Steps for QQ-plot : samples $x_1, x_2, \cdots, x_n$

Step 1 : Find sample quantiles $x_{(1)}, x_{(2)}, \cdots, x_{(n)}$

such that $x_{(1)} \leq x_{(2)} \leq \cdots \leq x_{(n)}$

Step 2 : Find theoretical quantiles $z_1, z_2, \cdots, z_n$

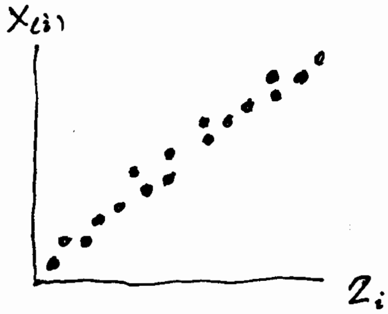
such that $P(Z < z_i) = \frac{i}{n+1}$, $i = 1, 2, \cdots, n$

(or $\frac{i-0.5}{n}$)

Step 3 : Plot $(z_i, x_{(i)})$, $i = 1, 2, \cdots, n$

Step 4 : Evaluate the linearity.

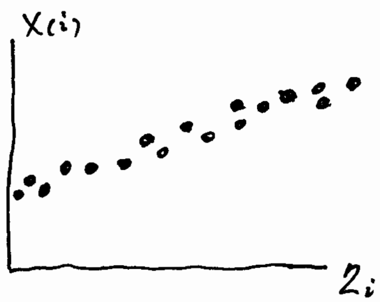
Case I : if



$X_{(i)} \doteq Z_i$

then $X \sim N(0, 1)$

Case II : if



$X_{(i)} \doteq \mu + \sigma Z_i$

then $X \sim N(\mu, \sigma^2)$.

Normal Probability Plot

EXAMPLE 2-13

Observations on the road octane number of ten gasoline blends are as follows: 88.9, 87.0, 90.0, 88.2, 87.2, 87.4, 87.8, 89.7, 86.0, and 89.6. We hypothesize that octane number is adequately modeled by a normal distribution. To use probability plotting to investigate this hypothesis, first arrange the observations in ascending order and calculate their cumulative frequencies $(j - 0.5)/10$ as shown in the accompanying table.

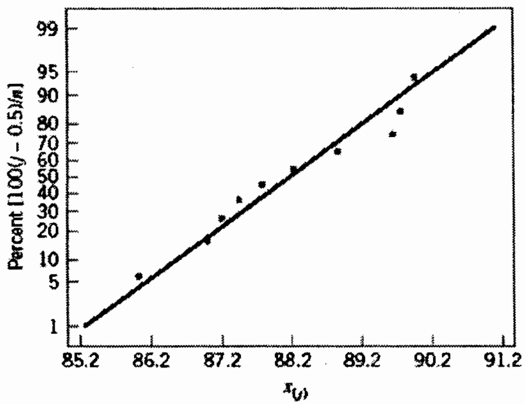
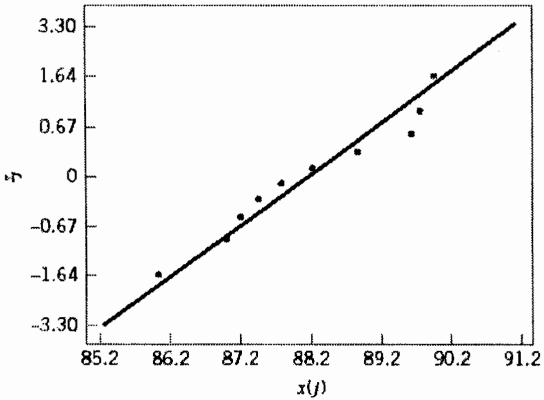


Figure 2-26 Normal probability plot of the road octane number data.

j	$x_{(j)}$	$(j - 0.5)/10$
1	86.0	0.05
2	87.0	0.15
3	87.2	0.25
4	87.4	0.35
5	87.8	0.45
6	88.2	0.55
7	88.9	0.65
8	89.6	0.75
9	89.7	0.85
10	90.0	0.95

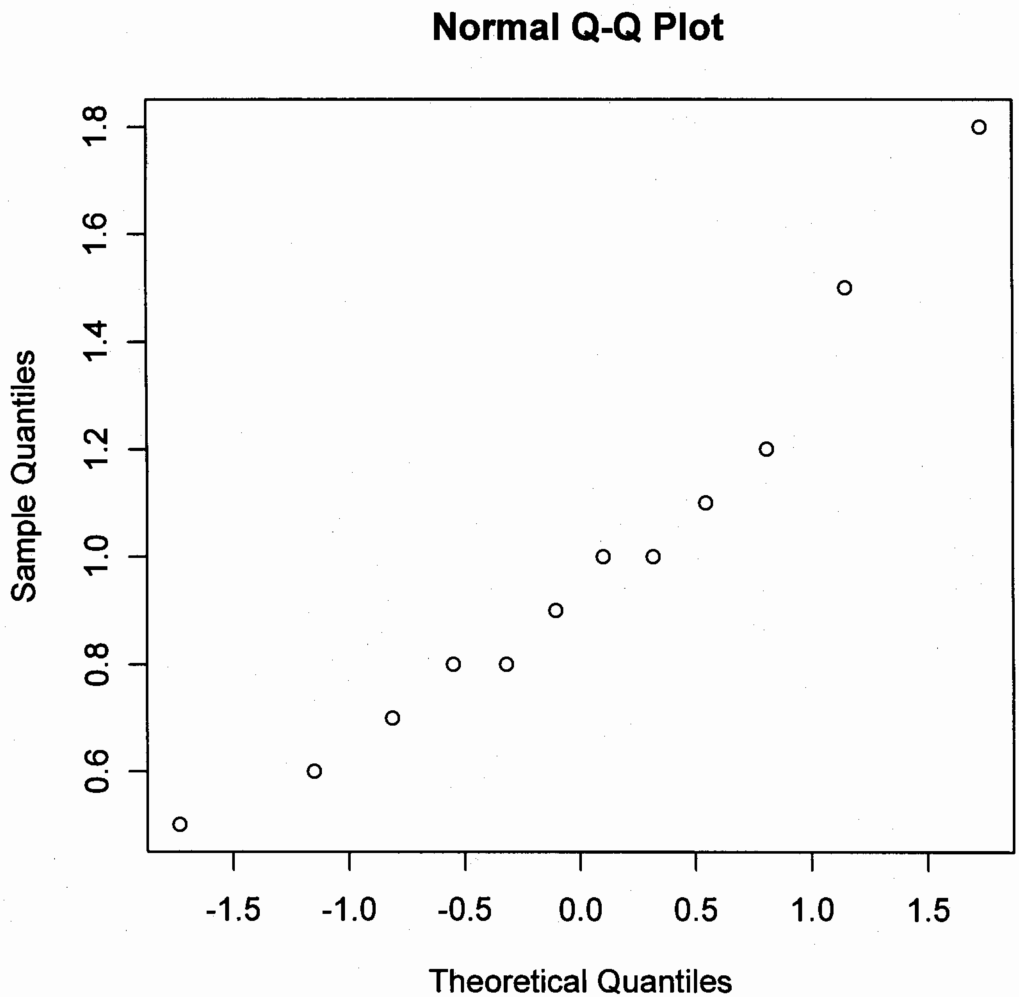
or $\frac{j}{n+1}$



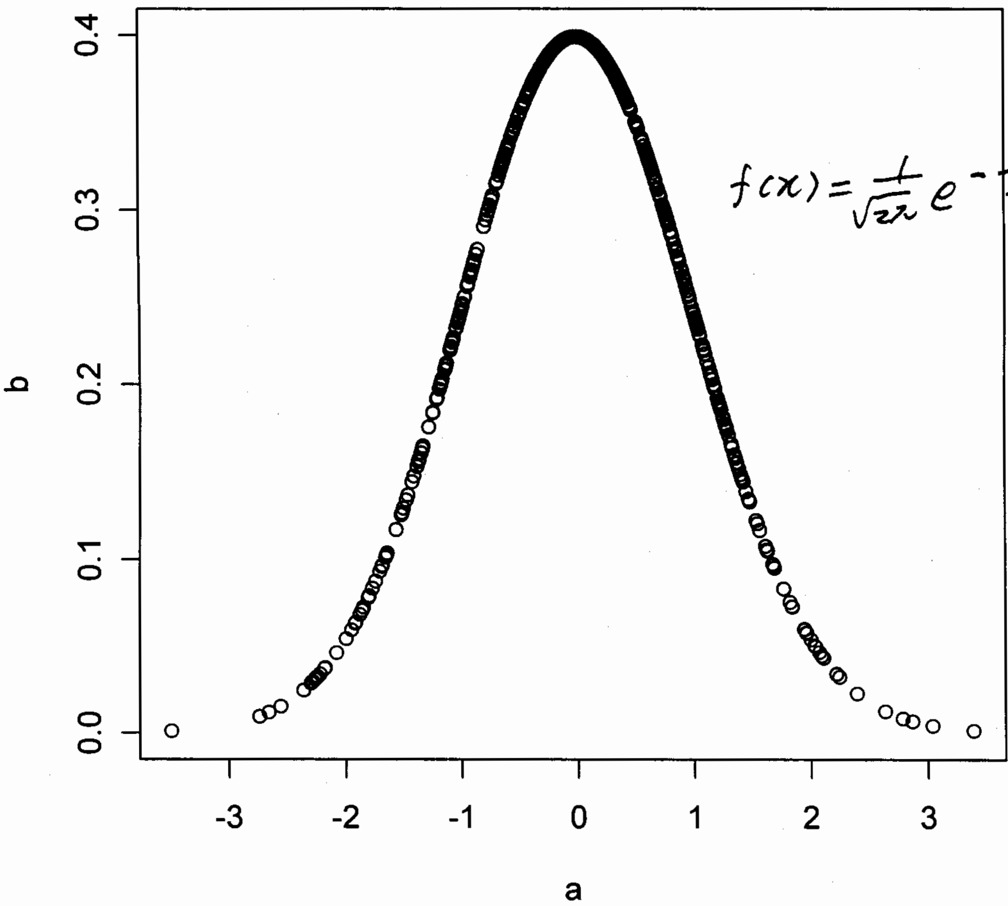
j	$x_{(j)}$	$(j - 0.5)/10$	z_j
1	86.0	0.05	−1.64
2	87.0	0.15	−1.04
3	87.2	0.25	−0.67
4	87.4	0.35	−0.39
5	87.8	0.45	−0.13
6	88.2	0.55	0.13
7	88.9	0.65	0.39
8	89.6	0.75	0.67
9	89.7	0.85	1.04
10	90.0	0.95	1.64

Figure 2-27 Normal probability plot of the road octane number data with standardized scores.

```
a <- c(1.0, 1.5, 1.2, 0.8, 1.8, 0.9, 0.7, 0.5, 0.6,
                                    0.8, 1.1, 1.0)
qqnorm(a)
```



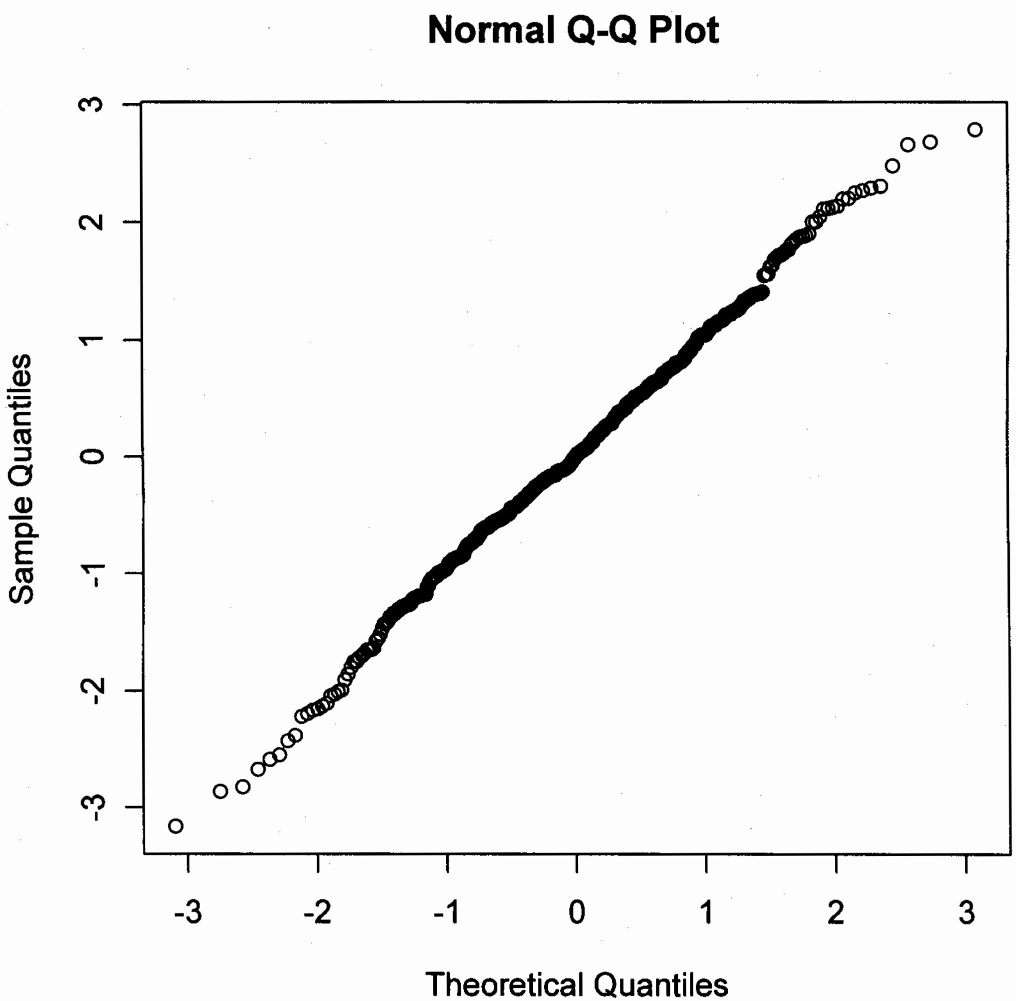
```
a=rnorm(500)

b=dnorm(a)

plot(a,b)
```



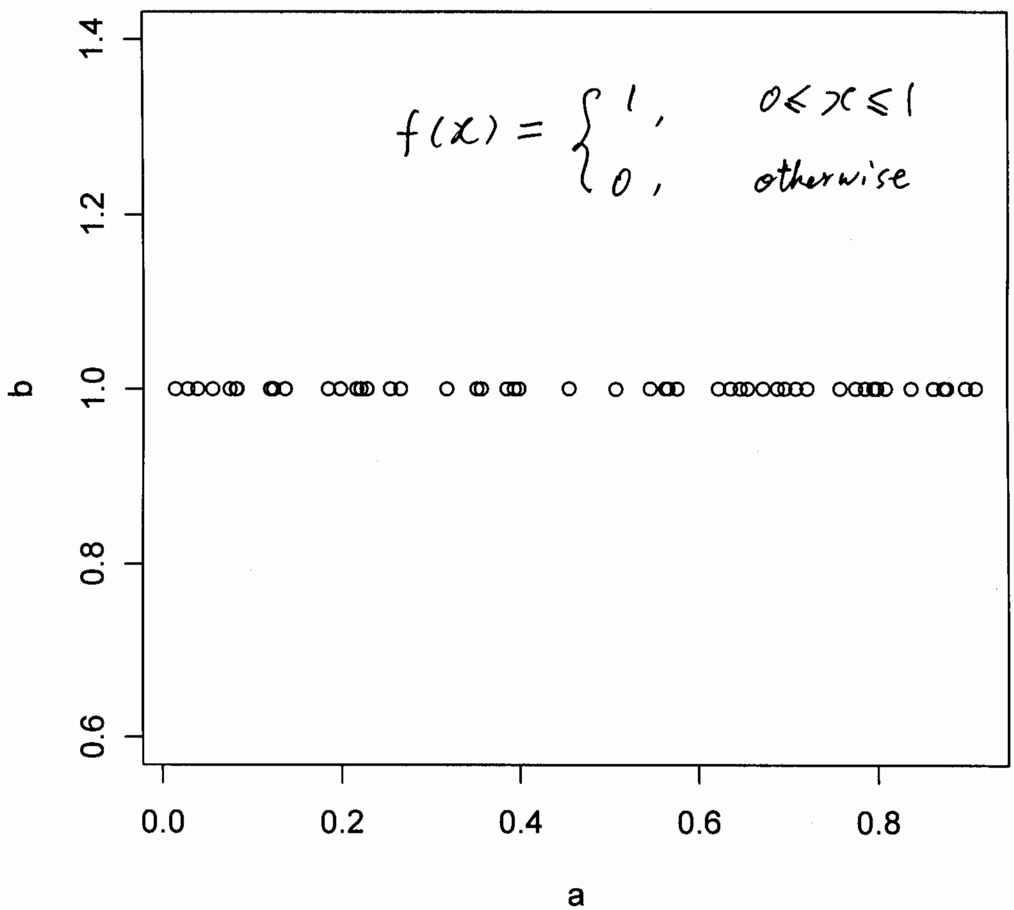
$$f(x)=\frac{1}{\sqrt{2\pi}}e^{-\frac{x^2}{2}}, \quad -\infty<x<\infty$$

a = rnorm (500)

qqnorm (a)

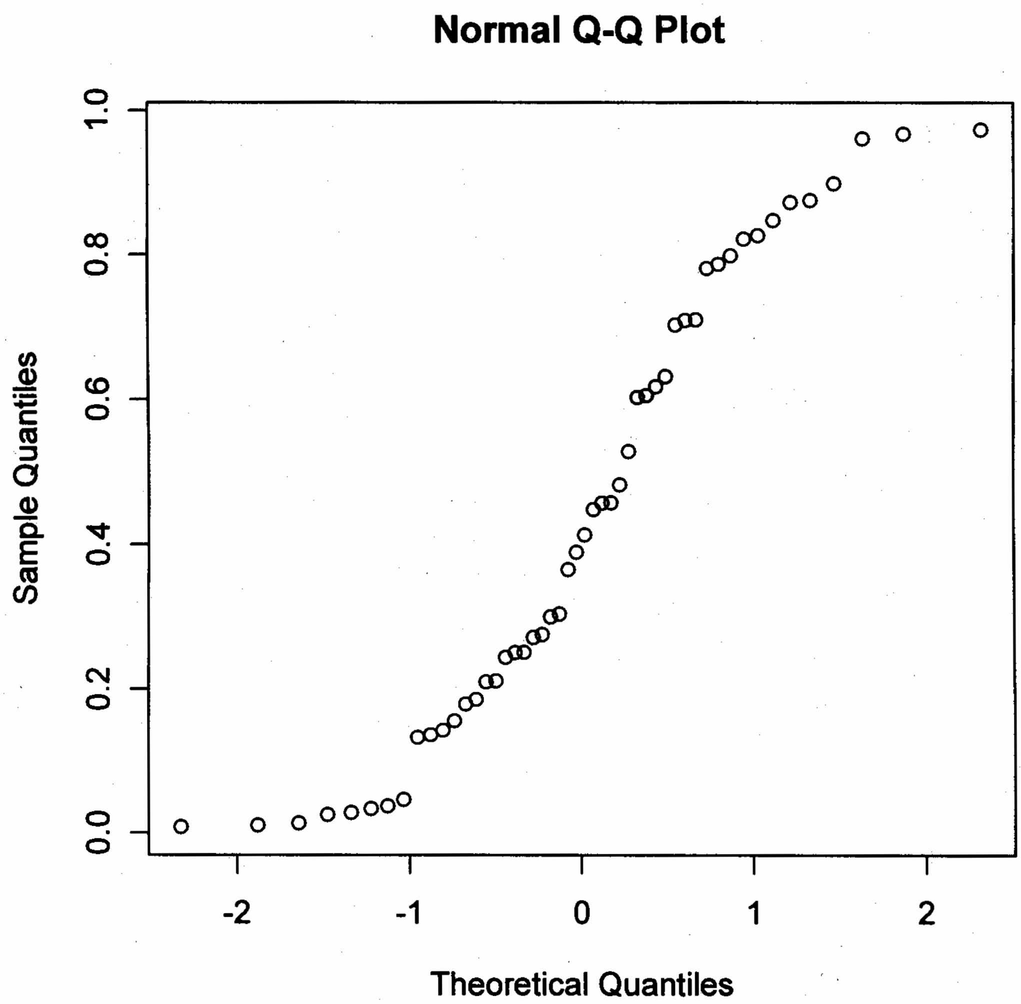


```
a = runif(1:50, 0, 1)

b = dunif(a, 0, 1)

plot(a, b)
```



a = runif(1:50, 0, 1)

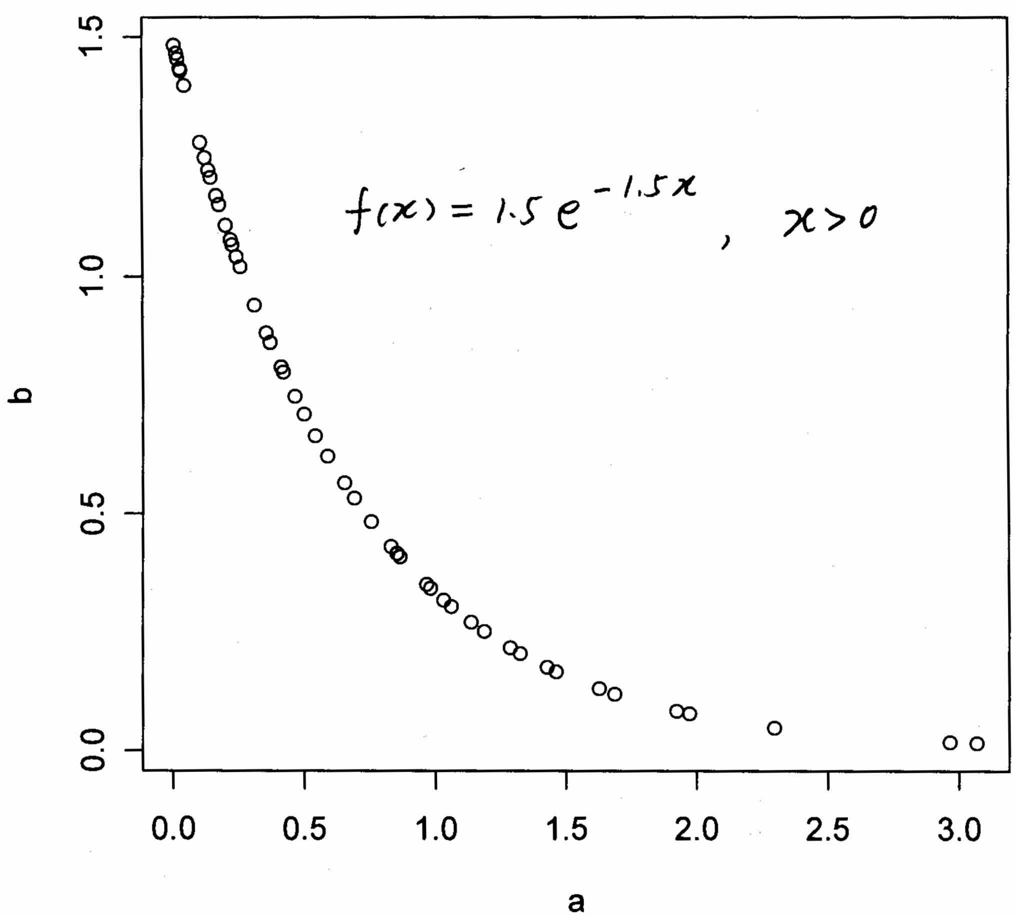
qqnorm(a)



a = rexp(1:50, 1.5)

b = dexp(a, 1.5)

plot(a, b)



a = rexp(1:50, 1.5)

qqnorm(a)