

# ***BUILDING UP MATHEMATICS***

**7<sup>th</sup>** Grade

**Basic Education**

**REVISED EDITION**

**SPECIMEN**

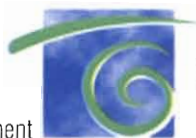
**Republic of Lebanon**

**Ministry of Education and Higher Education**

**BULDING UP MATHEMATICS**

**Basic Education**  
**Grade Seven**

Center for Educational Research and Development



National  
Textbook

**New Curricula**




General Coordinator  
**Victor Melhem**

Statistical Consultant  
**Michel Sadaka**

Pedagogical Consultant  
**Leila Abi Saleh Nasr**

Translation to English  
**George M. Eid**



# BULDING UP MATHEMATICS

Basic Education  
Grade Seven

**Walid Naji** (Coordinator)


**Elie Aoun**

**Hatem Chalak**

**Ahmad Dankar**

**Talal Nader**

Center for Educational Research and Development

 **Librairie du Liban Publishers** SAL

**Technical Preparation:** Technical Team ■ CERD  
**Illustrations** Graphics Team ■ CERD  
**Production and Distribution:** ❖ Librairie du Liban *Publishers* SAL  
**Impression:** TYPOPRESS

© CERD 1998, Sin-El-Fil - Liban, P.O.Box: 55264  
All Rights Reserved for CERD  
7<sup>th</sup> impression 2008



# 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

# Introduction

## **Building Up Mathematics**

The choice of this title reveals our intentions:

"We do not narrate Mathematics.. we build them up".

This is what the instructions of the new program require and this is what the new educational plan proclaims.

We believe that this concept of teaching reflects the will to respect the student as a dynamic human individual; in fact, it is no longer a matter of imposing information on him as a passive receiver, but presenting him with the information he requests. Therefore, the major difficulty is knowing how to induce the student to become a seeker of information.

We have designed this book with this goal in mind. Following are descriptions of the parts of this work:

- At the beginning of each chapter, the student gets to know the context in which he should be working: what he already knows and what additions he will be making to his knowledge.
- He then gets involved in the activities: this is the phase where he will be confronted with situations which make him ask questions, hypothesize, exchange ideas with his classmates, defend his ideas, discuss them, convince his peers or be convinced by them. We think that this is the most important phase in the use of this school book, a phase during which the role of the teacher is clearly explained in the Pedagogical Guide.
- The third phase is that of institutionalization: here the teacher puts some order into the ideas arrived at during the discussions among student groups.
- The "Results" is where the essential points of the chapter are summarized.
- The reminder and entertainment exercises are designed to consolidate the concepts already acquired.
- The "Self-evaluation" section is the space where the student can locate himself with respect to the new acquisitions. The answers are

given at the end of the book. It is at this stage that the student assumes responsibility for his work: it is up to him to judge the degree of his comprehension of the concepts presented.

- The problems section constitutes a space of reinvestment of the student's old and new information. It is a vast and diversified field of application.
- The last section "Just for Fun", is designed for reinvesting different abilities acquired by the students. The problems set are generally more difficult. The idea here is to look not only at the actual solution of the problem, but also at the time spent solving it, the discussions conducted for comprehending and analyzing it, and the atmosphere that pervades during the student's search for the solution.

Finally, we believe we will attain most of the objectives which we set for ourselves.

However, the actual results depend heavily on the use teachers make of this book.

**The Authors**



# How to make use of this manual

This the title of the chapter

## Parallelepiped (Cuboid), cube and prism <sup>2</sup>

### Introduction

In this chapter, you will learn to represent some objects in the plane. You will also learn formulas for calculating the area and volume of these objects.

I discover what it is about

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

- recognize a cube, a parallelepiped, a prism and their representations in the plane;
- recognize the pattern of a cube, a parallelepiped and a prism.

This what I already know

I discover

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

- prepare the pattern of a parallelepiped, a cube and a prism;
- sketch a parallelepiped, a cube and a prism;
- calculate the lateral area, the total area and the volume of a parallelepiped, a cube and a prism.

This is what I need to learn

To refresh my memory ...

For a good start

### Recall activities

#### Activity 1

Don't forget that:  
The area of a triangle is:  
 $S = \frac{b \times h}{2}$



Letters to formulate .. letters to calculate !

- 1) The side of a triangle measures  $a$  and the height relative to this measure is  $h$ . Express the area  $A$  of the triangle in terms of  $a$  and  $h$ .
- 2) The sides of a rectangle measure  $x$  and  $4x$ . What is its perimeter? What is its area?
- 3) The area of a rectangle is  $S$ . What is the area of the rectangle having the same width and 3 times the triple length of that of the given rectangle?

#### Activity 2



"Mathematics"

- The magician said:
- think of a number;
  - subtract 4 from this number;
  - multiply the result by 2;
  - subtract 2 from the result;
  - add 10 to the result;
- the number you find is the double of your original number !!
- 1) Everyone can take the role of a magician and with his friends, try this game to verify that he is correct.
  - 2) Denote the unknown number by  $x$ , then express the distinct steps by one expression.
  - 3) Reduce the obtained expression, by getting rid of the parentheses in order to discover the secret of the magician.
  - 4) Try to invent other magic tricks ?

### Preparatory activities

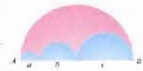
#### Activity 1

Don't forget that:  
The perimeter of a circle is:  
 $P = 2\pi r$  and the area is:  
 $S = \pi r^2$   
given  $r = 3, 4$  cm



Calculate to go faster !!

- To go from  $A$  to  $B$  in the indicated figure, we have two distinct paths: the red path and the blue path.  
What is the shortest path ?



#### Activity 2

There are calculations in "the area" !!

- In the indicated figure, the rectangle has as width the triple of the side of a square and its length measures twice its width.  
Determine the area of the figure in terms of the length  $s$  of the side of the square.



This the corner of the teacher..  
I take from him what he knows

**Focus**

**1. How to simplify a fraction .**  
We simplify a fraction by dividing the two terms by a common divisor.

*Example :*  
10 is a common divisor of the members of the fraction  $\frac{100}{60}$

Hence, simplify this fractions as follows :

$$\frac{100 \div 10}{60 \div 10} = \frac{10}{6}$$

**2. How to reduce a fraction to an irreducible fraction .**  
There are several methods to reduce a fraction .

a) By dividing the numerator and denominator by their GCD .

*Example :*  
 $\text{GCD}(180; 100) = 20$ . Hence  $\frac{180}{100} = \frac{180 \div 20}{100 \div 20} = \frac{9}{5}$

b) By decomposing the two numbers into prime factors and then by simplifying.

*Example :*  
 $\frac{180}{100} = \frac{2 \times 2 \times 3 \times 3 \times 5}{2 \times 2 \times 5 \times 5} = \frac{3 \times 3}{5} = \frac{9}{5}$

c) By proceeding by successive divisions by common divisors:

*Example :*  
 $\frac{180}{100} = \frac{180 \div 2}{100 \div 2} = \frac{90}{50} = \frac{90 \div 10}{50 \div 10} = \frac{9}{5}$   
where 9 and 5 are relatively prime.


We then get the reduced fraction  $\frac{180}{100}$

49

I Practice


**Text**

**I. Orthogonal system**



An orthogonal system is made up of two orthogonal axes  $x'Ox$  and  $y'Oy$ .  
The axis  $x'Ox$  is called the axis of abscissas.  
The axis  $y'Oy$  is called the axis of ordinates.  
The point of intersection  $O$  of the two axes is called the origin.


**II. Coordinates of a point**



A point  $M$  of the plane is determined by its coordinates :  
- its abscissa  $a$  on  $x'Ox$   
- its ordinate  $b$  on  $y'Oy$ .

We write then  $M(a; b)$ .


*Examples*  
a) In the indicated system, we locate the points  $A(3; 2)$  and  $B(-2; 4)$  .  
b) A point whose abscissa is 0 is a point of the axis  $y'Oy$ .  
c) A point whose ordinate is 0 is a point of the axis  $x'Ox$  .



**III. The four quadrants**

In a system of axes  $x'Ox$  and  $y'Oy$ , we divide the plane into four regions:

- 1- the region where the points have 0 abscissa, and 0 ordinate is the region (I);
- 2- The region where the points have 0 abscissa and 0 ordinate; it is the region (II);
- 3- The region where the points have 0 abscissa and 0 ordinate; it is the region (III);
- 4- The region where the points have 0 abscissa and 0 ordinate; it is the region (IV);



103

I learn the essential

**Exercises**

**Review and practice**

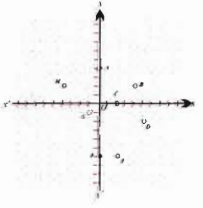
**1.** a) On the axis  $x'Ox$ , we locate the points  $L(-1)$ ,  $F(4)$  and  $H(-1)$ .  
What does  $H$  represent for  $[LF]$ ?  
b) Locate on  $[OL]$  the point  $M$  such that  $LM = 2$ . What is the abscissa of  $M$ ?  
c) Locate on  $[HF]$  the point  $N$  such that  $NN = 2$ . Determine the abscissa of  $N$ .

**2.** a) On the axis  $x'Ox$ , we locate the point  $A(3)$ .  
b) Locate the point  $B$  which satisfies:  $AB = 5$  and  $O$  is a point of  $[AB]$ .  
c) Locate the point  $C$  which satisfies:  $BC = 3$  and  $O$  is a point of  $[BC]$ .  
d) Determine the abscissa of  $B$  and  $C$ .

**3.** True or false?  
a)  $A(-5; 1)$  is a point of the first quadrant.  
b)  $M(-2; -1)$  is a point of the fourth quadrant.  
c)  $R(0; 3)$  is a point of  $x'Ox$ .  
d)  $F(4; 0)$  is a point of  $y'Oy$ .

**4.** Choose the right answer:  
a) The orthogonal projection of the point  $N(5; -3)$  on the axis  $x'Ox$  has as coordinates  $(-3; 0)$ ,  $(0; 5)$ ,  $(5; 0)$ ,  $(0; -3)$ .  
b) The orthogonal projection of the point  $P(-2; -5)$  on the axis  $y'Oy$  has as coordinates  $(0; -2)$ ,  $(0; -5)$ ,  $(0; 2)$ ,  $(-5; 0)$ .  
c) The point  $(-2; 0)$  is the orthogonal projection on the axis  $x'Ox$  of  $(2; 3)$ ,  $(1; -2)$ ,  $(-2; 3)$ ,  $(-2; -2)$ .  
d) The point  $(0; 3)$  is the orthogonal projection on the axis  $y'Oy$  of:  $(3; 2)$ ,  $(2; 3)$ ,  $(-2; 3)$ ,  $(-3; 3)$ .

**5.** Give the coordinates of the points located in the indicate system



**6.** In an orthogonal system, locate four points in each of the following cases:  
a) the abscissa is equal to the ordinate,  
b) the abscissa and the ordinate are opposite,  
c) the sum of the coordinates is equal to 3,  
d) the product of the coordinates is equal to 4,  
e) the difference between the coordinates is 1.

**7.** In an orthogonal coordinate system, locate four points with coordinates  $(a; b)$  in each of the following:  
a)  $a = -3$  and  $-2 \leq b \leq 4$   
b)  $b = 2$  and  $-5 \leq a \leq 2$ ,  
c)  $a \geq 3$  and  $b \leq 5$ ,  
d)  $a < 5$  and  $b$  arbitrary,  
e)  $-3 \leq a \leq 0$  and  $-2 \leq b \leq 0$ ,  
f)  $b > 2$  and  $a$  arbitrary.

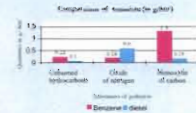
105

This is my corner!

They throw me a challenge,  
I take it up

## Self-evaluation

A The figure below represents pollution caused by 3 types of fuels.



- a) What is the number of items of polluting substances produced by each type of fuel?  
b) Draw the table corresponding to each distribution.

B We throw a die fifty times with the following results:

4	5	3	5	6	4	5	1	3	5
2	4	3	5	6	5	6	5	4	4
4	2	2	1	6	1	6	1	4	
6	5	2	4	1	2	1	6	4	2
3	6	3	6	2	2	5	5	6	3

- a) What is the population under study? What is an item? What is the character under study? What are the values taken by this character?  
b) What is the number of appearances of each face?  
c) Calculate the percentage of appearances of each face.  
d) Present this data in a table.  
e) Present this data by a bar diagram.

C The distribution of grades in mathematics of two sections of the seventh grade totaling 40 students is as follows:

Grade (/20)	Percentage
7	12.5%
10	37.5%
12	25%
15	20%
18	5%

- a) What is the number of items of this distribution?  
b) Organize the data in a table.  
c) Represent the distribution of grades by a bar diagram of the number of items.

165

## Problems

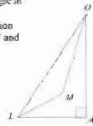
- A rectangular garden has a perimeter of 140m. Its width is three quarter of its length. What is the length and width?
- The perimeter of a rectangle is 92cm. Its length exceeds its width by 14cm. Find its length and width?
- At present, the sum of Taha's and Nabil's ages is 45 years. Taha has 27 years more than Nabil. What is the age of Taha? What is the age of Nabil?
- Samar and Mouna have the same age. Riad has 40 years less than each of them. If the sum of their ages is 125 years, what is the age of Riad? That of Mouna and that of Samar?
- Lina is 15 years old, her mother is 53. When will the age of the mother be the triple of the age of Lina?
- A class consists of 24 students. The numbers of girls is the double of that of boys. Find the number of boys and that of girls?
- The indicated figure represents an isosceles triangle  $ECO$  with base  $CO$ .  $L$  is the point of intersection of the bisectors of and. Find the angles of the triangle  $CLO = 100^\circ$ .



- In a farmyard, there are twice as many hens as rabbits. The number of feet of hens and rabbits is 96. What is the number of hens? What is the number of rabbits?



- $ALO$  is a right triangle at  $A$  and  $M$  is the point of intersection of the bisectors of  $OLA$  and  $AOL$ . It is denoted the measure of the angle  $OLM$ , express every angle in the figure in terms of  $x$  and deduce the measure of the angle  $LMO$ .



- A bottle and its contents weigh 55kg. The bottle weighs 20kg less than its content. How much does the bottle cost?



- A bottle of lemonade and its contents cost 1500 L.L. The bottle costs 1000 L.L. less than its contents. How much does the bottle cost?



- $ABC$  is an isosceles triangle with base  $BC$ . Find the angles of this triangle if  $B = 2A$ .

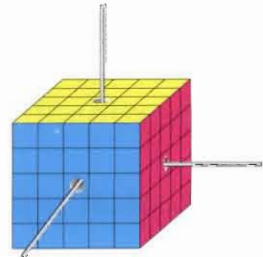
139

## Just For Fun

### A cube of cubes!

The following figure represents a cube of 5 cm of edge constructed by gathering small cubes of 1 cm of edge.

- a) How many small cubes are there?  
b) If we paint the six faces of the large cube, how many small cubes having only one painted face would there be? Two painted faces? Three painted faces? No painted faces?  
c) Suppose that each face of the large cube is pierced at its center with a small hole through the center of the opposite face. How many small pierced cubes with one hole would there be? common? With more than one hole? With no holes?



30

Between us,  
Mathematics  
is sometimes very amusing



## TABLE OF CONTENTS

1	<b>Powers</b> .....	13
2	<b>Prallelepiped, cube and prism</b> .....	22
3	<b>Prime numbers</b> .....	31
4	<b>Triangles: Case of equality (congruent triangles)</b> .....	39
5	<b>Signed numbers: Addition and subtraction</b> .....	52
6	<b>Signed numbers: Multiplication and division</b> .....	65
7	<b>Angles and lines</b> .....	76
8	<b>Reduction of fractions</b> .....	85
9	<b>Decimals and fractions</b> .....	94
10	<b>Locating a point</b> .....	101
11	<b>Algebraic expressions</b> .....	109
12	<b>The perpendicular bisector of a segment. The bisector of an angle</b> .....	117
13	<b>Translation</b> .....	125
14	<b>Equations</b> .....	132
15	<b>Fixed points. Variable points</b> .....	142
16	<b>Proportionality</b> .....	150
17	<b>Statistical reports</b> .....	159
18	<b>Answers Self - Evaluation</b> .....	168