

Graphing Key Chains

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Standard 1: Number and Operations (MA.S.1)

Students will:

- demonstrate understanding of numbers, ways of representing numbers, and relationships among numbers and number systems;

AGP.1.3 use order relations to compare, order, or locate whole numbers, integers, fractions, and decimals on a number line.

Standard 2: Algebra (MA.S.2)

Students will:

- demonstrate understanding of patterns, relations, and functions;
- represent and analyze mathematical situations and structures using algebraic symbols;
- use mathematical models to represent and understand quantitative relationships; and
- analyze change in various contexts through communication, representation, reasoning and proof, problem solving, and making connections within and beyond the field of mathematics.

AM1.2.1 solve practical problems involving computation using estimation.

AM1.2.3 distinguish between counting and measuring using micrometers, calipers and other precision tools to make measurements.

Performance Descriptors (MA.PD.A1.2)

■ Distinguished

The student demonstrates exceptional and exemplary performance with distinctive and sophisticated application of knowledge and skills that exceeds the standard in **Algebra I**. The student solves literal and linear equations to interpret solutions of complex, practical application problems. The student justifies and judges the reasonableness of real number solutions given in both exact and approximate forms in a clear concise manner. The student predicts and interprets outcomes of collected data based on measures of central tendency and dispersion, constructed graphs, and simple events using rules of probability summarizing results in a clear concise manner.

■ Above Mastery

The student demonstrates competent and proficient performance and shows a thorough and effective application of knowledge and skills that exceeds the standard in **Algebra I**. The student solves simple, multi-step practical application problems using literal and linear equations. The

student predicts outcomes of collected data based on measures of central tendency and dispersion, constructed graphs, and simple events using rules of probability.

■ **Mastery**

The student demonstrates fundamental course or grade level knowledge and skills by showing consistent and accurate academic performance that meets the standard in **Algebra I**. The student solves simple, multi-step problems using literal and linear equations. The student calculates measures of central tendency and dispersion of collected data, predicts outcomes of simple events using rules of probability, and reads frequency distributions and line plots to solve simple problems.

■ **Partial Mastery**

The student demonstrates basic but inconsistent performance of fundamental knowledge and skills characterized by errors and/or omissions in **Algebra I**. Performance needs further development. The student calculates the mean and range of given data and reads line plots.

■ **Novice**

The student demonstrates substantial need for the development of fundamental knowledge and skills, characterized by fragmented and incomplete performance in **Algebra I**. Performance needs considerable development. The student solves one-step linear equations in one variable with procedural errors and attempts to simplify algebraic expressions.

Materials Needed:

- 4 different colors of vinyl craft lace spools (90 foot spools)
- Key rings
- Yard sticks / rulers
- Scissors
- Graphing calculators (1 per student)
- Microsoft Excel
- 3 ring binder notebook paper

Day 1

Task # 1:

Students will be paired into groups of 3 – 4. The groups will get 1 finished key chain to look at. After viewing the finished product each group will be given the task of finding out:

1. How many combinations of key chains can be made using two strands of craft lace from 4 different colored spools of lace?
2. How many different combinations can be found if you don't use double colors? (ie: red / red)
3. How many different combinations can be found if you don't repeat colors? (ie: white / red, red / white)

Modifications:

Teacher selects groups and partners so that the stronger students are paired with the weaker students.

Give students a punnet square to help them decide all of the possible combinations. Students will add the colors together to find all of the combinations, then eliminate the double colors and then eliminate one of the repeat combination such as white / red and red / white.

| | Red | Yellow | Black | White |
|--------|--------------|--------------|-------|-------|
| Red | Red / Red | Red / Yellow | | |
| Yellow | Yellow / Red | | | |
| Black | | | | |
| White | | | | |

Task # 2:

Groups will be asked to figure out how many key chains can be made with four 90 feet spools of craft lace. They will be given the information that they need two strands that are 30 inches long for each key chain. Students must show how they calculated or arrived at their answer.

Modifications:

Students may need to use a calculator.

Day 2 (Making the key chains may take more than one day. It depends on the length of your class periods.)

Task # 1:

Each group will cut 2 strands, 30 inches in length of craft lace for each person in the group. Each student in the group will make a different color combination key chain.

Task # 2:

Each student in the group will measure their excess craft lace after tying their specific number of “knots”.

Student 1: Measure the lace that is left after each “knot”.

Student 2: Measure the lace that is left after tying every two “knots”.

Student 3: Measure the lace that is left after tying every three “knots”.

Student 4: Measure the lace that is left after tying every four “knots”.

Modifications:

For students with vision problems such as color blindness, use very contrasting colors such as white and a dark color.

Have key chains already started in 1 knot, 2 knot, 3 knot, and 4 knot sections.

Students work in groups of two so that one can knot and measure and the other can count as the knots are being made and then record the measurements. (It is very easy to lose track of how many knots have been tied, so having an extra person counting is helpful.)

Task # 3:

Each student will make a two column table for recording the data collected. Students will record their length in inches on a table that they can make on their own. They will fold their paper in half and draw a line down the center. Their chart will go down the length of their paper with number of “knots” on one side and the length in inches on the other. Data will be collected after tying each of the selected knots.

*Students will tie and record data until the key chain is complete. Students should quit tying knots when there is approximately two inches left in order to tie the finishing square knot.

Modifications:

Have the table pre-made with number of knots on it so the students only have to write down the length of the lace that is left after the knots are made.

Have rulers taped to desks for ease of measuring.

Task # 4:

When each group has completed their key chains and the data is collected, the students will:

1. look for a pattern
2. discuss why there is or isn't a pattern
3. if there is a pattern found, what is it?

Technology Use:

- Students will put data into lists on **graphing calculators** and graph
- Students will put data into **Microsoft Excel** and graph. Students can print graphs from Excel and compare with other groups.
- Students will discuss the differences and similarities in their graphs.

*Follow up lessons could include writing equations and finding slope if the lines for each of the different data collected.

Internet Resources

Directions for the keychain:

http://www.bluemoon.net/~dotoran/prj_square_stitch.htm

Craft lace supplier:

http://www.pepperell.com/Rexlace_plastic_vinyl_lacing_crafts_gimp_lanyard_boondoggie.htm

Online help and directions for other craft lace activities that could be measured:

<http://www.boondogleman.com/>