Math Q114 Review Sheet for Final Exam, Fall 2006

1. The following is a list of commuting times (in minutes) for workers in downtown Boston:

35 20 25 40 60 30 50 75 60 50

a) Calculate the mean and median for this data.
b) Use the data to generate a histogram.
c) Construct a 60-second summary, describing any patterns in the data.

2. The following frequency table shows the ages of students in a Quantitative Reasoning class.

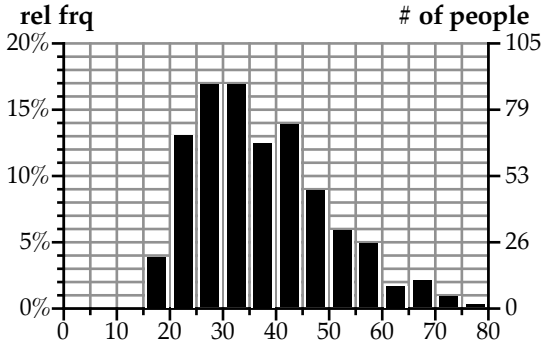
Age interval	frequency
18 – 20	2
21 – 23	4
24 – 26	1
27 - 29	3
30 – 32	0
33 – 35	2

a) Find relative frequencies.
b) Use Excel to make a relative frequency histogram of this data.
c) Estimate the mean age for this class.

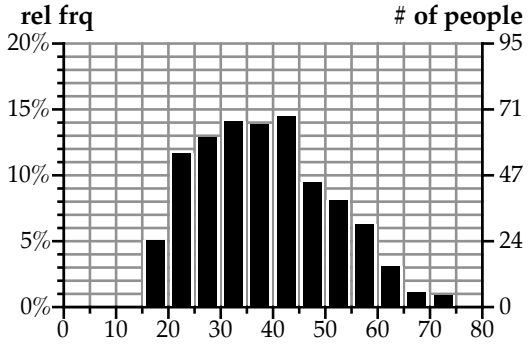
3. Two histograms derived from US Census data are shown below. This random sample includes 1000 people of age 15 years and older.

Distribution of Ages of Men **Distribution of Ages of Women**

Use the histograms to approximate the following:
a) the number of men between the ages of 55 and 60.
b) the percentage of women between the ages of 30 and 40.



Age / Men / 526 elements
U.S. Census Data



Age / Women / 474 elements
U.S. Census Data

c) the total number of people aged 60 and over.

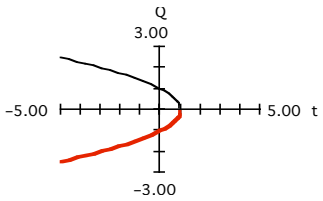
4. There are six starting players on my son's soccer team. The season average(mean) number of goals scored by the starters was 14. When the team's two substitutes' season goals were added the team average dropped to 12. If one substitute scored 3 goals for the season, how many goals did the other score? Show how you found the answer.

5. . Families living on one short block in Dorchester have annual incomes of $10,000, $4,000, $2,000, $6,000, $100,000, and $4,000.

a. Find the mean and medium income for these families.

b. Explain why is there such a big difference in size between the mean and the median?
c. Two additional families moved onto the block and lowered the mean to $17,500. The annual income for one of them was $4000, what was the other?

6. a) State the definition of a function.
b) Determine in each case whether Q is a function of t. If not, state a reason.
i)



ii). The chart below gives the height (H) and weight (W) for students enrolled in a seminar. Is weight a function of height? Explain your answer with reference to the data.

H	68 in.	70 in.	67 in.	71 in.	64 in.	70 in.
W	160 lbs.	140 lbs.	130 lbs.	155 lbs.	105 lbs.	145 lbs.

iv) Q represents the amount of gas in the tank of a car over the period of a year.

7. Open the data file **MENSMILE.xls**. This data file shows the record times for the men's mile.
a) Insert a new column, titled "years since 1913". Use Excel to calculate the years since 1913 in that column.
b) Make a scatter plot of the men's mile record versus years since 1913. Label your graph clearly and make sure your name is on the graph.
c) Assume that the data are linear and fit a linear least squares regression line to the data. Using the variable *m* for record time and *t* for *years since 1913*, record the regression equation and correlation coefficient for the data in the space below (Round off numbers in the equation to 3 decimal places.).
equation: _____ correlation coefficient = _____
d) Using a word description interpret the slope and explain what the correlation coefficient tells you about the regression line associated with the data.

e) Using the regression equation, answer the following questions:

i) In what year would your linear model predict a winning time of 3.00 minutes?
ii) What does your linear model predict as the record time for the year 1965

8. The following table shows the number of cigarettes consumed in the U.S., along with the Census Bureau's estimate of the U.S. population at that time.

Year	U.S. Consumption of Cigarettes	U.S. Population
1960	484,400,000,000	180,000,000
1970	536,400,000,000	204,000,000
1980	631,500,000,000	227,200,000
1990	525,000,000,000	249,400,000
1997	480,000,000,000	267,800,000

a) What was the average rate of change in cigarette consumption between 1960 and 1980? Between 1960 and 1997? Between 1980 and 1997?

b) Create a 4th column in this table and calculate the number of cigarette smoker per person for each of the years. What are the units here?
c) Calculate the rate of change in number of cigarettes smoked per person between 1960 and 1997.
c) The total number of cigarettes consumed in the U.S. in 1960 is very close to the number of cigarettes consumed in 1997. Does that mean that smoking was as popular in 1997 as it was in 1960? Explain your answer, making specific references to the data and to your calculations.

9. In 1997 AT&T offered two long distance calling plans. The "One Rate" plan charged a flat rate of $0.15 per minute. The "One Rate Plus" plan charged a service fee of $4.95 a month plus $0.10 per minute. Consider the monthly telephone cost as a function of minutes for both plans and construct a cost function for both plans. Use C_1 to represent the monthly cost of the "One Rate" plan and C_2 to represent the monthly cost of the "One Rate Plus" plan and t to represent the time, in minutes. Find the linear functions for C_1 and C_2.

10. Compute the indicated operations and express the result in scientific notation.

a) $(3.54 \times 10^{21})(8.9 \times 10^{-66})$
b) $(7.9 \times 10^{89}) / (1.33 \times 10^{55})$
c) $(6.7 \times 10^{73})^{33}$

11. Computer company Alpha is offering the following deal: For only $399, you can buy a brand-new computer. However, you must also buy their internet service, which costs $29.99 per month.

a) Write an equation that describes the amount of money you pay based on the number of months of internet service that you buy.

b) Identify each of the following in your equation, including units.
Independent variable: _____ Dependent variable: _____
Rate of change (slope): _____ Vertical intercept: _____

c) The fine print says that you must buy at least 24 months of internet service. With this in mind, what is a reasonable domain for your equation from part a? You may also want to consider the lifetime of a computer. You must explain your answer.

d) Computer company Beta offers the same computer for lease for $49.99 per month.

i) Write an equation that describes the amount of money you pay based on the number of months you lease the computer from Beta.

ii) Use Excel to create a spreadsheet showing the total amount of money paid under each plan for 24 months. Make a scatter plot of the data and insert it into your worksheet. Label your graph carefully. Put your name on top of the worksheet and use print preview to make sure that it will print properly.

e) Which is the most cost effective plan? Explain your answer with reference to the equations and graph you made.

12. A car is traveling at a rate of 58 miles per hour. Express the speed of the car in kilometers per minute.

13. The earth has an approximate diameter of $2 * 10^7$ meters. A hydrogen atom has a diameter of approximately .0000000000529 meters. How many objects the size of a hydrogen atom would you need to create a line as long as the earth's diameter? Write your answer in scientific notation.

14. The sun is approximately 3 orders of magnitude larger in diameter than the earth. The diameter of the earth is 6,300,000 meters. Approximately how large is the sun's diameter?

15. The CEO of a major corporation has a total compensation package (salary plus stocks) of $785,000,000 per year. A worker in a factory owned by the corporation has a total compensation package of $28,000 per year. How many orders of magnitude are there between these two incomes? Write your answer in a complete sentence.

16. The projected budget for the United States in fiscal year 2005 is 2.4 trillion dollars. Approximately 13% of this budget will be used to pay interest on the federal debt. Estimate the amount of money this represents.

17. A Boston homeowner is currently heating her house with oil but is considering switching systems. She can choose to keep her oil or switch to gas or switch to electricity. She currently spends $3,000 per year to heat with oil. Based on her best estimate it would cost $10,000 to install a gas heater and she estimates that she would pay $2,200 each year for gas. An electric heating system would cost $15,000 to install and her annual heating costs with electricity are estimated to be $2,000.

Let L, G, and E represent the total cost of operating oil, gas, and electricity after t years, respectively, then the equations for the three options are:

$$L = 3{,}000t \qquad G = 2{,}200t + 10{,}000 \qquad E = 2{,}000t + 15{,}000$$

a. Create a table of values in Excel comparing the three heating options for 30 years.

- Include a title and your name in the top left-hand corner of your worksheet.
- Include descriptive labels for each column.
- Use Excel formulas for your calculations.
- Turn in the printout of your worksheet.

b. Create a graph in Excel showing all three options on the same graph.

- Choose "XY Scatter" graph.
- Include your name, a suitable title and suitable labels for the X- and Y-axes.
- Turn in the printout of your graph.

c. Based on your printouts, what option would you recommend to this homeowner? Your recommendation should take into account how long the homeowner plans to stay in her house, *e.g.*, 5 years, 10 years, 12 years, or indefinitely. You should write your answer in MS Word and remember to include your name on the print out.