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Introduction

Math Mammoth Geometry 3 can be studied after the student has finished *Math Mammoth Geometry 1*, and is suitable for grades 5-7. This book does not require the students to calculate area or volume, and that is why it is not necessary to study *Math Mammoth Geometry 2* (which deals with those topics in depth) before this book.

We start out with basic angle relationships, such as adjacent angles (angles along a line), vertical angles, and corresponding angles (the last only briefly). Classifying triangles according to both angles and sides and the angle sum of a triangle are our next topics, giving students lots of opportunities for drawing exercises. *Angles in Polygons* is a sequel to studying angles in a triangle.

The next set of lessons deals with congruent and similar figures. The first lessons here are simpler, suitable for 4th-5th grade students. The lesson *Similar Figures and Scale Ratio* uses the concepts of ratio and proportion, and is meant for 6th-7th grades.

Next, we practice some basic compass-and-ruler constructions. These constructions were practiced and studied a lot by the ancient Greeks. In fact, the mathematics of ancient Greece centered around geometry. Most students will probably enjoy doing the drawing problems in these lessons on blank paper instead of in the worktext. Students also draw figures using a normal ruler and compass in the lesson *Drawing Problems*. They especially determine whether the given information defines a unique figure (triangle or a parallelogram).

The last section of this book focuses on the Pythagorean Theorem and its applications. First, students need to become familiar with square roots so they can solve the equations that result from applying the Pythagorean Theorem. The first lesson of the section introduces taking a square root as the opposite operation of squaring a number. The lesson includes both a guess and check method and using a calculator to find the square root of a number.

Next, students learn how to solve simple equations that involve taking a square root. This makes them fully ready to study and apply the Pythagorean Theorem.

The Pythagorean Theorem is introduced in the lesson with the same name. Students learn to check whether or not a triangle fulfills the Pythagorean Theorem and thus is a right triangle. They apply their knowledge about square roots and solving equations to solve for an unknown side in a right triangle when two of the sides are given.

Students solve a variety of real-life and geometric problems that involve the usage of the Pythagorean Theorem. This theorem is extremely important in many practical situations. Students should show their work for these word problems and include the solution process of the equation resulting from the Pythagorean Theorem.

There are literally hundreds of proofs for the Pythagorean Theorem. In this book, we present a proof that is easy and based on geometry (not algebra). Students are asked to supply the steps of reasoning to another, geometric proof of the theorem, and for those interested the lesson also provides an Internet link that has even more proofs of this theorem.

I wish you success in teaching math!
Maria Miller, the author

Helpful Resources on the Internet

Use the online resources as you see fit to supplement the main text.

Angles

Working with Angles

An interactive lesson with explanations and a quiz from Absorb Mathematics course written by Kadie Armstrong, a mathematician.

<http://www.absorblearning.com/mathematics/demo/units/KCA003.html>

Geometry Bridge

An interactive review lesson on types of angles, types of triangles, angle sum of a triangle, and the Pythagorean Theorem. You get to build a bridge!

<http://mysite.verizon.net/vzex2lij/>

Angles in Polygons

An interactive lesson with explanations and a quiz from Absorb Mathematics course written by Kadie Armstrong, a mathematician.

<http://www.absorblearning.com/mathematics/demo/units/KCA004.html>

Properties of Parallelograms

Investigate the sides and interior angles of parallelograms using these two interactive tools.

<http://math.kendallhunt.com/x19430.html>

Interior Angles

A nice lesson and explanation about interior angles of polygons.

<http://www.coolmath4kids.com/interior.html>

Classifying Triangles

Classify Triangles Worksheets

Make free printable worksheets for classifying triangles by their sides, angles, or both.

http://www.homeschoolmath.net/worksheets/classify_triangles.php

Triangle Classification at Cut The Knot

A tutorial and an applet about classifying triangles by their sides and angles. In the applet, you can drag any of the vertices of the triangle, and the applet tells you whether your triangle is acute, obtuse, or right, or equilateral, isosceles, or scalene.

<http://www.cut-the-knot.org/triangle/Triangles.shtml>

Rags to Riches: Classify Triangles by Sides and Angles

Answer multiple-choice questions about the angles of a triangle and classification of triangles in a quest for fame and fortune.

<http://www.quia.com/rr/457498.html>

Identify Triangles Quiz

A simple multiple-choice quiz about identifying (classifying) triangles either by their sides or angles. You can modify some of the quiz parameters, such as the number of problems in it.

<http://www.thatquiz.org/tq-A/?-j1-l34-p0>

Triangles and Quadrilaterals Classification Game

Look at the shapes as they go past, and drag them into the right groups (equilateral, isosceles, or scalene triangles, and quadrilaterals with 4 congruent sides, 2 congruent sides, or no congruent sides).

http://www.bbc.co.uk/bitesize/ks2/maths/shape_space/shapes/play/

Classifying Triangles Game

A fast-paced game where you drag triangles into the correct basket as fast as you can (acute, obtuse, right).

<http://www.math-play.com/classifying-triangles/classifying-triangles.html>

Triangle Classification Exploration Tool

Line segment AB is drawn in the plane. Where should point C be placed so that ABC is a right triangle? ...so that it is an isosceles triangle? ...so that it is obtuse? This activity will allow you to explore these questions.

<http://illuminations.nctm.org/ActivityDetail.aspx?ID=142>

Polygons

Properties of Kites

Investigate the interior angles and diagonals of kites with these interactive tools.

<http://math.kendallhunt.com/x19428.html>

Interactive Quadrilaterals

See all the different kinds of quadrilaterals “in action”. You can drag the corners, see how the angles change, and observe what properties do not change.

<http://www.mathsisfun.com/geometry/quadrilaterals-interactive.html>

Looking at Polygons

An interactive lesson with explanations and a quiz from Absorb Mathematics course written by Kadie Armstrong, a mathematician.

<http://www.absorblearning.com/mathematics/demo/units/KCA007.html>

Congruent Transformations

Free Worksheets for the Coordinate Grid

Generate printable and customizable worksheets for plotting points and shapes, and for moving and reflecting shapes in the coordinate grid. Options include choosing either the first or all quadrants, scaling, image size, workspace, and border.

http://www.homeschoolmath.net/worksheets/coordinate_grid.php

Primary Resources: Reflection

Color the squares and reflect the given pattern in a line.

<http://www.primaryresources.co.uk/online/reflection.swf>

Primary Resources: Rotation

From the arrow you can change the shape. Use the circular arrow buttons to rotate the shapes either 90 or 45 degrees.

<http://www.primaryresources.co.uk/online/rotation.swf>

Similarity and Congruence

An interactive lesson with explanations and a quiz from Absorb Mathematics course written by Kadie Armstrong, a mathematician.

<http://www.absorblearning.com/mathematics/demo/units/KCA035.html>

National Library of Virtual Manipulatives for Interactive Mathematics: Geometry

A collection of interactive geometry activities: Congruent triangles, fractals, geoboard activities, golden rectangle, ladybug leaf, ladybug mazes, platonic solids, tangrams, tessellations, transformations and more.

http://nlvm.usu.edu/en/nav/category_g_3_t_3.html

Recognizing Transformations

A ready-to-use lesson that introduces students to the world of symmetry and rotation in figures and patterns.

Students learn how to recognize and classify symmetry in decorative figures and frieze patterns, and get the chance to create and classify their own figures and patterns using interactive applets.

<http://illuminations.nctm.org/Lesson.aspx?id=2591>

Transformations

Use these interactive figures to explore geometric transformations (rotations, translations, and reflections) AND a composition of these.

<http://www.nctm.org/standards/content.aspx?id=26885>

Similar Figures

Length, Perimeter, Area and Volume of Similar Figures

Use this interactive figure to explore how the scale factor affects the size and the area of similar figures. The discussion provided helps the teacher, but a specific lesson plan would be more helpful.

<http://www.nctm.org/standards/content.aspx?id=26884>

Ratio and Scale

An interactive lesson with explanations and a quiz from Absorb Mathematics course written by Kadie Armstrong, a mathematician.

<http://www.absorblearning.com/mathematics/demo/units/KCA024.html>

Similar Triangles Quiz from ThatQuiz.org

This quiz has 10 questions and asks to provide a missing side length when two similar triangles are shown. You can also modify the quiz parameters to your liking.

<http://www.thatquiz.org/tq-A/?-jg-11i-m2kc0-na-p0>

Constructions

Geometric Construction

An interactive lesson with explanations and a quiz from Absorb Mathematics course written by Kadie Armstrong, a mathematician.

<http://www.absorblearning.com/mathematics/demo/units/KCA006.html>

Animated Geometric Constructions

Simple animations that show how to do basic geometric constructions.

<http://www.mathsisfun.com/geometry/constructions.html>

Geometric Constructions Illustrated with Interactive Java Applets

Interactive applets and instructions for doing the basic geometric constructions online.

<http://www.personal.psu.edu/dpl14/java/geometry/>

GRACE - Graphical Ruler and Compass Editor

An interactive online tool that allows dynamic creation and modification of ruler and compass constructions. Constructions may be built from one of five geometric primitives (Line, Line Segment, Ray, Circle, Perpendicular Bisector, and Intersection), and from other constructions; thus constructions may be built by composing more basic constructions.

<http://www.cs.rice.edu/~jwarren/grace/>

General

Geometry - Math Warehouse

Detailed lessons about angles, triangles, quadrilaterals, circles, similar triangles, parallelograms, polygons, and trapezoids.

<http://www.mathwarehouse.com/geometry/>

Geometry Course from Learning Math

This online geometry course includes readings, problems, videos, interactive activities, homework problems and solutions. It is meant for K-8 teachers but will work well for middle school students as well.

<http://www.learner.org/courses/learningmath/geometry>

Geometry Reference Sheet

Both online and printable versions; includes area and volume formulas for common shapes plus the Pythagorean Theorem.

<http://www.ecalc.com/math-help/worksheet/geometry>

Geometry Tutorials

Simple tutorials on triangles and their properties, polygons, symmetry, angles and much more. Also includes lots of solved geometry questions and some interactive applets.

<http://www.analyzemath.com/geometry.html#tutorials>

Online Kaleidoscope

Create your own kaleidoscope pattern with this interactive tool.

http://www.zefrank.com/dtoy_vs_byokal/

Interactive Tangram Puzzle

Place the tangram pieces so they form the given shape.

http://nlvm.usu.edu/en/nav/frames_asid_112_g_2_t_1.html

Interactivate! Tessellate

An online, interactive tool for creating your own tessellations. Choose a shape, then edit its corners or edges. The program automatically changes the shape so that it will tessellate (tile) the plane. Then push the tessellate button to see your creation!

<http://www.shodor.org/interactivate/activities/Tessellate>

Square roots

Squares and Square Roots

A fun lesson about squares and square roots with lots of visuals and little tips. It is followed by 10 multiple-choice interactive questions.

<http://www.mathsisfun.com/square-root.html>

The Roots of Life

Practice finding square roots of perfect squares and help the roots of a tree grow. Easy, medium, hard, and contest levels.

<http://www.hoodamath.com/games/therootsoflife.html>

Square Root Game

Match square roots of perfect squares with the answers. Includes several levels.

<http://www.math-play.com/square-root-game.html>

Pyramid Math

Choose "SQRT" to find square roots of perfect squares. Drag the right answer to the jar on the left. This game is pretty easy.

<http://www.mathnook.com/math/pyramidmath.html>

Rags to Riches Square Root Practice

Answer multiple-choice questions that increase in difficulty. The questions include finding a square root of perfect squares, finding between which two whole numbers a given square root is, and finding square roots of non-perfect squares to one decimal digit.

<http://www.quia.com/rr/382994.html>

The Pythagorean Theorem

Video Lessons by Maria

My own videos where I explain several word problems that involve the Pythagorean Theorem.

https://www.youtube.com/playlist?list=PLYM4yncims39aK3r_qc4ZsGcqGJgu-xX0

Pythagorean Theorem - Braining Camp

This learning module includes a lesson, an interactive manipulative, multiple-choice questions, real-life problems, and interactive open response questions.

<https://www.brainincamp.com/content/pythagorean-theorem/>

Pythagoras' Theorem from Maths Is Fun

A very clear lesson about the Pythagorean Theorem and how to use it, followed by 10 interactive practice questions.

<http://www.mathsisfun.com/pythagoras.html>

Pythagorean Triplets

Move the two orange points in this activity and try to find Pythagorean Triplets - a set of three lengths that are whole numbers and that fulfill the Pythagorean Theorem.

<http://www.interactive-maths.com/pythagorean-triples-ggb.html>

The Pythagorean Theorem Quiz

A 10-question quiz that asks for the third side of a right triangle when two sides are given.

<http://www.thatquiz.org/tq-A/?-j10-la-plug>

Interactivate: Pythagorean Theorem

Interactive practice problems for calculating the third side of a right triangle when two sides are given.

<http://www.shodor.org/interactivate/activities/PythagoreanExplorer/>

Practice with the Pythagorean Theorem

Twelve word problems to solve that all involve the usage of the Pythagorean Theorem. The page also includes a concise solution for each problem (click the “Explanation” drop down menu).

<http://www.regentsprep.org/regents/math/algebra/AT1/PracPyth.htm>

Pythagoras in 3D

Can you find the longest length in a box? Includes an interactive illustration for the problem.

<http://www.interactive-maths.com/pythagoras-in-3d-ggb.html>

Proof

Two interactive and Animated Proofs of the Pythagorean Theorem

The first proof is by dissection: Rearrange the colored pieces from the smaller squares so that they fill the square on the hypotenuse. You can manipulate the pieces yourself or see an animation of it. The second is titled “Chinese”, and once again is based on rearranging pieces.

http://hotmath.com/learning_activities/interactivities/pythagorean.swf

Pythagorean Theorem and Its Many Proofs

A collection of 111 approaches to prove this theorem. Many proofs are accompanied by interactive Java illustrations.

<http://cut-the-knot.com/pythagoras/>

Annotated Animated Proof of the Pythagorean Theorem

Watch the animation to learn a particular proof of the Pythagorean Theorem.

<http://www.davis-inc.com/pythagor/proof2.html>

Proving the Pythagorean Theorem

See if you can figure out two more proofs of the Pythagorean theorem Only the pictures are given to you. tips and Solutions are available.

http://www.learner.org/courses/learningmath/geometry/session6/part_b/more.html

Many Proofs of the Pythagorean Theorem

A list of animated proofs.

http://www.takayaiwamoto.com/Pythagorean_Theorem/Pythagorean_Theorem.html