

Table 2.5. Linearizable Functions with Corresponding Transformations

Function	Transformation	Linear Form	Graph Shown in Figure
$y = \alpha x^\beta$	$y' = \log y, x' = \log x$	$y' = \log \alpha + \beta x'$	2.5(a, b)
$y = \alpha e^{\beta x}$	$y' = \ln y$	$y' = \ln \alpha + \beta x$	2.5(c, d)
$y = \alpha + \beta \log x$	$x' = \log x$	$y = \alpha + \beta x'$	2.5(e, f)
$y = \frac{x}{\alpha x - \beta}$	$y' = \frac{1}{y}, x' = \frac{1}{x}$	$y' = \alpha - \beta x'$	2.5(g, h)
$y = \frac{e^{\alpha + \beta x}}{1 + e^{\alpha + \beta x}}$	$y' = \ln \frac{y}{1-y}$	$y' = \alpha + \beta x$	2.5(i)

^aIn Chapter 5 we describe an application using this transformation.

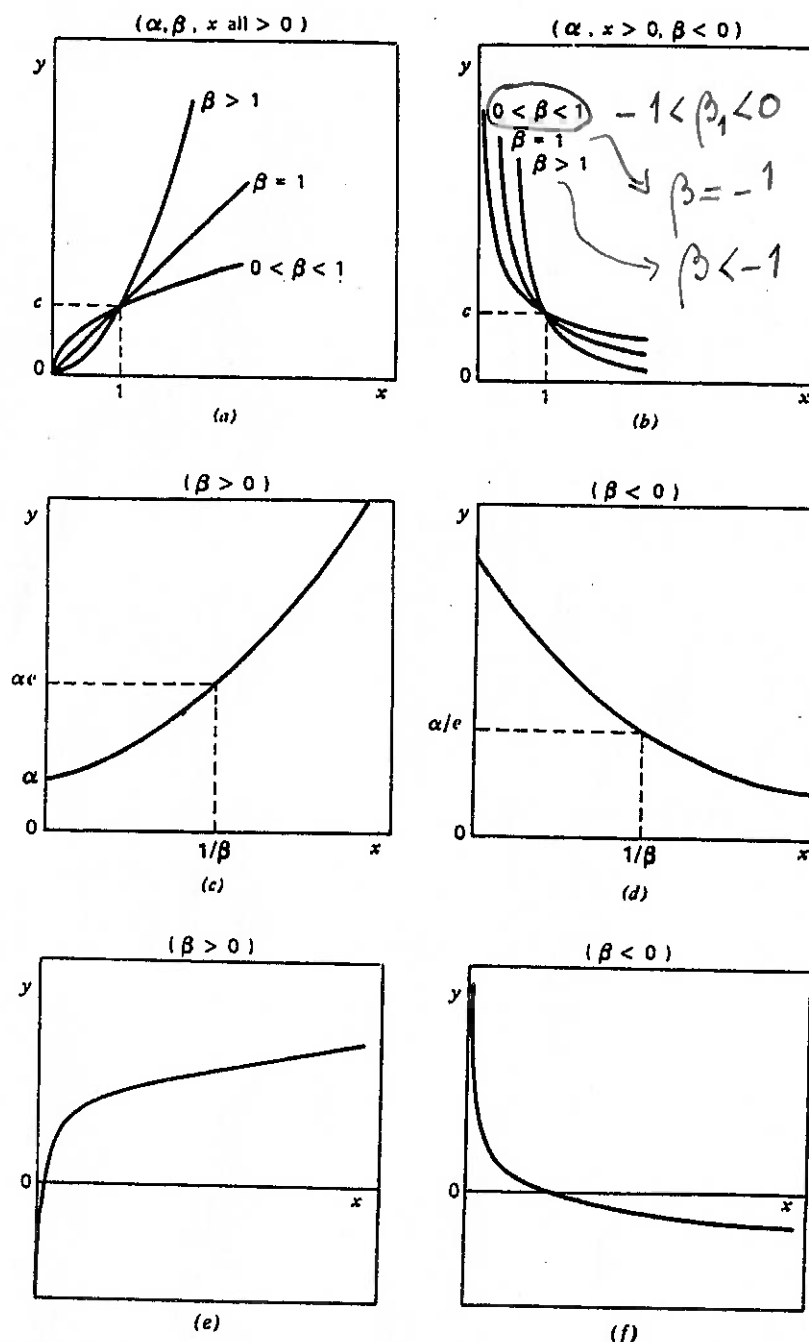


Fig. 2.5. Graphs of linearizeable functions. *Source:* Daniel and Wood (1980, pp. 20–21).

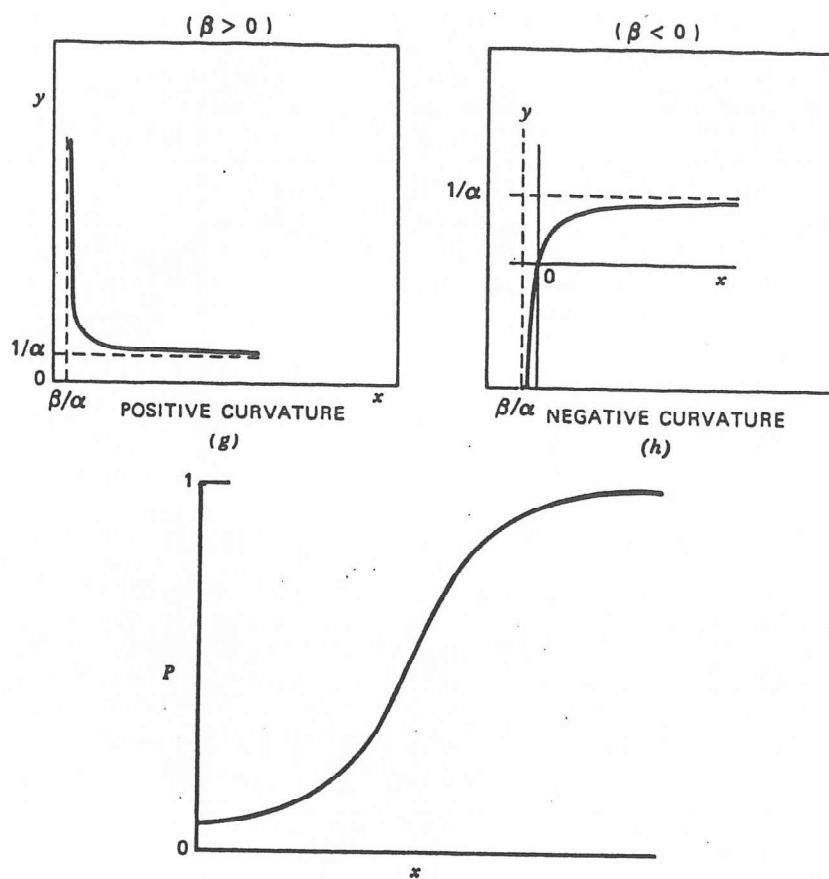


Fig 2.5. (Continued)

Table 2.9. Transformations to Stabilize Variance

Probability Distribution of Variable y	Variance of y in Terms of Its Mean μ	Transformation	Resulting Variance
Poisson ^a	μ	$\sqrt{y}$ or $(\sqrt{y} + \sqrt{y+1})$	0.25
Binomial ^b	$\frac{\mu(1-\mu)}{n}$	$\sin^{-1} \sqrt{y}$ (degrees)	$\frac{821}{n}$
		$\sin^{-1} \sqrt{y}$ (radians)	$\frac{0.25}{n}$
Negative binomial	$\mu + \lambda^2 m^2$	$\lambda^{-1} \sin h^{-1}(\lambda \sqrt{y})$ or $\lambda^{-1} \sin h^{-1}(\lambda \sqrt{y} + 0.5)$	0.25

^aFor small values of y , $\sqrt{y+0.5}$ is sometimes recommended.

^b n is an index describing the sample size; for $y = r/n$ a slightly better transformation is

$$\sin^{-1} \left(\frac{r + 3/8}{n + 3/4} \right)^{1/2}$$

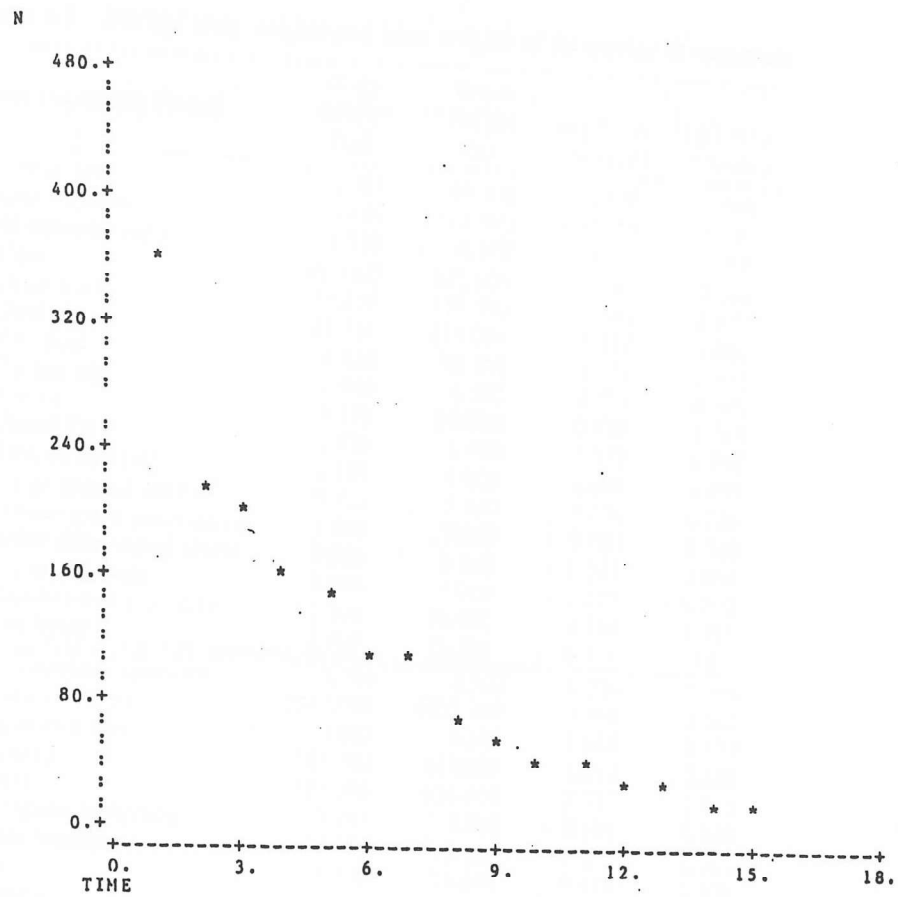


Fig. 2.6. Plot of n_i against time (t).

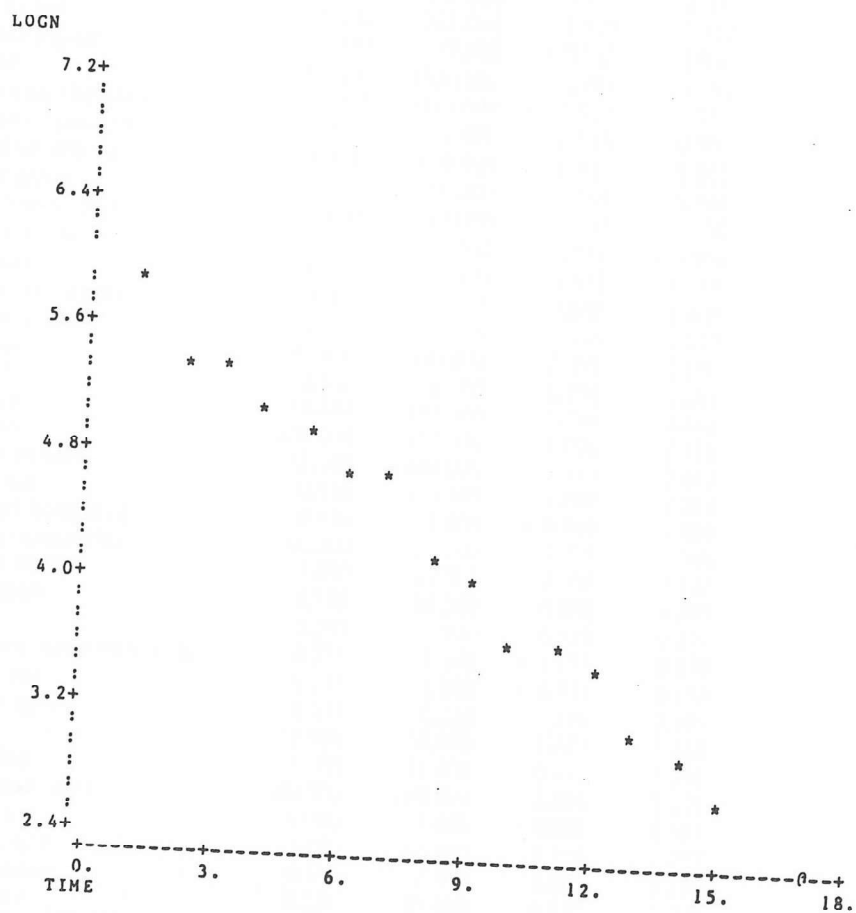


Fig. 2.8. Plot of $\ln n_i$ against time (t).

Table 6.3 Average brain weights and body weights of 62 species of mammals

Species (Common Name)	Body weight (kg)	Brain weight (g)	log(body weight)	log(brain weight)
1 Arctic fox	3.385	44.500	0.530	1.648
2 Owl monkey	0.480	15.500	-0.319	1.190
3 Mountain beaver	1.350	8.100	0.130	0.908
4 Cow	465.000	423.000	2.667	2.626
5 Gray wolf	36.330	119.500	1.560	2.077
6 Goat	27.660	115.000	1.442	2.061
7 Roe deer	14.830	98.200	1.171	1.992
8 Guinea pig	1.040	5.500	0.017	0.740
9 Vervet	4.190	58.000	0.622	1.763
10 Chinchilla	0.425	6.400	-0.372	0.806
11 Ground squirrel	0.101	4.000	-0.996	0.602
12 Arctic ground squirrel	0.920	5.700	-0.036	0.756
13 African giant pouched rat	1.000	6.600	-0.000	0.820
14 Lesser short-tailed shrew	0.005	0.140	-2.301	-0.854
15 Star nosed mole	0.060	1.000	-1.222	-0.000
16 Nine-banded armadillo	3.500	10.800	0.544	1.033
17 Tree hyrax	2.000	12.300	0.301	1.090
18 N. American opossum	1.700	6.300	0.230	0.799
19 Asian elephant	2547.000	4603.000	3.406	3.663
20 Big brown bat	0.023	0.300	-1.638	-0.523
21 Donkey	187.100	419.000	2.272	2.622
22 Horse	521.000	655.000	2.717	2.816
23 European hedgehog	0.785	3.500	-0.105	0.544
24 Patas monkey	10.000	115.000	1.000	2.061
25 Cat	3.300	25.600	0.519	1.408
26 Galago	0.200	5.000	-0.699	0.699
27 Genet	1.410	17.500	0.149	1.243
28 Giraffe	529.000	680.000	2.723	2.833
29 Gorilla	207.000	406.000	2.316	2.609
30 Gray seal	85.000	325.000	1.929	2.512
31 Rock hyrax ^a	0.750	12.300	-0.125	1.090
32 Man	62.000	1320.000	1.792	3.121
33 African elephant	6654.000	5712.000	3.823	3.757
34 Water opossum	3.500	3.900	0.544	0.591
35 Rhesus monkey	6.800	179.000	0.833	2.253
36 Kangaroo	35.000	56.000	1.544	1.748
37 Yellow-bellied marmot	4.050	17.000	0.607	1.230
38 Golder hamster	0.120	1.000	-0.921	-0.000
39 Mouse	0.023	0.400	-1.638	-0.398
40 Little brown bat	0.010	0.250	-2.000	-0.602
41 Slow loris	1.400	12.500	0.146	1.097
42 Okapi	250.000	490.000	2.398	2.690
43 Rabbit	2.500	12.100	0.398	1.083
44 Sheep	55.500	175.000	1.744	2.243
45 Jaguar	100.000	157.000	2.000	2.196
46 Chimpanzee	52.160	440.000	1.717	2.643
47 Baboon	10.550	179.500	1.023	2.254
48 Desert hedgehog	0.550	2.400	-0.260	0.380
49 Giant armadillo	60.000	81.000	1.778	1.908
50 Rock hyrax ^b	3.600	21.000	0.556	1.322
51 Raccoon	4.288	39.200	0.632	1.593
52 Rat	0.280	1.900	-0.553	0.279
53 Eastern American mole	0.075	1.200	-1.125	0.079
54 Mole rat	0.122	3.000	-0.914	0.477
55 Musk shrew	0.048	0.330	-1.319	-0.481
56 Pig	192.000	180.000	2.283	2.255
57 Echidna	3.000	25.000	0.477	1.398
58 Brazilian tapir	160.000	169.000	2.204	2.228
59 Tenrec	0.900	2.600	-0.046	0.415
60 Phalanger	1.620	11.400	0.210	1.057
61 Tree shrew	0.104	2.500	-0.983	0.398
62 Red fox	4.235	50.400	0.627	1.702

^a *Heterohyrax brucci*.

^b *Procavia habessinica*.

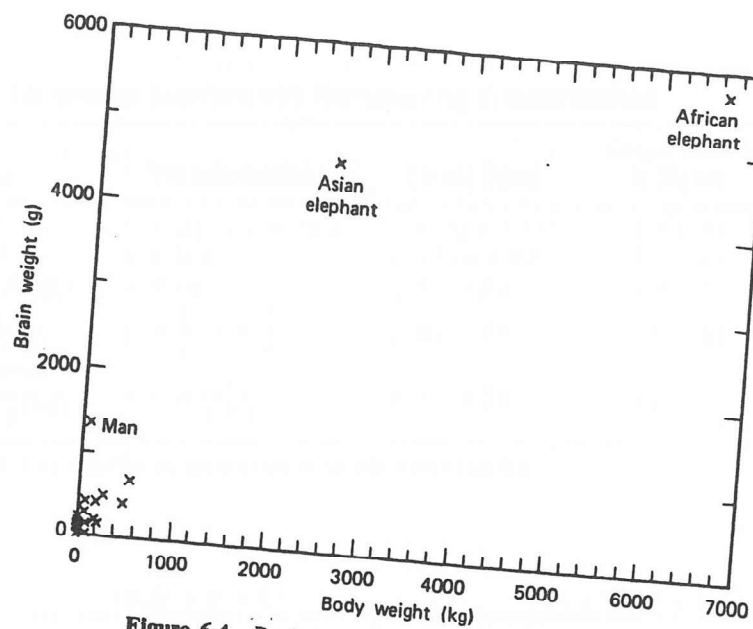


Figure 6.4 Brain weight versus body weight.

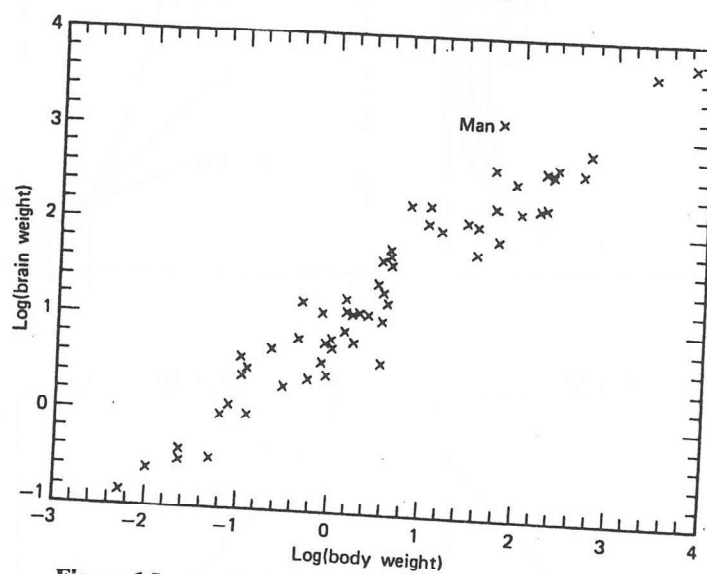


Figure 6.5 Log(brain weight) versus log(body weight).

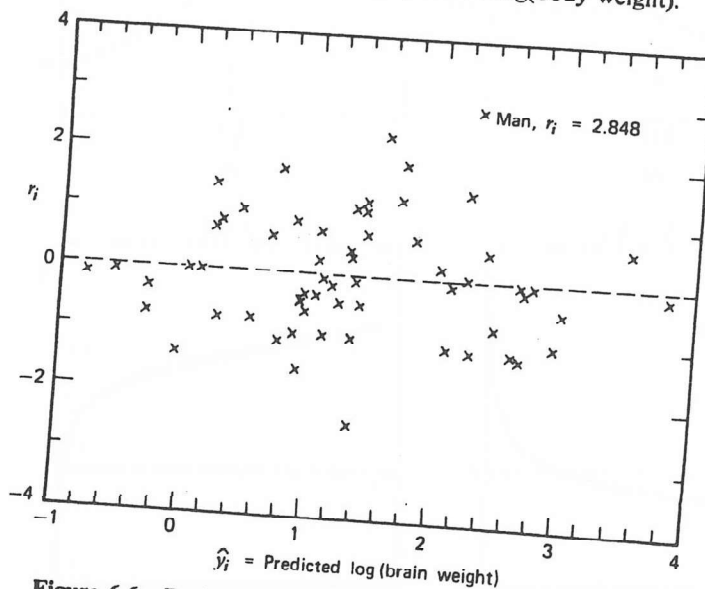


Figure 6.6 Residual plot, brain weight-body weight data.

Table 6.4 Regression summary: brain weight/body weight data

	Estimate	Standard Error	t-Value
Intercept	0.927	0.0417	22.23
Slope	0.752	0.0285	26.41

$R^2 = 0.92$, $\hat{\sigma} = 0.0191$, d.f. = 60