

Converting Static Textbooks to Interactive EPUB Learning Materials



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The New Textbook

- ❖ Personalized
- ❖ Adaptable
- ❖ Engaging
- ❖ Animated
- ❖ Interactive
- ❖ Accessible
- ❖ Collaborative



Repurposing Published Books

1. Discover missing document structure
2. Convert to structured EPUB
3. Annotate, collaborate and supplement

Discover Missing Structure

Publishing Pipelines

- ❖ Publishing pipelines involve many formats
- ❖ Different software for word processing, illustration, graphs, equations, page layout and local or syndicated content
- ❖ There is not a single object model shared by all
- ❖ The document reading model useful for e-book readers is different anyway
- ❖ Print pipelines end with a vector graphic model e.g. PDF

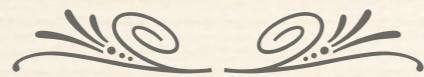
Unstructured PDF

- ❖ PDF *does* encode precise, fixed-layout drawing instructions for glyphs, shapes and images, enabling a consistent appearance
- ❖ PDF *does not* (usually) encode reading order, words, paragraphs, columns, lists, tables, stories, chapters, text roles, shape/image groupings, shape/image roles, etc.

Structure Reconstruction

Analysis	Structure
Border shapes	Tables, Callouts, Articles
Clusters of glyph positions	Words
Clusters of word positions	Alignment
Vertical white strips	Line breaks, Columns, Lists
Text line spacing & alignment	Paragraphs
Shape grouping	Diagram

Demo



White Strip Analysis

2.1 Pythagorean Triples

As mentioned earlier in the “History of the Pythagorean Theorem” chapter, the Babylonians demonstrated an understanding of the Pythagorean Theorem by listing Pythagorean triples on a clay tablet. Pythagorean triples are sets of three integers—positive whole numbers—that make a right triangle. Pythagorean triples are frequently used in examples and problems, making it worthwhile to memorize some of the more common triples. Pythagorean triples are frequently used in examples and problems, making it worthwhile to memorize some of the more common triples.

The most common Pythagorean triples are (3, 4, 5) and (5, 12, 13). Multiples of these triples—such as (6, 8, 10)—are also Pythagorean triples. Pythagorean triples are frequently used in examples and problems, making it worthwhile to memorize some of the more common triples. Though these triples are the most common, there is an infinite number of combinations of integers that satisfy the Pythagorean Theorem. Table 2.1 lists all primitive triples with a hypotenuse length less than 100. Note that the set (6, 8, 10) is not listed in the table because it is a multiple of the primitive triple (3, 4, 5).

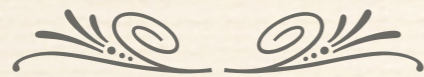
TABLE 2.1: A list of primitive Pythagorean triples with a hypotenuse length less than 100.

leg	leg	hypotenuse
3	4	5
5	12	13
7	24	25
8	15	17
9	40	41
11	60	61
12	35	37
13	84	85
16	63	65
20	21	29
28	45	53
33	56	65
36	77	85
39	80	89
48	55	73
55	72	97

Semantic Role Reconstruction

- ❖ Each publication has its own set of relevant semantic roles
 - ❖ e.g. “example,” “note,” “exercise,” “caption,” “chapter header,” “bibliography,” “author,” “continuation”
- ❖ Style-to-role mapping rules are created for each publication, and applied by an inference engine
- ❖ Time tradeoff between improving rules and manual fix-up

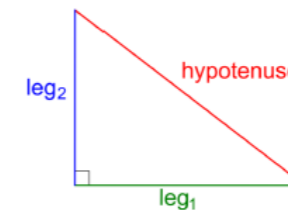
Demo



Rules and Roles

1.2 Pythagorean Theorem

The Pythagorean Theorem allows you to find the lengths of the sides of a **right triangle** which is a triangle with one 90° angle (known as the right angle). An example of a right triangle is depicted below.



A right triangle is composed of three sides: two legs, which are labeled in the diagram as leg_1 and leg_2 , and a **hypotenuse**, which is the side opposite to the right angle. The hypotenuse is always the longest of the three sides. Typically, we denote the right angle with a small square, as shown above, but this is not required.

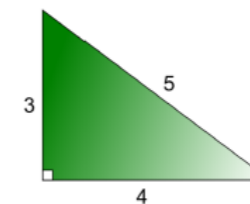
The Pythagorean Theorem states that the length of the hypotenuse squared equals the sum of the squares of the two legs. This is written mathematically as:

$$leg_1^2 + leg_2^2 = hypotenuse^2$$

To verify this statement, first explicitly expressed by Pythagoreans so many years ago, let's look at an example.

Example 1

Consider the right triangle below. Does the Pythagorean Theorem hold for this triangle?



Solution

As labeled, this right triangle has sides with lengths 3, 4, and 5. The side with length 5, the longest side, is the hypotenuse because it is opposite to the right angle. Let's say the side of length 4 is leg_1 and the side of length 3 is leg_2 .

Recall that the Pythagorean Theorem states

Convert to EPUB

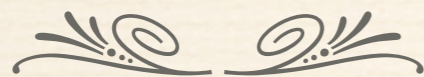
Structure Enables Functionality

- ❖ Reflow requires reading order, words and other content groupings
- ❖ Table of contents can be generated from section headers
- ❖ Search with predicates requires structured markup
 - ❖ e.g. “chapter heading contains ‘EPUB’”
- ❖ Use HTML for structure, not to guide appearance
 - ❖ e.g. tables used for image or text column layout don’t reflow properly

Preserve Structure

- ❖ Map reconstructed structure to HTML elements where possible, or class attributes where not
 - ❖ e.g. `<p>`, `<h1>`, `<table>`, ``, ``,
`<div class="example">`
- ❖ Create CSS styles for each role
- ❖ Use SVG for shapes, MathML for equations

Demo

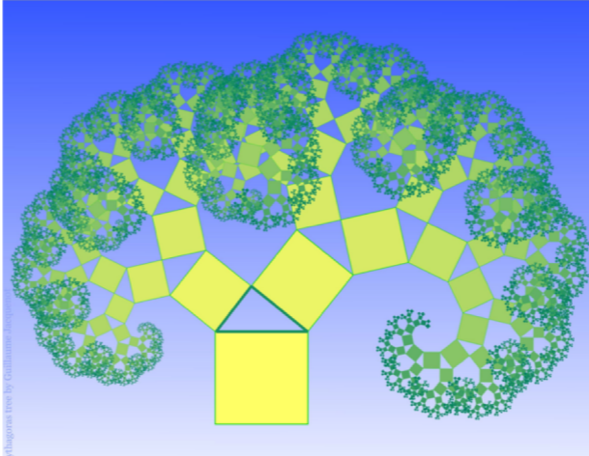


Converted EPUB

Pythagorean Theorem

ck-12 flexbook
next generation textbooks

Pythagorean Theorem
History, Applications, and Proofs



Contents

Title

Credits

1. History of the Pythagorean Theorem
 - 1.1 Pythagoras and the Pythagoreans
 - 1.2 Pythagorean Theorem
 - 1.3 A Debate about True Origins
 - 1.4 The Theorem's Significance
 - 1.5 References
2. Applying the Pythagorean Theorem
 - 2.1 Pythagorean Triples
 - 2.2 Area of an Isosceles Triangle
 - 2.3 Side Lengths of Shapes other than Triangles
 - 2.4 Finding Distances on a Coordinate Grid
 - 2.5 The Distance Formula
 - 2.6 The 30°-60°-90° Triangle
 - 2.7 The 45°-45°-90° Triangle
 - 2.8 Converse Pythagorean Theorem
 - 2.9 Determining Right, Acute, or Obtuse Triangles
3. Proving the Pythagorean Theorem
 - 3.1 "Chinese Proof"

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Annotate ~ Collaborate ~
Supplement

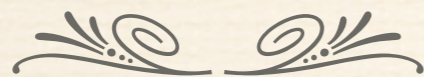
Online Class Discussion

- ❖ Annotations such as comments, bookmarks, highlights, links and multimedia can be stored separately from the EPUB
- ❖ Use EPUB CFIs (Canonical Fragment Identifiers)
- ❖ Locations move along with text as it reflows
- ❖ Shared annotations enable students and teachers to discuss specific locations in their textbook

Connected Learning Resources

- ❖ Teachers can include shared annotations that link or embed multimedia
 - ❖ e.g. images, audio, video, animations, widgets, sites
- ❖ Related course materials are directly accessible from the textbook
 - ❖ e.g. tests, lectures, schedules, assignments

Demo



Active Textbook

Bookmarks

- Chinese proof
- Diameter is Hypotenuse

right triangle, as indicated by the square drawn in the corner. Using the length of the hypotenuse of the right triangle, which is also the diameter of the

$$(leg_1)^2 + (leg_2)^2 = (hypotenuse)^2$$
$$(8 \text{ in})^2 + (6 \text{ in})^2 = (hypotenuse)^2$$
$$64 \text{ in}^2 + 36 \text{ in}^2 = (hypotenuse)^2$$

A friendly suggestion

Teacher - Classroom 03
22/08/2013 at 9:34 AM
Remember, this is important to understand for the 2nd quiz!

Teacher - Classroom 03

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+ - ? [Slider] 1 of 1