How to lace your shoes

Preface

Do you still have shoes with laces? Take a look at how the laces are laced in these shoes. Compare this with your classmates. Has this been done in the same way with all shoes? How many different ways are there to lace your shoes, and what are the advantages and disadvantages of the different ways? You will investigate that in this assignment.


Exploration

How are your shoes or sneakers laced?
How can you represent and compare different lacing methods?
What are important characteristics of 'well-laced' shoes? What do you pay attention to?

Make a short report in which you show how your shoes are laced; you can take pictures and make drawings to show the lacing and to make clear what are important details in well-laced shoes.

The situation

A new lace manufacturer wants to launch a line of laces. Of course, he wants to stand out and be different from other lace manufacturers, so he consults you to do research and give advice.

Preliminary study

Part 1

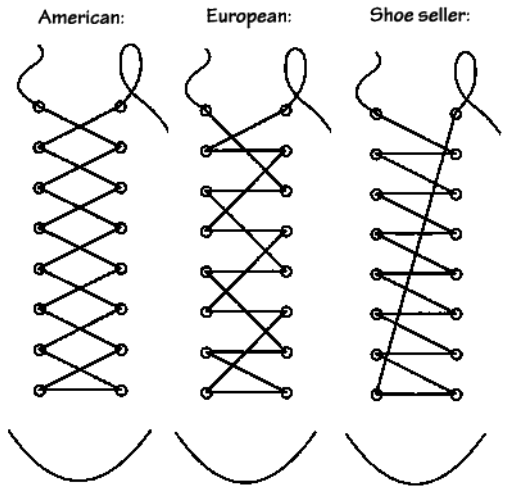
Examine how many *really different* ways there are of feeding a lace through 3 pairs of eyelets.
There are the following constraints:
- the ends of the laces are both at the top of the shoe;
- the two ends must be on different sides;
- the shoe must really be tightened;
- all eyelets shall be used;
- each eyelet may only be used once.

Please note: whether you tie a lace from the inside or from the outside through an eyelet does not matter (these are NOT different ways). Tip: use drawings like you see below.

How many *really different* lacing methods can you find?
Design a top 3 and elucidate your considerations in determining your top 3.

Part 2

Below, you see three common ways of lacing shoes.



Compare these three ways, pay attention to the following:
o Required length of the lace
o Convenience of lacing
o Convenience of tightening
o Strength
o Attractive to see
o [maybe you can think of more?] .....

Part 3

For each of the three lacing methods in part 2, calculate the minimum length of the lace. Use the following constraints: the two rows of 8 eyelets are 4 cm apart, and the distance between two eyelets in a row is 2 cm.

For all three lacing methods, design a formula for the length of the lace. This formula should be applicable for different numbers of eyelets. For each formula, explain very clearly how you constructed it, how you found this formula.

Final assignment

You can probably imagine that there are many ways to lace shoes. Especially when there are many eyelets, this number quickly increases. Furthermore, the number of methods of course depends on the constraints you agree upon, for example: are you allowed to skip eyelets or not? Should the ends of the lace be on different sides? Can the lace go through the same eyelet more than once? Etc.

The lace manufacturer consulted several agencies. You are one of those agencies. Write an advice to the lace manufacturer about the lengths of the laces that are the best to launch.

In this advice you indicate which lengths are best to be produced, and why. In your advice, consider different types of shoes with 2 to 10 pairs of eyelets, take into account different sizes and different lacing methods and other things that are important for a starting lace manufacturer.
Use the information from the exploration and the preliminary study, and include this as an attachment in your advice.

Make sure the advice is clear and well substantiated, so you can convince the lace manufacturer. Use illustrations and examples to clarify your advice.