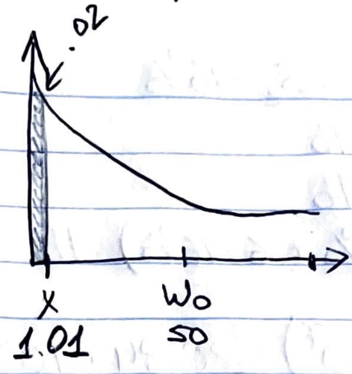
#HW1 Aliaksei Konstantsinau

① a)



$VaR = 50 - x = 50 - 1.01 = \boxed{48.99}$

$f(x) = \frac{1}{50} e^{-\frac{x}{50}} = .02 e^{-.02x}$

$.02 = 1 - e^{-.02x}$

$e^{-.02x} = .98$

$x = \frac{\ln(.98)}{-.02} = 1.01$

b) Short flips tails, now we solve:

$.98 = 1 - e^{-.02x}$

$e^{-.02x} = .02 \Rightarrow x = \frac{\ln(.02)}{-.02} = 195.6$

$Var = -50 - (-195.6) = \boxed{145.6}$

c) When we short we worry about the upside which flips tails and signs for Wo and W.

d) $ES = W_0 - \frac{\int_{-\infty}^{W_0 - VaR} w f(w)\,dw}{\int_{-\infty}^{W_0 - VaR} f(w)\,dw} = W_0 - \frac{\int_0^{1.01} w\lambda e^{-\lambda w}\,dw}{\int_0^{1.01} \lambda e^{-\lambda w}\,dw}$

for long: $= 50 - \frac{\frac{w^2}{2}\cancel{(1-e^{-1.01\lambda})}}{\cancel{1-e^{-1.01\lambda}}} = 50 - \left(\frac{1.01^2}{2}\right) = \boxed{49.49}$

for short: $ES = 50 + \frac{\int_{-\infty}^{-195.6} w f(w)\,dw}{\int_{-\infty}^{-195.6} f(w)\,dw}$

$= 50 + \frac{\int_{-\infty}^{-195.6} w\lambda e^{-\lambda w}\,dw}{\int_{-\infty}^{-195.6} w\lambda e^{-\lambda w}\,dw} = 50 - \frac{\int_{195.6}^{\infty} w\lambda e^{-\lambda w}\,dw}{\int_{195.6}^{\infty} \lambda e^{-\lambda w}\,dw}$

$= 50 - \frac{\frac{w^2}{2}(1-e^{-\lambda w})\Big|_{195.6}^{\infty}}{(1-e^{-\lambda w})\Big|_{195.6}^{\infty}} = 50 - \frac{\infty}{-(1-e^{-195.6w})} =$

$= 50 - (-\infty) = \infty$

Intuitionally the result makes sense as the upside has no boundaries.

② a) $\mu = 7\%$ $\pi = .4$ $\sigma_1 = 12\%$ $\sigma_2 = 16\%$

$\mu_{V1} = 7\% \cdot 1b$ $\sigma_{V1} = 12\% \cdot 1b$

$\mu_{V2} = 7\% \cdot 1b$ $\sigma_{V2} = 16\% \cdot 1b$

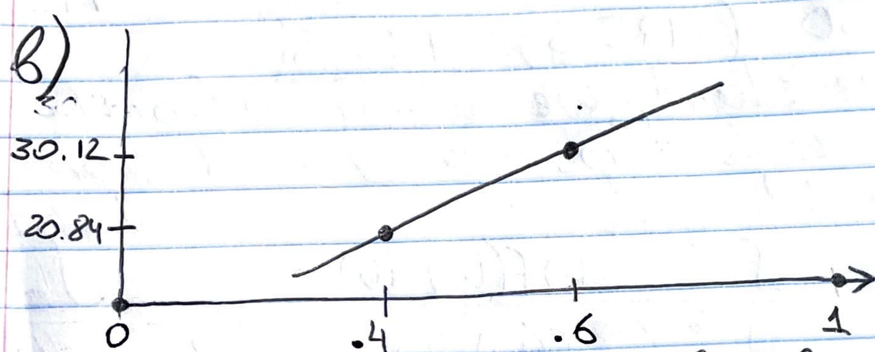
$\mu_{VM} = 7\% \cdot 1b$ $\sigma_{VM} = (.4 \cdot 12\% + .6 \cdot 16\%) \cdot 1b$

$$VaR_{V1} = -\left(7 \cdot 10^7 - 2.32 \cdot 12 \cdot 10^7\right) = \boxed{20.84 \cdot 10^7}$$

$$VaR_{V2} = -\left(7 \cdot 10^7 - 2.32 \cdot 16 \cdot 10^7\right) = \boxed{30.12 \cdot 10^7}$$

$$VaR_{VM} = -\left(7 \cdot 10^7 - 2.32 \cdot 14.4 \cdot 10^7\right) = \boxed{26.4 \cdot 10^7}$$

b)



On this graph we can clearly see how VaR increases as vol increases.

(Assuming 99%) c) $VaR = -\left(7 \cdot 10^7 - 2.32 \cdot \sigma \cdot 10^7\right)$

$var(X) = \frac{\alpha}{\beta^2}$ for $X \sim (\alpha, \beta)$

$std(X) = \frac{\sqrt{\alpha}}{\beta}$ ← this value goes into σ.