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
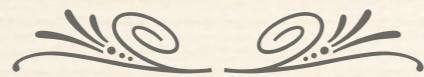
White Strip Analysis

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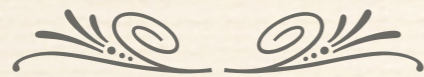
TABLE 2.1: A list of primitive Pythagorean triples with a hypotenuse length less than 100.

leg1	leg2	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
65	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
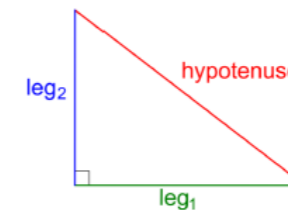
- Time tradeoff between improving rules and manual fix-up
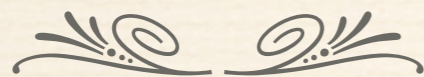
Demo

Rules and Roles

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>, <ul>, <ol>, <div class="example">

- Create CSS styles for each role
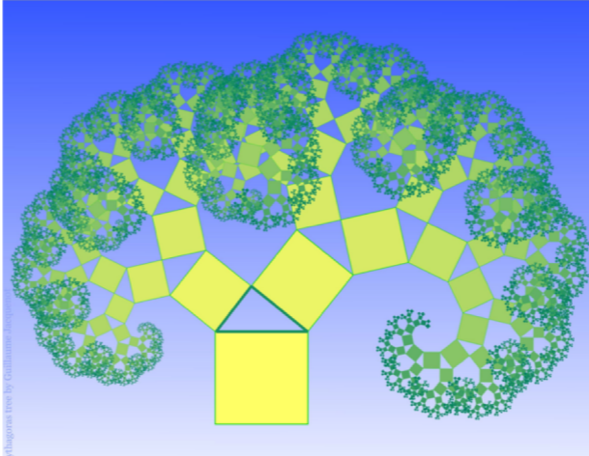
- Use SVG for shapes, MathML for equations

Demo

Converted EPUB

cK-12

flexbook
next generation textbooks

Pythagorean Theorem
History, Applications, and Proofs
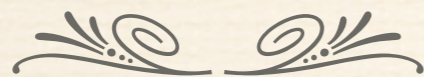
Contents

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

8 in 6 in

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

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

$$(8\ in)^2 + (6\ in)^2 = (hypotenuse)^2$$

$$64\ in^2 + 36\ in^2 = (hypotenuse)^2$$

circle's ... we should
in whic ... half the
rcumfer

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

Comment

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