Exam 1 0824.004 Spring 2009
VERSION 1.

Solutions
(PRINT YOUR NAME)

GR1	
GR2	
GR3	
GR4	
Total	

Group 1 Exercises	Point Value	Pts Awarded
1	6	
2	6	
3	6	
4	6	
5	6	
	Total Points Awarded →	

Group 3 Exercises	Point Value	Pts Awarded
1	6	
2	12	
	Total Points Awarded →	

Group 2 Exercises Do any SIX Put an X through the one NOT to be graded	Point Value	Pts Awarded
1	6	
2	6	
3	6	
4	6	
5	6	
6	6	
7	6	
	Total Points Awarded →	

Group 4 Exercises	Point Value	Pts Awarded
1	2	
2	2	
3	2	
4	2	
5	2	
6	2	
7	4	
	Total Points Awarded →	

++

The distance between (x_1, y_1) and (x_2, y_2) is

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}.$$

If a quantity changes from c_1 to c_2, then the percent change equals $\frac{c_2 - c_1}{c_1} \times 100$.

The midpoint of the line segment connecting (x_1, y_1) and (x_2, y_2) is

$$M = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right).$$

If (x_1, y_1) and (x_2, y_2) lie on the graph of f, then the average rate of change from x_1 to x_2 equals

$$\frac{y_2 - y_1}{x_2 - x_1}.$$

Group 1

1. Let **N** = set of natural numbers, **I** =set of integers, **RAT** = set of rational numbers and **IR** = the set of irrational numbers. Next to each of the following statements write the letter code for **all** the sets **N, I, RAT, and IR** containing the numerical value given or described.

(a) The number of ipods sold. N, I, RAT
(b) The value -0.99456 RAT
(c) The value $\sqrt{19}$ IR

2. Find the percent of change if a quantity changes from V_1 to V_2. Round your answer to the nearest tenth of a percent. $V_1 = 1.42$ $V_2 = 0.919$ **(SHOW YOUR WORK!)**

$$\frac{0.919 - 1.42}{1.42} \times 100 = \frac{-0.501}{1.42} \times 100$$

$$\approx -35.28169\ldots$$

Round to -35.3

ANSWER: -35.3%

3. Compute the numerical value of the following expression. Write your answer in scientific notation ~~form~~ rounded to the nearest hundredth.

$$\left(\frac{101+23}{0.42}\right)^2 + \sqrt{0.0034} = \left(\frac{124}{0.42}\right)^2 + \sqrt{0.0034}$$

$$\approx 87165.53286 + .058309\ldots$$

$$\approx 87165.59119 \Rightarrow 8.7165\ldots \times 10^4$$

Round to 8.72×10^4

ANSWER: 8.72×10^4

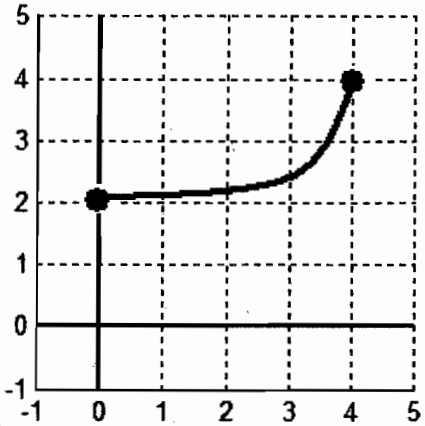
4. Find the mean, median, and range of the following data set. Round each answer to the nearest hundredth. **{-1.25, 4.75, -3.5, 1.5, 2.5, 4.74, 1.5}**

1.4629

$4.75 - (-3.5)$

Mean = 1.46 **Median =** 1.5 **Range =** 8.25

5. For the points indicated by solid dots shown on the graph find the **equation** of the line between them, the **length** of the line segment between them, and the **midpoint** of the line segment between. (Express the length and midpoint coordinates to the nearest tenth.)



Pts
(0,2) (4,4)

Slope $= \frac{4-2}{4-0} = \frac{1}{2}$

$b = 2$

Equation: $y = \frac{1}{2}x + 2$

Length $= \sqrt{(0-4)^2 + (2-4)^2} = \sqrt{16+4} = \sqrt{20}$

$\approx 4.472\ldots$

Round to 4.5

Length = 4.5

Midpoint = (2, 3)

Group 2 (In this group you are to do any SIX of the SEVEN exercises. Put a large X through the one NOT TO BE GRADED.

1. In 1980 there were 330 thousand inmates in state and federal prisons and in1983 there were 435 thousand. For this problem lets us adopt the convention that 1980 is "year zero" and 1983 is "year 3". **(SHOW YOUR WORK!)** The wording here changed slightly

(a) Find the rate of change in the number of inmates from "year zero" to "year 3". ~~(The answer is to have units thousands of inmates per year.)~~

x	0	3
y	330	435

$$\frac{\Delta y}{\Delta x} = \frac{435-330}{3} = \frac{105}{3} = 35$$

Rate of change of inmates = 35 per year (really 35 thousand)

(b) Predict the number of inmates for 1986, "year 6".

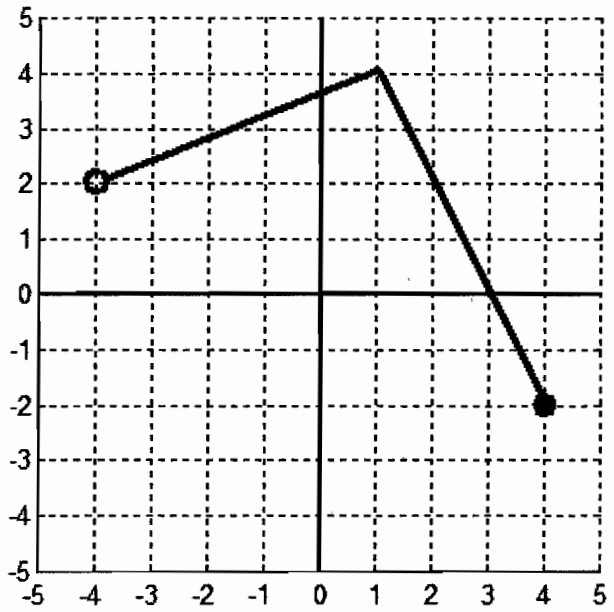
One way: Use line $y = 35x + 330$ → set $x = 6 \Rightarrow y = 210 + 330 = 540$

Estimate of inmates in 1986 = 540 thousand

2. Determine the domain of the function $f(x) = \frac{x}{x^2 - 1}$. (Give your answer in interval notation or in sentence form.)

Domain = All (real) numbers except ± 1 or $(-\infty, -1) \cup (1, +\infty)$

3. Determine the domain and range for the function shown in the figure. (Give your answers in interval notation or in sentence form.)



Domain = (-4, 4] (must get parens & sq. bracket correct)

Range = [-3, 4] ↓ dittos

4. For each table determine if the data is linear or nonlinear. Circle the appropriate response. If the data is linear compute the slope of the linear function that would be an exact model for the data.

x	0	5	10	15	20
y	−4	−2	0	2	4

(Linear Data) **Nonlinear Data**

If linear, slope = 2/5

x	0	1	3	6	10
y	3	6	9	12	15

Linear Data **(Nonlinear Data)**

If linear, slope = _____

5. Determine the average rate of change of $f(x) = x^2 - 2x$ over the interval from $x = -1$ to $x = 2$.
(SHOW YOUR WORK!)

x	-1	2
y	3	0

$f(-1) = 1+2 = 3$

$f(2) = 0$

$$\frac{\Delta y}{\Delta x} = \frac{3-0}{-1-2} = -1$$

Average rate of change = −1

6. Develop a linear equation model for the **speed of the car** in the following situation.

A car's speed is initially 50 mph, and then it begins to slow down at a constant rate of 10 mph each second. (Let **s** represent the speed of the car and **t** represent the time in seconds.)

$b = 50$ $\quad m = -10$

$$s = -10t + 50$$

Linear model: or $y = -10x + 50$

7. ~~Determine which of the following equations represents a function where y is to be a function of x.~~
Circle the appropriate choice for each part

(a) $y = x^2$ **(y is a function of x)** y is NOT a function of x

(b) $\sqrt{x-2} = y$ **(y is a function of x)** y is NOT a function of x

(c) $y^2 = 1+2x$ y is a function of x **(y is NOT a function of x)**

Group 3

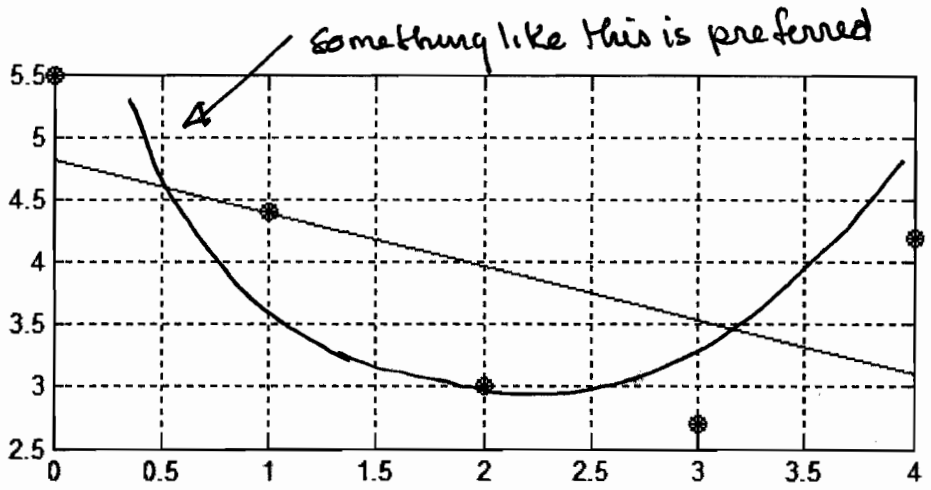
1. The following table shows the percentage of a three-person American family's weekly income spent on gasoline for the year indicated. For ease in labeling the graph we have set 1996 to be the "zero year", 1976 to be "year 1", etc.

Year	1966	1976	1986	1996	2006
x = "years as integers"	0	1	2	3	4
y = %spent on gasoline	5.5	4.4	3.0	2.7	4.2

The accompanying graph shows points (x, y) and the line of best fit.

Many people would say that the line of best fit is not a good model.

(a) On the graph draw a continuous nonlinear graph that would seem to be a better model.



(b) Give a reason that you think your graph is a better model. Data is nonlinear.
OR my graph seems to follow the trend of the data better.

2. Construct the line of best fit to the data set in the table.

x	1	2	3	5
y	2	8	6	4

Show your work!

x	y	xy	x^2
S_x= 11	S_y= 20	S_{xy}= 56	S_{xx}= 39

n = the number of points = 4

(S_{xy}) = sum of products = $x_1y_1 + x_2y_2 + x_3y_3 + \ldots + x_ny_1$

(S_x) = sum of x – values = $x_1 + x_2 + x_3 + \ldots + x_n$

(S_y) = sum of y – values = $y_1 + y_2 + y_3 + \ldots + y_n$

(S_{xx}) = sum of squares of x – values = $x_1^2 + x_2^2 + x_3^2 \cdot$

m = 0.11429

b = 4.6857

Give your values for m and b to nearest hundredth.

$$\text{slope} = m = \frac{n(S_{xy}) - (S_x)(S_y)}{n(S_{xx}) - (S_x)^2}$$

$$y\text{-intercept} = b = \frac{(S_y) - m(S_x)}{n}$$

Line of best fit equation: $y = 0.11x + 4.69$

Group 4

TRUE/FALSE Print the appropriate response on the line provided.

TRUE 1. If linear function y = mx + b has m = $\frac{2}{3}$ and point A(1, 2) is on its graph, then point B(4, 4) is also on the graph.

$y = \frac{2}{3}x + b$

$2 = \frac{2}{3} + b$

$\frac{4}{3} = b$

$\Rightarrow y = \frac{2}{3}x + \frac{4}{3}$

$y = \frac{2}{3}(4) + \frac{4}{3} = \frac{12}{3} = 4$

FALSE 2. Every line is a function.

TRUE 3. Relation {(-2, 6), (4, 0), (5, 0), (3, 1)} is a function.

FALSE 4. If the correlation coefficient associated with a data set is -0.92, then the line of best is increasing.

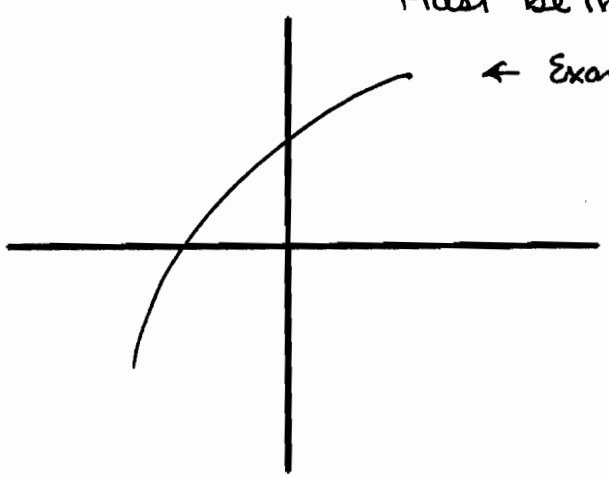
FALSE 5. Let n be any natural number, then $\sqrt{n}$ is an irrational number.

++

6. Sketch the graph of a nonlinear function y = f(x) that has only positive average rate of change.

Lots of answers. Must be increasing curve.

← Example



7. Functions **y = f(x) = mx + b** and **y = g(x) = sx + a** are both linear functions that have the same average rate of change, but their graphs are not identical.

What is the same in the two equations? Slope (m = s)

What is different in the two equations? y-intercepts (b ≠ a)