

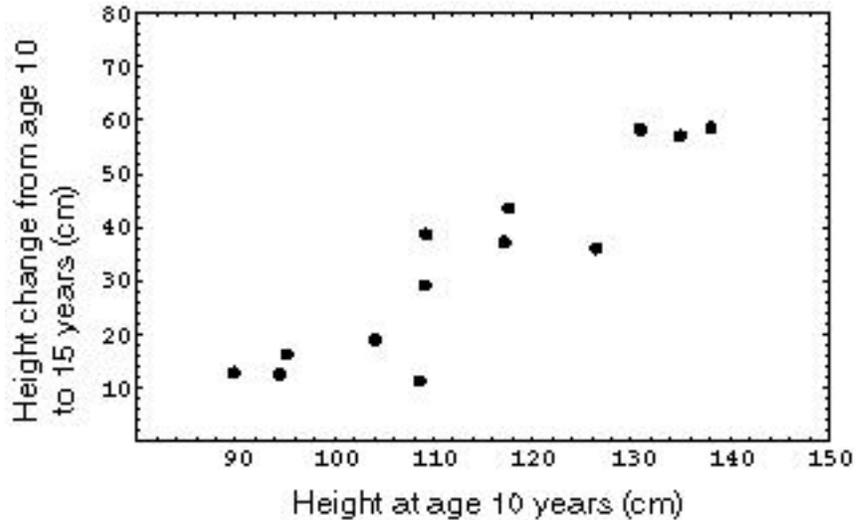
## Math 151 – Exam 1 – Fall 2006 – Louis Gross

Do all your work on the sheets provided (please use only one side of a sheet), not this problem sheet. Be sure to SHOW YOUR WORK and please put your name on each sheet. The sheets will be stapled together when you turn the exam in.

**Honor Statement: By signing this statement I agree that I will not discuss any aspects of the material covered in this exam with any other individual until after 6:00PM Knoxville time on Tuesday September 19. Additionally, if anyone approaches me before 6PM requesting any information regarding the exam, I will report this individuals' action to Dr. Gross.**

Signature: \_\_\_\_\_ Section # \_\_\_\_\_

1. The below graph shows data on height changes from age 10 to 15 versus height at age 10 for a group of females.
  - a) state whether the data appear to be positively, negatively, or non-correlated and give a rough estimate of  $r^2$  the square of the correlation coefficient, stating whether it is in the range 0-.5 or .5-1. (choose one of these ranges);
  - b) give an estimate for the linear regression line, being careful to state how you derived it (e.g. state what points you used and show how you calculated the line);
  - c) from the regression line you obtained, estimate the height at age 15 for an individual female of height 150 cm at age 10;
  - d) from the regression line you obtained, below what height at age 10 will height change from age 10 to 15 become negative? Does this make sense? (5 points each part)



2. For the following sample, compute the mean, median, range, variance and standard deviation: 2, 1, 4, 5, 8 (15 pts)

3. Solve each of the following for  $y$  (5 pts each):

(a)  $\log_{10}(4y) = 2$     (b)  $3e^{-2y} = 15$     (c)  $\ln(4 + x^2) = 3$

4. A farmer wishes to have about 400 trout in a pond on the farm and stocks the pond with 100 trout initially. After 2 months, there are approximately 160 trout in the pond.

(a) Find an exponential function  $N(t) = a b^t$  for the number of trout in the pond which is consistent with the data given (7 points)

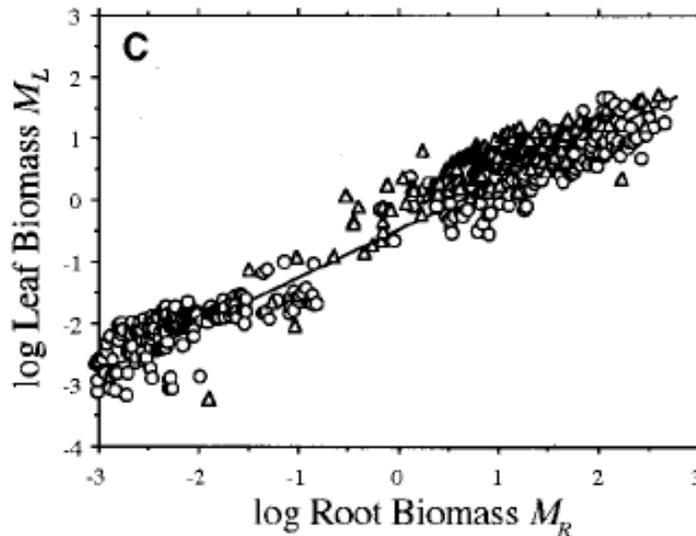
(b) At what time will the number of trout reach 400? (3 points)

5. Below is Figure 1C from the paper by Enquist and Niklas (Science Feb. 22, 2003) discussed in class. This shows that leaf biomass  $M_L$  (measured in kg dry weight) is allometrically related to root biomass  $M_R$  (measured in kg dry weight). The linear regression through these data is shown, and note that it approximately goes through the points  $(-2, -2)$  and  $(1, 0)$  on this log-log graph.

(a) Give an equation which expresses  $M_L$  as a function of  $M_R$  being sure to estimate any parameters in the equation using the regression line. So you should have an answer with  $M_L$  on the left hand side of the equation by itself. (10 pts)

(b) If you compare two plants, with plant A having twice the root biomass of plant B, is the leaf biomass of plant A twice that of plant B, less than twice

or more than twice? (2pts)



6. The following weights (in grams) were obtained from a group of 20 measurements of seeds when plants were grown in a greenhouse : 41, 38, 35, 48, 57, 51, 46, 56, 51, 37, 42, 41, 36, 59, 52, 38, 54, 37, 39, 44.

(a) Construct a histogram for these data, using a width class of size 5. (8 pts)

(b) From this histogram, state whether the arithmetic mean of the data is larger, smaller or equal to the midrange (the midpoint of the data set's range) of the data. (2 pts)

(c) Based upon this data set, approximately what fraction of seeds from similarly grown plants do you expect to weigh greater than 50 grams? (2 pts)

7. Below is a semi-logarithmic graph of drug concentration (mg/ml) in the blood of a patient following administration of a dose at time 0. Note that the data clearly fall on a line.

(a) What was the initial concentration of drug at time 0 (e.g. what is  $D(0)$ )? (4 pts)

(b) Give an equation for  $D(t)$  = drug concentration at time  $t$  hours following drug administration. (8 pts)

(c) At what time should a second drug dose be given if it is to be administered when the drug concentration has fallen to 5% of the initial concentration? (4 pts)

