

Liberty Mathematics Level B



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TEACHER'S MANUAL

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Author: Edward J. Shewan

Copyediting: Diane C. Olson

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Introduction

In the early years of a child's education, the parents' role is inescapable. The young learner depends upon his parents' love and guidance. Therefore, it is the goal of Christian Liberty Press not just to provide books, but to assist parents in the God-given task of bringing their children up in the nurture and admonition of the Lord. Books like *Liberty Mathematics, Level B*, and this teacher's manual are a means of communicating a small part of God's knowledge and wisdom to children.

The parent or teacher should realize that it is not enough for the student to simply complete the material in the workbook. It is essential that he grasps the learning goals presented for each unit. Ask yourself the following questions: "Does my student understand what he has learned?" "Can he complete the exercises quickly?" "Is he frustrated by some of the concepts or requirements?" It is important for you to move slowly and carefully through the material, whenever necessary. You should also repeat a math concept if the student needs reinforcement. Do more drilling. Stop and take a break, if necessary. It is better to build a good foundation, helping your student to understand and even enjoy math, than to finish in record time. Perhaps playing some math games and continuing with some simple number drills would be helpful.

The student workbook is designed to give the student a reasonable amount of written work. However, it is assumed that the teacher will do "classwork" with the student during each daily lesson. (See "Components of a Daily Lesson" on page *vi* of this manual.) This manual presents specific learning goals (see "Setting Goals" on page *v*), drills, and games that will guide the teacher in what to cover in each day's lesson. In addition, "preparatory activities" provide the teacher with a means to introduce new material to the student before it appears in the workbook. Finally, "Unit Tests" (available from Christian Liberty Press) have been created to determine your student's progress. Note that students enrolled in CLASS do not submit these tests. Use these tools at your discretion to help with the ultimate goal of teaching your student the basic math concepts.

I would like to take this opportunity to thank God for His blessing during the planning, formulating, and writing of this course. I am also grateful to the teachers and home school parents who helped me to determine what would be most useful to include in the workbook. I praise the Lord as well for the talents of Ed and Belit Shewan, who worked so hard in the layout and formatting of the workbook.

This course is dedicated to my children, who taught me patience as I taught them during their early years of schooling. Children truly are a blessing from the Lord!

May God richly bless you as you endeavor to present these fundamentals of mathematics to your student. May students who complete these lessons seek to glorify God in their preparation to be our country's future leaders.

Wendy Kramer

"I can do all things through Christ who strengthens me" (Philippians 4:13).

Setting Goals

Before you begin working with your student, consider the following goals you should set for the *Liberty Mathematics, Level B*, math curriculum:

- Numeral Recognition and Ordinal Numbers
- Counting from 0 to 300 and Story Problems
- Addition and Subtraction up to the Thousands Place Value
- Place Value—Ones, Tens, Hundreds, and Thousands
- Counting by 1's, 2's, 3's, 4's, 5's, 10's, 25's, and 100's
- Units of Time—Hour, Half Hour, Quarter Hour, Minutes, and Seconds
- Scheduling With Time and Time Problems
- Months, Weeks, and Days; Calendars and Seasons
- Value of Money, Money Problems, Working with Change, and Rounding and Estimating
- Measuring Temperature, Time, and Length of Objects; Working with Maps
- Fractions, Tallies, Charts and Graphs, and Shapes
- Multiplication and Division through the Family of Five
- Learning to Take Tests with Bubble Answers; Working with Tables
- Working with Math Signs; Introducing Balance in Equations

Each lesson should be directed by the teacher. Through number drills, math games, and real-life discussions, you should try to double the amount of time the student spends on his written math “lesson” each day. Review and drill. Count aloud using a number line. Count objects and use them to illustrate math facts. Discuss the meaning of place value, or odd and even numbers. Suggestions for drills and games will be made throughout the teacher’s manual.

The following is a list of the materials you may want to have on hand for this course:

- Dot cards or Dominoes (to learn numerals)
- Flashcards
- Coins (pennies, nickels, dimes, and quarters) and dollar bills
- Ruler with inches and centimeters
- “Judy” clock or toy clock with movable hands
- Miscellaneous manipulatives for counting (Popsicle® sticks, toothpicks, etc.)

Flexibility is one of the blessings of a home school program. Adjust your math lessons to meet the learning needs of your child. This teacher’s manual will describe a variety of drills and games, and list learning objectives so that you can assess your child’s progress. Occasionally, peruse your child’s work and the learning goals for this course to make sure you are on track. Remember that mastering the material is the objective, not having fun, and certainly not just “getting finished.”

Components of a Daily Lesson

The workbook is a significant part of your student's daily work, but it is only part of the daily lesson. There are also concepts and skills that should be taught to your student during each lesson; they must be clearly mastered by him. Each unit in this manual lists the goals that are covered on the corresponding pages in the workbook. To reach these goals, each day's lesson should consist of the following components.

◆ Component 1—Counting and Numbers

Your student needs to practice counting by 1's, 2's, 3's, 4's, 5's, 10's, 25's, and 100's—as they are introduced in subsequent lessons. This can be accomplished in many ways, such as counting a jar of pennies, counting via a number line or the hundred chart (see page *viii* of this teacher's manual or the back cover of the workbook), and rehearsing the sequences orally. Counting exercises are especially helpful in preparing your student to understand the concepts of addition and subtraction—and, at this grade level, multiplication and division; to compare numbers—*greater than, less than, or equal to*; to read clocks and thermometers; and to count money. Ultimately, these counting exercises will help him memorize multiplication and division tables.

◆ Component 2—Math Facts

The term “math facts” is used in this course for the organization of multiplication and division facts, as well as addition and subtraction facts. ***These math facts must be memorized.*** Rehearsing the facts may be accomplished in different ways—reciting the facts, writing the facts, demonstrating them with manipulatives, answering random quiz questions, working with flashcards, and posing “missing number” problems. Be creative, but be thorough and consistent. These math facts are a core part of this course, and they need to be rehearsed each day.

◆ Component 3—Lesson Goals

Each unit in this manual lists goals that correspond to the material covered in the student workbook. These goals will guide you in what you teach each day. They will help you to achieve the overall objectives of this course. If place value, for example, is one of the learning goals for a particular lesson, then practice and discussion of this goal should be a part of your teaching time.

◆ Component 4—Drills and Tests

To review the math facts, introduce and administer the drills that appear throughout *Liberty Mathematics, Level B*. When needed, you may want to make up your own drills. To reinforce these math facts, you should frequently use the appropriate drills in structuring your lessons. At the beginning of this course, you may also find the drills at the end of *Liberty Mathematics, Level A, Drill Book* useful for review.

Finally, Unit Tests for each division of the student workbook are available from Christian Liberty Press; they should be given at the end of each unit.

◆ Component 5—Workbook Assignment

When you have worked through the first four components of your daily lesson with your student, he should now be equipped to complete the workbook page(s). Initially, it will probably be necessary to sit beside your student as he works through the problems, reading the questions, and giving general guidance. The goal, however, is to eventually permit him to do part of this work independently.

Each lesson should consist of “classwork,” where you, the teacher, are instructing the student; but there should also be “seatwork,” in which the student works independently to complete all or part of the workbook page. Of course, you could use other related material for the “seatwork” time. When your student completes these exercises, you should discuss them with him and review any facts or concepts that he needs to work on.

Conclusion

The “Unit Goals” and “General Lesson Plans” in this manual are constructed with the above five components in view. Let them be your guide as you teach each daily lesson. These goals and plans answer the following questions: “What will I teach my student(s)?” “In what order?” and “How will I teach?” Be creative and flexible as you prayerfully seek to answer these questions. And remember, these lesson plans are not rigid assignments that must be precisely followed but guidelines to help you achieve the overall objectives of this course.

Looking Ahead

The *Preparatory & Review Activities* are designed to introduce new math concepts and to go over material already learned in previous units. By doing the preparatory activities ahead of time, the new math concepts will not be entirely new when they are introduced in the workbook; thus the lessons should be easier to explain and complete.

Hundred Chart

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

Unit 2

Addition and Subtraction to Four Columns, Carrying and Borrowing, Place Value, and Telling Time

Pages 17–48

This unit covers two-column addition and carrying, place value, telling time, time schedules, time problems, two-column subtraction and borrowing. Also, addition and subtraction up to four columns is introduced.

Unit Goals:

- To recite numbers 0–100 on the hundred chart on the back cover of the workbook (or page *viii* of this manual) and to write them properly; to count higher, up to 200
- To count backwards from 20 to 0, relating this concept to subtraction
- To review two-column addition and carrying with addition facts
- To review the addition of three numbers
- To review math signs *greater than* ($>$) and *less than* ($<$)
- To practice with the use of tallies and to count by 1's, 10's, and 100's
- To introduce place values of hundreds and thousands
- To review telling time, to introduce time schedules, and to do time problems
- To introduce two-column subtraction and borrowing
- To practice reading temperatures; to review the months of the year and the days of the week
- To introduce three- and four-column addition; carrying up to four places
- To introduce four-column subtraction; borrowing up to four places
- To review the values of a penny, nickel, dime, and quarter
- To count these pennies, nickels, dimes, and quarters by 1's, 5's, 10's, and 25's, respectively

General Lesson Plan

Each day your math lesson should include a variety of drills and games; the student should also complete two pages in his workbook. He should go over all the pages in this unit carefully. In addition, the math concepts already learned will be reviewed.

Suggested Drills:

- Depending on your student's progress, continue to count higher, up to 200.
- Beginning with 20, count backwards, from 20 to 0. Explain that each time you count down, or back, you are subtracting one. Illustrate with an abacus or manipulatives.
- As your student reviews his subtraction facts up to 18, drill with flashcards. If he gets the answer to a flashcard wrong, have him use dot cards and/or dominoes to help him understand it.

- If you have access to the *Liberty Mathematics, Level A, Drill Book*, complete any Drill Sheets or Speed Drills toward the end of the *Drill Book* (pp. 112–129) that would be helpful with the math facts your student needs to review. If he is having difficulty with certain math facts, you may copy and repeat any drill in the *Drill Book*.
- Count various objects by 1's, 5's, and 10's. Also, count pennies, nickels, and dimes up to \$1.00.
- Count various objects by 2's, 3's, and 5's—also count by tallies with bundles of 5 each.
- Count by 5's to 60 with the help of the clock on page 25 of the workbook.
- Recite the days of the week, the months of the year, and the four seasons.

Suggested Games:

- Put ten objects on the table. “Subtract” one at a time by taking them, and ask each time, “How many are left?” Explain that to “take away” is to subtract.
- Continue using oral story problems. Here are a couple of examples:
 - “If you see 4 cows in a field, and 2 cows go back to the barn, how many are left?”
 - “If you have 3 pencils, and you give 1 pencil away, how many do you have left?”
- If you have a board game or computer game that teaches numbers, let your student play it. Explain how the game helps to explain the orderly system of numbers God has given us.
- If at any time your student is having difficulty, slow down. Go back and ask, “Where did he get lost?” and “Why?” Have him explain concepts and problems using manipulatives, so you can see where he lacks in understanding. Stop if necessary and use another approach, or wait for a later time to cover the material. Above all, be patient.

Preparatory & Review Activities:

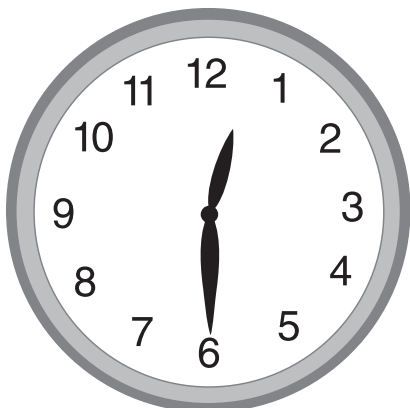
1. Review Measuring Time

- Say, “Sixty minutes equal one hour.” Count the minutes by 1's, 5's, and 10's.
- Say, “Twenty-four hours equal one day.” “Seven days equal one week.”
- Recite the days of the week together. Explain four weeks equal one month.
- Introduce the months of the year. Have your student say them by himself.

2. Review Telling Time

Use a toy clock, a “Judy Clock,” or even a real watch or clock to do this activity.

- Explain that the short hand, or **hour hand**, tells you the hour. It moves from one number to the next in one hour. Likewise, the long hand, or **minute hand**, tells the minutes. Show which direction the hands move; this is called “clockwise.”
- Explain that 60 seconds equal a *minute* and 60 minutes equal an *hour*.



- Use a clock to explain *hours* and *half hours*. Since there are 60 minutes in one hour, each tiny line represents one minute. The long *minute hand* moves from one tiny line to the next every 5 minutes. It moves to a new number every 5 minutes. Count the tiny lines between the numbers. There are five of them.

- Count by 5's to 30, pointing to the numbers on the clock. There are 30 minutes in a half hour. When the long *minute hand* has moved to the 6, 30 minutes have gone by. The *hour hand* has only moved halfway to the next number. At the half hour, the short *hour hand* is halfway between the hour and the next hour, and the long *minute hand* rests on the 6.

- Explain the 5- and 15-minute intervals on a clock by showing your student the clock’s position at 12:15, 12:30, 12:45, and 1:00; and the clock’s position at 12:05, 12:10, 12:15, up to 1:00. Explain that when he counts either by 15-minute or 5-minute intervals, both methods end at 1 o’clock. Which is faster? Also, illustrate how these times would be written on a digital clock.

3. Review Months, Seasons, and Calendars

In Unit 3, your student will officially learn about seasons, months corresponding to each season, and calendars. These concepts have already been introduced in the preparatory activities of previous units. Yet, for the sake of completeness, they are reexamined for your benefit.

- Have your student memorize the months of the year in order.

January March May July September November
February April June August October December

- Say, “Recite the names of the *four seasons.*” (*winter, spring, summer, and fall*)
- Explain that the following months correspond to each of the four seasons.

Winter	Spring	Summer	Fall
December	March	June	September
January	April	July	October
February	May	August	November

- If the seasons are different where you live, make the appropriate changes.
- Discuss the concept of a calendar with your student. Have him fill out one using a calendar for the current month.*

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY

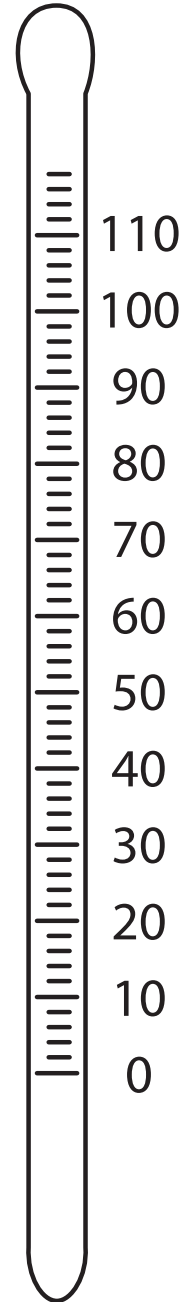
- Explain that seven months have 31 days (*January, March, May, July, August, October, and December*). Four months have 30 days (*April, June, September, and November*). Only one month has 28 days, except for leap year when it has 29 days (*February*).

* Note that calendars usually have six (6) lines of spaces because the months begin and end on various days of the week.

4. Using Thermometers

This and subsequent units (pages 33, 67, and 200) cover *thermometers* and how to measure temperature with them. Use this activity early on in your lessons for this unit, so your student will be prepared to do the workbook exercises. Since he already knows how to count by 2's and 10's, reading thermometers should be easy to learn.

- Explain that a *thermometer* measures heat—*thermo* means “heat” and *meter* means “measure.”
- Tell your student that the red liquid in a thermometer is called “mercury” because years ago most thermometers had mercury inside them. But mercury is very poisonous, so most thermometers today do not use mercury.
- Discuss some of the uses of a thermometer. If your student is already familiar with it, ask him what a thermometer is used for.
- Explain the *markings* on a thermometer—the *large lines* represent counting by 10's (every large line stands for a 10° interval), and the *small lines* represent counting by 2's (every small line stands for a 2° interval). Also demonstrate how to write temperatures with the *degree sign* (°).
- Have your student practice counting degrees by 10's, starting with 0°. Remind him that each large line represents 10°.
- Next, have your student practice counting degrees by 2's, starting with 0°. Remind him that each small line represents 2°.
- Tell your student that in the United States, temperature is measured by a scale named after a man named **Daniel G. Fahrenheit**. So it is called the *Fahrenheit scale*, and temperature is written like this: ° F. This is the scale used in this course.
- Explain that most of the world uses the *Celsius scale* (named after **Anders Celsius**), and temperature is written like this: ° C. Many scientists also use this scale for measuring temperature.
- If it is not too confusing, explain that there is another scientific scale called the *Kelvin scale* (named after **Lord Kelvin**); it is based on *absolute zero*. (See the chart below.)
- Do not belabor the difference between these scales; this information is provided only as background information. However, if your student is curious, show him the comparison chart below:



Conditions	Fahrenheit	Celsius	Kelvin
<i>Boiling point of water</i>	212° F	100° C	373.15 K
<i>Freezing point of water</i>	32° F	0° C	273.15 K
<i>Absolute zero</i>	-459.67° F	-273.15° C	0.0 K

- Have your student read a thermometer in your home, such as the one on the thermostat. You may have your student take a person's temperature.
- Explain that the freezing point for water is 32° F.
- Talk about the ice cubes in the freezer. Have your student place a plastic thermometer in the freezer for ten minutes. Ask, “Does the thermometer read 32° or is it colder?”

5. *Working with the Value of Money*

Money is covered in Unit 3, pages 52–63. Discussing the value of money will help your student easily grasp the concepts developed in future units. Cover the following material over several lessons.

- A **nickel** is worth *five cents* (5¢), so 5 pennies are equal to one nickel.
- A **dime** is worth *ten cents* (10¢), so 10 pennies are equal to one dime.
In addition, explain that 2 nickels are equal to one dime.
- A **quarter** is worth *twenty-five cents* (25¢), so 25 pennies are equal to one quarter.
In addition, explain that 5 nickels are equal to one quarter.
If your student is a quick learner, explain that 2 dimes and 1 nickel are equal to a quarter.
- A **dollar** is worth a *hundred cents* (100¢), so 100 pennies are equal to one dollar.
In addition, 20 nickels are equal to one dollar.
Similarly, 10 dimes are equal to one dollar, and 4 quarters are equal to one dollar.

Have your student do various exercises counting out certain coins up to \$1.00. For example, count 100 pennies, 20 nickels, 4 quarters; ask how many of each equals \$1.00.

6. *Learning about Fractions*

This math concept builds on an understanding of shapes and dividing things into equal parts.

- The best way to introduce this concept is to use pages 79 and 80 in the workbook. Go over them carefully with your student, so he understands what one half, one fourth, one eighth, one third, and one sixth mean.
- Evenly divide the shapes you have drawn into halves, thirds, and fourths. Have your student shade in one part. Talk about which part is $\frac{1}{2}$, $\frac{1}{3}$, or $\frac{1}{4}$.
- Make a “pizza” out of clay or play dough. Use a pizza cutter to cut it into pieces. Show your student how one (1) piece out of two (2) is different from one (1) out of four (4) or eight (8).
- You may want to copy pages 79 and 80 in the workbook and use them as activity sheets toward the end of this unit, in preparation for Unit 3.

7. *Questions for Measuring Time, Length, and Volume*

This math concept should come easily to your student.

- First, explain that *measuring* answers the following questions: “when,” “how long,” and “how much.” Say, “Different things are measured in different ways.”
- **When?** *Time* is measured in seconds, minutes, hours, and so forth.
- **How long?** *Length* is measured in inches, feet, and yards; or in centimeters and meters. Explain how a ruler works. Have your student measure various objects in inches and centimeters.
- **How much?** *Volume* is measured in cups, pints, quarts, and so forth.* Show your student how to measure liquids by volume. Use measuring cups to fill containers (pint, quart pan, gallon jug, etc.) with water. Ask, “How many cups did it take to fill each?”

On completing this unit, your student should take Test 2.

* In regard to measuring volume, the *metric system* (milliliters, deciliters, liters, etc.) is not taught in this course.