Skymath Scoring Profile Sheet

Rainfall Task

NCTM Standards

1. Mathematics as Problem Solving
2. Mathematics as Communication
3. Mathematics as Reasoning
4. Mathematical Connections
5. Number and Number Relations
7. Computation and Estimation
10. Statistics
13. Measurement

Essential Requirements of the Task

- Interpret data in tabular form
- Translate tabular data to alternative graphical representation
- Make inferences and conjectures based on an analysis of the data

Potential Elements of Students Responses

- Determines scales and intervals for the graph of rainfall data (eg. line, bar, coordinate) and plots data points
- Calculates rainfall for each season by adding the corresponding monthly rainfall amounts from the table or graph and compares seasons' totals (winter is the wettest season with 6.4 inches of rain)
- Reads the graph to infer the rainfall for October (about 1.6 inches)
- Looks for the steepest line segment connecting two data points or compares the differences between monthly rainfall amounts to determine the greatest change in rainfall (it occurs between June and July)

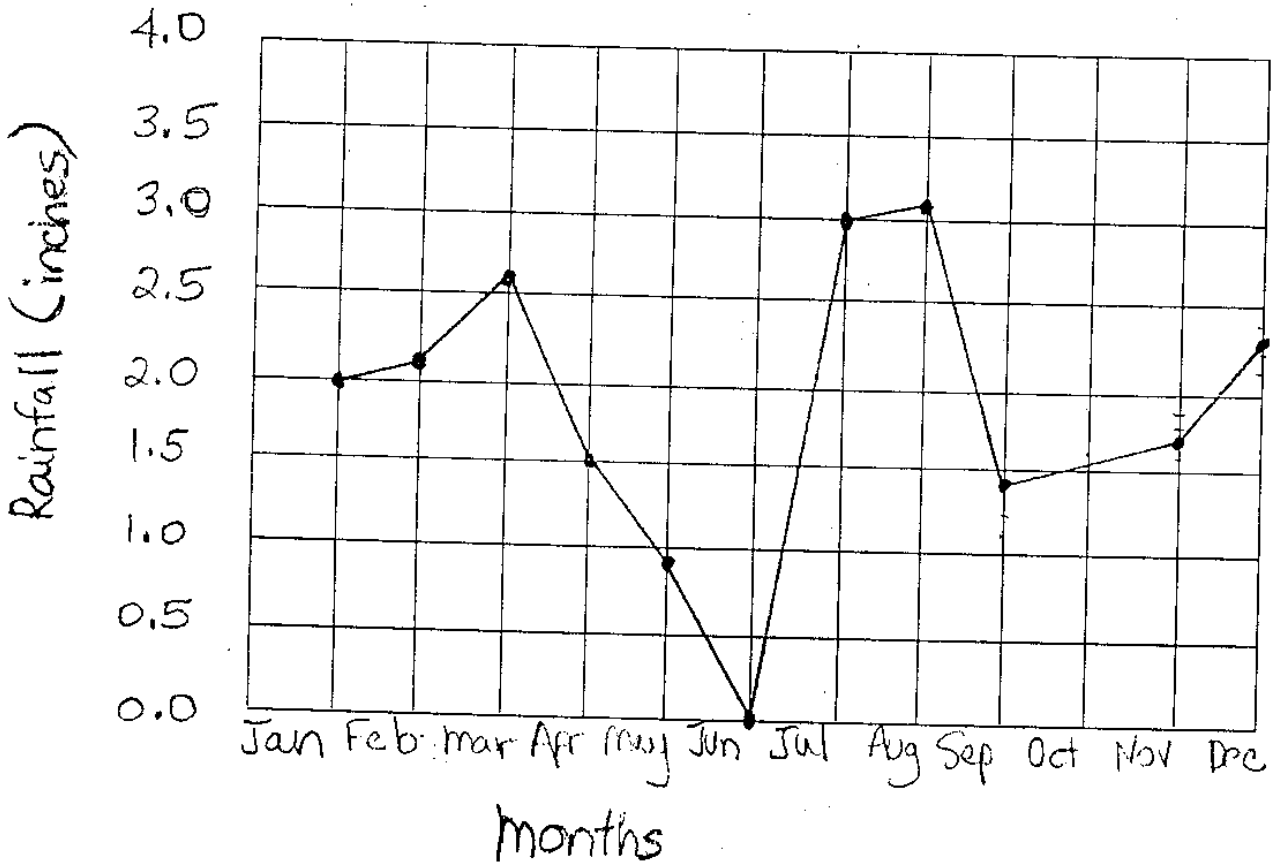
Major Flaws

- Incorrectly plotted data as the result of a systematic error
- Inappropriate scales and intervals (eg. intervals are not the same size or scale values are not in ascending order)
- Computations are based on non-related numbers and / or operations

Minor Flaws

- Calculation errors which don't conflict with the logic of the problem (eg. the rainfall data for a particular month is misread from the table but is used appropriately in calculation to the determine the wettest season)
- Elements of the graph are missing labels (eg. inches is not included in the label of the vertical axis or scale)

FLAGSTAFF


Rainfall (inches)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Months

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Bear Task

NCTM Standards

1. Mathematics as Problem Solving
2. Mathematics as Communication
3. Mathematics as Reasoning
4. Mathematical Connections
5. Number and Number Relations
7. Computation and Estimation
10. Statistics
13. Measurement

Essential Requirements of the Task

- Organize data
- Describe data using written statements
- Represent data using summary statistics
- Compare measurements

Potential Elements of Student Responses

- Makes a table or graph in which weights are rank-ordered (ascending or descending order) by bear type (and possibly by gender within each bear type)
- Selects one of the measures of central tendency (most likely the mean, possibly the median) to represent the typical or average weight for each type of bear; the mean grizzly bear weight is 227.5 lbs. and the mean black bear weight is 182 lbs.)
- Calculates the difference between these typical or average weights (the typical grizzly bear is 45.5 lbs. heavier than the typical black bear)
- Provides an explanation of the solution process

Major Flaws

- Data is not systematically organized in a way that informs the solution of this problem
- Descriptions are based on an inaccurate interpretation of the data or are irrelevant to the problem (eg. "there are more grizzly bears than black bears" is the response to a question about the weight of the bears)
- It is concluded that one type of bear is heavier, say the grizzly, but no explanation or an inadequate explanation is given for the solution process (eg. the typical bear weights or the difference in typical bear weights are not calculated)
- Decisions are made on the basis of a comparison of weight totals instead of using a measure of central tendency

Minor Flaws

- Calculation errors which don't conflict with the logic of the problem (eg. an arithmetic error results in a larger black bear average weight than grizzly bear average weight, or data organization results in some miscopied bear weights which affect subsequent calculations)

- The explanation provided does not contain explicit references to measures of central tendency, although an understanding of them is implied

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Temperature Task - Part 1

NCTM Standards

1. Mathematics as Problem Solving
2. Mathematics as Communication
3. Mathematics as Reasoning
4. Mathematical Connections
5. Number and Number Relations
7. Computation and Estimation
10. Statistics
13. Measurement

Essential Requirements of the Task

- Calculate summary statistics (maximum, minimum, mean, median, mode) for the data
- Determine which measure of central tendency best represents this set of data
- Make an argument based on data analysis that supports this decision
- Make inferences regarding the causes of variation in the data

Potential Elements of Student Responses

- Identifies the maximum temperature (125 degrees Fahrenheit), minimum temperature (62), and calculates the range (63)
- Calculates the mean (72 degrees Fahrenheit), median (66 degrees), mode (62 degrees) using the standard algorithms
- Justifies the best measure of central tendency for this set of temperature data (probably the median); makes the case for one measure or rules out one or more of the other measures (eg. argues that the mean and mode do not best represent this data because the mean temperature is higher than all but one of the recorded temperatures, and the mode is lower than all but a couple of the temperatures)
- Provides an explanation of temperature variation which contains references to different temperatures in places in the classroom where large variations may be expected (eg. the window, heating vent, etc.)

Major Flaws

- Incorrectly identifies maximum, minimum temperatures and range
- Calculations of the mean, median or mode are based on algorithms which do not match the definitions of these measures (eg. scores are not rank-ordered to determine the median, or the mode is obtained by computing the sum of the recorded temperatures)
- Solution does not properly distinguish among measures of central tendency (eg. the mode is confused with the median)
- Argument supporting choice of temperature which typifies the data set is not provided or does not use measures of central tendency in data analysis
- No explanation of the variation in temperatures or an explanation which is unclear or irrelevant to the problem is provided (eg. the explanation consists solely of the computed range)

Minor Flaws

- Computation errors which don't conflict with the logic of the problem (eg. in determining the mean, a mistake is made in calculating the sum of the recorded temperatures)
- Explanations or arguments are nearly complete (eg. explanation of temperature variation does not account for temperatures throughout the reported range)

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Temperature Tasks - Part 2

NCTM Standards

1. Mathematics as Problem Solving
2. Mathematics as Communication
3. Mathematics as Reasoning
4. Mathematical Connections
5. Number and Number Relations
7. Computation and Estimation
10. Statistics
13. Measurement

Essential Requirements of the Task

- Read and interpret tabular data
- Describe and justify appropriate methods for finding the typical measure - the measure which best represents the data - in a given situation
- Account for the effects of sample size and variability on measures of central tendency
- Determine a method for sampling temperature data in order to determine the typical temperature for a certain location

Potential Elements of Student Responses

- Describes methods for finding the average or typical temperature in the classroom and school which incorporate measures of central tendency (mean, median, mode); the mean temperature of 55.4 degrees Fahrenheit will be determined to be the typical classroom temperature when the maximum / minimum data are used
- Makes a case for methods adopted which is based on
    * an analysis of the temperature data provided (eg. a good case can be made that maximum / minimum data is insufficient for determining the typical temperature)
    * the effects of sample size (eg. this is reflected in the number of thermometers needed to collect additional temperature data)
    * the variation in temperatures (eg. placement of thermometers in places where considerable temperature variation is expected - cafeteria, hallways, gym, classrooms on different floors facing different directions, etc.)
- Describes procedures for the systematic collection of temperature data (eg. record temperatures hourly on school days for one week, don't touch the thermometer while reading the temperature, etc.)

Major Flaws

- An inappropriate temperature is provided and the procedure by which it was determined is unclear or undocumented (eg. no work is shown and the solution is not one of the measures of central tendency)

- Fails to account for the effects of sample size or variation on the typical temperature (eg. to determine the school temperature, a few thermometers are placed in settings where the variation is minimal)

Minor Flaws

- Computation errors which don't affect the logic of the problem (eg. an incorrect value for the mean is the result of an arithmetic error)
- Explanations of the solution process are nearly complete (eg. the list of locations for thermometer placements is reasonable but falls short of being comprehensive)