

TEACHER GUIDE

Includes Student
Worksheets

-  Answer Keys
-  Weekly Lesson Schedule
-  Worksheets
-  Quizzes

7th – 8th Grade

Math

PRINCIPLES OF MATHEMATICS BOOK 2



First printing: March 2016

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For information write:

Master Books®, P.O. Box 726, Green Forest, AR 72638

Master Books® is a division of the New Leaf Publishing Group, Inc.

ISBN: 978-0-89051-906-6

Unless otherwise noted, Scripture quotations are from the King James Version of the Bible.

Based on and designed to go with *Principles of Mathematics Student Textbook* (Book 2). Please see the *Student Textbook* for further information and sources.

For the most part, units are based on the official standards given in Tina Butcher, Linda Crown, Rick Harshman, and Juana Williams, eds. *NIST Handbook 44: 97th National Conference on Weights and Measures 2012, 2013 ed.* (Washington: U. S. Department of Commerce, 2012), Appendix C. Found on <http://www.nist.gov/pml/wmd/pubs/h44-13.cfm>, accessed 10/6/2014.

Printed in the United States of America

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Problems from the Early 1900s

History...in math? Why not! Throughout the text, we've sprinkled in some math problems from early 1900 math textbooks, often with significant adaptation. The sources are listed here for your reference.

The following problems were adapted from Eugene Henry Barker, *Applied Mathematics for Junior High Schools and High Schools* (Boston: Allyn and Bacon, 1920). Available on Google Books, <http://books.google.com/books?id=-t5EAAAIAAJ&vq=3427&pg=PR2#v=onepage&q&f=false>

Worksheet 2.3, problem 3c; Quiz 1, problems 3a and 5c; Worksheet 5.4, problems 2a and 2b; Quiz 4, problems 1a–1b; Test 1, problem 1a–1b; Worksheet 6.1, problem 2; Worksheet 6.3A, problems 1 and 2; Worksheet 6.3B, problems 1a and 1c; Quiz 5, problem 1c; Worksheet 7.1, problems 4c and 4d; Worksheet 7.2, problem 5; Worksheet 7.3, problem 3; Quiz 6, problem 3; Worksheet 11.6, problems 1a and 1c; Test 2, problem 3d; Worksheet 17.5, problem 4; Worksheet 20.3, problem 5a; Worksheet 21.3C, problem 3

The following problems were adapted from John C. Stone and James F. Millis, *A Secondary Arithmetic: Commercial and Industrial for High, Industrial, Commercial, Normal Schools, and Academies* (Boston: Benj. H. Sanborn & Co., 1908). Available on Google Books, <http://books.google.com/books?id=RtYGAAAAYAAJ&pg=PP1#v=onepage&q&f=false>

Worksheet 1.4, problem 3; Worksheet 3.7, problem 5; Worksheet 5.2, problem 3; Worksheet 5.3, problem 3; Worksheet 5.5, problem 1a; Worksheet 11.6, problem 9; Worksheet 12.1, problem 5; Worksheet 13.4, problems 3b–3c; Worksheet 14.7, problem 2, Quiz 16, problem 4; Worksheet 18.4, problem 6; Worksheet 20.4, problem 3; Worksheet 21.3C, problem 2

This problems were adapted from Joseph Victor Collins, *Practical Algebra: First Year Course* (New York: American Book Co., 1910). Available on Google Books, <http://google.com/books?id=hNdHAAAIAAJ&pg=PP1#v=onepage&q&f=false>

Worksheet 3.2, problem 5b; Worksheet 5.6, problems 6a–6c; Worksheet 7.4, problem 5; Worksheet 9.4, problem 1; Worksheet 10.1, problem 4; Worksheet 10.3, problem 3; Worksheet 11.3, problem 3b–3d; Worksheet 11.4, problem 5c; Worksheet 12.3, Problems 3 and 4

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Preparing to Use the Curriculum

We've tried to streamline everything to make this curriculum as easy to use as possible. Rather than long instructions on how to teach each lesson, the *Student Textbook* contains all the explanation of the material. Important terms are bolded in the textbook so you can easily spot them. Examples you can work through with the student if needed are all included there.

Here are two different suggestions for how to prep the information in this *Teacher Guide*:

- Tear out the schedule, answer key, quizzes, and tests and put them in a binder for you to use as needed, and then hand the student the rest of the guide to work from when instructed.
- Tear out each worksheet as you assign it and hand it to the student, and have them store the completed pages in a binder.

Either way, all the pages are already hole punched for you and ready to go.

The schedule on page 6 explains what to assign each day. This schedule can be adapted to fit your needs. For example, in a classroom setting, several days could be taught at once, with the assignments due at the next class.



Katherine Loop is a homeschool graduate from northern Virginia. Understanding the biblical worldview in math made a tremendous difference in her life and started her on a journey of researching and sharing on the topic. For over a decade now, she's been researching, writing, and speaking on math, along with other topics. Her books on math and a biblical worldview have been used by various Christian colleges, homeschool groups, and individuals. You can connect with her at www.ChristianPerspective.net.

Using This Teacher Guide

Features: The suggested weekly schedule enclosed has easy-to-manage lessons that guide the reading, worksheets, and all assessments. The pages of this guide are perforated and three-hole punched so materials are easy to tear out, hand out, grade, and store. Teachers are encouraged to adjust the schedule and materials as needed in order to best work within their unique educational program.

Lesson Scheduling: Students are instructed to read the pages in their book and then complete the corresponding section provided by the teacher. Assessments that may include worksheets, activities, quizzes, and tests are given at regular intervals, with space to record each grade. Space is provided on the weekly schedule for assignment dates, and flexibility in scheduling is encouraged. Teachers may adapt the scheduled days per each unique student situation. As the student completes each assignment, this can be marked with an “X” in the box.



Approximately 30 to 45 minutes per lesson, four to five days a week



Includes answer keys for worksheets, quizzes, and tests.



Worksheets for each section



Quizzes and tests are included to help reinforce learning and provide assessment opportunities.



Designed for grades 7 to 8 to complete in a one-year course or for older students to use at an accelerated speed.

Course Description

This is Book 2 of a two-book math course designed to give students a firm mathematical foundation, both academically and spiritually. Not only does the curriculum build mathematical thinking and problem-solving skills, it also shows students how a biblical worldview affects our approach to math's various concepts. Students learn to see math, not as an academic exercise, but as a way of exploring and describing consistencies God created and sustains. The worldview is not just an addition to the curriculum, but is the starting point. Science, history, and real life are integrated throughout.

Course Objectives

Students completing this course will:

- Discover how a biblical worldview affects how we view and use math, and how math's very existence points us to a faithful Creator we can trust
- Be equipped to use the math they learn as a useful tool in a wide range of settings, learning to see math as much more than a textbook exercise
- Have a solid foundation for algebra, understanding the core concepts of working with unknowns, equalities, inequalities, functions, and graphing relationships
- Grasp core concepts in statistics and probability, including line graphs and trends, scatter graphs and correlation, stem-and-leaf plots, averages, independent events, dependent events, and the fundamental counting principle
- Work with exponents and square roots, including negative exponents, scientific notation, finding square roots, and the Pythagorean theorem
- Get a glimpse of how math applies in other areas, including trigonometry, sets, and consumer math

Supplies Needed

- *Principles of Mathematics Student Textbook (Book 2)*
- **Binder with Lined Paper** — Students will need to tear out the reference section from this book and put it in the binder, as well as add notes to the binder during the course. They can also use their binder to store their completed worksheets, if desired.
- **Calculator** — Students need a calculator that is able to handle scientific notation; has at least a 10-digit display; and has exponent (y^x), square root ($\sqrt{\quad}$), sine (**SIN**), cosine (**COS**), and tangent (**TAN**) buttons. Graphing calculators should not be used in this course.
- **Graph Paper** — Students will need graph paper to draw coordinate graphs.
- **Ruler** — Students will need a ruler to draw straight lines when graphing.
- **Additional Paper** (if needed) — Students should have extra paper available in case they need more room to complete a problem.
- **Index Cards** (optional)— Making flashcards of definitions or formulas can be a helpful way to learn and review the material. Students are encouraged to use index cards to make flashcards as needed.

Additional Resources and Course Notes

- Please see <http://www.christianperspective.net/math/pom2> for links to helpful online resources, along with additional notes and information related to this course. There is also a way to ask questions there.

Suggested Daily Schedule
(to complete Book 2 in a school year)

Date	Day	Assignment	Due Date	✓	Grade
First Semester—First Quarter					
Week 1	Day 1	Lesson 1.1 (<i>Student Textbook</i> , pages 13–18) Worksheet 1.1 (<i>Teacher Guide</i> , pages 21–22)			
	Day 2	Lesson 1.2 (<i>Student Textbook</i> , pages 18–22) Worksheet 1.2 (<i>Teacher Guide</i> , pages 23–24)			
	Day 3	Lesson 1.3 (<i>Student Textbook</i> , pages 22–24) Worksheet 1.3 (<i>Teacher Guide</i> , pages 25–26)			
	Day 4	Lesson 1.4 (<i>Student Textbook</i> , pages 24–26) Worksheet 1.4 (<i>Teacher Guide</i> , pages 27–28)			
	Day 5	Lesson 1.5–1.6 (<i>Student Textbook</i> , pages 27–31) Worksheet 1.5 (<i>Teacher Guide</i> , pages 29–30)			
Week 2	Day 6	Lesson 2.1 (<i>Student Textbook</i> , pages 33–35) Worksheet 2.1 (<i>Teacher Guide</i> , page 31)			
	Day 7	Lesson 2.2 (<i>Student Textbook</i> , pages 36–38) Worksheet 2.2 (<i>Teacher Guide</i> , pages 33–34)			
	Day 8	Lesson 2.3 (<i>Student Textbook</i> , pages 38–41) Worksheet 2.3 (<i>Teacher Guide</i> , pages 35–36)			
	Day 9	Lesson 2.4 (<i>Student Textbook</i> , pages 41–46) Worksheet 2.4 (<i>Teacher Guide</i> , pages 37–38)			
	Day 10	Lesson 2.5 (<i>Student Textbook</i> , pages 46–52) Worksheet 2.5 (<i>Teacher Guide</i> , pages 39–40)			
Week 3	Day 11	Lesson 2.6 (<i>Student Textbook</i> , pages 53–57) Worksheet 2.6 (<i>Teacher Guide</i> , pages 41–42)			
	Day 12	Lesson 2.7 (<i>Student Textbook</i> , page 58) Study Day			
	Day 13	Quiz 1 (<i>Teacher Guide</i> , pages 309–310)			
	Day 14	Study Day*			
	Day 15	Study Day*			
Week 4	Day 16	Lesson 3.1 (<i>Student Textbook</i> , pages 59–61) Worksheet 3.1 (<i>Teacher Guide</i> , pages 43–44)			
	Day 17	Lesson 3.2 (<i>Student Textbook</i> , pages 61–64) Worksheet 3.2 (<i>Teacher Guide</i> , pages 45–46)			
	Day 18	Lesson 3.3 (<i>Student Textbook</i> , pages 64–68) Worksheet 3.3 (<i>Teacher Guide</i> , pages 47–48)			
	Day 19	Lesson 3.4 (<i>Student Textbook</i> , pages 68–70) Worksheet 3.4 (<i>Teacher Guide</i> , pages 49–50)			
	Day 20	Lesson 3.5 (<i>Student Textbook</i> , pages 70–72) Worksheet 3.5 (<i>Teacher Guide</i> , pages 51–52)			

* Use these study days to spend extra time reviewing any concepts covered in the first two chapters that need more review. The first two chapters reviewed many foundational concepts; it's important to be comfortable with them before continuing.

Worksheets

5. Term Time

- a. Is $5 + 9$ an expression or an equation?

- b. Simplify $5 + 9$

6. “How to Use This Curriculum” — Be sure to read the “How to Use This Curriculum” section (p. 423–424).

- a. When are you allowed to use a calculator in this course?

- b. Round 0.5432 the way it should be rounded if it’s the answer to a problem.

- c. Round 0.8975 the way it should be rounded if it’s the answer to a problem.

- d. Should you round 0.8975 if it’s a number you need to input into your calculator in order to solve a problem?

- e. When should you include a unit of measure in your answer?

- f. List one suggestion given for how to study on study days.



You may use a calculator on this worksheet whenever you see this symbol ().

- 1. Finding Unknowns** — Solve each equation for x (that is, isolate x on a side by itself so as to find its value). Show how you added or subtracted (i.e., added a negative number) the same amount to both sides to isolate x on a side by itself.

Example: $x - 3 = 10$
 $x - 3 + 3 = 10 + 3$
 $x = 13$

a. $x - 7 = 20$

Example Meaning: How many brownies were there before dinner if your family ate 7 brownies after dinner and you have 20 brownies left?



b. $x + 7 = 38$

Example Meaning: How much more do you have to save if you've saved \$7 and your goal is to save \$38?

c. $x + 8 = 26$

d. $x - 98 = 113$

e. $78 + x = 240$

f. $15 + x = 121$

- 2. Checking Your Work** — Go back and check each of the answers you obtained in problem 1 by substituting the value you found for x into the original equation. Does it hold true? Show your work.

For example, we can check the example we showed for problem 1 by substituting the value for x we obtained into the original equation:

$$\begin{aligned}x - 3 &= 10 \\13 - 3 &= 10 \\10 &= 10\end{aligned}$$

a.

b.

c.

d.

e.

f.

3. Understanding the Meaning

- If we were using the equation in problem 1a to solve the example meaning given, what would the x represent?
- If we were using the equation in problem 1b to solve the example meaning given, what would the x represent?
- Write your own example meaning for the problem in 1c.

4. **Challenge Problem** — Solve: $-8 + x = 10$ *Hint:* It doesn't matter that the negative number comes first. This problem means the exact same as $x - 8 = 10$, which we could think of as $x + -8 = 10$.

5. Skill Sharpening — Simplify.

a. $-23 \cdot -45 \cdot -1$

b. $\frac{45}{-5}$

c. $\frac{72}{-8}$

d. $82.5 \cdot -6$

e. $\frac{2}{3} \cdot -\frac{6}{7}$

f. $\frac{5}{3} \div \frac{2}{3}$

g. $\frac{6}{\frac{2}{3}}$

h. $\frac{60 \text{ m}^2}{10 \text{ m}}$

6. Miscellaneous Review (📊)

- In order to earn \$55,670 a year, how much do you need to earn on average each month?
- If you spend \$32.56 on a phone a month, how much do you spend a year?

7. **Fill in the Blanks** — Look at the box on page 65 of your *Student Textbook* to fill in the blanks.

To find an unknown in an equation, _____
_____. Do this by performing the _____ operation using the
_____ to _____ of the equation.



You may use a calculator on this worksheet whenever you see this symbol ().

1. **Under Pressure** () — Use the proportion $\frac{P_1}{P_2} = \frac{V_2}{V_1}$ and cross multiplication to solve these problems.
- 24 cubic inches (V_1) of air under a pressure of 40 pounds (P_1) will have what volume when the pressure is increased to 100 pounds (P_2), assuming the temperature remains the same?

 - 15 cubic yards (V_1) of air under a pressure of 35 pounds (P_1) will have what volume when the pressure is decreased to 10 pounds (P_2), assuming the temperature remains the same?
2. **Looking at Proportions** ()
- If the fall in a barometer (device for measuring atmospheric pressure) is 0.1 inch for every 100 feet of elevation, what will the fall due to elevation be if the elevation is increased by 2,600 feet?

 - If 1 acre of alfalfa produces 1.5 tons of alfalfa each time the alfalfa is cut, and the alfalfa is cut 7 times each growing season, how much alfalfa can you cut in one season on 12 acres? *Hint*: First find the alfalfa per time cut, and then find the alfalfa per season.
- c. Solve: $\frac{50 \text{ ft}}{20 \text{ sec}} = \frac{20 \text{ ft}}{x}$
- If you want to draw a scale drawing where every inch represents 11 feet of a building that is 75 feet tall, how tall will your drawing be?

3. **Similar Figures** () — If you have two similar right triangles, one of which has a base of 4 in and a height of 8 in, and the other of which has a base of 3 in, what is the height of the second triangle? *Hint:* Draw the right triangles if you need to.

4. **Time and Distance** () — Solve.

a. How fast do you have to travel to go 400 miles in 5 hours?

b. If you're traveling at $65 \frac{\text{mi}}{\text{hr}}$, how much less time will it take you to go 400 miles than if you travel at $55 \frac{\text{mi}}{\text{hr}}$? Give your final answer in hours and minutes, rounded to the nearest minute.

Example: If your final answer is 1.33 hr, convert the 0.33 portion to minutes.

$$0.33 \text{ hr} \cdot \frac{60 \text{ min}}{1 \text{ hr}} = 19.8 \text{ min, which rounds to 20 min}$$

A final answer of 1.33 hr should be listed as 1 hr, 20 min

5. **Skill Sharpening**

a. Solve: $x - \frac{-3}{7} = 5\frac{1}{3}$

b. Solve: $x + \frac{-2}{-7} = 2\frac{1}{4}$

c. Say $\frac{7}{9}$ of your total land is planted with tomatoes; how many acres total do you have if you have 6 acres of tomatoes?

d. Solve: $x \cdot \frac{8}{7} = 12$

e. Simplify: $\frac{5}{\frac{5}{6}}$

f. If a field is 26 m long, how many feet long is it?

Quizzes and Tests



You may use a calculator () on *all* problems on this quiz.

You may consult the reference sheets (p. 425–434) as needed.

1. **Skill Check** — Simplify, except where otherwise instructed.

a. $7 + 8.2(1.5 - 1.25) - 8$

b. $-8 \cdot -1 \cdot -1$

c. $|-9|$

d. $\frac{1}{9} \div \frac{2}{3}$

e. $2\frac{1}{2} \cdot \frac{3}{10}$

f. $2\frac{1}{3} + 5\frac{6}{9}$

g. Solve using the distributive property, showing your work: $5(7 + 8)$

h. $8 + -7 + -3$

2. **More with Fractions and Factoring**

a. Simplify: $\frac{85 \text{ ft}}{1,045 \text{ ft}}$

b. What are the prime factors of 8 and of 88?

c. What is the greatest common factor of 8 and 88?

Chapter 1:

Worksheet 1.1

- Math notebook should be prepped.
- Student should have added terms to notebook and (optionally) made flashcards for them.
- Answer should be 10 ways math applies outside of a textbook. See the "Where Did Math Originate?" section of Lesson 1.1 in the *Student Textbook* for ideas.
- A worldview is a set of truths (or falsehoods we believe to be true) through which we interpret life.
 - Math is a way of describing God's creation that works because of God's faithfulness.
 - We find evidence of God's wisdom and care because a wise and caring God created all things very good, and we find evidence of suffering and death because this world is marred by sin and no longer the perfect world God created.
- an expression
 - 14
- Note on questions 6b and 6c:* Rounding was taught back in Book 1, Lesson 3.2. Please review if needed.
 - I can use a calculator whenever I see the symbol  or when instructed to on a quiz or test.
 - 0.54
 - 0.9
 - no
 - whenever one is given
 - Answer should be one of the study day suggestions given on p. 421 of this *Teacher Guide*.

Worksheet 1.2

Note: On this worksheet and the next, students will be reviewing a lot of the basics of arithmetic, including adding, subtracting, multiplying, and dividing both whole and decimal numbers. The book assumes students already know how to perform these mechanics; if they do not, do not start this book until they do.

- name, identify, and order
 - , +, =, ≠
 - Three of these methods should be listed: 20×6 , $20 \cdot 6$, $20(6)$, $(20)6$
 - Conventions are agreed-upon protocols or rules that aid us in communication.
- 8 tens or eighty
 - 8 hundredths or $\frac{8}{100}$
- Students were told to both rewrite the multiplication with parentheses and solve.
 - $5(6) = 30$
 - $2(105) = 210$
- Students were told to both rewrite the multiplication with a \cdot and solve.
 - $8 \cdot 9 = 72$
 - $7 \cdot 218 = 1,526$
- $8 - 3 + 2 =$

- $5 + 2 = 7$
 - $(8 - 2)10 \div 2 =$
 $(6)10 \div 2 =$
 $60 \div 2 =$
30
 - $7.5(0.23 + 0.96) - 1.8 =$
 $7.5(1.19) - 1.8 =$
 $8.925 - 1.8 =$
7.13
 - $4\overline{)4 + 9 + 7} = 4\overline{)20} = 5$
 - $2.5 + 4.1(5.6 - 3) \div 2 =$
 $2.5 + 4.1(2.6) \div 2 =$
 $2.5 + 10.66 \div 2 =$
 $2.5 + 5.33 = 7.83$
- an expression
 - 4.25

Worksheet 1.3

- ≠
 - =
 - associative property of addition
 - ≠
 - =
 - identity property of multiplication
 - =
 - identity property of addition
 - =
 - =
- Check to make sure problems were solved using the distributive property.
 - $9(15 + 22) =$
 $9(15) + 9(22) =$
 $135 + 198 = 333$
 - $5(\$8.45 + \$3.99) =$
 $5(\$8.45) + 5(\$3.99) =$
 $\$42.25 + \$19.95 = \$62.20$
- 256
 - $256 \div 3 = 85.33$
 - \$11.36
 - \$2,918.58

Worksheet 1.4

- total cost of Option B* = $50(\$5.50 + \$25.30) + \$50 = \$1,590$
cost per employee of Option B = $\$1,590 \div 50 = \31.80
difference in cost per employee = $\$32.50 - \$31.80 = \$0.70$
Option B is less expensive by \$0.70 per employee.
- Plan A* = $\$76.45 + \$19.99 + \$19.99 = \116.43
Plan B = $4(\$23.45 + \$35.40) = \$235.40$
difference in monthly cost = $\$235.40 - \$116.43 = \$118.97$
- amount made* = *income* - *expenses*
income = $\$6 + 3(280)(\$0.05) + \$12 = \60
expenses =
 $\$6 + 3.5(\$6.50) + (1,200 \div 100)\$0.75 =$
 $\$6 + \$22.75 + (12)\$0.75 =$
 $\$28.75 + \$9 = \$37.75$
amount made = $\$60 - \$37.75 = \$22.25$
- $8 + (164)5 + 5 =$