

beauty & truth
MATH

Mathematics in a
Charlotte Mason Education

INTRO TO GEOMETRY

SAMPLE

YEAR 1 BUNDLE

SAMPLE

Beauty & Truth Math

- Mathematics in a Charlotte Mason Education -

INTRO TO GEOMETRY

YEAR 1 • BUNDLE

Used in conjunction with
LESSONS IN EXPERIMENTAL AND PRACTICAL GEOMETRY
by H.S. Hall and F.H. Stevens

INTRO TO GEOMETRY • YEAR 1 • 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.

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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 Intro to Geometry, Year 1 Guide provides one weekly geometry lesson. We also recommend four arithmetic lessons. 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 want 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!

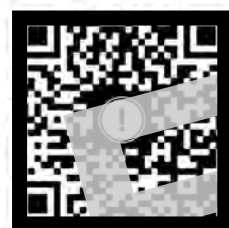
"Putting in the work up front to make the school days run easy."

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.Y1) 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. Y1)



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.



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



YEAR OVERVIEW

In Term 1, we introduce students to the formal study of geometry, including foundational vocabulary and concepts. The first half focuses on length measurements, and the second half focuses on circle properties.

In Term 2, students learn about congruent circles and angles.

In Term 3, students learn several constructions using angles. We then focus on parallel lines and the special angles formed when a transversal intersects them.

The **maximum** lesson time for students in Intro to Geometry, Year 1 is 30 minutes.

STREAMS OF MATH

The Intro to Geometry, Year 1 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. The link and QR code for the printables are always provided in the "Special Materials Needed" section.

INDEPENDENT STUDENT WORK

The Printables folder includes Independent Student Work. 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.

- Angles
- Geometry Art Projects
- Geometry City Map
- Geometry Puzzles
- Independent Student Responses
- Intersecting Circles
- Intro to Geometry Support Videos
- Lessons in Experimental and Practical Geometry Constructions & Solutions
- Measuring in Different Units
- Parallel Lines
- Reference Pages
- Scale Drawings



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

Cardstock Printables

- IG Geometry Symbols Page



Everyday Materials

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

Printables

- IG Reference Pages Resource (optional)
- IG.Y1.Bundle Independent Student Work (optional)
- IG.Y1.Bundle Printables
- IG.Y1.Bundle Printables Answer Keys



SPECIAL MATERIALS

- Cardboard (about 7" x 7")
- Cardstock Paper
- Circle (1, $r = 3"$, cut from any paper)
- Circle (1, $r = 5$ cm, cut from red colored paper)
- Circles (2, $r = 8$ cm, cut from blue colored paper)
- Circular Object (bicycle wheel, embroidery hoop, hula hoop, etc.)
- Colored Pencils
- Highlighters (2, different colors)
- Internet Access
- Large Piece of Paper
- Magnetic Compass (2)
- Markers
- Objects Representing 3D Shapes (cone, cylinder, pyramid, rectangular prism [box], sphere)
- Painter's Tape
- Paper Clip
- Pencils (2, sharpened)
- Pushpin
- Scissors
- Templates #1, #2, and/or #3 (Choose what you would like to print.)
- Tape
- Tracing Paper



beauty & truth
MATH

Mathematics in a
Charlotte Mason Education

INTRO TO GEOMETRY

SAMPLE

YEAR 1 • TERM 1

• Introduction to Geometry •

IG. Y1. T1. W1

STREAM

Geometry



RESOURCES USED

Lessons in Experimental and Practical Geometry (Ch. I)

OBJECTIVES

Students will be able to describe a surface, face, line, and point.

SPECIAL MATERIALS NEEDED

Internet Access, Objects Representing 3D Shapes (rectangular prism [box], sphere, cylinder, cone, pyramid)

THE PLAN

1. If you could go back in time and visit any time period, which one would you choose? Maybe you would like to see what the Middle Ages were like! Or maybe you would want to hang out with Laura and Mary Ingalls in the days of the pioneers! Or maybe you would want to walk with Jesus in the first century!
2. You may have said Ancient Egypt! If so, you are in luck! Well, we are unable to go back and actually visit Ancient Egypt, but we can use our imagination and pretend to visit.
3. Let's learn about the people who were some of the first to develop our new type of mathematics that we will begin studying this year. Watch a brief history of geometry (2:40).
4. Let's break the word, geometry, down a bit to think about its meaning.
 - a. What do you think the first part of *geo-* means? Maybe you could think of another subject that you study that sounds similar. (Geography) *Geo* means the earth. In geometry and geography, you study the Earth from different perspectives.
 - b. What about the second part of geometry, *-metry*? It comes from the Greek *metron*, which means to measure.
 - c. When we study geometry, we explore how to measure the Earth.
5. There are other branches of geometry, but we will be studying plane or flat geometry because we will be learning about things you can draw on flat paper or a plane, like Egyptian fields. We will look at the world around us. Are your surroundings plane or flat? (No) They aren't flat, but we will practice taking things that aren't flat and imagining that they are flat or using the flat parts to describe the whole object. Let's see what that looks like now.



6. First, can you name the shapes that you see? *Help the student name the rectangular prism or box, sphere, cylinder, cone, and pyramid, and use those solids for the next steps.*
7. Look at the box and the sphere.
 - a. Are these objects flat or plane? (No) But let's look at the flat or plane things on them.
 - b. Can you explain what a surface is? (The surface of objects is the outside.)
 - c. How could you describe the **surface** of these solids? (The outside of the solid)
 - d. What is the difference between the box's and sphere's surfaces? (The box's surface is in several pieces, and the sphere's surface is in just one piece.)
 - e. Pick up the sphere, cone, and cylinder. Looking at each, how many surface pieces are there? (The sphere has one, the cone has two, and the cylinder has three.)
 - f. Can you imagine that you cut these solids open and lay them out on the table, then describe those pieces of the surfaces? *Draw out the idea that some are straight and some are rounded.*
 - g. How would you describe the surface of a solid? *Draw out the idea of the outside of the solid - what can be seen and touched.*
8. Now, look at just the box.
 - a. Tell me how many pieces the surface is. (6 pieces)
 - b. Each of these pieces or sides is called a **face**. So, how many faces does a box have? (6 faces)
 - c. How would you describe the face of a solid? *Draw out that the face is a part of the surface of the solid.*
9. Let's continue looking at the box, but focus on what happens when these faces come together.
 - a. What do you notice about where the two faces meet? (They meet on an edge.) This edge represents a line.
 - b. Where do three faces intersect? (They intersect in a corner.) A corner of a solid is called a **vertex**, and it represents a point.
 - c. Look at some other solids and find examples of lines and points. Find some examples of points and lines around the room.
10. In geometry, a **point** is considered a location in space. We represent it with a small dot and name or label it with an uppercase print letter.
 - a. Can you draw and label point A on your dry-erase board? Point B? 
 - b. Now, connect those points. Draw at least three different ways to connect those two points. (i.e., loops, curved, zigzag, and straight lines)
 - c. Which one of those ways is the shortest way of connecting A and B? (The straight line)
 - d. What is this figure called? (A line) 



11. The Greek mathematician Euclid, known as the “father of geometry,” referred to a **line** as “breadthless length.” What do you think he meant by this? A true line has only one dimension, and believe it or not, it exists only in our imaginations. It is measured only in length, has no width, and has no stopping point in either direction. Though when we draw a line, our pencil or pen gives it width; otherwise, we wouldn’t be able to see it! Therefore, our drawing *represents* a line.
12. Go back and extend the line past points A and B. Then draw arrows at both ends to show that the line does not end.
13. We name a line according to any two points it passes through. So we say “line AB” and write it as $\overleftrightarrow{AB}$.



STUDENT RESPONSE

1. In your math notebook, complete the following.
 - a. Draw two points a little distance apart.
 - b. Name one C and the other D.
 - c. Do your best to connect C and D with a neat straight line, extending the line past both points.
 - d. Draw arrows at both ends.
 - e. Label the line, $\overleftrightarrow{CD}$.
2. Optional Afternoon Activity: Be a Rope-Stretcher! *The purpose of this activity is not to show students any theorem or proof. It is intended to help them imagine how they could measure things without modern measuring tools and standards, illustrating the development of geometry.*
 - a. Take a string that is two feet long.
 - b. See if you can tie knots in it at 12 equal increments without the help of a ruler or measuring tape. How hard is that? Can you see why tools of standard measurements, such as the foot ruler, yardstick, etc., were developed and their importance?
 - c. If your student struggled with the knot-tying, please provide the string with pre-tied knots at this point. Try your hand at being a rope stretcher. What can you measure? How is this knotted rope helpful? Try to make a triangle. How could this shape be helpful? Can you measure your room using this rope? *Guide the student in imagining a rectangle by combining two triangles to see how the Egyptians measured the fields.*



• Straight and Curved Lines •

IG. Y1. T1. W2

STREAM

Geometry



RESOURCES USED

Lessons in Experimental and Practical Geometry (Ch. I)

OBJECTIVES

Students will be able to investigate the properties of lines.

SPECIAL MATERIALS NEEDED

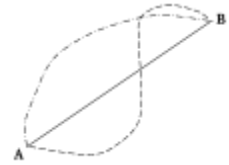
Box, Internet Access

THE PLAN

1. Tell me what you remember from our last geometry lesson. Draw out the ideas of the history of geometry, surfaces, and faces of solids, points, and lines.
2. Grab the box and show me the surface, a face, an edge, and a vertex.
 - a. What geometric shape does an edge represent? (A line)
 - b. What geometric shape does a vertex represent? (A point)
3. Let's investigate some different situations that include points and lines.
 - a. Find a blank page in your math notebook and write the title "Characteristics of Lines."
 - b. As we draw today, let's practice using a straightedge to help draw neat, straight lines.
 - c. We will list what is true about points and lines by writing down your conclusions after each investigation.
 - d. Here we go!
 - i. Think about taking two different walks from the same starting place. (Based on Ch. I: (i)).
 1. Draw a diagram of a path that continually goes north.
 2. Draw another path that starts going north and then gradually moves to the east.
 3. Which one of these paths represents a straight line? What can you say about a straight line and its direction? (A straight line continues in the same direction.) The teacher or student can write this beside the drawing.

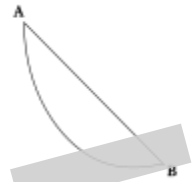


- ii. “In a field, there are two trees whose positions are marked by the letters A and B. Suppose you want to go from one tree to the other by the shortest way” (Ch. I: (ii)).



1. Draw your path.
2. How many of these lines can there be? (Only one)
3. What can you say about a line in this example? (There can be only one line with the shortest distance between two points.)
The teacher or student can write this beside the drawing.

- iii. “A strip of ground has been enclosed by two fences. One of these is straight; can the other fence be straight also?” (Ch. I: (iii)).



1. Draw a picture of the two fences.
2. Can two straight lines enclose a space? (Two straight lines cannot enclose a space. One must be curved.)
3. What is the smallest number of straight lines needed to enclose a space? (We need three straight lines to enclose a space.) *The teacher or student can write this beside the drawing.*

- iv. “We will draw a curve and call it $\overleftrightarrow{AB}$; then we will [draw] a straight line $\overleftrightarrow{CD}$ across it” (Ch. I: (iv)).

1. Draw a picture.
2. How many times does the straight line cut the curved one? (Depending on the curved line, a straight line can cross it 0, 1, or more points.) *The teacher or student can write this beside the drawing.*

- e. “Now take a straight line $\overleftrightarrow{AB}$, and [draw] another straight line $\overleftrightarrow{CD}$ across it” (Ch. I: (iv)).

1. Draw a picture.
2. Can $\overleftrightarrow{CD}$ cross $\overleftrightarrow{AB}$ at more than one point? (No)
3. What can you say about the intersection of two straight lines? (If two straight lines cross, they can intersect at only one point.) *The teacher or student can write this beside the drawing.*

4. For more information about Euclid and to summarize some of the things we discussed last time, check out [What's the Point of Geometry?](#) (3:18).
a. If you keep a timeline, add Euclid to it.



STUDENT RESPONSE

1. In your math notebook, complete Ch. I: Ex. 1 and 2.

