

beauty & truth
MATH

Mathematics in a
Charlotte Mason Education

INTRO TO GEOMETRY

SAMPLE

YEAR 2 BUNDLE

SAMPLE

Beauty & Truth Math

- Mathematics in a Charlotte Mason Education -

INTRO TO GEOMETRY YEAR 2 • BUNDLE

Used in conjunction with

LESSONS IN EXPERIMENTAL AND PRACTICAL GEOMETRY

by H.S. Hall and F.H. Stevens

INTRO TO GEOMETRY • YEAR 2 • BUNDLE

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We turn from the sciences of facts as we see them to the science of facts as they must be. Truth is the key-note and core of mathematics. There is no "nearly right" or "probably is so" or "certainly may be" about $2+2=4$. Logic, the putting of two and two mentally and inevitably together, and truth in all her majesty and tidiness are to be the mental acquisitions gained from arithmetic, Euclid, and algebra.

(Pennethorne, The Parents' Review, 1899, Vol. 10, p. 559)

The application of algebra to curves, etc., brings us to its meeting-point with geometry. Nothing can help children better to understand that abstract logical reasoning is not unreal than the mental discipline of going from figure to proof, and proof to figure, in what we term "propositions." Geometry trains the mind to severe reasoning, the hand to absolute accuracy, and it lies at the root base of many important and honourable professions, which is a real, though utilitarian, reason why we should teach it.

Geometry is especially remarkable in that it converts each idea it gives into a habit of mind or action in construction, and a base for the next idea to rise upon. Thus, when we give a lesson upon a proposition, we make clear the idea (equality perhaps of two triangles) to be conveyed, and then help the pupil to discover the logical as well as the obvious proof of its reality, and never make the children learn by heart without comprehension a chatter of ABC=Q.E.D.

(Pennethorne, The Parents' Review, 1899, Vol. 10, pp. 559-560)

Knowledge is valued by our society as a source of delight and of power, and as enabling the character and the intellect to develop, and, in this regard, the mode in which the knowledge is acquired is all-important.

Take geometry. Foreign nations laugh at us for still sticking to the old methods of Euclid. Euclid says: These are the facts and here are the reasons for it. Teaching in the spirit of the P.N.E.U. would say: Here are the lines and the angles, what can you find out about them?

(Nesbitt, The Parents' Review, 1904, Vol. 1, pp. 96, 98)

SAMPLE

WELCOME

Thank you for purchasing this guide! We are humbled and honored by your support. Please read through this introduction carefully. Understanding our approach is vital to maximizing the benefits of each guide.

THE VISION

Beauty & Truth Math exists to assist students AND teachers in the realm of mathematics in a Charlotte Mason education. Reading the scripted lessons and checking your students' answers is possible. However, this keeps the teacher from being an engaged and involved partner in the learning process.

These lessons are designed with the assumption that the teacher will work *with* the students, ask questions, facilitate discussions, and monitor student progress. Each lesson is an opportunity for building relationships between you, your students, and the Lord. Please make the most of this time together, walking alongside your students as they explore and understand mathematical ideas.

We thoroughly believe that math done completely in isolation misses opportunities to make deep connections. Just like a foreign language needs to be communicated and spoken to make connections, math is its own language with its own big ideas. Discussing these ideas is the best way for students to learn these living ideas.

We aim to provide a *living* education as we work with living, born persons. *Living* involves changes and adaptations. These lessons are guides and servants, not masters you must follow. Please use the Spirit's wisdom when discerning what you should modify, skip altogether, push forward on, or slow down on as you and your students are on this journey.

MAKING FORWARD PROGRESS

The Beauty and Truth Math curriculum is a blend of spiral and mastery learning. We strive to teach the reasonableness of each math concept and review each year to help build conceptual understanding.

We never want students to get bogged down in an idea they have not fully mastered. **Please keep moving forward**, even if your student's understanding is still emerging. Students will continue to see these ideas in future geometry courses.



CONTACTING US

We welcome feedback and questions! For general inquiries, please email us at contact@beautyandtruthmath.com.

For questions about this guide's content, please email Emily Al-Khatib at emily@beautyandtruthmath.com. We have done our best to remove all typos from these guides. However, if you find any mistakes, please forgive us and let us know.

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These guides have been a labor of love. Please respect our hard work and do not share any content and links that are not publicly available on our site.

CORRECTIONS

We have done our best to remove all typos from these guides. If you find any mistakes, please forgive us and let us know *after* checking the [Corrections](#) document in the Important Teacher Helps folder.



STREAMS OF MATH

The Practical Geometry, Year 2 Guide provides one weekly geometry lesson. We also recommend three arithmetic lessons and an algebra lesson. See [Our Guides](#) page for more information about our guides' math streams.



WEBSITE LINKS DISCLAIMER

PLEASE PREVIEW LINKS BEFORE USING! While we have done our best to ensure that all sites we link to are appropriate, we do not have control over their content or changes.

We are grateful for the free resources offered by other sites and strive to support them whenever possible. We link directly to their pages as they generate revenue through traffic on their sites.

Ensuring the content is age-appropriate for lessons is the teacher's final responsibility. Please email us at contact@beautyandtruthmath.com to report broken links.



READY, SET, GO!

"Putting in the work up front to make the school days run easy."

We have created three folders in this guide to make it easy to access the teacher help documents and printables. Their unique QR codes and links are included in multiple places in this introduction and are shown here for easy identification.

We will walk you through using these linked folders in the following few pages, so please don't worry about viewing them now. This page is simply an introduction to them.

Important Teacher Helps – This folder contains helpful resources to assist and support you as you implement math in a Charlotte Mason education. It includes the following documents:

- A CHARLOTTE MASON MATH EDUCATION outlines a vision for a Charlotte Mason math education.
- ALL ABOUT THE GUIDES (IG.Y2) is everything you need to know about the guide's setup.
- LEPG SOLUTIONS provides the constructions to assigned problems from *Lessons in Experimental and Practical Geometry*.
- PROGRAMME EXAM ANSWER KEY provides the construction answers to the P.U.S. Programme Exam questions.
- SUPPORT VIDEOS LIST is a compiled, linked list of support videos in this guide.
- ADDITIONAL SUPPLEMENTAL RESOURCES provide extra teacher support.



Cardstock Printables – This folder contains all resources that require printing on cardstock, as the student will use these documents frequently.



Printables – This folder contains all of the consumable printables for your student.



GET READY!

- **SEE** the **Materials Needed** section in this guide to determine what materials you have and still need to purchase.
- **BUY** *Lessons in Experimental and Practical Geometry* (1911) in physical and/or digital form and the geometry toolkit. **Our Favorites** page links the textbook and other recommendations we have compiled to help you prepare and organize your materials.
- **PRINT ALL OF THE DOCUMENTS** in the **Cardstock Printables** folder. We recommend using cardstock, as the student will be using these documents frequently.
- **PRINT ALL OF THE DOCUMENTS** in the **Printables** folder.
- **DECIDE** if you will print the guide or use it on a screen.



GET SET!

READ THROUGH THE FOLLOWING IMPORTANT TEACHER HELPS:

1. A CHARLOTTE MASON MATH EDUCATION
2. ALL ABOUT THE GUIDES (IG.Y2)



Prepare your materials. There is no one right way to do this! The following list is simply a compilation of ideas Beauty & Truth Math users have found helpful.

- **Create a student math notebook for each student.**
 - Fill it with both graph and unlined, blank paper. We generally recommend $\frac{1}{4}$ " squares. Based on their writing ability, some students may need larger squares.
 - Create sections in the notebook for daily assignments and reference pages. Decide with your student how to organize the notebook. If applicable, create different sections for each stream of math.
 - Determine whether you will have your student write headings for each assignment; including information, such as the date and page number, is a great idea. Writing the problem number and showing the final answer, either with a box or a circle around it, is also strongly encouraged.
- **Put together a teacher math notebook for yourself.**
 - Create sections for your calendar, lessons from the guides, printable and supplementary resources, exams, notes, and other relevant materials.
- **Find a place for the Cardstock Printables.**
 - Store these in a folder or pocket of your teacher's notebook or inside an accordion file folder. The goal is to keep them accessible and in good condition, as they will be used frequently.
- **Use tabs to label and easily find what you need!**
 - In the *Lessons in Experimental and Practical Geometry* text, tab the current lesson and the corresponding answer key section in the back of the book.
 - If you choose to print the LEPG Solutions document, mark your place with a sticky tab.
- **Have individual containers for each of your student's supplies.**



GO!

Any author of math textbooks or guides will tell you that we write to accommodate as many students as possible and provide more than is needed. You have complete freedom to modify the lessons and adjust the number of problems assigned to meet your students' needs.

First, take the Beauty & Truth Math Guide Vow – I do solemnly promise that I will remember and implement the following statements:

- I have permission from Charlotte Mason and the authors of these lessons to adjust or modify any lesson, at any time, to provide a living education to my unique, born persons.
- I have permission from Charlotte Mason and the authors of these lessons to assign fewer problems than what is written in the lessons to provide a living education to my unique, born persons.
- I have permission from Charlotte Mason and the authors of these lessons to assign additional problems beyond those written in the lessons to provide a living education to my unique, born students.

“...the educator has to deal with a self-acting, self-developing being, and his business is to guide, and assist in, the production of the latent good in that being, the dissipation of the latent evil, the preparation of the child to take his place in the world at his best, with every capacity for good that is in him developed into a power.” (Mason, Vol. 1, p. 9)

Then, look over the new lesson to cover with your student.

- Understand the big ideas and objectives.
 - If you are unfamiliar with any constructions, take a few minutes to go through the steps to complete them on your own.

Now, pray for joy and wisdom as you explore mathematical truths with your students daily. Then dive right into using the lessons, confident that the Lord is with you and for you!



ALL ABOUT THE YEAR

SEEING THE BIG PICTURE

There is no one-size-fits-all way to teach math using the Charlotte Mason method. Our guides are one option for teachers to use. We have created them to be adaptable to each unique student, both in the big picture and in the guides' details.

We have designed our curriculum to imitate the math streams used in Charlotte Mason's schools. Students have several options for the tracks and combinations of these streams. For more information, see our [Scope & Sequence](#) page on our website.



Our [The Guides' Big Ideas](#) page shows the main ideas throughout the years.



YEAR OVERVIEW

In Term 1, students learn about perpendicular lines and triangles.

In Term 2, students learn more about triangles, including their properties and practical applications. The term ends with an introduction to quadrilaterals.

In Term 3, students learn more about quadrilaterals, including their properties, and create a flowchart to classify them. Students also learn about area, surface area, and volume.

The **maximum** lesson time for students in Practical Geometry, Year 2, is 30 minutes, and lessons occur once a week.

STREAMS OF MATH

The Practical Geometry, Year 2 Guide provides one weekly geometry lesson. We recommend including arithmetic for the other four days of math lessons. Please see [Our Guides](#) page for more information about how our guides present the math streams.



EVERYDAY & SPECIAL MATERIALS

We assume students will always have their pencil, math notebook with grid and blank paper, the geometry toolkit, ruler, and a large eraser handy for lesson time. Any additional materials beyond these items are listed in the “Special Materials Needed” section.

CARDSTOCK PRINTABLES VS. PRINTABLES

The teacher must prepare all cardstock printables before the term begins. The cardstock printables are listed as special materials in each lesson, but links are not provided. Links for the Printables Folder are always provided in the “Special Materials Needed.”

INDEPENDENT STUDENT WORK

The Printables folder includes Independent Student Work (optional). This document contains all the Student Response sections that the student can complete independently, excluding the answers. We recommend printing it at the beginning of the term.



THINGS TO LOOK FORWARD TO THIS YEAR

This list highlights the special features and noteworthy things throughout the year.

- Centers of Triangles
- Congruent Triangles
- Geometry Picture Study
- Geometry Puzzles
- Independent Student Responses
- Intro to Geometry Support Videos
- *Lessons in Experimental and Practical Geometry* Constructions & Solutions
- Quadrilateral Family Tree
- Reference Pages



MATERIALS NEEDED FOR THE ENTIRE YEAR

Our Favorites

Check out our recommendations to see if any of them would be helpful to you in preparing and organizing your materials.



Textbook

Lessons in Experimental and Practical Geometry (1911) from Yesterday's Classics

Everyday Materials

- Notebook (with grid & blank paper)
- Pencil
- Geometry Toolkit (includes a compass, dividers, protractor, and set squares, large eraser)
- Ruler (with markings of inches in tenths and sixteenths of an inch and centimeters and millimeters)

Cardstock Printables

- IG.Y2.T3 Geometry Formulas Page
- IG Geometry Symbols Page



Printables

- IG Reference Page Resource (optional)
- IG.Y2.Bundle Independent Student Work (optional)
- IG.Y2.Bundle Printables
- IG.Y2.Bundle Printables Answer Keys



SPECIAL MATERIALS

- Calculator
- Cardboard
- Cardboard Box (small, all sides are intact)
- Cardstock Paper
- Colored Paper (8, including white, red, blue, yellow, and green)
- Colored Pencils
- Cubes (24, any type that can be used for measuring volume)
- Dictionary
- Drinking Straws (11)
- Dry-Erase Board
- Dry-Erase Marker
- Geometry Riddles Worksheet (Worksheet 5A)
- Glue
- Highlighters (yellow and other colors)
- Internet Access
- Masking or Painter's Tape
- Markers
- Paper Cups



- Parallel Lines Cut By A Transversal Poster (Print p. 4 or 5.)
- Scissors
- Soup Can (with label)
- String (about 1.5 ft. long)
- Salt



- Tape
- Tenths Graph Paper (4)
- Unlined Paper (5)
- Washer (or something small, heavy, and can be easily tied onto the string)



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MATH

Mathematics in a
Charlotte Mason Education

INTRO TO GEOMETRY

SAMPLE

YEAR 2 • TERM 1

• Introduction to Perpendicular Lines •

IG. Y2. T1. W1

STREAM

Geometry



RESOURCES USED

Lessons in Experimental and Practical Geometry (Ch. VIII)

OBJECTIVES

Students will be able to define and construct perpendicular lines.

SPECIAL MATERIALS NEEDED

Parallel Lines Cut By A

Transversal Poster, Markers (or

colored pencils), Internet

Access, String (about 1.5 ft.

long), Washer (or something small, heavy,

and that can be easily tied onto the string),

Tracing Paper, Geometry Symbols Page



THE PLAN

1. Welcome back to a new year of geometry! We talked about and learned so much last year. Do you remember a favorite idea, activity, or project? Tell me about it.
2. 🕒 Color the Parallel Lines Cut By a Transversal poster to warm up and review from last year. *The directions are included in the download.*
3. Now, let's review a construction from last year. Do you remember how to bisect a line segment using intersecting circles?
 - a. Complete Ch. IV: Problem 1.
 - b. Measure the angles formed with the protractor. What do you notice? (They are right angles.)
 - c. Two lines that intersect at right angles are very special. Do you know what we call these lines? They are **perpendicular lines**.
 - d. How many right angles do perpendicular lines form? (Four right angles) Excellent!
4. Grab a piece of string and something that would weigh it down.
 - a. Tie the item onto the end of the string.
 - b. Hold it next to the wall and notice where the string would intersect the floor.
 - c. What angles do you see? (The string intersects the floor at right angles.)
 - d. The string and the floor are perpendicular.



5. You made a plumb line when you tied the washer onto the string. Have you ever used one or seen someone use a plumb line (or a plumb bob)? What is its purpose? *Draw out the idea that a plumb line uses perpendicular lines to see if something is straight or level.* The word perpendicular comes from the Latin *perpendicularis*, from *perpendicularum* ‘plumb line,’ from *per-* ‘through’ + *pendere* ‘to hang.’ You were hanging the string through the floor at right angles, which means perpendicular. And you already know one way to construct them using a compass and a straightedge! When constructing a line segment bisector using intersecting circles, the bisector is also perpendicular to the original segment. Did you notice that last year?
6. The symbol for perpendicular lines is $\perp$. When you see this, it is a shortcut way of saying perpendicular to. An example is $\overline{AB} \perp \overline{CD}$. We read that as AB is perpendicular to CD. If you see this, what angles do you know are formed? (Right angles) You can mark the angles between the lines with the symbol for right angles.
7. In your math notebook, complete Ch. VIII: Ex. 2 and ⌚ 3.

STUDENT RESPONSE

1. In your math notebook, complete Ch. VIII: Ex. 4.
2. Just like in Intro to Geometry, Year 1, you will continue to add new symbols to your Geometry Symbols Page. Add the perpendicular lines symbol. ($\perp$)



• Constructing Perpendicular Lines, Pt. 1 •

IG. Y2. T1. W2

STREAM

Geometry



RESOURCES USED

Lessons in Experimental and Practical Geometry (Ch. VIII)

OBJECTIVES

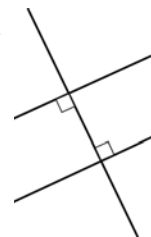
Students will be able to construct perpendicular lines using set squares.

SPECIAL MATERIALS NEEDED

Internet Access, Highlighters (yellow and another color)

THE PLAN

1. To warm up, complete Ch. VIII: Ex. 5 in your math notebook.
2. Let's look more at drawing perpendicular lines using a set square.
 - a. Draw a line segment of 10 cm in the middle of a piece of paper.
 - b. Label one endpoint A and the other B.
 - c. Draw a point not on the line anywhere on the piece of paper. Let's label the point, P.
 - d. Last year, we learned how to draw a parallel line to the given line through the point with a set square. Today, we will learn how to use a set square to draw the line that goes through point P and is perpendicular to line $\overline{AB}$.
 - e. Follow the directions given in Ch. VIII: Problem 8.
 - f. Draw the line that is parallel to $\overline{AB}$. (You need to use the edge of the triangle that was originally lined up with $\overline{AB}$.)
 - g. Use a yellow highlighter to mark the two parallel lines on your paper.
 - h. Use another color highlighter to mark the transversal.
 - i. Can you find the alternate interior angles? What is the measure of both of these angles? (90°) Mark the angles as right angles. See the diagram to the right.
 - j. In fact, look at all the angles formed. What can you say about them? (They are all right angles.)
 - k. Can you say the steps you took to construct perpendicular lines?
Draw out that a point and a line were drawn. Then, one side of the set square containing the right angle was placed along the line. A straightedge was placed along the longest side. Then, the set square can be moved along the straightedge to go through the point. A perpendicular line can then be drawn through the point to the line.



3. Play around with the idea of using set squares and a straightedge to draw a line through a given point P, making angles of 30° , 60° , and 45° with a given line $\overline{AB}$.

Hint: those are the angles that make up the set squares. See [Making Various Angles with the Set Square](#) for help if needed.



4. Complete Ch. VIII: Ex. 6. (The lines are parallel because the angle relationships between parallel lines and a transversal are true. For example, the corresponding angles are congruent. Another answer is that the lines are parallel because the alternate interior angles are congruent.)

STUDENT RESPONSE

1. In your math notebook, complete Ch. VIII: Ex. 7.

SAMPLE

