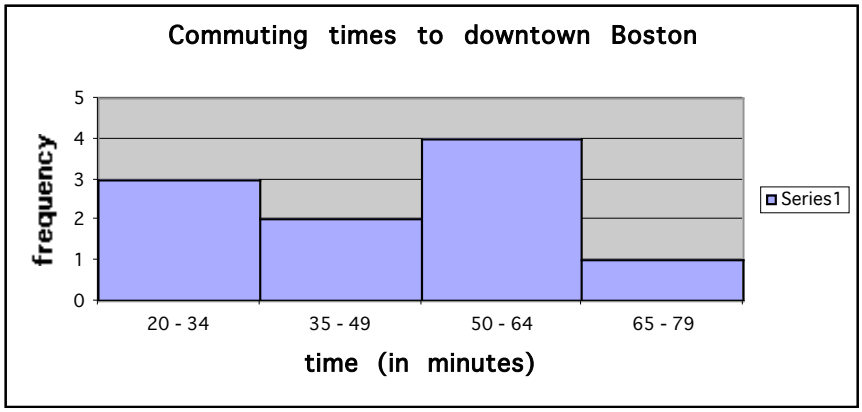
Solutions for Review Sheet Math Q114

1. a) Mean = (35+20+25+40+60+30+50+75+60+50)/10=44.5 minutes
Median = 45 minutes
b) Histograms will vary depending on intervals chosen.
Here is one example, using intervals that are 15 minutes wide:



c) summary could note that
- Commuting times are diverse – ranging from 20 minute to 75 minutes
- The largest interval was 50 – 64 minutes, representing 40% of the data. The mean and the median are close to this interval.

2. a) Here is the table with relative frequencies inserted. This can be used to make the histogram.

interval	**freq.**	**rel. freq.**		**representative age**
18 - 20	2	17%		19
21 - 23	4	33%		22
24 - 26	1	8%		25
27 - 29	3	25%		28
30 - 32	0	0%		31
33 - 35	2	17%		34
total	12	100%		

b) To estimate the mean age, we find an age that represents each interval. These ages are shown in the last column.
Mean age = [19(2)+22(4)+25(1)+28(3)+31(0)+34(2)]/12 = 25.25, or about 25 years.

3. a) number of men between ages of 55 and 60: 26
b) percentage of women between ages of 30 and 40: 28%
c) total number of people aged 60 and over: 26+24=50
Analysis could include the following points:
- The ages for men are skewed to the right, with a peak of 17% in the groups 25 – 30 years old and 30 – 35 years old.
- The ages for women are more uniformly spread out, with a fairly even distribution between ages 20 and 45. More specifically, there were about 12% in the 20 – 25 year group, 13% in the 25 – 30 year group, and about 14% in the 30 – 45 age group.
- For both genders, the ages extended up through 75; it appears that there are a couple of people in the 75 – 80 age group for men, but not for women

4. (Sum for 6 players)/6 = 14 therefore Sum for 6 players = (6)(14) or 84

(Sum for 8 players)/8 = 12 therefore Sum for 8 players = (8)(12) or 96
The difference between to two sums is 12 goals and these were contributed by the two subs. Since one sub scored 3 goals, the other must have scored 9 goals (12-3 = 9).

Answer: 9 goals.

5. a. Mean = $21,000; Median = $5000 (first put in order then average two middle incomes since there is an even number of them).

b. The $100,000 is an outlier that skews the mean but doesn't effect the median.

c. If mean of 8 families is $17,500 then sum of these is 8x17500 = 140,000.

d. The sum for the 6 families is 126,000. Theefore the two new families must contribute 14,000 to the sum. One you are told is $4000, so the other is $10,000.

6. a) A function is a relationship between two quantities (usually called x and y), such that each value of x determines exactly one value of y. That is, given one input, there is exactly one output.

b) i) Q is NOT a function of t, since the graph does not pass the vertical line test.
ii) From the table, we see that Weight is NOT a function of Height That's because when H = 70 in., we have two different values for Weight.
iv) Q is a function of t, since for one particular time, we have exactly one amount of gas in the tank.

7. a) Regression equation is: $R = 4.249 - 0.007t$
Correlation Coefficient: 0.989
b) The slope is -0.007 min/year. That means that for every one year increase in time, the record time for the men's mile decreased by about 0.007 minutes.
c) When would we predict a winning time of 3 minutes? Solve the equation
$3 = 4.249 - 0.007t$ gives $t = 178$ years, or in the year 2091.
We can use our model to predict the record time for 1965 (= 52 years after 1913):
$R = 4.249 - 0.007(52) = 3.885$ minutes.
This is pretty close to the actual time of 3.89 minutes.

8. a) Average rate of change in cigarette consumption between 1960 and 1980:
Ave. rate of change = $(4.844 \times 10^{11} - 6.31 \times 10^{11})/(1960 - 1980) = 7.35 \times 10^{9}$ cigarettes per year
Between 1960 and 1997, the average rate of change is
Ave. rate of change = $(4.844 \times 10^{11} - 4.80 \times 10^{11})/(1960 - 1997) = 1.12 \times 10^{8}$ cigarettes per year
Between 1980 and 1997, the average rate of change is
Ave. rate of change = $(6.315 \times 10^{11} - 4.8 \times 10^{11})/(1980 - 1997) = -8.91 \times 10^{11}$ cigarettes per year
b) Add to table:

Year	U.S. Cig. Consumption	U.S. Population	Cigs per person
1960	484,400,000,000	180,000,000	2691
1970	536,400,000,000	204,000,000	2629
1980	631,500,000,000	227,200,000	2779
1990	525,000,000,000	249,400,000	2105
1997	480,000,000,000	267,800,000	1792

To obtain the numbers in the fourth column: take cigarette consumption and divide it by the U.S. population.
c) Between 1960 and 1997, rate of change in number of cigarettes smoked per person is:
(1792 – 2691)/37 = -24.2 cigarettes per person.
d) Although the number of cigarette smokers in 1997 is about the same as that number from 1960, we can't conclude that smoking was as popular in 1997 as it was in 1960. We need to look at the <u>percentage</u> of Americans who smoked, not the raw numbers. The size of the population grew in that time period, and our

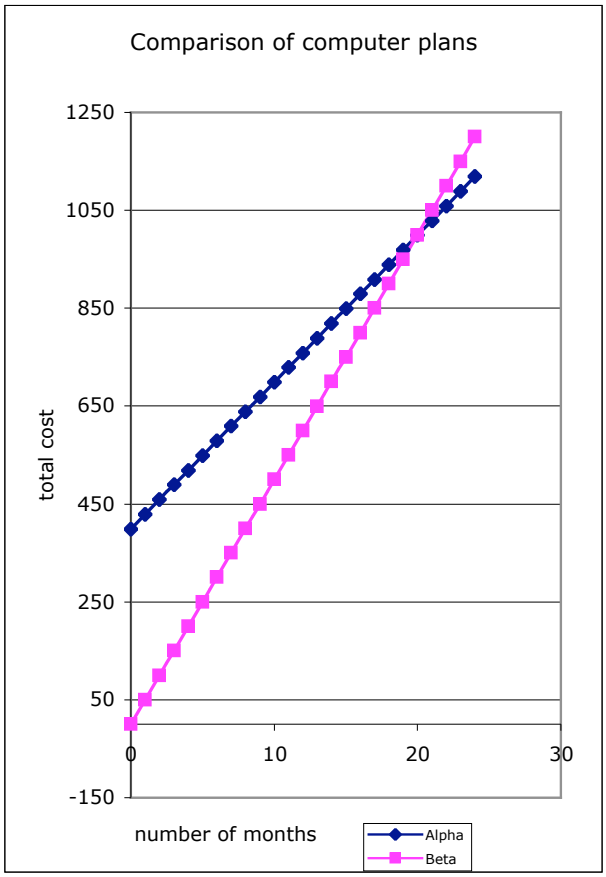
work with column 4 in the table shows that the number of cigarettes per person decreased during this time. Thus, we conclude that smoking is not as popular in 1997 as it was in 1960.

9. $C_1 = 0.15t$
   $C_2 = 4.95 + 0.10\ t$

10. a) $(3.54 \times 10^{21})(8.9 \times 10^{-66}) = (3.54)(8.9) \times 10^{21-66} = 31.51 \times 10^{-45} = 3.151 \times 10^{-44}$.
    b) $(7.9 \times 10^{89}) / (1.33 \times 10^{55}) = (7.9/1.33) \times 10^{89-55} = 5.9 \times 10^{34.}$
    c) $(6.7 \times 10^{73})^{33} = 6.7^{33} \times (10^{73})^{33} = (1.8 \times 10^{27})(10^{2409}) = 1.8 \times 10^{2436}$.

11. a) For computer company Alpha, slope is 29.99 $ per month and initial value is $399. Linear equation is: a = 399 + 29.99m, where a = total cost and m = number of months
b) independent = m (number of months)
dependent = A ($, total cost for Alpha plan)
slope = 29.99 $/month
vertical intercept = $399
c) The domain refers to the set of values for the independent variable (months) that make sense. In this case, it is reasonable to use m between 0 and 60 months, as most computers last about 5 years before being replaced.
d) Beta: slope = 49.99 $/month, but initial value is $0.
i) Equation is b = 49.99m, where b = total cost for Beta plan and m = number of months.
ii) Use Excel to create table and graph:

months	Alpha	Beta
0	399	0
1	428.99	49.99
2	458.98	99.98
3	488.97	149.97
4	518.96	199.96
5	548.95	249.95
6	578.94	299.94
7	608.93	349.93
8	638.92	399.92
9	668.91	449.91
10	698.9	499.9
11	728.89	549.89
12	758.88	599.88
13	788.87	649.87
14	818.86	699.86
15	848.85	749.85
16	878.84	799.84
17	908.83	849.83
18	938.82	899.82
19	968.81	949.81
20	998.8	999.8
21	1028.79	1049.79
22	1058.78	1099.78
23	1088.77	1149.77
24	1118.76	1199.76



e) From the table and the graph, we see that for the first 20 months, Alpha is the cheaper plan. After that, Beta is cheaper. Whether you would use plan Alpha or Beta depends on several factors. With plan Alpha, you own the computer and, after 24 months, could switch to a different (maybe cheaper) internet service. With plan Beta, you may be able to switch to a different plan and upgrade to a different computer after awhile.

12. We know that 1 km = 0.62 miles. Then

$$\frac{58 \text{ miles}}{1 \text{ hour}} \cdot \frac{1 \text{ km}}{0.62 \text{ miles}} = 93.55 \text{ km per hour.}$$

Since there are 60 minutes in 1 hour, the speed is 93.55 km/hour x 1 hr/60 min = 1.55 km per minute.

13. 1 Earth diameter = 2×10^7 meters; 1 hydrogen diameter = 5.29×10^{-11} meters.

Then 1 Earth diameter = 2×10^7 meters x $\frac{1 \text{ hydrogen diameter}}{5.29 \times 10^{-11} \text{ meters}} = 3.8 \times 10^{17}$

14. Diameter of earth is 6.2×10^6 meters, which we round to 10^7. Thus we estimate that the sun's diameter is about 10^{10} meters.

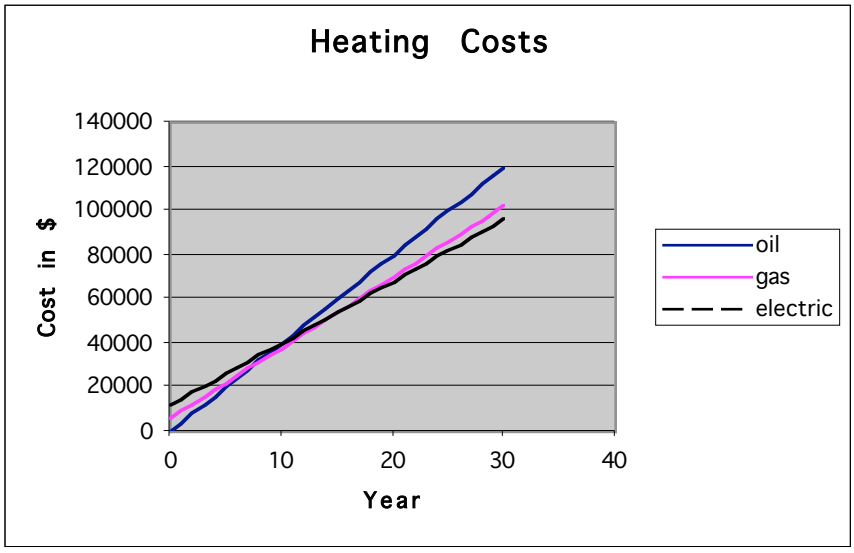
15. The CEO's compensation is 7.85×10^8, which we round to 10^9. The average worker earns about 2.8×10^4, which we round to 10^4. Thus, the CEO's earnings are 5 orders of magnitude higher than the average worker's.

16. 13% of $2.4 \times 10^{12} = 0.312 \times 10^{12}$ or 312 billion dollars.

17. a.

Year	Oil	Gas		Year	Oil	Gas	Electric
0	0	6000	12000	16	64000	57200	56800
1	4000	9200	14800	17	68000	60400	59600
2	8000	12400	17600	18	72000	63600	62400
3	12000	15600	20400	19	76000	66800	65200
4	16000	18800	23200	20	80000	70000	68000
5	**20000**	**22000**	**26000**	21	84000	73200	70800
6	24000	25200	28800	22	88000	76400	73600
7	28000	28400	31600	23	92000	79600	76400
8	32000	31600	34400	24	96000	82800	79200
9	36000	34800	37200	25	100000	86000	82000
10	**40000**	**38000**	**40000**	26	104000	89200	84800
11	44000	41200	42800	27	108000	92400	87600
12	**48000**	**44400**	**45600**	28	112000	95600	90400
13	52000	47600	48400	29	116000	98800	93200
14	56000	50800	51200	30	120000	102000	96000
15	60000	54000	54000				

b.



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c. If she plans to stay in her house 5 years OIL is cheapest.
If she plans to stay in her house 10 years GAS is cheapest.
If she plans to stay in her house 12 years GAS is still cheapest.
But after 15 years ELECTRICITY is cheaper than both gas and oil.