Probability & Statistics Lesson Plan Math 693
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Algebra Can Be A Real Handful

Time: 90 minute block
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OPTIONS:
If you only have 45 minutes of class,

- Algebra 2 should be able to complete steps 1 – 12 in a class.
- Algebra 1, and Applied Math 2 should be able to complete steps 1 – 7 in a class.
- Applied Math 1 students may need to do Clean Graph activity first.

INFORMATION:
Activity 2: A Handful of DATA using graphing calculators can be **completed in pairs** if you do not have a classroom set OR you could contact Texas Instrument and request to borrow a classroom set for the week and do several activities.
If your students are inexperienced graphing calculator users, you will need to give them a copy of the DETAILS as well as Activity 1 and 2.

Related Web Sites:

Extensions: These extensions would be good for integration activities
http://members.optushome.com.au/fmetrol/geom/handwidth.html
This site discusses how hand size relates to the Fibonacci sequence.
http://biometrics.cse.msu.edu/hand_geometry.html
Using hand Geometry as a biometric identification device is discussed at this site.

Additional Probability and Statistics Activities:

http://reinvent.k12.wv.us/
Enter as guest. Choose "Best Practices". Choose ***Mathematics*** as the course; good activities would be ***"Populations***" and ***"Probability and Genetics".*** If you choose ***Science***, "***CLEAN Graphing"*** is recommended resource.

http://home.moravian.edu/public/math/Course_Information/TI-83_Materials/linreg/linreg.html
This site provides directions for fitting a line to (almost) linear data. You will want to use this site with students who are good readers.

http://www.kuleuven.ac.be/ucs/java/
Java applets for visualization of statistical concepts are provided at this site. You will want to peruse the site to find the applet that best suits your class needs.

Previous knowledge required:

How to use a ruler to measure to the nearest tenth of a centimeter
How to set-up a scatter plot on paper (**see CLEAN Graphing resource**)

Materials:

Centimeter cubes (or other counting manipulatives you have available)
Centimeter rulers
Pencil
Paper
Graphing calculators
TI Presenter
Graphing paper
Recording sheets (below)
Worksheet (below)

Instructional Goals and Objectives:

Applied Math I IGO's

AM1.1 use a scientific calculator to perform the basic operations of whole numbers, fractions, and decimals

AM1.4 distinguish between counting and measuring using precision tools to make measurements

AM1.11 $_{9,10,11}$ collect**, organize, and interpret data using graphs, charts, and tables**

AM1.15 use appropriate software to practice and master Applied Mathematics I instructional objectives

AM1.18 use a spreadsheet to solve linear equations

Applied Math II IGO's

AM2.6 $_{9,10,11}$ analyze a given set of data for the existence of a pattern, represent the pattern algebraically and graphically, determine the domain and range, and determine if the relation is a function

AM2.10 $_{9,10,11}$ **collect, organize, interpret data, and predict outcomes using the mean, mode, median, range, and standard deviation**

AM2.11 $_{9,10,11}$ **predict the outcomes of simple events using the rules of probability**

AM2.12 load and use single spreadsheet template to solve practical problems

AM2.13 $_{9,10,11}$ **use process charts and histograms, run charts, scatter diagrams, and normal distribution curves in order to perform statistical process (quality) control**

AM2.18 use graphing software to create graphs, charts, histograms, and tables of given data; to find frequency distribution and standard deviation (AM2.10)

AM2.19 use graphing software to create process charts and histograms, run charts, scatter diagrams, and distribution curves (AM2.13)

AM2.20 use spreadsheet software to solve given problems. (AM2.12)

Algebra I IGO's

AI.6 9,10,11 **analyze a given set of data for the existence of a pattern, represent the pattern algebraically and graphically, determine the domain and range, and determine if the relation is a function**

Algebra II IGO's

A2.2 9,10,11 **continue to review the concept of slope of a line, write equations of lines given various information, and graph linear equations. Graphing calculators will be used as a teaching aid**

A2.15 solve problems involving direct, inverse, and joint variation. Applications to practical problems will be investigated

A2.19 9,10,11 **solve problems using non-routine strategies**

A2.20 use appropriate software to practice and master Algebra II instructional objectives

A2.21 use graphing software to explore, analyze, and display algebraic relationships

A2.22 use a graphing calculator to graph linear equations (A2.2 and A2.9)

A2.25 use a graphing calculator to investigate functions (A2.12)

Name _____

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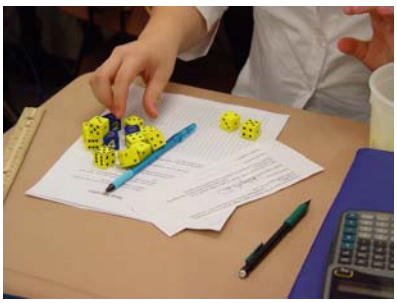
ACTIVITY 1: Algebra by HAND

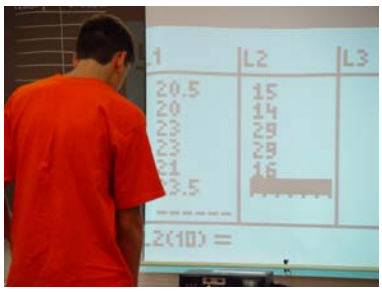
With this activity you will collect some data about yourself, contribute it to a set of class data, and use it to construct a scatter plot graph to analyze the results.

Step 1: Using a centimeter ruler, measure your hand span (stretch out your hand and measure from the tip of your thumb to the tip of your pinky) to the nearest 0.1 cm.
Record your hand span: _____ cm

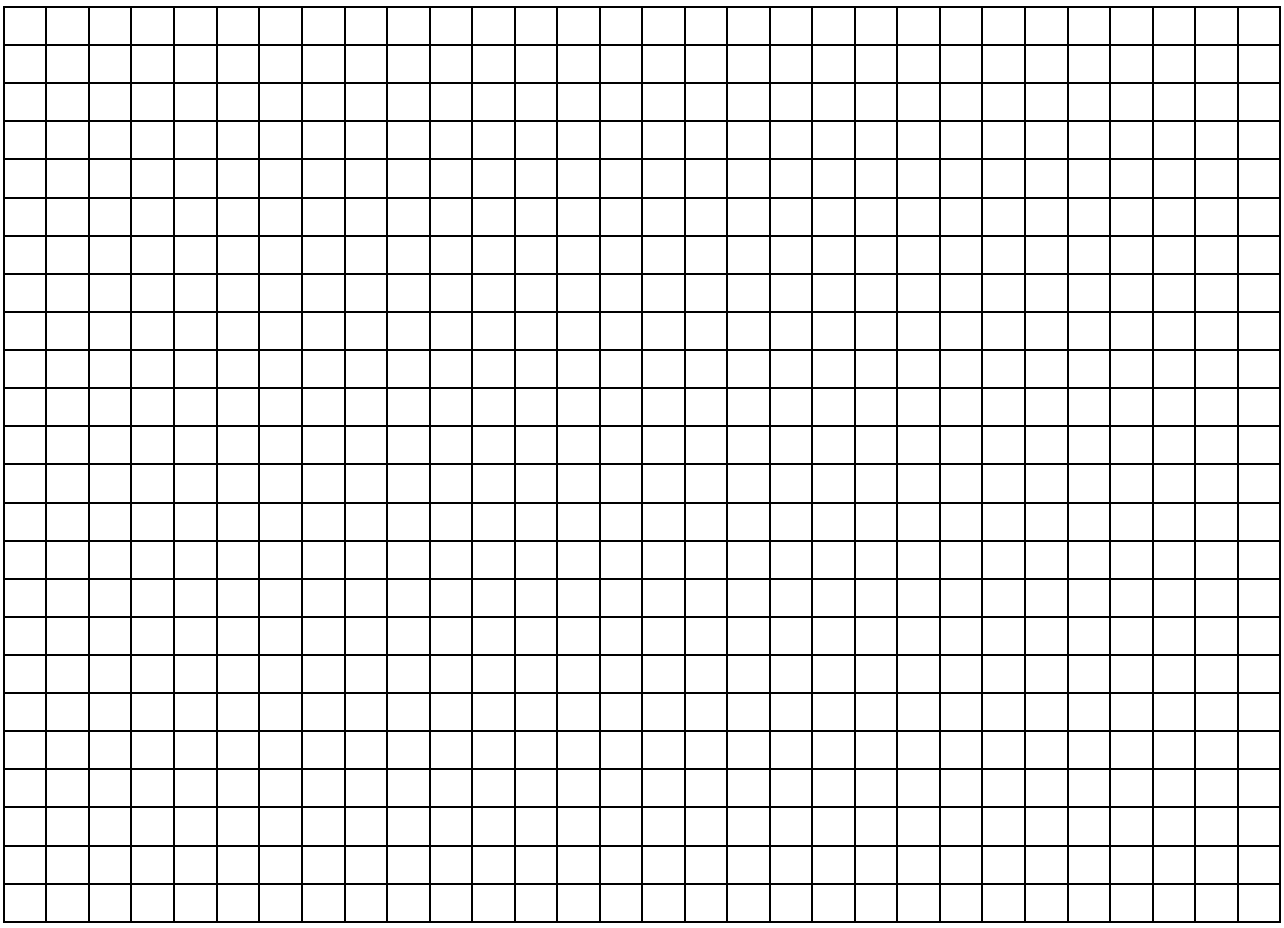
Step 2: Place your hand into the container with the counters, grasp as many as you can. Pull them out of the container and count them. Record your results.
Number of counters _____



Step 3: Submit your responses for steps 1 and 2 to your teacher for class compilation.



Step 4: Using the hand span for the x-axis and number of counters for the y-axis, graph the class results on the graph on the next page.



Step 5: *Answer the following questions concerning the above graph.*

a) Do you see a correlation ? _____ If so, describe it.

b) If a hand span were 18.2 cm, how many counters would you expect to be picked up? _____

c) If 40 counters are picked up, what would you expect the hand span to be?_____

Step 6: Use the ruler to draw a line that best-fits the data points; remember, all the points will NOT be included in this line.

Step 7: *Choose two points* on the line you drew. Determine the slope of your line and an equation for the line. Write the line equation in the format of y=ax+b.

Slope: _____ y-intercept: _____ Line equation: _____

This workspace is for you to show how you arrived at the above answers.

Activity 2: A Handful of DATA using graphing calculators

Step 8: Using the graphing calculator, enter your data. Put the data for hand span in L1 and the data for the number of counters in L2.

Step 9: Plot your data from L1 and L2 on a scatter plot.

Step 10: Put the equation for your line in Y1 and graph it on the scatter plot.

Step 11: Use the graphing calculator to determine a "best fit" line. Store it in Y2 and graph it also.

Step 12: Determine the accuracy of your line using the formula:

SqRt [(actual slope – your slope)/number of data points]

DETAILS For ACTIVITY 2

Step 8:

- Press [STAT]
- The menu will say: EDIT CALC TESTS
- You want to edit the current list so press [ENTER]
- You should now see L1 L2 L3
- If there is presently data in either L1 or L2, you will need to clear it. Cursor up to highlight L1, press [CLEAR] then [ENTER] to clear the list
- Repeat to clear L2
- Enter each piece of data – hand span in L1 and corresponding counters in L2.

Step 9:

- You need to plot the data points on a graph so press [2^{nd}][y=], which is STAT PLOT
- Press [ENTER]
- You need to turn the plot on so press [ENTER]
- Cursor down and choose the scatter plot – press [ENTER]
- X list should be L1, if the calculator has a different list, press [2^{nd}][⇑], which will tell the calculator that you want the values in L1 to be your x coordinates.
- Y list should be L2, find L2 on the calculator
- Change the mark if you wish, press [GRAPH]
- If you do not see your points, then your window settings (max, min, and increments on the x and y axes) are incorrect.
- Press [WINDOW]
- Look at your data do the hand span lengths fall within the x min and max?
- Change them
  - Repeat for the y values
  - Check by pressing [GRAPH]
  - Repeat until you can see all of your data points

Step 10:

- Press [y =], enter your ax + b from step 7, [GRAPH]

Step 11:

- For the calculator to find the "best – fit" line, you need to know this line is also called the regression line.
- Press [STAT], you will see EDIT CALC TESTS
- Choose [CALC] and 4[LinReg (ax +b)] this is short for Linear Regression
- The calculator will now show a screen that says LinReg (ax +b)
- Press [VARS], you will see VARS Y-VARS, choose [Y – VARS]
- You need the Function command so just press [ENTER]
- Cursor DOWN to 2:Y_2 [ENTER] , you will see LinReg (ax +b) Y_2 on your screen [ENTER]
- You will now see the value of a and b in the equation ax+b, write down these values for later, press [GRAPH]

Step 12:

- **To put the formula in your calculator, you need to use the square root or [2^{nd}] [x^2]**
- **Now you need the actual slope, which is the value of a in the calculator**
- **You will also need the slope you found in step 7 and the number of data points (the number of students who measured their handspan and counters)**
- **Press the following [2^{nd}] [x^2](The value of "a" you copied down in step 11 - the slope you wrote down for your slope in step 7) ÷ (the number of students who measured their handspan and counters)**