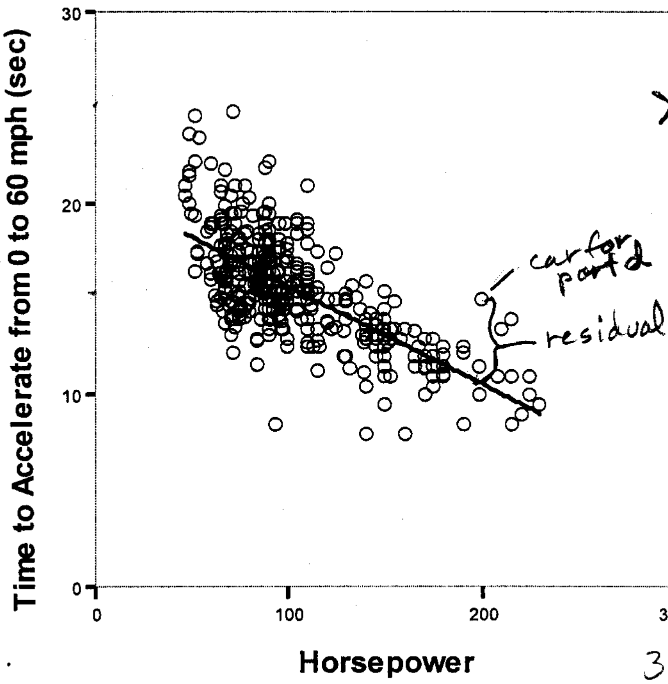
Math 251, Fall 2007 Quiz 3 inclass, closed book Day 15 **NAME** Solutions

Work on these pages. Use the backs or extra paper if you need it.

22pts 1) This problem refers to data from 400 different makes of cars from the years 1970-82.
In this picture, the regression line (graphed) is

Time= 20.855 – .0514 Horsepower

R-square = .49



3 a) What is the correlation coefficient r for these variables?

$\sqrt{.49} = .7$

clearly r is negative, so

$-.7$

3 b) What proportion of the variability in the Time to accelerate from 0 to 60 is explained or predicted by knowing the Horsepower?

$r^2 = .49$

8 c) i) Use the regression equation to predict the acceleration for a proposed car with 300 horsepower .

Time = 2.0855 – .0514 × 300

= 5.435 sec.

3 | 00
2 | 56666778
2 | 23
1 | 99
1 | 2

ii) Is this a good thing to do? Why or why not? NO – somewhat dangerous! 300 is quite far outside the range of the data, and the linear relationship may not continue that far. From 0 to 60 in 5½ seconds seems very fast. Also if we look at the data we see some curving already!

iii) What is the name for doing it? Extrapolation

3 d) One of the cars has 200 horsepower, and takes 15 seconds to accelerate to 60mph. Find the residual for this car.

(200, 15) Time = 2.0855 – .0514 × 200 = 10.575

15 sec. is observed, 10.575 is predicted

Residual = observed – predicted = 15 – 10.575 = 4.475

5 e) Suppose we discover another 20 cars which belong in this dataset which all have horsepower 300 and time to accelerate of 25 seconds! (SUV's?)

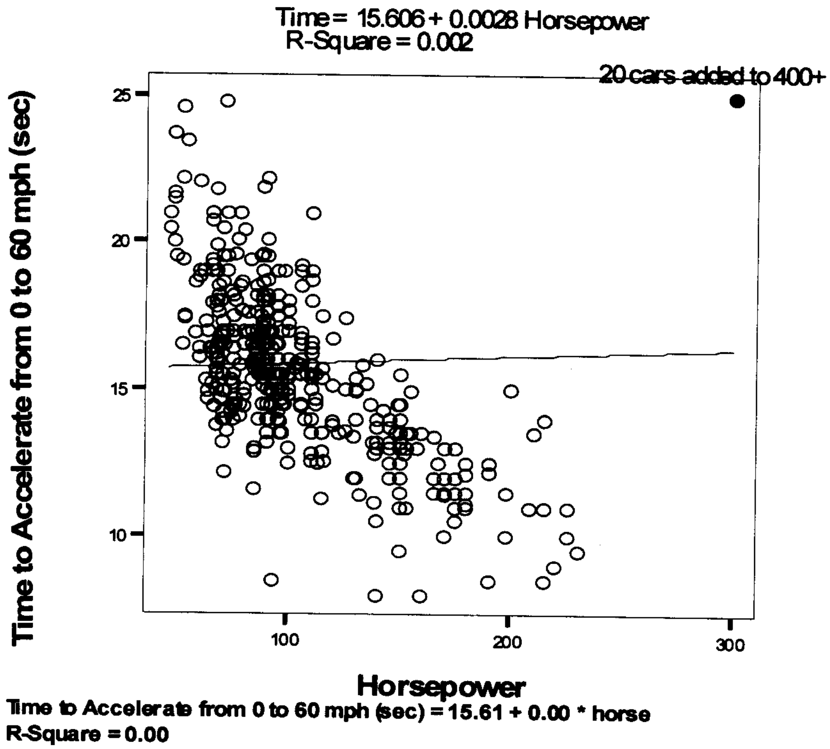
i) **Mark with an X where they go on the graph**, roughly, and circle the best answers:

With these cars added,

ii) The regression line will **become flatter / stay the same /become steeper**.

iii) The correlation coefficient r will **become closer to 0/ stay the same/ become farther from 0**

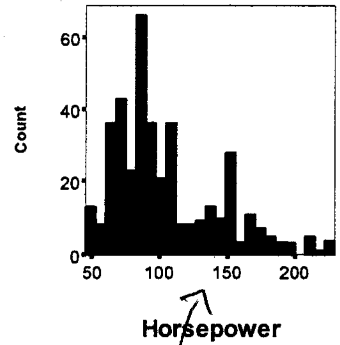
1e, actual results

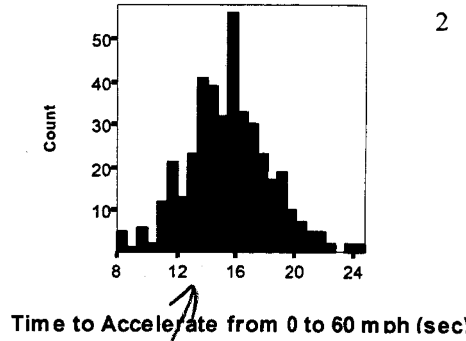


The formulas that come with the Interactive Graph regression line are rounded to 2 decimal places and can't be changed. (Another reason to do linear transformations – at least by 10's —to get slopes to be in nice units.
I got more decimal places from Analyze>Regression>Linear, where the numbers have to be picked out of the sea of numerical output.

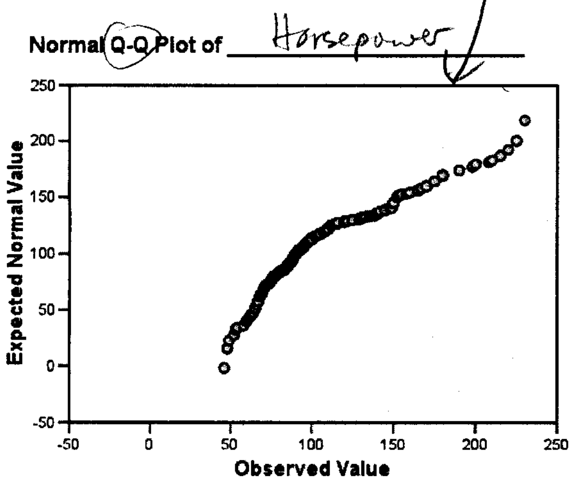
4pts 2) Look at the two variables of the first problem separately:

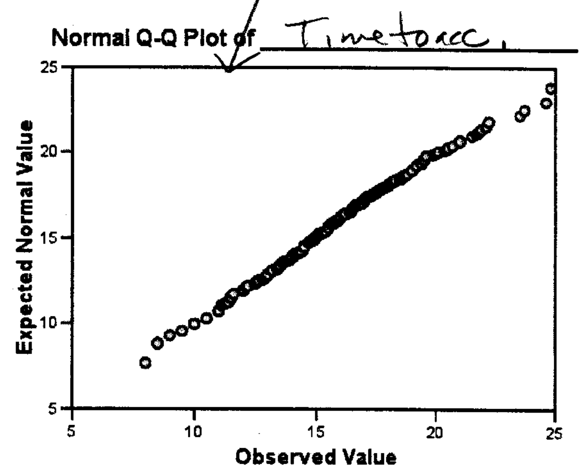
Which Normal quantile plot goes with which histogram?





(reversed from Textbook)





9pts 3) A set of measurements is made on a group of unicorn eggs. We will use x for their width and y for their length.
We find $\bar{x} = 8$ inches, $\bar{y} = 12$ inches, $r = 0.5$, $s_X = 2$, $s_Y = 6$.

a) Find a and b and write down the equation for the regression line $\hat{y} = a + bx$.

6

$$b = r\frac{\Delta y}{\Delta x} = .5 \times \frac{6}{2} = 1.5$$

$$\bar{y} = a + b\bar{x}$$

$$12 = a + 1.5 \cdot 8$$

$$12 = a + 12 \qquad \hat{y} = 0 + 1.5x$$

$$a = 0 \qquad \hat{y} = 1.5x$$

3 b) If we standardize both variables here (rewrite each value in standard deviations above the mean) what will the slope of the regression line be? Find z-scores. Then both z-variables will have mean 0 and standard deviation 1!

$$b = r\frac{\Delta y}{\Delta x} = r \cdot \frac{1}{1} = r \quad \text{(or you can just know it)}$$

X 4) 100 adult Basilisks are measured and weighed. Optional!
It is found that straight line regression describes the data well in this form:
$\log_{10}(\text{weight}) = 1 + 2.5\log_{10}(\text{length})$. Write the corresponding equation for weight = a formula using length.

$$10^{\log_{10}(\text{weight})} = 10^{1 + 2.5\log_{10}(\text{length})} \qquad \text{Using } 10^{\log_{10} x} = x$$

$$= \text{weight} = 10^1 \cdot 10^{2.5\log_{10}(\text{length})} = 10\left[\left(10^{\log_{10}(\text{length})}\right)^{2.5}\right] \quad \left(\text{Using } 10^{ab} = (10^b)^a\right)$$

$$= 10 \cdot (\text{length})^{2.5}$$