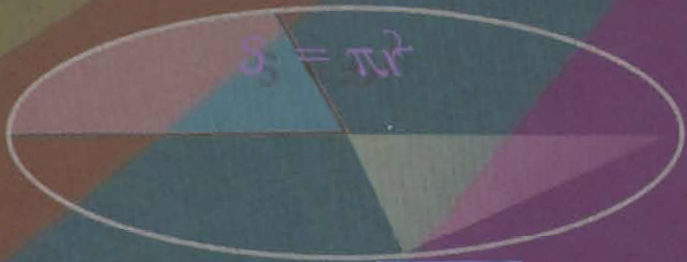
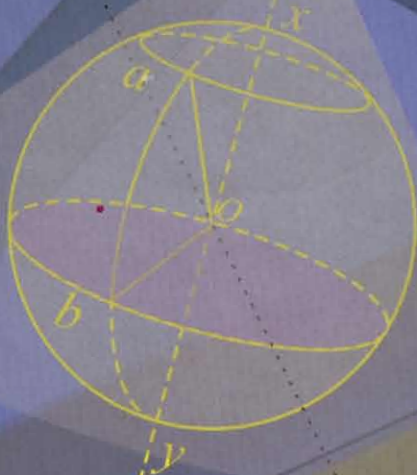


# Building up **MATHEMATICS**

**8<sup>th</sup>** Grade  
Basic Education



**SPECIMEN**



National  
Textbook

**NEW CURRICULA**



**Republic of Lebanon**

Ministry of Education and Higher Education

■

**BUILDING UP**

**MATHEMATICS**

■

**Basic Education**  
Grade Eight



**New Curricula**

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# BUILDING UP MATHEMATICS

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# Together We Build Through Education!

The Center for Educational Research and Development (CERD) has embarked on an extensive workshop for assessing and developing the educational framework and curricula which have been placed into effect more than three years ago. With full realization of the fact that the educational cycle must continue normally through its components, and until the development process attains its aspired objectives, we are placing in the hands of students, teachers and directors of public schools, this corrected version of textbooks issued by CERD as part of the National Textbook Series.

This version is an interim stage incorporating the corrected typographical and linguistic errors discovered by CERD specialists as well as teachers and students through their daily dealings with the books. The process of assessment and development of the framework and curricula will take into consideration all the comments that have been made, or will be made, in this regard.

It is expected that once the curricula are developed and aligned with the general and specific objectives set for them, the textbooks will be realigned with the new curricular and framework requirements, including tying the content of a course to the number of teaching hours set for it during the school year, taking into consideration vertical alignment within the same course as well as the horizontal alignment with the rest of the courses.

I take this opportunity to invite all school administrators, teachers and students and all officials concerned in public and private schools alike, to promptly send their comments on these curricula and books as their contribution to enrichment of this momentous national process.

This workshop, which was launched under the kind sponsorship of His Excellency the Minister of Education and Higher Education in implementation of Decree No. 10227 embodying the educational curricula and their objectives, fits in with CERD's proclaimed new motto "Together We Build Through Education"

It is our earnest desire to see this national, all-inclusive workshop attracting the greatest amount of interest and participation to define the safest and soundest educational options that directly affect our children, as we vow to continually modernize education and develop its ways and means to keep abreast of modern developments and progress in science and technology.

**Dr. Leila MALEEHA**  
President CERD





## Preface

### "We do not narrate mathematics... we construct it..."

We believe that this teaching concept reflects the will to respect the student as a human being; it is no longer a matter of imposing information on him but presenting him with the one he demands. Our main objective in this book is to direct the student to become an information seeker.

Material covered in the following chapters includes:

- The **Introduction**, in which the student is reminded of what he has learned and what he will learn.
- The **Activities**: In this phase, the student is confronted with situations that urge him to pose questions, conclude, and exchange ideas with his classmates and defend them.  
We think that this is the most important phase of using the national textbook.  
The role of the teacher is clearly defined in the Pedagogical Guide.
- The **Text**: This is the phase of systematization where teaching is put into order through the ideas proposed by student groups.
- The **Focus**: This is a place where students can find the main points of the chapter summarized.
- The **Exercises**: Devised to consolidate the already-acquired notions.
- The **Self-evaluation**: A set of questions, put by students, after their acquisition of new material. Answers to the proposed questions are given at the end of the book. At this stage, the student is held responsible for his work. It is only up to him to judge the degree of comprehension of the notions presented so far.
- The **Problems**: Place of relocating the student's new and old acquisitions. It is a wide and varied field of applications.
- **Just for fun**: Place where the posed problems are less classical and more extracurricular. The essential interest is not in the solution of these problems but in the attempts made towards their solution in a lively atmosphere.

At the end of this work, we hope to reach most of the goals that we set for ourselves. Nevertheless, the results depend heavily on how the teachers will use this book.

The authors

# How to use the book

This is the title of the chapter

I find out what it is all about

I discover

What I already know

What will I learn

5

Powers of 10



**Introduction** What if the sign “-” comes above?

The exponent 10 plays an important role in scientific notation. In fact, it is the base of the exponential system and a decimal number (expressed as power of 10) and generally, it gives a multiplicative operation of the numbers that can be represented on a number line using a scientific notation.

▶▶▶ At the beginning of this chapter, I am able to:

- ▶ identify the powers of 10 and  $\frac{1}{10}$
- ▶ explain a binary number in terms of power of 10 and  $\frac{1}{10}$
- ▶ express the value of calculating with powers.

▶▶▶ At the end of this chapter, I will be able to:

- ▶ use the ordered 10<sup>n</sup> where n is a natural number
- ▶ give in the form of power, the product or ratio of two powers of 10
- ▶ use the ordered powers to carry a decimal number
- ▶ use scientific notation.

PP-41

To refresh my memory

For a good start

This is the teacher's corner.

I take what he gives

In this part of the chapter, I find :  
all the definitions ..  
all the properties ..  
proofs of these properties ..  
some illustrative examples.

I learn the essentials..

In this part, I find :  
a summary of the text ..  
of explanations ..  
of methods of solving ..  
of geometric constructions.

## Recall activity

**Activity** *The account is good!*

Through a market study, a series of 10 families in a certain country, was selected to know how many laptops they own. The following were the results:

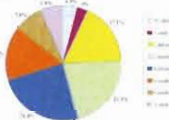
1	2	3	4	5	6	7	8	9	10
1	2	3	4	5	6	7	8	9	10
1	2	3	4	5	6	7	8	9	10
1	2	3	4	5	6	7	8	9	10

Organize these results in a table of your choice and then represent it using a bar graph.

## Preparatory activity

**Activity** *The Carromboard*

The following figure represents a percentage distribution of families of a certain region according to the number of children that they have.



- Organize these results in a table.
- How do you calculate the percentage of families having at most 1 child or at most 3 children? How do you show this on the graph?
- How do you calculate the percentage of families having between 2 and 4 children?

214-215

## Focus

**Description of Carromboard shapes**



**Formulas**

Form	Elements	Lateral area	Total area	Volume
Pyramid	Height or altitude	Sum of the areas of the faces	Sum of the area of the base and lateral area	$\frac{1}{3} \times B \times H$
Right circular cone	Radius of base r, Height h	$\pi r l$	$\pi r^2 + \pi r l$	$\frac{1}{3} \pi r^2 h$
Right circular cylinder	Radius of base r, Height h	$2\pi r h$	$2\pi r h + 2\pi r^2$	$\pi r^2 h$
Sphere	Radius r	$4\pi r^2$	$4\pi r^2$	$\frac{4}{3} \pi r^3$

- Useful notes**
- ▶ Two lines are collinear (intersecting, parallel, or non coplanar lines)
  - ▶ Two planes are intersecting or parallel.
  - ▶ A line is contained in a plane, perpendicular to a plane, or parallel to a plane.
  - ▶ Two intersecting lines - segment at only one point.
  - ▶ Two intersecting planes - intersect at only one line.

108-109

## Exercises

I. Integral powers of 10

**Task**  
Write the number 10<sup>n</sup> for the following values of n: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10.  
Observe the pattern, and write the number 10<sup>n</sup> for n = 11, 12, 13, 14, 15.

**Properties and rules of calculation**

1. Properties of integral powers of 10

**Property 1** Multiplying a natural number greater than 1, by 10, is the same as multiplying it by 10 to the power of 1.

**Property 2** Multiplying a natural number greater than 1, by 100, is the same as multiplying it by 10 to the power of 2.

**Property 3** If a and b are two integers greater than 1, then:

**Property 4** If a and b are two integers greater than 1, then:

**Property 5** If a and b are two integers greater than 1, then:

PP-66

# I practice

In this part of the chapter, I find :  
 miscellaneous revision exercises..  
 direct application exercises..  
 training exercises.

### Exercises

1.  $AB^2$  is a right angled at  $B$ . Complete the following table.

$AB$	$AC$	$BC$
3	4	10
5	8	12

2.  $ABC$  is an isosceles triangle right angled at  $C$ . Calculate  $\sin B$  when  $BC = 6$ .

3.  $FGH$  is a rectangle of length 7 and width 4.  
 a) Calculate the diagonals of this rectangle.  
 b) Show and verify a property concerning the diagonals of a rectangle.

4.  $LMN$  is a triangle right angled at  $L$ .  $LM = 7$  and  $LN = 6$ , and  $M$  is the midpoint of  $LN$ .

5. In the following figure,  $BEAC$  is a right isosceles.

6. Prove that  $ED$  is an altitude triangle for  $ABC$ . Calculate  $ED$ ,  $AD$ , and  $EB$ .

7. In the following figure,  $ECDE$  is a right isosceles. Calculate  $ED$ .

8.  $LMN$  is an isosceles triangle with vertex  $L$  in which  $LM = LN = 2\text{cm}$  and  $\angle L = 120^\circ$ .  
 a) Calculate  $MN$ .  
 b) Calculate  $ED$  where  $E$  is the midpoint of  $LN$ .

9.  $ABC$  is an isosceles triangle with vertex  $A$  in which  $AB = AC = 10\text{cm}$  and  $\angle A = 120^\circ$ .  
 a) Calculate  $BC$ .  
 b) Calculate  $AD$  where  $D$  is the midpoint of  $BC$ .

### Self-evaluation

A. In the following figure,  $ST = 5\sqrt{2}$ . Find  $SN$ .

B. Evaluate  $\sin A$  if  $\angle A = 100^\circ$ .

C. Evaluate  $\cos C$  if  $\angle C = 100^\circ$  and  $\sin C = 1/2$ .

D. In the following figure, calculate the length of  $ED$  and the area of the yellow region.

E. Prove that the triangle inscribed in a semicircle is right.

# This is my own corner!

In this part, I find :  
 some exercises treating the essentials;  
 the student selects appropriate ones for himself to solve.  
 The solutions are given at the end of the book.  
 I can always ask the teacher for explanations.

# A challenge? I accept it.

In this part of the chapter, I find :  
 problems relating to the text,  
 problems for everyday application,  
 problems using the properties already seen.

### Problems

1. Complete each of the following to obtain a perfect square:  
 a)  $x^2 + 2x + \dots$   
 b)  $x^2 + 4x + \dots$   
 c)  $x^2 + 6x + \dots$   
 d)  $x^2 + 8x + \dots$   
 e)  $x^2 + 10x + \dots$   
 f)  $x^2 + 12x + \dots$

2. Solve each of the following equations:  
 a)  $x^2 - 2x - 3 = 0$   
 b)  $x^2 - 4x + 4 = 0$   
 c)  $x^2 + 2x - 3 = 0$   
 d)  $x^2 - 5x + 6 = 0$   
 e)  $x^2 - 8x + 16 = 0$   
 f)  $x^2 - 10x + 25 = 0$   
 g)  $x^2 - 12x + 36 = 0$   
 h)  $x^2 - 14x + 49 = 0$   
 i)  $x^2 - 16x + 64 = 0$   
 j)  $x^2 - 18x + 81 = 0$   
 k)  $x^2 - 20x + 100 = 0$   
 l)  $x^2 - 22x + 121 = 0$   
 m)  $x^2 - 24x + 144 = 0$   
 n)  $x^2 - 26x + 169 = 0$   
 o)  $x^2 - 28x + 196 = 0$   
 p)  $x^2 - 30x + 225 = 0$

3. To make a box from a square piece of cardboard, a student who is four inches shorter than each side of the square cuts each corner a square with side length  $x$ .  
 a) What does the side of the base of the box measure?  
 b) Calculate  $x$  so the surface of the base will be  $100\text{cm}^2$ .  
 c) What is the shape of the box?

4. Given a right triangle  $ABC$  of hypotenuse  $BC$  and right angle at  $A$ .  
 Calculate the length of the two other sides, knowing that the difference between them is  $2\text{cm}$ .

5. a) Express  $\sin A$  in terms of  $\cos A$ .  
 b) By adding the two equalities obtained in a), find an equation in  $\sin A$  independent of  $\cos A$ .  
 c) Deduce the value of  $\sin A$ .

6.  $ABCD$  is a parallelogram.  $E$  is the bisector of  $AD$ , and  $F$  is the bisector of  $BC$ .  
 a) Show that  $EF \parallel AC$ .  
 b) Assuming  $AD = 10$  and  $BC = 12$ , find the length of  $EF$ .

Between us,  
 Mathematics is  
 sometimes lots of fun!

In this part, we find :  
 interesting problems that require  
 collective thinking.

### The spiral of Archimedes

In the following figure, a hat particular property depicts the spiral of Archimedes process.

**N** - The spiral of Archimedes is named after the Greek mathematician Archimedes in 287-212 BC. It was known to him because he was able to find the area of a circle by using the spiral.

**O** - This Archimedes spiral is a special kind of Archimedes spiral. It is a curve that winds around a center point, getting closer and closer to it but never reaching it.

**T** - The spiral of Archimedes is a curve that winds around a center point, getting closer and closer to it but never reaching it.

**E** - The spiral of Archimedes is a curve that winds around a center point, getting closer and closer to it but never reaching it.

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