

the Yo-Yo Problem

Mathematical Goals

- Explore linear patterns.
- Create one variable and two variable linear equations.
- Graph equations on coordinate axes with labels and scales.

Common Core State Standards

MCC9-12.A.CED.1 Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and exponential functions.

MCC9-12.A.CED.2 Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.

MCC9-12.A.CED.3 Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context.

MCC9-12.N.Q.1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.

MCC9-12.N.Q.2 Define appropriate quantities for the purpose of descriptive modeling.

MCC9-12.N.Q.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

MCC9-12.A.SSE.1 Interpret expressions that represent a quantity in terms of its context.

MCC9-12.A.SSE.1a Interpret parts of an expression, such as terms, factors, and coefficients.

MCC9-12.A.SSE.1b Interpret complicated expressions by viewing one or more of their parts as a single entity.

Standards for Mathematical Practice

1. Make sense of problems and persevere in solving them.
 2. Reason abstractly and quantitatively.
 4. Model with mathematics.
 6. Attend to precision.
 7. Look for and make use of structure.
 8. Look for and express regularity in repeated reasoning.
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Part 1: The Yo-Yo Problem

Andy wants to buy a very special yo-yo. He is hoping to be able to save enough money to buy it in time to take a class in which he would learn how to do many fancy tricks. The 5-ounce aluminum yo-yo costs \$89.99 plus 6% sales tax. Andy has already saved \$17.25, and he is earning \$7.20 a week by doing odd jobs and chores. How many weeks will it take him to save enough money for the yo-yo?

1. How much sales tax will Andy have to pay?

2. What will be the total cost of the yo-yo, including tax?
3. Let w be the number of weeks that it will take Andy to save enough money to buy the yo-yo. Write an algebraic equation that will help you solve the problem. (w should be the only variable in the equation.)
4. Solve your equation for w , and check your answer. Be prepared to present your solution to the class.

Part 2: The Penny Pattern



5. Create a pattern using pennies. Stage one of the pattern is shown above—one penny surrounded by six additional pennies. To create each additional stage of the design, place more pennies extending out from the six that surround the center penny. Continue making this design until you have used up all of your pennies. Below, sketch the first four stages of the pattern.

Stage 2	Stage 3
Stage 4	Stage 5

6. Using your penny pattern or the sketches of your penny pattern, create a table of values.

Stage Number, n	1	2	3	4	5
Number of Pennies Required					

7. How many pennies are needed to make stage 6, stage 7, and stage 8 of the penny pattern? How did you determine your answer? Explain this in complete sentences.

Stage 6: _____

Stage 7: _____

Stage 8: _____

8. Write an algebraic model that expresses the relationship between the stage number, n , and the number of pennies required to make that design, p .

9. Use your model (equation) to determine how many pennies are needed to make stage 80, stage 95, and stage 100 of the penny pattern.

Stage 80: _____

Stage 95: _____

Stage 100: _____

10. If you use 127 pennies to make the penny pattern, how many pennies will be in each spoke coming out from the center penny?