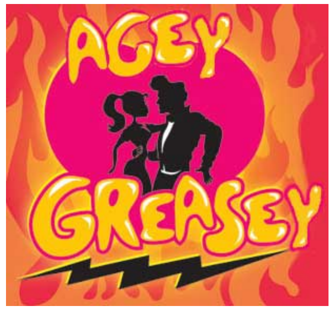
Emmy Noether - Circle 1 for 2007-2008

Part I: Problems

Problem 1

Axel pays with a $20.00 bill to buy the new Acey-Greasey CD, which costs $19.59, including tax. Eager to get home so he can rip the CD onto his MP3 player, he pockets the change without counting it.



a) If Axel has at least two dimes, what are the possible combinations of coins in his pocket?

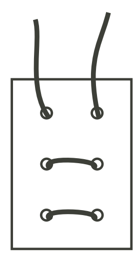
b) If all types of coins (quarters, dimes, nickels and pennies) are available, what combination of coins would the cashier most likely give to Alex?

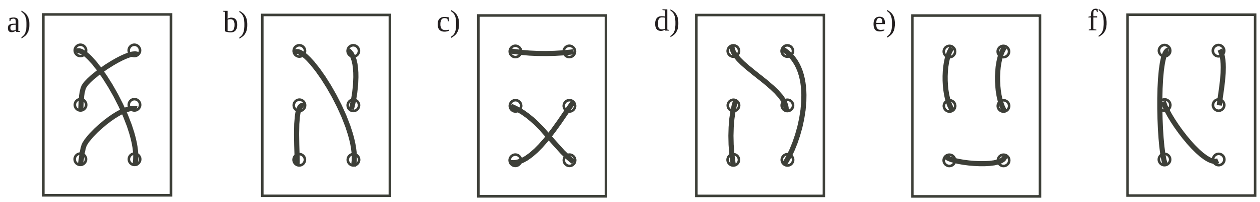
Extension :

1. Axel discovers he has 10 coins in his pocket. Could he have the correct change? Explain. (You need not assume he has only two dimes.)
2. Could he have the correct change with 18 coins? Explain.

Problem 2

A single piece of string is laced through six holes in a piece of cardboard. The top side of the card is shown an the right. From the diagrams below, select the two that could NOT be the underside of the card. Explain your choices.





Problem 3

In a remote village of Melatron Township, time is kept using only minutes. If you lived there, and counted minutes from the time you were born, would you be older or younger than one million minutes on your most recent birthday? Make a prediction, and then calculate approximately how many minutes old you actually were on that birthday.

Extension :
Do you think it's possible that your teacher is 39 447 000 minutes old? Explain.

Problem 4

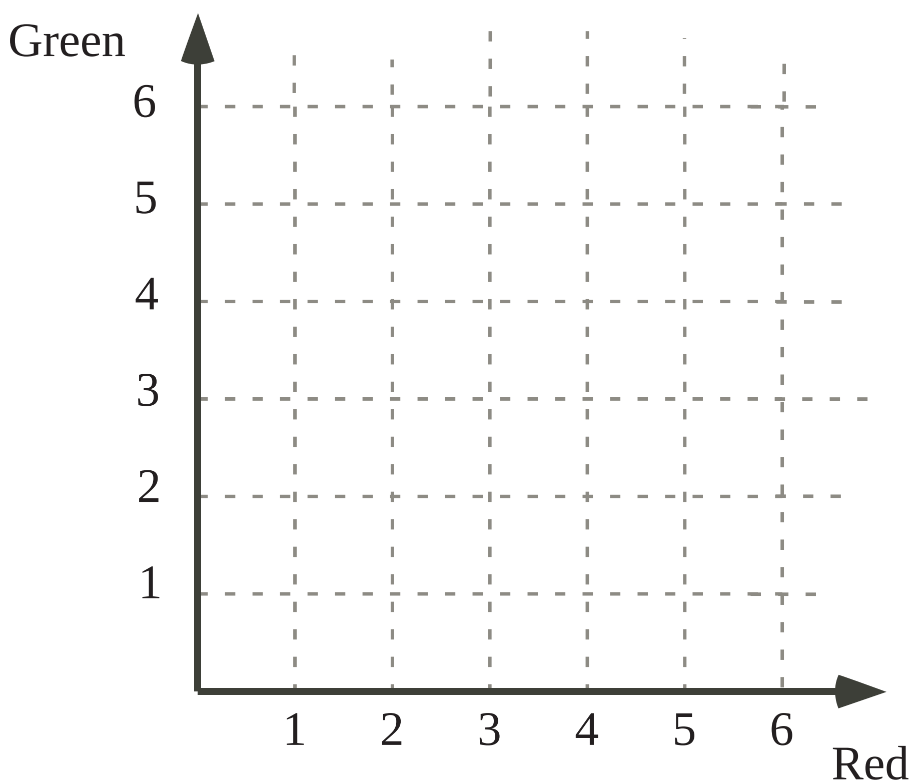
Using exactly 12 toothpicks joined together with marshmallows (or licorice bits), how many skeletons of geometric solids can you make? Toothpicks cannot be broken, but two or more toothpicks may be joined to create edges longer than one toothpick, (). Sketch each polyhedron skeleton you design. What are the names of your polyhedrons?

Extension :
Make ten different skeletons of polyhedrons using fewer than 12 toothpicks. Name your polyhedrons.

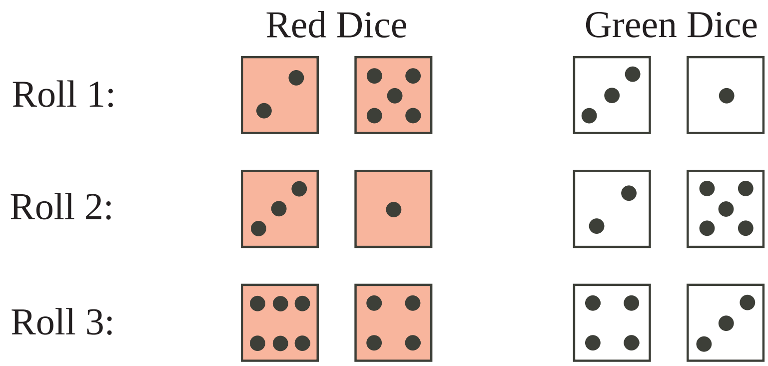
Problem 5

PLOTTING THREE IN A ROW! (a game for pairs of students)

Use two pairs of dice, one pair of one colour (say red), and one pair of another colour (say, green). Decide who will play first. The chosen player rolls all four dice and chooses one red value (for the horizontal axis on the 6×6 grid below), and one green value (for the vertical axis), and then plots the point (red number, green number) on the grid. The second player then rolls all four dice, chooses a red number and a green number, and plots the point on the grid, using a different colour pen. The goal of the game is to get 3 adjacent points in a row, in any direction. (horizontally, vertically, or diagonally).

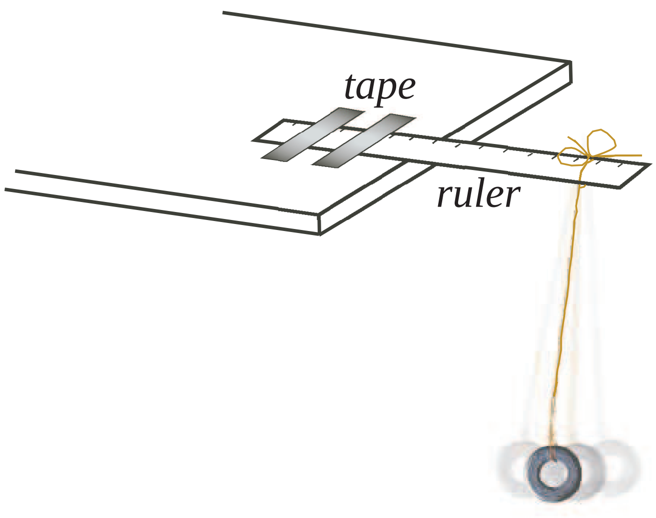


Extension:
If Chris goes first, and rolls the following three sets of dice in her first three turns, can she choose ordered pairs so as to win? Explain.



Problem 6

Pendulum Patterns (suggested for groups of two to four students). Each group will need a 30 cm ruler, a 75-80 cm length of string, four identical washers, some tape, and a watch or clock that measures seconds.



MAKE A PENDULUM:

Tie a washer to one end of the string, and tie the other end of the string to one end of a 30 cm ruler taped to a table or desk, as shown, so the pendulum can swing freely.

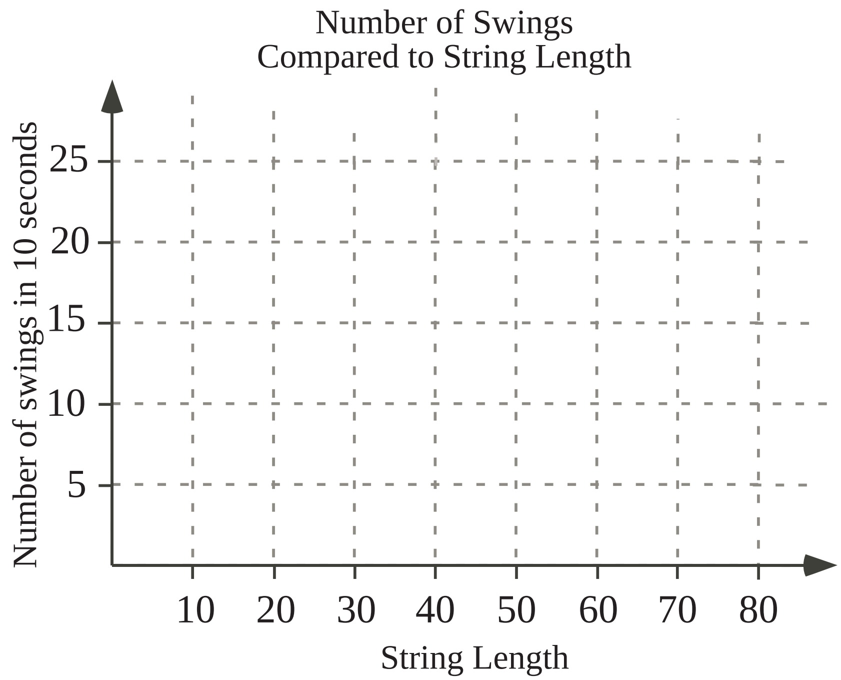
For the first trial, adjust the string so there is 60 cm between the washer and the ruler. Pull the washer to one side (as shown), keeping the string taut, and release it. Count the number of swings (each time the washer passes from one side to the other under the ruler) in 10 seconds, and record your result in the table below. Repeat the experiment for pendulum string lengths of 50 cm, 40 cm, 30 cm and 20 cm. Then plot your data on the given graph, and use your graph to answer the following questions.

a) How many swings do you think there would be if the pendulum string length were 45 cm? Explain how you might use your graph to get your answer.

b) How might you use your graph to predict the number of swings for a pendulum string length of 70 cm? Test your prediction by experimenting with that string length.

Experimental Observations

String Length	Number of Swings in 10 Seconds
60 cm	
50 cm	
40 cm	
30 cm	
20 cm	



Extension :

1. a) Tie 2 washers on the end of the string with a length of 60 cm, and again count the number of swings in 10 seconds and record your result in Table 2 below. Repeat for hanging lengths of 50 cm, 40 cm, 30 cm and 20 cm.

   b) Repeat the experiment in a) with 3 washers, and then 4 washers. Record your results in Table 2.

String Length	Number of Swings in 10 Seconds		
	2 washers	3 washers	4 washers
60 cm			
50 cm			
40 cm			
30 cm			
20 cm			

Number of Swings for Different Lengths and Different Weights.

What do you notice about your results?

How do they compare with your results using only one washer?

Write a short paragraph describing how the number of swings in 10 seconds changes as the string length increases, and as the number of washers changes.