

ITESM Campus Monterrey
Mathematical Physical Modelling F4005
Opening activity
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Instructions. Work in pairs and solve the following task.

Problem.

A market research team is conducting a controlled survey to determine people's preferences in two different products. The sample consists of 200 people, each of whom is asked to try two brands, A and B, over a period of several months. Based on the responses of the survey, the research team compiles the following statistics about toothpaste preferences.

- Of those using Brand A in any month, 70% continue to use it the following month, while 30% switch to Brand B.
- Of those using Brand B in any month, 80% continue to use it the following month, while 20% switch to Brand A.

Exercise.

1 Suppose that, when the survey begins, $x = 120$ people are using Brand A and $y = 80$ people are using Brand B. Answer the following questions:

1. How many people will be using brand A 1 month later?
2. How many people will be using brand B 1 month later?
3. How many people will be using brand A 2 months later?
4. How many people will be using brand B 2 months later?
5. How many people will be using brand A 3 months later?
6. How many people will be using brand B 3 months later?
7. How can you use matrices to answer the above questions? Describe the algorithm and make it formal (mathematically speaking).
8. Compute the number of people that will be using brand A after 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29 and 30 months. *Hint:* Mathematica! recall the *Table* command.
9. Compute the number of people that will be using brand B after 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29 and 30 months.
10. Is there any particular pattern? What is going on? Describe what happens in the long run.
11. In this context, 200 people correspond to 100% of the survey sample size. Describe the percentage of the total sample that eventually will be using brand A and brand B.

2 Answer **all** the above questions but now assuming that $x = 45$ people are using Brand A and $y = 155$ people are using Brand B.