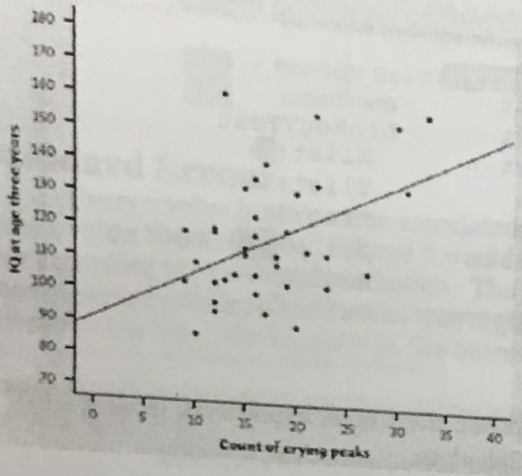
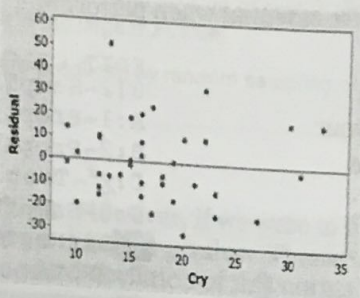
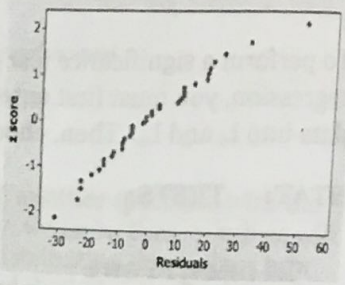
Example: Crying and IQ

Infants who cry easily may be more easily stimulated than others. This may be a sign of higher IQ. Child development researchers explored the relationship between the crying of infants 4 to 10 days old and their later IQ test scores. A snap of a rubber band on the sole of the foot caused the infants to cry. The researchers recorded the crying and measured its intensity by the number of peaks in the most active 20 seconds. They later measured the children's IQ at age three years using the Stanford-Binet IQ test. A scatterplot and Minitab output for the data from a random sample of 38 infants is below.







Regression Analysis: IQ versus Crycount

Predictor	Coef	SE Coef	T	P
Constant	91.268	8.934	10.22	0.000
Crycount	1.4929	0.4870	3.07	0.004

S = 17.50 R-Sq = 20.7% R-Sq(adj) = 18.5%

Do these data provide convincing evidence that there is a positive linear relationship between crying counts and IQ in the population of infants?

$H_0: \beta = 0$

$H_a: \beta > 0$

where β is the slope relating count of crying peaks and IQ at 3 years old

$\alpha = .05$

~~P=.002~~ ~~3.07~~

Plan - T test for Regression

L Residual Plot no pattern

I 38 ≥ 10 all infants

N normal prob plot appears linear

E Residual plot is equal spread about the line $y=0$

R Random sample of 38 infants

Do: $T = 3.07$

Pvalue .002

Conclude: reject H_0, $p < \alpha$

There is sign to suggest slope > 0, a pos. relationship

Power

log x

log y

A Full Example…

x

y

This table shows a random sample of 17 countries in the world, the average life expectancy at birth, and the number of people per television set.

$\log \hat{y} = 1.88 (-.062)(\log x)$

Country	People per Television Set	Life Expectancy (in years)
Bangladesh	315	53.5
China	8	70.0
Egypt	15	60.5
Ethiopia	503	51.5
France	2.6	78.0
India	44	57.5
Indonesia	24	61.0
Japan	1.8	79.0
Kenya	96	61.0
Pakistan	73	56.5
Poland	3.9	73.0
South Africa	11	64.0
Taiwan	3.2	75.0
Thailand	11	68.5
Ukraine	3	70.5
United States	1.3	75.5
Vietnam	29	65.0

(a) Find a good-fitting model that can be used to predict the life expectancy given the number of people per television set.

(b) Calculate a 95% confidence interval for the slope and interpret it.

log Power

$b = -.062$

$(-.0802, -.0431)$

95% confident the true slope is contained in

df = 15

$s = .0085$

(c) Perform a significance test for the slope and interpret your result. Is this consistent with your finding in part b?

$t = -7.099$

$P = .0000363$

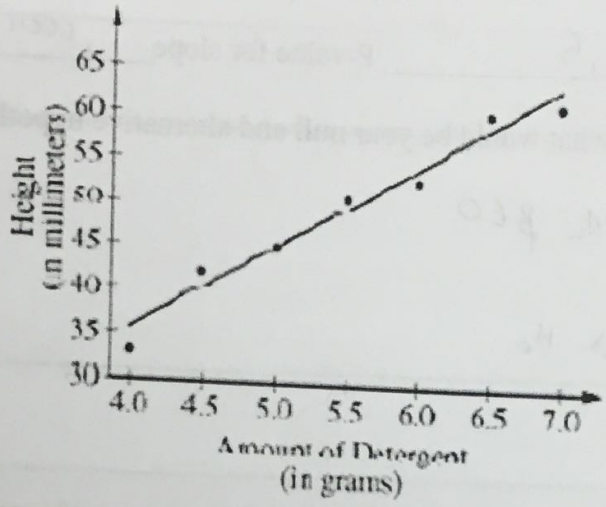
≈ 0

$s = .0085$

reject, sig. evid slope is not 0

3. A manufacturer of dish detergent believes the height of soapsuds in the dishpan depends on the amount of detergent used. A study of the suds' heights for a new dish detergent was conducted. Seven pans of water were prepared. All pans were of the same size and type and contained the same amount of water. The temperature of the water was the same for each pan. An amount of dish detergent was assigned at random to each pan, and that amount of detergent was added to the pan. Then the water in the dishpan was agitated for a set amount of time, and the height of the resulting suds was measured.

A plot of the data and the computer output from fitting a least squares regression line to the data are shown below.



Predictor	Coef	SE Coef	T	P
Constant	−2.679	4.222	−0.63	0.554
Amount	9.5000	0.7553	12.58	0.000

S = 1.99821 R-Sq = 96.9% R-Sq(adj) = 96.3%

(a) Write the equation of the fitted regression line. Define any variables used in this equation.

$\hat{y} = -2.679 + 9.5x$ $\hat{y}$: predict studs height

x = amount of det

(b) Note that $s = 1.99821$ in the computer output. Interpret this value in the context of this study.

standard deviation of residuals

average distance an observed value is from the expected

(c) Identify and interpret the standard error of the slope.

.7553

average distance from the expected slope of the population