



English + Spanish Edition

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Companion
book for
teachers
and families



TABLE OF CONTENTS • ÍNDICE

Why Matemax	5
Matemax and school problems.....	6
Solutions and suggestions	8
Tables.....	47
¿Por qué Matemax?.....	51
Matemax y los problemas escolares.....	52
Soluciones y sugerencias	54
Tablas.....	94

*Solutions
and suggestions*

F O R

TEACHERS



Why Matemax?

*I*n the school curriculum, mathematics serves the dual purpose of getting students to learn “useful” things and to give them powerful tools for analysis and reflection, which can then be transferred to different fields.

This book was designed taking into account both aspects of the teaching of mathematics, and with a third objective: to entertain. To accomplish all this we have emphasized the mathematical problems of everyday life, both to reveal the practicality and relevance of mathematics, and to bring students elements of the reality that we live in: the distance from Earth to the Sun, the speeds at which light and sound travel, time and currency differences in different countries, and more generally the existence of different cultures and habits, or even a recipe for making pancakes.

Rather than trying to comprehensively cover each topic, each chapter contains suggestions for exploring the ideas more deeply. The intention is that the students work with the problems of this book, but also that each teacher or family member develops and multiplies the ideas presented.

Matemax and school problems

MATEMAX is primarily aimed at students between 11 and 13 years old, but some problems are accessible to younger students while the last problems in each chapter can be used with older students. The problems are grouped into 7 chapters according to the story topic and not to the mathematical tools involved in each one. At the end of the book for students, there are concise answers to the questions.

The essential point in the proposed problems is to understand the statement and to decide what needs to be done to find the answer. Students will probably need guidance and training for this work until they can do it themselves. Once the statement is well understood, the solution is reduced in many cases to simple calculations, as in the case of problems with soccer tables. In other problems the calculations are also important. In most problems, there is a unique answer but there are several ways to reach the solution. However, in some problems, such as "Designing a house", there is not a single correct answer.

Surely, discussions about how the answers were found and what difficulties arose (both in understanding the statement and in the mathematics) will be very enriching.

In all cases, the task of the teacher would not be to give the solution (or a solution) but to channel the ideas and proposals of the students and to help them to apply strategies to arrive at the solution, to acquire criteria that indicate whether or not their reasoning is correct, to find generalizations, to notice how changes in the initial data influence the final result, and to express their ideas in a clear way, with increasing confidence.

Next to the title of each problem, we have coded the mathematical subjects at play, according to the following table.

Subject	Codification
Natural numbers	N
Combinatorics	C
Divisibility	D
Fractions and percentages	F
Decimal numbers	DN
Proportions	Pr
Planar geometry	G
Spatial geometry	G3
Time units	T
Length units	L
Area units	A
Volume and capacity units	V
Weight units	P
Statistical graphics	E
Interpretation of tables	IT
Reasoning	R

Of course, all problems involve reasoning. Problems indicated with R are essentially of reasoning, with very simple calculations. Also, all problems involving combinatorics or divisibility use natural numbers, but we have pointed out in what problems these are the main notions.

To help you use the book, there is a table per chapter that indicates in what problems each topic comes into play, after all the detailed solutions.

TRAVELING

Time mess (N, T, R)

As Madrid is farther east than Montevideo, in Madrid it is 5 hours later, that is, you have to add 5 hours to Montevideo time to "translate" it to Madrid time. Then, Carlos called at 6 p.m. (Madrid time), the Uruguayan friend had breakfast at 11 a.m. (Montevideo time), when Carlos woke up with a toothache it was 11 p.m. in Montevideo and the Uruguayan friend had not gone to bed yet. To answer the question about the plane, it is convenient to use the same "reference system" for take-off and arrival times: the plane leaves when it is 8 p.m. in Montevideo and arrives at 8 a.m. (Montevideo time) or, equivalently, it is 1 a.m. when it takes off and 1 p.m. when it lands (Madrid time). Then, the plane takes 12 hours to fly from Madrid to Montevideo. In fact, flights from Montevideo to Madrid are approximately 12 hours, but flights from Madrid to Montevideo are almost 13 hours because in this case the plane flies in the opposite direction to Earth's rotation direction.

Daylight saving time is obtained by "adding one hour" to winter time to save electricity using the afternoon light in summer. For example, the following could be discussed: If Uruguay and Spain had time changes in summer and winter, as they are in two different hemispheres, in one the hour would be delayed while in the other it would be advanced. Thus, the difference would be 3 hours when it is summer in Uruguay and 5 hours when it is summer in Spain. However, if both countries were in the same hemisphere, the difference would always be the same! In fact, not all countries change the time exactly the same day, so there could be short periods in which the time difference would be different. Many different activities may be designed to investigate and compare the time between states of the United States of America according to their location. Here is a sample problem:

Dustin and his cousin Mia live in different coasts of the USA but both go to bed at 8 pm and wake up at 8 am. How many hours a day are they both awake simultaneously?

Happy route (N, L)

From the starting point to Big City, there are 29 miles + 55 miles + 26 miles + 24 miles = 134 miles. Then, from Big City to Happy Lake there are 204 miles - 134 miles = 70 miles. Since from Second Town to Big City there are 26 miles + 24 miles = 50 miles, from Happy Lake to Second Town there are 70 miles - 50 miles = 20 miles. The computation is $204 - 29 - 55 - 26 - 24 - 26 - 24 = 20$ and the terms can be grouped in different ways.

On the other hand, from First Town to Second Town there are 55 miles. Then First