8

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(a)

```
b <- 1.694*1e-5
ga <- log(1.10960)
beta <- function(x) b*exp(ga*x)

w <- 130
h <- 1/1024

kPx <- function(x,k) exp(-beta(x)/ga*(exp(ga*k)-1))
fto <- function(x) beta(x)*kPx(0,x)

(E_to <- h/2+h*sum(sapply(seq(w/h-1),function(i) kPx(0,h*i))))
```

```
## [1] 78.33433
```

```
(CV_to <- sqrt((h/2+h*sum(sapply(seq(w/h-1), function(i) (i*h)^2*fto(i*h)))) - E_to^2)/E_to)
```

```
## [1] 0.156783
```

(b)

$$
\begin{aligned}
Mod(T_0) = \text{solution } & \frac{d}{dt} f_{T_0}(t) = 0 \\
\Rightarrow & \frac{d}{dt} \mu(t) * \bar{F}_{T_0}(t) = 0 \\
= & \ ... \\
\Rightarrow & \ \mu(t) = \gamma \\
\Rightarrow & \ t = \frac{\ln(\frac{\gamma}{\beta})}{\beta}
\end{aligned}
$$

```
log(ga/b)/ga
```

```
## [1] 83.87018
```

```
## Vérification
fto <- expression(b*exp(ga*x)*exp(-b/ga*(exp(ga*x)-1)))
uniroot(function(x) eval(D(fto,"x"))-0,c(0,130))$root
```

```
## [1] 83.87018
```

```
# D(fto,"x") effectue la dérivé, puis eval(D(...)) évalue cette dérivé pour x.
```

(c)

```
log(-ga*log(0.5)/b+1)/ga
```

```
## [1] 80.34826
```

```r
## Vérification
uniroot(function(x) kPx(0,x)-0.5,c(0,130))$root # Ça revient à la VaR0.5
```

```
## [1] 80.34826
```

(d)

```r
kappa <- c(0.1,0.25,0.75,0.9)

log(-ga*log(1-kappa)/b+1)/ga
```

```
## [1] 62.24680 71.89578 87.01204 91.89044
```

```r
## Vérification
VaR <- function(k) uniroot(function(x) kPx(0,x)-k,c(0,130))$root
sapply(rev(kappa),VaR) # rev(kappa) inverse le vecteur car sinon les résultats sont inversés ..
```

```
## [1] 62.24681 71.89579 87.01204 91.89044
```

(e)

The fuck.

(f)

Non.