

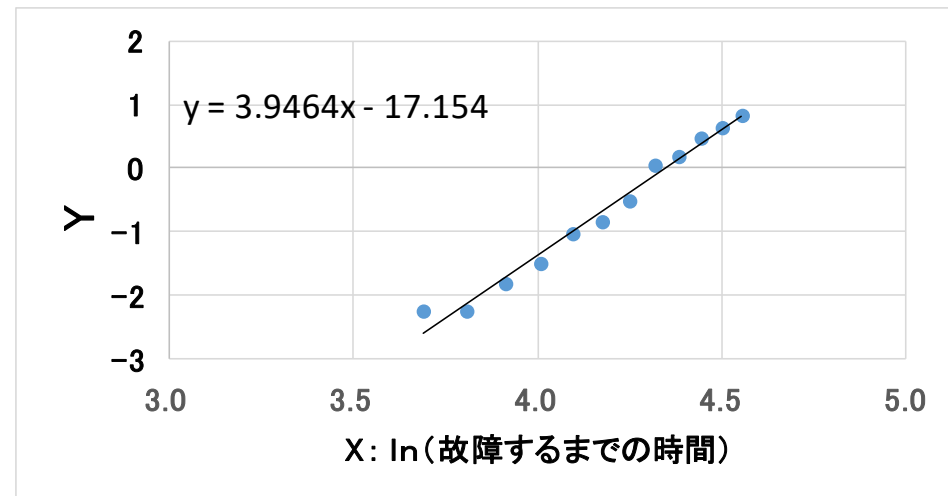
x: 故障するまでの日数

39
40
46
53
57
59
62
69
69
71
73
73
74
76
81
83
88
94
98
98

①  $x$ 幅5の度数  $X = \ln x$

x	y	$X = \ln x$	確率密度	累積y	Y
30	0	3.4012	0.0000	0.0000	#NUM!
35	0	3.5553	0.0000	0.0000	#NUM!
40	2	3.6889	0.1000	0.1000	-2.25037
45	0	3.8067	0.0000	0.1000	-2.25037
50	1	3.9120	0.0500	0.1500	-1.81696
55	1	4.0073	0.0500	0.2000	-1.49994
60	2	4.0943	0.1000	0.3000	-1.03093
65	1	4.1744	0.0500	0.3500	-0.84215
70	2	4.2485	0.1000	0.4500	-0.51444
75	4	4.3175	0.2000	0.6500	0.048621
80	1	4.3820	0.0500	0.7000	0.185627
85	2	4.4427	0.1000	0.8000	0.475885
90	1	4.4998	0.0500	0.8500	0.640337
95	1	4.5539	0.0500	0.9000	0.834032
100	2	4.6052	0.1000	1.0000	#NUM!
合計	20				

$$Y = \ln \left[ \ln \left[ \frac{1}{1 - F(x)} \right] \right]$$



② 確率密度 =  $\frac{\text{度数}}{\text{度数の合計}}$

③ 累積確率密度  $y = \sum \text{確率密度}$

$$Y = 3.9464X - 17.154$$

$$\alpha = a = 3.9464$$

$$\beta = \exp\left(-\frac{b}{\alpha}\right) = 77.26$$

## 参考 式の誘導

確率密度関数

$$f(x) = \frac{\alpha}{\beta} \left(\frac{x}{\beta}\right)^{\alpha-1} \exp\left[-\left(\frac{x}{\beta}\right)^\alpha\right]$$

累積分布関数

$$F(x) = 1 - \exp\left[-\left(\frac{x}{\beta}\right)^\alpha\right]$$

故障率

$$\lambda(x) = \frac{f(x)}{1 - F(x)} = \frac{\alpha}{\beta^\alpha} x^{\alpha-1}$$

$$\lambda = \frac{x \text{で故障する確率}}{x \text{まで故障しないで残っている確率}}$$

$$F(x) = 1 - \exp\left[-\left(\frac{x}{\beta}\right)^\alpha\right]$$

$$1 - F(x) = \exp\left[-\left(\frac{x}{\beta}\right)^\alpha\right]$$

$$\ln[1 - F(x)] = -\left(\frac{x}{\beta}\right)^\alpha$$

$$-\ln[1 - F(x)] = \left(\frac{x}{\beta}\right)^\alpha$$

$$\ln\left[\frac{1}{1 - F(x)}\right] = \left(\frac{x}{\beta}\right)^\alpha$$

$$\ln\left[\ln\left[\frac{1}{1 - F(x)}\right]\right] = \alpha \ln x - \alpha \ln \beta$$

$$Y = \ln\left[\ln\left[\frac{1}{1 - F(x)}\right]\right], X = \ln x$$

$$a = \alpha, b = -\alpha \ln \beta \quad \text{とおくと}$$

$$Y = aX + b$$

$\alpha = 3.95$ 、 $\beta = 77.26$

$$f(x) = \frac{\alpha}{\beta} \left(\frac{x}{\beta}\right)^{\alpha-1} \exp\left[-\left(\frac{x}{\beta}\right)^\alpha\right]$$

$$F(x) = 1 - \exp\left[-\left(\frac{x}{\beta}\right)^\alpha\right]$$

$$\lambda(x) = \frac{f(x)}{1 - F(x)} = \frac{\alpha}{\beta^\alpha} x^{\alpha-1}$$

x	y
30	0
35	0
40	2
45	0
50	1
55	1
60	2
65	1
70	2
75	4
80	1
85	2
90	1
95	1
100	2
合計	20

$\beta = a$		3.95			
$\alpha =$		77.26			
x			f(x)	$\lambda(x)$	
30	0.003147	0.97636	0.003072	0.003147	
35	0.004956	0.956997	0.004742	0.004956	
40	0.007344	0.928258	0.006817	0.007344	
45	0.01039	0.888259	0.009229	0.01039	
50	0.014172	0.835625	0.011843	0.014172	
55	0.018766	0.769844	0.014447	0.018766	
60	0.02425	0.691619	0.016771	0.02425	
65	0.030698	0.6031	0.018514	0.030698	
70	0.038188	0.507917	0.019396	0.038188	
75	0.046795	0.410896	0.019228	0.046795	
80	0.056594	0.317469	0.017967	0.056594	
85	0.067661	0.232825	0.015753	0.067661	
90	0.08007	0.161021	0.012893	0.08007	
95	0.093895	0.104295	0.009793	0.093895	
100	0.109212	0.062809	0.006859	0.109212	

