline{\underline{0}}$$

h) Porteføljen $(0{,}4 ; 0{,}6)$ er risikofri og bør gi samme avkastning som et risikofritt aktivum:

$$E[r_p|_{\alpha=0{,}4}) = 0{,}08 + 0{,}02 \cdot 0{,}4$$
$$= 0{,}08 + 0{,}008 = \underline{0{,}088}$$

$):$ $\underline{\underline{8{,}8\%}}$

# #2

a) $$P_0^1 = \frac{2,98}{1,02} + \frac{2,98}{(1,025)^2} + \frac{2,98+100}{(1,03)^3} = \underline{\underline{100,00}}$$

$$P_0^2 = \frac{6,492}{1,02} + \frac{6,492}{(1,025)^2} + \frac{6,492+100}{(1,03)^3} = \underline{\underline{110,00}}$$

b) $$\frac{2,98}{1,0298} + \frac{2,98}{(1,0298)^2} + \frac{2,98+100}{(1,0298)^3} = \underline{100,00}$$

$$\frac{6,492}{1,02959} + \frac{6,492}{(1,02959)^2} + \frac{6,492+100}{(1,02959)^3} = \underline{110,00}$$

c) $$D_1 = \left(\frac{1\cdot 2,98}{1,0298} + \frac{2\cdot 2,98}{(1,0298)^2} + \frac{3\cdot(2,98+100)}{(1,0298)^3}\right) / 100 = \underline{\underline{2,914}}$$

$$D_2 = \left(\frac{1\cdot 6,492}{1,02959} + \frac{2\cdot 6,492}{1,02959} + \frac{3\cdot(6,492+100)}{(1,02959)^3}\right) / 110 = \underline{\underline{2,830}}$$

d) Den har høyere kuponger og disse er relativt viktigere for verdien av obligasjonen og de betales tidligere (år 1,2,3) enn hovedstolen
↳ lavere durasjon.

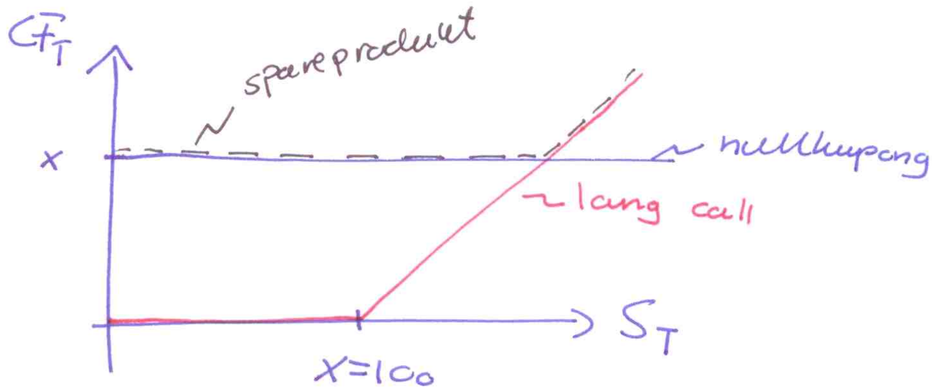
e) $$\Delta P_0 \approx -\frac{\Delta y \cdot D \cdot P_0}{1+y}$$

$$\Delta P_0^1 \approx -\frac{0,003 \cdot 2,914 \cdot 100}{1,0298} = \underline{\underline{-0,85}}$$

$$\Delta P_0^2 \approx -\frac{0,003 \cdot 2,830 \cdot 110}{1,02959} = \underline{\underline{-0,91}}$$

# #3

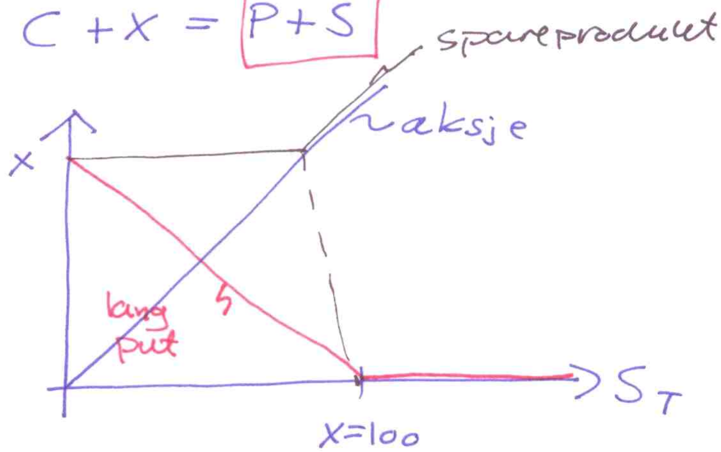
a)




Spareprodukt = lang call + lang nullkupong

b) Fra put-call pariteten har vi at

$$C + X = \boxed{P + S}$$

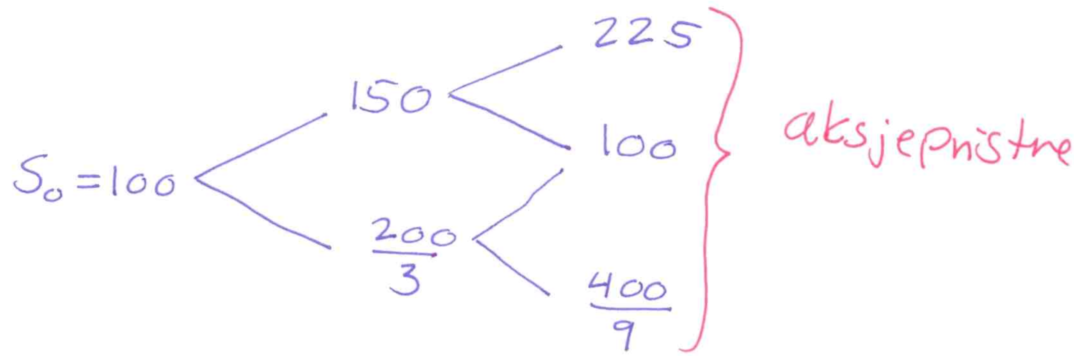


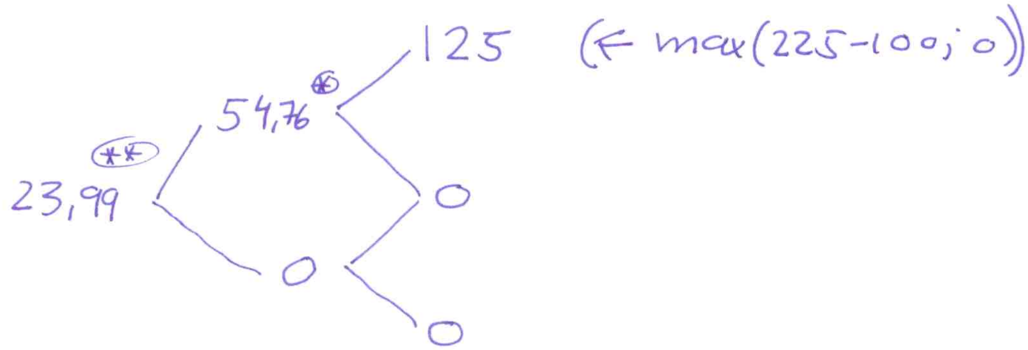

Spareprodukt = lang put + aksje/underliggende

c) $PV(X) = \frac{100}{(1{,}05)^2} = \underline{\underline{90{,}70}}$

d) Vi finner først de risikonøytrale sannsynlighetene:

$$p^* = \frac{1{,}05 - \frac{2}{3}}{\frac{3}{2} - \frac{2}{3}} = \underline{0{,}46}$$




(*) $54,76 = \frac{0,46 \times 125 + (1-0,46) \times 0}{1,05}$

(**) $23,99 = \frac{0,46 \times 54,76 + (1-0,46) \times 0}{1,05}$

$\underline{\underline{C_0 = 23,99}}$

e) Det koster banken $90,70 + 23,99 = \underline{\underline{114,69}}$ å konstruere spareproduktet.

f) De selger produktet for 100, men det koster 114,69 å konstruere det

↳ De må ha et salgsgebyr på mer enn <u>14,69, dvs 14,69%</u>