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(a)

```
a <- 4.393 * 1e-4
beta <- 1.571 * 1e-5
ga <- log(1.11053)
b_x <- function(x) beta*exp(ga*x)

Ft0 <- expression(exp(-beta/ga*(exp(ga*x)-1)-a*x))


(E_T0 <- integrate(function(x) -eval(D(Ft0,"x"))*x,0,130)[[1]])
```

```
## [1] 77.13309
```

```
sqrt(integrate(function(x) -eval(D(Ft0,"x"))*x^2,0,130)[[1]] - E_T0^2)/E_T0
```

```
## [1] 0.1889473
```

(b)

```
uniroot(function(x) -eval(D(D(Ft0,"x"),"x"))-0,c(0,130))$root
```

```
## [1] 83.91506
```

(c)

```
uniroot(function(x) eval(Ft0) - 0.5,c(0,130))$root
```

```
## [1] 80.00531
```

(d)

```
VaR <- function(k) uniroot(function(x) eval(Ft0)-(1-k),c(0,150))$root
(V <- sapply(c(0.1,0.25,0.75,0.9),VaR))
```

```
## [1] 59.81197 71.02196 86.84600 91.78311
```

```
V[3]-V[2]
```

```
## [1] 15.82405
```

```
V[4]-V[1]
```

```
## [1] 31.97114
```