

PRETEXT

WRITE ONCE, READ ANYWHERE

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WHAT IS PRETEXT?

- An authoring and publishing system:
 - Extensive support for mathematics (and STEM)
 - Designed to create openly licensed materials
- An abstract specification of a scholarly document
- Implementations of conversions to various formats
- A modern replacement for LaTeX
- A commitment to creating accessible materials
- A community of instructors, authors, and publishers
- Guided by 11 principles, e.g. ...
- Principle #10: PreTeXt recognizes that scholarly documents involve the interaction of authors, publishers, scholars, instructors, students, and readers, with each group having its own needs and goals.

KEY IDEA: WRITE ONCE

The PreTeXt authoring language captures an author's intent and document structure, AS THE AUTHOR WRITES.

An author concentrates on CONTENT and is not able to influence PRESENTATION.

Principle #1: PreTeXt captures the structure of textbooks and research papers

PAYOFF: READ ANYWHERE

- PDF: print and electronic versions
- HTML: highly interactive, amazingly accessible
- EPUB/Kindle: an improvement on PDF
- Jupyter notebooks: popular for data science, Python programming
- Runestone: open-source hosting of open textbooks, with LMS, more interactivity
- Braille: embossable and electronic, 100% automated, no transcriber
- Slideshows: you are viewing one now
- Principle #3: PreTeXt documents serve as a single source which can be easily converted to multiple other formats, current and future.

PDF, FOR PRINT AND SCREEN

- Via LaTeX, two slightly different PDFs are possible.
- Electronic is different than hardcopy print.
 - Active links, colored?
 - Color versus B/W
 - One-sided v. two-sided
 - Page size, margins
- Example: Judson's Abstract Algebra

- A superior offline format
- On desktops or laptops
- Or on tablets or dedicated devices
- Example: Foliate reader on Linux

5.2 Dihedral Groups

Another special type of permutation group is the dihedral group. Recall the symmetry group of an equilateral triangle in [Chapter 3](#). Such groups consist of the rigid motions of a regular n -sided polygon or n -gon. For $n = 3, 4, \dots$ we define the **n th dihedral group** to be the group of rigid motions of a regular n -gon. We will denote this group by D_n . We can number the vertices of a regular n -gon by $1, 2, \dots, n$ ([Figure 5.2.1](#)). Notice that there are exactly n choices to replace the first vertex. If we replace the first vertex by k then the second vertex must be replaced either by vertex $k + 1$ or by vertex $k - 1$ hence, there are $2n$ possible rigid motions of the n -gon. We summarize these results in the following theorem.

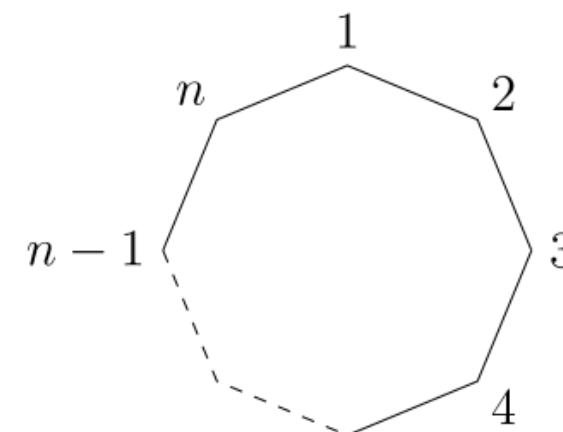


Figure 5.2.1. A regular n -gon

Theorem 5.2.2. *The dihedral group, D_n is a subgroup of S_n of order $2n$*

Theorem 5.2.3. *The group D_n $n \geq 3$ consists of all products of the two elements r and s satisfying the relations*

$$\begin{aligned} r^n &= 1 \\ s^2 &= 1 \\ srs &= r^{-1}. \end{aligned}$$

Proof. The possible motions of a regular n -gon are either reflections or rotations ([Figure 5.2.4](#)). There are exactly n possible rotations:

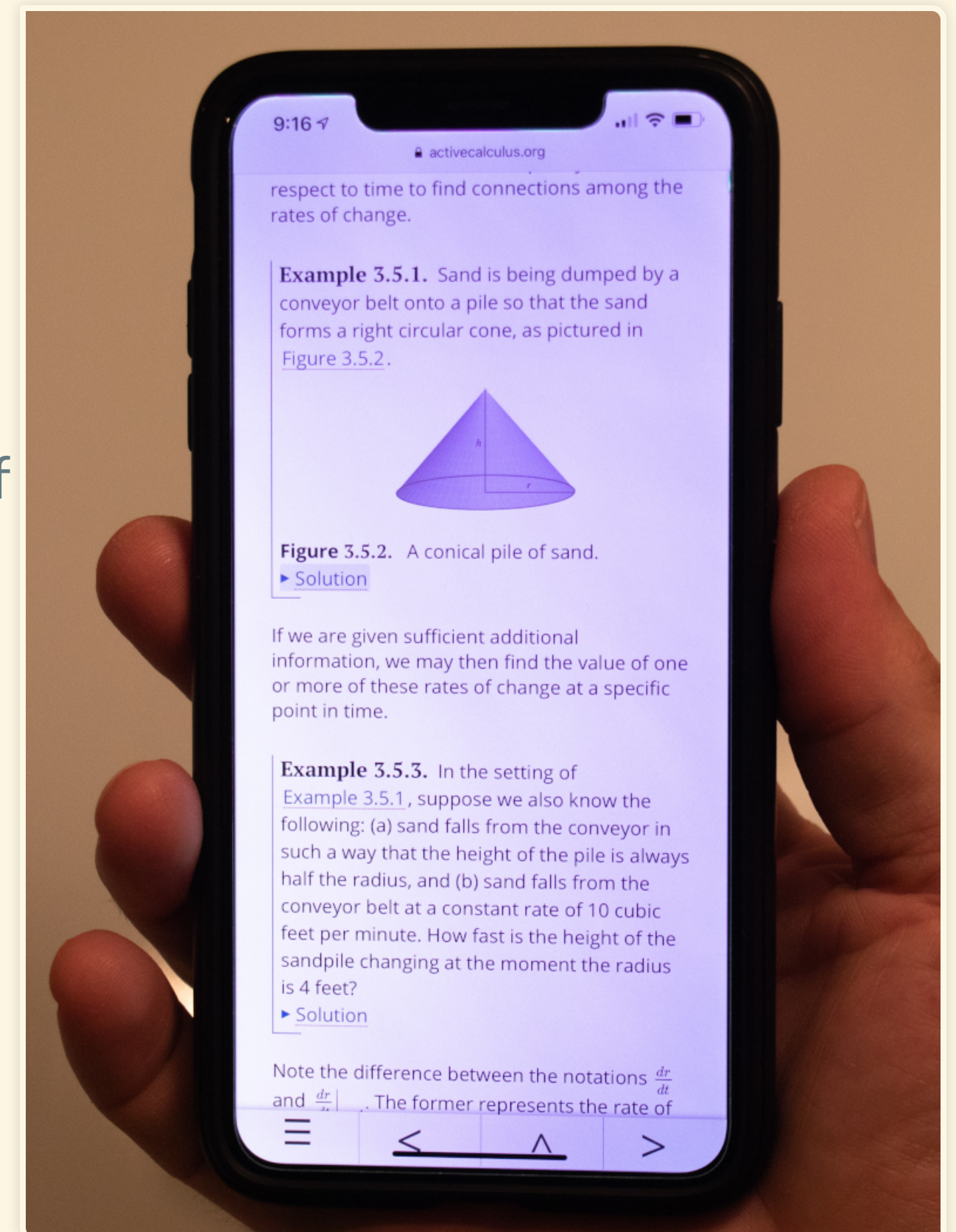
$$\text{id}, \frac{360^\circ}{n}, 2 \cdot \frac{360^\circ}{n}, \dots, (n-1) \cdot \frac{360^\circ}{n}.$$

We will denote the rotation $360^\circ/n$ by r . The rotation r generates all of the other rotations. That is,

$$r^k = k \cdot \frac{360^\circ}{n}.$$

HTML

- Everybody's favorite
- Takes advantage of HTML, CSS, Javascript
- Works well on small screens
- Accessible: works well with screen readers
- Math is powered by MathJax
- Many interactive features
- Principle #6: PreTeXt makes use of the full capabilities of the Web.



DEMONSTRATION

Judson's Abstract Algebra: Theory and Applications

INTERACTIVE ASSESSMENTS

- Author WeBWorK problems within PreTeXt source
- Host PreTeXt book on Runestone, with login and LMS
- More question types coming:
 - short answer, essay
 - multiple choice
 - true/false
 - fill-in
 - etc.
- MyOpenMath: preliminary, PreTeXt “endpoint”
- NUMBAS, STACK?

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Authored in PreTeXt

POWERED BY MathJax

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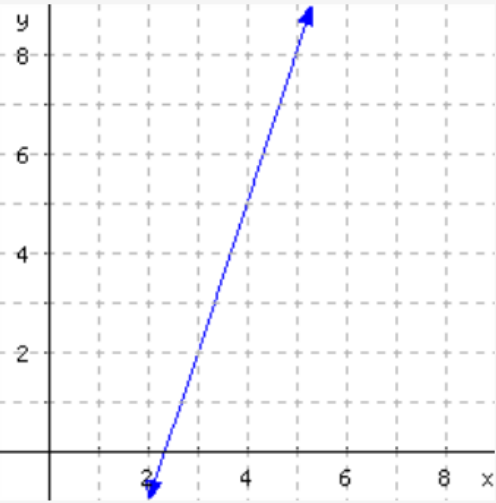
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Remark 4.6.4 Alternative Point-Slope Form. It is also common to define point-slope form as
$$y - y_0 = m(x - x_0) \tag{4.6.2}$$
by subtracting y_0 from each side. Some exercises may appear using this form.

Checkpoint 4.6.5.

Consider the line in this graph:

a. Identify a point visible on this line that has integer coordinates.

b. What is the slope of the line?

c. Use point-slope form to write an equation for this line, making use of a point with integer coordinates.

Solution:

BRAILLE

Principle #11: PreTeXt recognizes the inherent value in producing material that is accessible to everyone.

- MathJax's Speech Rule Engine makes Nemeth braille
- `liblouis` makes braille for literary text
- `liblouis` formats an embossed page
- One-line (electronic) display is also possible
- PreTeXt makes the integration possible
- Speech Rule Engine makes 2D math using layout
- Working on tactile graphics for diagrams with labels
- This talk could be converted to braille!



BRAILLE EXAMPLE

AATA's theorem on a presentation of a dihedral group:

[illegible]

Theorem 5.2.3. *The group D_n $n \geq 3$ consists of all products of the two elements r and s satisfying the relations*

$$\begin{aligned} r^n &= 1 \\ s^2 &= 1 \\ srs &= r^{-1}. \end{aligned}$$

JUPYTER NOTEBOOKS

- Computational notebook format
- Popular in data science community
- We support a Sage kernel
- Conversion could use some attention

ACCESSIBILITY

- HTML output follows standards, screen readers work exceedingly well
- Extra devices, like “Skip to Main Content” link
- Author support: “description” element for images
- Math support: from Speech Rule Engine within MathJax
- Braille, using Nemeth braille and 2D layouts

MISCELLANEOUS

- WeBWorK, natively
- Super-simple YouTube, Vimeo, MP4 embeddings
- Desmos, Geogebra, various Javascript libraries
- Automatic index, back-of-the-book solutions
- Solutions Manual conversion (PDF only)
- Literate Programming support, code generation
- International use: 14 contributed localizations
- Code on GitHub: 39 contributors, 167 forks

UNDERGRADUATE MATHEMATICS CURRICULUM

All PreTeXt textbooks. Lower-division first.

- ORCCA: Open Resources for Community College Algebra (Jordan)
- Modeling, Functions, and Graphs: Algebra for College Students (Yoshiwara/Yoshiwara)
- Advanced High School Statistics (Diez/Çetinkaya-Rundel/Dorazio/Barr)
- Active Calculus (Boelkins, GVSU)
- APEX Calculus (through multivariate) (Hartman)
- Calculus (4 volumes) (Feldman/Rechnitzer/Yeager)
- A First Course in Linear Algebra (Beezer)
- Understanding Linear Algebra (Austin, GVSU)
- Discover Linear Algebra: A First Course in Linear Algebra (Sylvestre)

The PreTeXt Catalog: pretextbook.org/catalog.html

UNDERGRADUATE MATHEMATICS CURRICULUM

All PreTeXt textbooks. Now upper-division.

- The Ordinary Differential Equations Project (Judson)
- Notes on Diffy Qs: Differential Equations for Engineers (Lebl)
- Applied Discrete Structures (Levasseur)
- Discrete Mathematics: an Open Introduction (Levin)
- Applied Combinatorics (Keller/Trotter)
- Combinatorics Through Guided Discovery (Bogart)
- Introduction to Game Theory: a Discovery Approach (Nordstrom)
- Geometry with an Introduction to Cosmic Topology (Hitchman)
- Number Theory: In Context and Interactive (Crisman)
- How We Got From There To Here: A Story of Real Analysis (Rogers/Bowman)
- Abstract Algebra: Theory and Applications (Judson)

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CONCLUSION

Principle #8: PreTeXt is free: the software is available at no cost, with an open license. The use of PreTeXt does not impose any constraints on documents prepared with the system.

Links

- pretextbook.org
- buzzard.ups.edu/talks.html
- Twitter: [#PreTeXtGang](https://twitter.com/PreTeXtGang)

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