

Data Analysis and Assessment

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MATH 5961 – Assessment of Instruction

1) What are you attempting to change or improve?

We are introducing several new statistical concepts and exploration activities in order to improve students understanding of the data collection, analysis, and interpretation process.

2) What actual changes are you making?

We are changing our instruction to include data analysis through a variety of exploration activities. We are also conducting pre- and post- tests to assess individual student growth and determine instructional effectiveness.

3) What effect should these changes have?

Students should become actively involved in the learning process and increase their knowledge of data collection, analysis, and interpretation.

4) Formulate hypotheses – null and alternative

H_{01} : The instruction resulted in no increase in individual student growth in understanding data analysis terminology and concepts.

H_{a1} : The instruction resulted in an increase in individual student growth in understanding data analysis terminology and concepts.

H_{02} : There will be no difference in mean results from class to class.

H_{a2} : There will be a difference in mean results from class to class.

5) Experimental design for collecting data

Paired pre- and post-test data will be collected from each student in each course. Students who are missing all or part of the test data will be excluded. A paired-data t-test will be conducted on the data to

measure individual student growth in understanding data analysis terminology and concepts.

A two-sample t-test will also be conducted to compare class mean data.

Cooperation is essential among participating instructors, as is the willingness to compare and share both data and techniques.

6) Data is collected, reviewed for problems and documented

7) Data analysis - statistical tools you will use to analyze your data:

i) Graphical tools: Bar graph, Histogram, Box plot, time plot, ...

ii) Statistical tools: mean, median, paired-data t-test, two-sample t-test, ...

8) Statistical results and statements of conclusions

9) Interpretation in the appropriate context

10) Action and dissemination

i) Local – students, administrators, parents, community

ii) State – conferences

iii) National – conferences and journals

MATH 5961 - Data Analysis

Capstone Assessment:

Pre/Post Test on Data Analysis Terminology and Concepts

Activity: Glyphs

Standard: Students use mathematical models to represent and understand quantitative relationships.

Description: Students will construct glyphs of themselves representing personal data as outlined in the key as provided by the instructor. Working in groups of two, students will match the glyphs to the appropriate student. Each student will then introduce their group partner. (Refer to MATH 5961 - Glyphs.)

Topics: Data Collection, Representation, and Interpretation

Technology: Paper/Pencil

Assessment: Class Introductions/Presentations

Activity: Grade Analysis

Standard: Students select and use appropriate statistical methods to analyze data.

Description: Students take the “Four-Minute, Divisible-by-Nine” Pre-Test. Afterwards, an educational intervention is provided on the technique of simply adding the digits. Students then re-take the “Four-Minute, Divisible-by-Nine” Test. (Refer to MATH 5961 - Divisibility Exam I.) The tests are then corrected.

Discuss how you might determine the “Grade” assigned to each student. Demonstrate the various methods and calculations to find central tendency.

Topics: Data Collection, Mean, Median, Mode, Min, Max, Q1, Q2, Scatter Plots, Box Plots, IQR, Standard Deviation

Technology: Paper/Pencil, Graphing Calculator, Excel, Statistical Software

Assessment: Classroom Discussion

Activity: Raisin Count

Standard: Students develop and evaluate inferences and predictions that are based on data.

Description: Students collect data on the number of raisins found in a one-half ounce box of raisins and compute the various measures of central tendency. (Refer to MATH 5961 - Raisin Experiment.)

Topics: Data Collection, Mean, Median, Mode, Min, Max, Q1, Q2, Scatter Plots, Box Plots, IQR, Standard Deviation

Technology: Paper/Pencil, Graphing Calculator, Excel, Statistical Software

Assessment: Group Presentation

Activity: Closed-Eye, One-Foot Balance

Standard: Students select and use appropriate statistical methods to analyze data.

Description: Students perform the closed-eye, one-foot balance experiment, collect data, and compute the various measures of central tendency. (Refer to MATH 5961 - Collecting Data on Balancing.)

Topics: Data Collection, Mean, Median, Mode, Min, Max, Q1, Q2, Scatter Plots, Box Plots, IQR, Standard Deviation

Technology: Paper/Pencil, Graphing Calculator, Excel, Statistical Software

Assessment: Group Presentation

Activity: Marbleous Rolls

Standards: Students select and use appropriate statistical methods to analyze data. Students develop and evaluate inferences and predictions that are based on data.

Description: Students conduct the Marbleous Rolls experiment, collect data, and compute the various measures of central tendency. Students then interpret the data collected and make a prediction based on that data. (Refer to MATH 5961 - Marbleous Rolls.)

Topics: Data Collection, Mean, Median, Mode, Min, Max, Q1, Q2, Scatter Plots, Box Plots, IQR, Standard Deviation

Technology: Paper/Pencil, Graphing Calculator, Excel, Statistical Software

Assessment: Group Presentation

Activity: Auto Depreciation Analysis and Slope

Standard: Students develop and evaluate inferences and predictions that are based on data.

Description: Students will be given the price of 17 used Toyota Corollas. In groups of three or four they will do a scatter plot of this data, plotting age of the car versus the sale price. They should see that there is a strong linear correlation and should find the line of best fit.

The data starts with the newest used car being a 2003 model. They should extend their best fit line to the year 2008 and predict the value of a corolla for a 2007 and a 2008 car. They should also estimate the value of a 1996, since there was no car from that year in our data. The instructor will provide them with the price the dealer recently gave for these years. The student should check their prediction against the actual price and answer some questions as to why there is a difference, and what else affects the price besides age of the auto. The student can also go on the internet to sites such as CarSoup.Com to get more data or check on other prices.

Topics: Scatter Plots, Linear Correlation, Slope, Line of Best Fit

Technology: Pencil/Paper, Graphing Calculator, Excel, Statistical Software

Assessment: Pre/Post Test, Class Presentation

Activity: Gas Mileage Analysis (Extra Credit)

Standard: Students use mathematical models to represent and understand quantitative relationships.

Description: Students will do a project lasting most of the semester. This will be given out during this unit and lasting at least seven weeks. Each student will record their car's mileage when filling up their tank. Each time the student fills the tank they need to record the mileage and how many gallons they purchased. After seven times they should calculate the miles per gallon and find the mean, median, standard deviation, and create a box plot.

Topics: Data Collection, Mean, Median, Mode, Min, Max, Q1, Q2, Scatterplots, Boxplots, IQR, Standard Deviation

Technology: Paper/Pencil, Graphing Calculator, Excel, Statistical Software

Assessment: Group Presentation

Lesson Plans: Linear Equations

Pre-Assessment

The class will **FIRST** take a short 10 minute Pre-Test on the following material:

1. Given a set of points on a graph, find the related ordered pairs.
2. Graph set of points on the co-ordinate Axis given the ordered pairs.
3. Given a set of points that follow a linear path, graph the points, and use a straight edge to draw a line thru the points.
4. Given a set of points that are close to being linear but are not, and discuss the best fit line.
5. Given an equation of a line, graph the line using 4 points.
6. Discuss intercepts and graphing lines from an equation using that method. Discuss the following special cases:
 - a) when the line goes thru the origin.
 - b) vertical and horizontal lines.
7. Discuss slope and finding the slope given 2 points.
8. Find the equation of a line given
 - a) the slope and the y-intercept
 - b) the slope and any point the falls on the line
 - c) at least 2 points on the line
 - d) again discuss special cases horizontal ,vertical, and lines through the origin.
9. Given and equation of a line find the slope and y-intercept, and graph the line.
10. Do the Investigation “Depreciation of a car”.

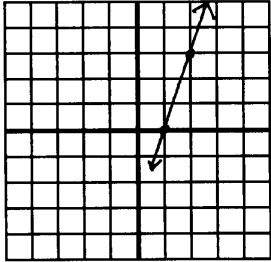
Post –Assessment

FINALLY the class will take a Post-Test, exactly the same as the Pre-Test.

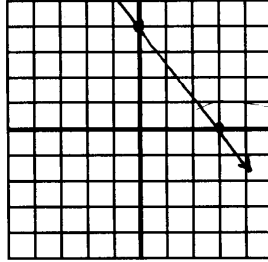
Name: _____

Pre-Test Linear Equations (Straight Lines)

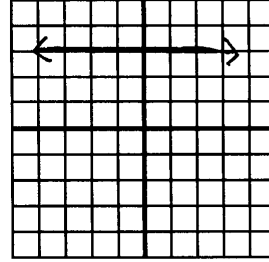
1. Find the slope of each of the following lines:



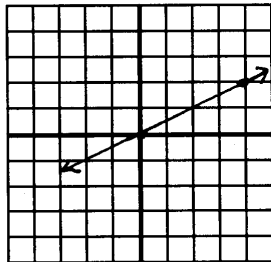
a) slope = _____



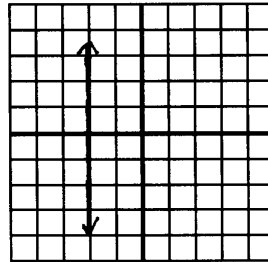
b) slope = _____



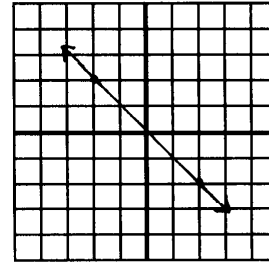
c) slope = _____



d) slope = _____

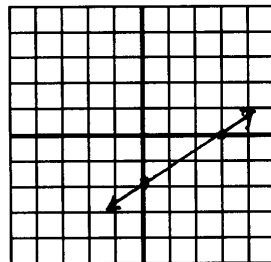


e) slope = _____



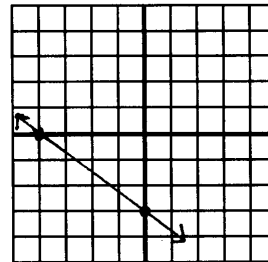
f) slope = _____

2. Every line has an equation. What is the equation for each of the following 2 lines?



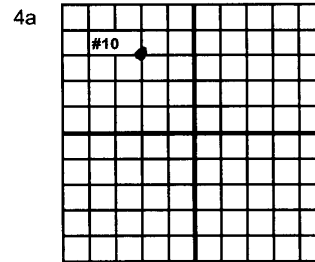
Circle the correct equation

- a) $y = 3x + 2$
- b) $y = -2x + 3$
- c) $y = \frac{2}{3}x - 2$
- d) $y = \frac{3}{2}x - 2$



Circle the correct equation

- a) $y = -4x - 3$
- b) $y = -\frac{3}{4}x - 3$
- c) $y = \frac{4}{3}x - 3$
- d) $y = -\frac{4}{3}x - 3$



3. Find the equation of the line given the slope $\frac{2}{3}$ and the point on the line $(3, -4)$.

$y =$ _____

4. From graph #4a above, give the ordered pair for the point labeled #10. (____, ____)

5. On graph #4a, plot the point $(4, -2)$ and label it #11.