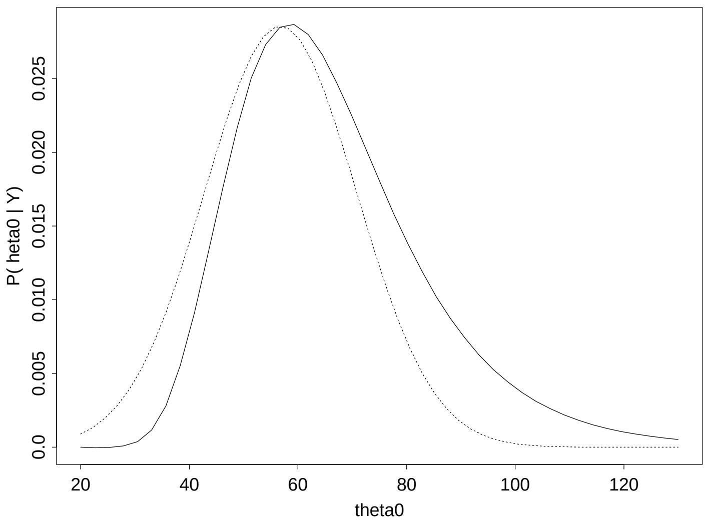
```
># Same data as before

> Y <- c(65, 156,100,134,16,108,121,4,39,143,56,26,22,1,1,5,65)
> wbc <- c(2300,750,4300,2600,6000,10500,10000,17000,5400,7000,9400,
 32000,35000,100000,100000,52000,100000)

> x <- log(wbc/10000)

# logposterior must be a function of theta only; other datavalues are
# specified using the data option.

> logpost <- function(theta) {
  theta0 <- theta[1]
  theta1 <- theta[2]
  mu <- theta0*exp(- theta1*x)
  ll <- sum(log(dexp(y, 1/mu)) )
return(ll) }

> library(sbayes)   #  currently only works on the DEC stations ?
                    #  sbayes is available from statlib.
                    #  http://lib.stat.cmu.edu/

> # Usage:  function for logposterior, starting values, scale, other data
> lp <- bayes.model(logpost,c(35,.8),scale=c(10, .5), data=list(x=x,y=Y))

adjusting scale and derivstep for derivatives...
maximizing...
Iteration 0.
Criterion value = -138.717
Iteration 1.
Criterion value = -102.315
Iteration 2.
Criterion value = -88.2159
Iteration 3.
Criterion value = -84.5377
Iteration 4.
Criterion value = -83.9406
Iteration 5.
Criterion value = -83.8787
Iteration 6.
Criterion value = -83.8774
Iteration 7.
Criterion value = -83.8774
Reason for termination: gradient size is less than gradient tolerance.
adjusting scale and derivstep for derivatives...
```

```
> # 1st order approximation - normal approximation  (should agree with our previous results !!!)

> bayes.moments(lp,method="1st")
$mean:
[1] 56.8489148  0.4818293
$stdev:
[1] 13.9713143  0.1796938

> # Laplace or second order approximation
> bayes.moments(lp, method="2nd")
$mean:
[1] 65.3084974  0.4852952
$stdev:
[1] 17.1564427  0.1865635

> # option covar=T will give 2nd order covariance matrix of theta
>  bayes.moments(lp, method="2nd", covar=T)
$mean:
[1] 65.3084974  0.4852952

$stdev:
[1] 17.1564427  0.1865635

$covar:
            [,1]       [,2]
[1,] 294.3435264 0.53279471
[2,]   0.5327947 0.03480593

> motif()
> plot(bayes.mar1(lp, 1, seq(20,130,len=15)),
type="l", xlab="theta0", ylab="P(\theta0 | Y)")

> lines(seq(20,130,len=50), dnorm(seq(20,130,len=50), mean=56.8, sd=13.97), lty=2)
```



```
# P(Y* > 52 | Y) = probability of survivng more than 1 year if wbc=50,000

> g <- function(theta) {
mu <- theta[1]* exp(-log(50000/10000) * theta[2])
exp(-52 /mu) }

> bayes.moments(lp,g, method="1st")
$mean:
[1] 0.1371886

$stdev:
[1] 0.09482441


> bayes.moments(lp,g, method="2nd")
$mean:
[1] 0.1842753

$stdev:
[1] 0.111171

> plot(bayes.mar1(lp, g, seq(.00,.3, len=10), method="2nd"), type="l",
xlab="1 Year Survival Probability",
ylab="Posterior Density")

> lines(seq(0,.3, len=100), dnorm(seq(0,.3, len=100), mean=.18, sd=.11), lty=2)
```