

# Resources to Support Teachers

(BIRS Workshop)

Barb Forrest  
University of Waterloo

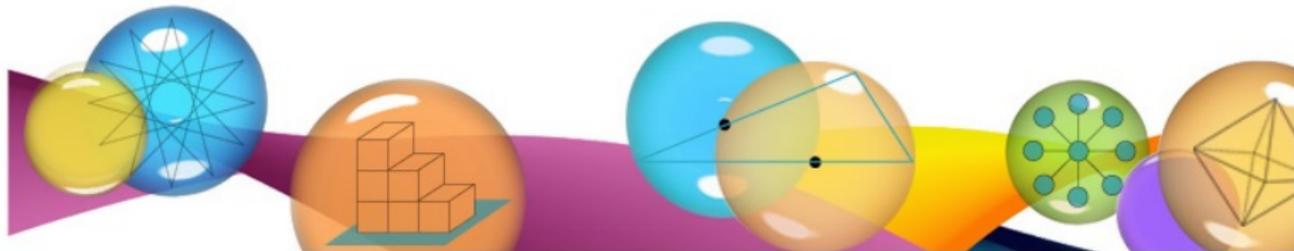
[baforres@uwaterloo.ca](mailto:baforres@uwaterloo.ca)

July 2023

# Math Problem of the Week

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## Problem of the Week



The Problem of the Week is designed to provide students with an ongoing opportunity to solve mathematical problems. Each week, problems from various areas of mathematics will be posted and e-mailed to teachers to use with their students from grades 3 and up.

### Reference:

<https://www.cemc.uwaterloo.ca/resources/potw.php>

# Math Problem of the Week

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## Current Problems

[\(3/4 Problem A\)  
Recess Randomness](#)

[\(5/6 Problem B\)  
Powerful Patterns](#)

[\(7/8 Problem C\)  
Will that be Large or  
Small?](#)

[\(9/10 Problem D\)  
Sum Ways](#)

[\(11/12 Problem E\)  
What is Possible?](#)

## Subscribe Now!

|        |  |  |  |  |   |  |
|--------|--|--|--|--|---|--|
| Action | <input checked="" type="radio"/> Subscribe <input type="radio"/> Unsubscribe |  |  |  |   |  |
| Grade  | <input checked="" type="checkbox"/> All                                      | <input type="checkbox"/> 3/4 Problem A | <input type="checkbox"/> 5/6 Problem B | <input type="checkbox"/> 7/8 Problem C | <input type="checkbox"/> 9/10 Problem D | <input type="checkbox"/> 11/12 Problem E |
| E-mail | <input type="text" value="MaryJones@HighSchool.ca"/>                         |  |  |  |   |  |

Reference:

<https://www.cemc.uwaterloo.ca/resources/potw.php>

# Math Problem of the Week

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Mail

+ New | v ...

Inbox

Problem of the Week

[11-12] Problem E What is Possible?

Problem of the Week

[9-10] Problem D Sum Ways

Problem of the Week

[7-8] Problem C Will that be Large or Small?

Problem of the Week

[5-6] Problem B Powerful Patterns

Problem of the Week

[3-4] Problem A Recess Randomness

You will receive email messages containing links to the current week's problems [operates September through May each school year; past problems are archived and can be downloaded from the website].

# Math Problem of the Week: Themes

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Grades

3/4

5/6

7/8

9/10

11/12

## Number Sense (N)

*Numeration*

*Numbers*

*Number Theory*

*Financial Literacy*

## Geometry & Measurement (G)

*Spatial Sense*

*Shape and Space*

*Trigonometry*

## Algebra (A)

*Patterning*

*Relations*

*Sequences*

*Functions*

## Data Management (D)

*Probability*

*Statistics*

## Computational Thinking (C)

*Logic*

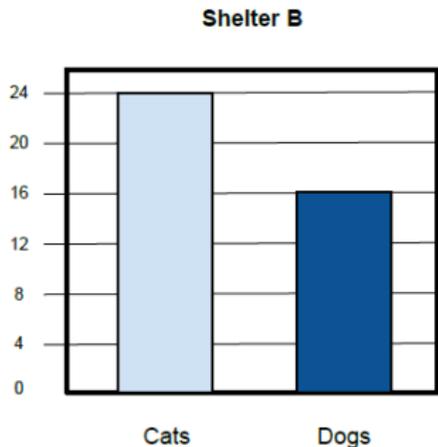
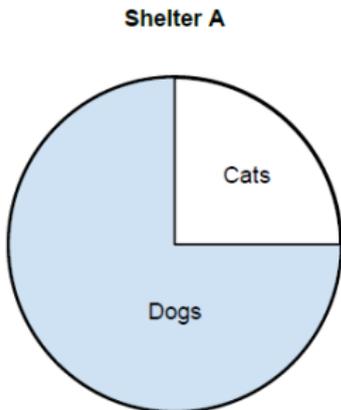
*Coding*

# Math Problem of the Week:

## Grade 3/4: Data Management and Number Sense

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The graphs below represent the number of cats and dogs in two local animal shelters. Shelter A and Shelter B have the same number of animals.



There are more dogs in Shelter A than in Shelter B. How many more? Justify your answer.

**Reference:**

<https://www.cemc.uwaterloo.ca/resources/potw.php>

# Math Problem of the Week: **Solution**

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## Solution

Looking at Shelter B, we see that there are 24 cats and 16 dogs. This means there is a total of  $24 + 16 = 40$  animals in each of the two shelters.

It appears that in Shelter A,  $\frac{3}{4}$  of the shelter is filled with dogs, and  $\frac{1}{4}$  are cats. If the total number of animals at this shelter is 40, then we need to calculate  $\frac{1}{4}$  of 40.

Since  $10 + 10 + 10 + 10 = 40$ , then  $\frac{1}{4}$  of  $40 = 10$ . So there are 10 cats in Shelter A. This means that there are  $40 - 10 = 30$  dogs in Shelter A.

Since there are 30 dogs at Shelter A and 16 dogs at Shelter B, then there are  $30 - 16 = 14$  more dogs at Shelter A than Shelter B.

**Reference:** <https://www.cemc.uwaterloo.ca/resources/potw.php>

# Math Problem of the Week: **Notes**

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## Teacher's Notes

Data can be visualized in many ways. A tool like a spreadsheet can automatically convert numeric data into a chart. The same data can be used to generate different styles of charts. Consider the bar chart showing the data for Shelter B. The spreadsheet automatically calculated the maximum value on the y-axis and chose the distance between the horizontal lines in the chart. Most spreadsheets would give the user the option of changing the maximum value and changing the distance between each of the horizontal lines. Once those decisions are made, the spreadsheet will automatically recalculate the size of the chart and its elements.

If students want to create their own charts, they would need to do all of those calculations themselves. The work to determine the values of regular intervals from the minimum to the maximum as the locations of the horizontal lines is not trivial. Suppose you use graph paper to draw the chart. You need to determine a

⋮

**Reference:** <https://www.cemc.uwaterloo.ca/resources/potw.php>

# Invitations to Mathematics

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“*Invitations to Mathematics*” is a series of 18 free booklets (PDF format) to assist teachers of Grades 4, 5, 6.

The content in these booklets can be used for either individual or group work. Activities, reproducible worksheet masters, and solutions are included in the booklets as well as instructional guidance and suggested assessment strategies for teachers.

**Grades: 4, 5, and 6**

| <b>TOPICS</b>               |
|-----------------------------|
| Number Sense and Estimation |
| Geometry                    |
| Data Management             |
| Patterns and Algebra        |
| Probability                 |
| Measurement                 |

**Reference:**

**<https://www.cemc.uwaterloo.ca/resources/invitations-to-math.html>**

# Master of Mathematics for Teachers Degree Program (MMT)

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Course: Mathematical  
Software  
for  
Teachers

LaTeX

Inkscape

GeoGebra

Maple

# Open Source Software

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What is **LaTeX**?

Open source software that enables the user to create **typeset mathematical documents**.

“Open source”

= download and use the software for free.

# Creating Math Resources from Open Source Software: **LaTeX**

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$$\sqrt{1 + \sqrt{1 + \sqrt{1 + \sqrt{1 + \sqrt{1 + \sqrt{1 + \sqrt{1 + x}}}}}}}$$

# Open Source Software

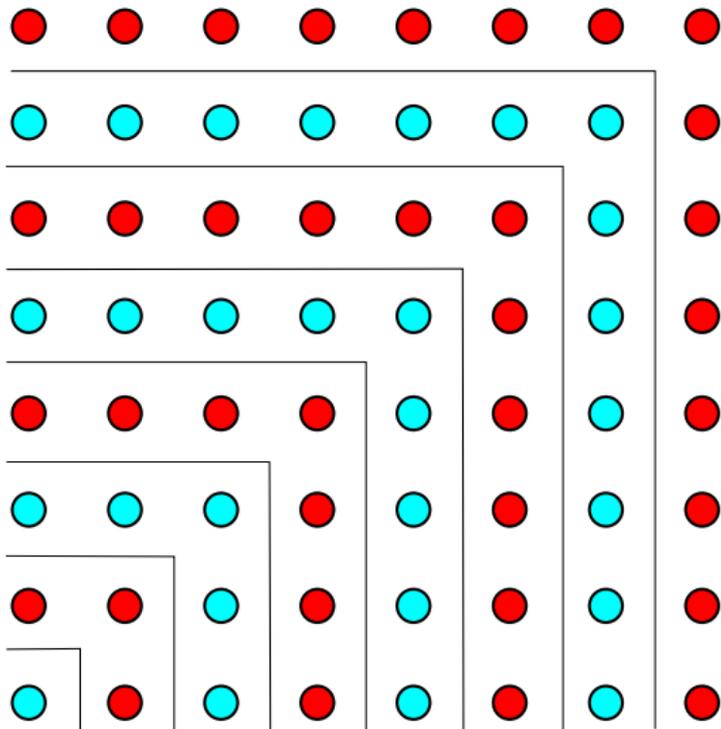
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What is **Inkscape**?

Free open source software that enables the user to produce **professional quality graphics**.

# Visual Proofs: Sum of Odd Integers

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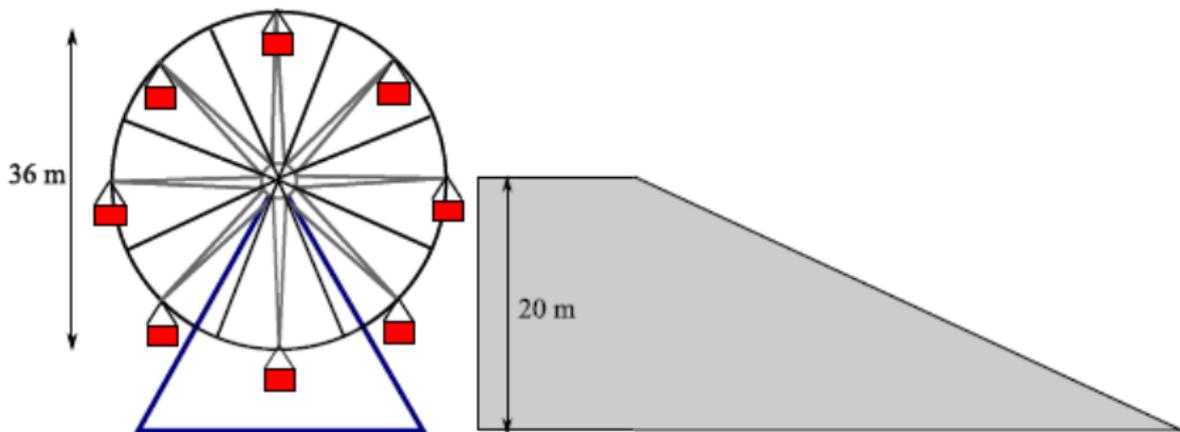


Sums of Odd Integers  
Nicomachus of Gerasa (circa A.D. 100)  
 $1 + 3 + 5 + \dots + (2n - 1) = n^2$

# Enhancing Assignment Questions

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A ferris wheel has a diameter of 36 m and a center which is 20 m above the ground. The wheel rotates once every 32 seconds. A rider uses a platform that is 20 m above the ground to board the ferris wheel. Write a sine function that gives the rider's height  $h$  at time  $t$ .



# Inkscape's Associated Open Source Clip Art Library

[currently 175,000 graphics/ updated daily]

Open Clipart is an online media collection of thousands of vectorial graphics, **entirely in the public domain.**

<https://openclipart.org>

The screenshot shows the Open Clipart website interface. At the top, there is a dark blue navigation bar with the Open Clipart logo on the left, and 'Log in | Sign Up' and a green 'Upload Clipart' button on the right. Below the navigation bar is a search bar containing the word 'cartoon'. The main content area is titled 'Cartoon Clipart:' and displays a grid of 12 cartoon clipart items. Each item consists of a small icon, a title, the creator's name, the upload date, and a star rating with a heart icon.

| Cartoon Alligator Digi Stamp                     | Cartoon Alligator Clip Art                          | wise Cartoon owl who has sat under a Mango tree for many years and knows how to listen well and has | Yellow Cartoon Girl-Boy                         |
|--|---|---|---|
| by janesartcoormer<br>2018-04-12<br>★ 1450 ♥ 2   | by janesartcoormer<br>2018-04-11<br>★ 2200 ♥ 4      |   | by IslandVibz<br>2014-09-25<br>★ 5535 ♥ 5       |
| Pink Funny Cartoon Face                          | Blue surprised cartoon smiley                       | Cartoon Tank  | Female cartoon avatar                           |
| by IslandVibz<br>2014-09-24<br>★ 3766 ♥ 4        | by IslandVibz<br>2014-09-24<br>★ 5435 ♥ 5           | by firestorm200<br>2014-03-13<br>★ 6107 ♥ 4   | by AlMinniah<br>2013-07-28<br>★ 10291 ♥ 8       |
| Cartoon Dragon                                   | Funny Chick Cartoon Newborn Coming Out from the Egg | Cartoon Mallard   | toon, cartoon, bujung, thai cartoon             |
| by aPAULcalypse<br>2013-04-18<br>★ 9733 ♥ 14     | by palomaironique<br>2011-04-24<br>★ 10166 ♥ 10     | by 14thWarrior<br>2010-09-03<br>★ 9468 ♥ 13   | by aungkarns<br>2010-08-05<br>★ 2788 ♥ 2        |
| Cartoon tyrannosaurus rex                        | Cartoon triceratops                                 | Cartoon brontosaurus  | Cartoon llama                                   |
| by StudioFibonacci<br>2009-03-30<br>★ 15687 ♥ 23 | by StudioFibonacci<br>2009-03-30<br>★ 17175 ♥ 31    | by StudioFibonacci<br>2009-03-30<br>★ 13665 ♥ 24  | by StudioFibonacci<br>2009-03-23<br>★ 9315 ♥ 17 |

# Creating Math Resources: Inkscape + Clip Art Library

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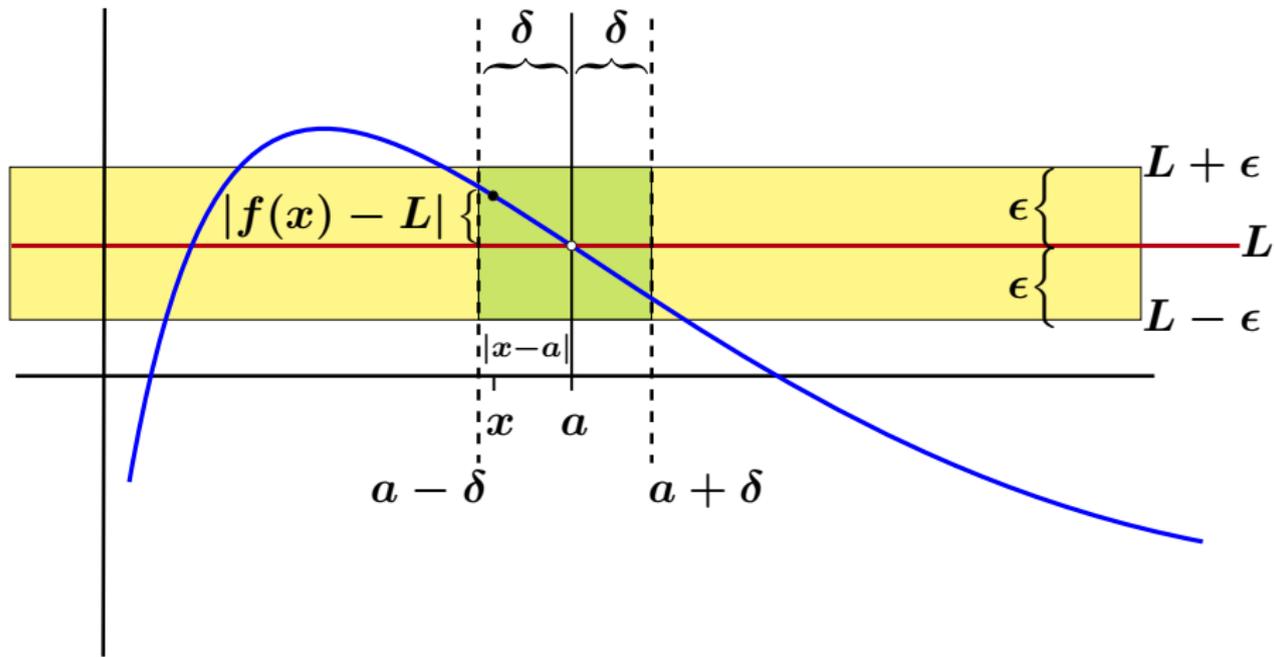


\*Accessed from <https://openclipart.org>  
Search: cartoon elk



# Creating Math Resources from Open Source Software: **Inkscape + LaTeX**

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# Creating Math Resources from Open Source Software: **Course Notes**

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The University of Waterloo has moved toward replacing publisher's textbooks in first year math core classes by free\* downloadable pdf course notes.

Math 137    Calculus 1 for Honours Math

Math 138    Calculus 2 for Honours Math

Math 135    Algebra for Honours Math

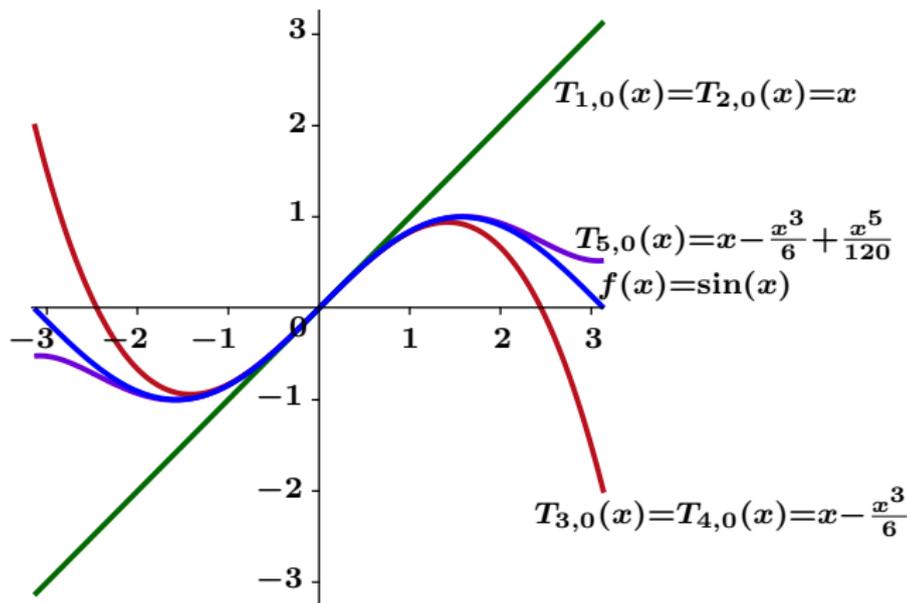
Math 136    Linear Algebra for Honours Math

\* free = free downloadable PDF copy or  
for cost of printing at the UW Bookstore

# Classroom Demos and Lectures:

## Taylor Polynomials for $\sin(x)$

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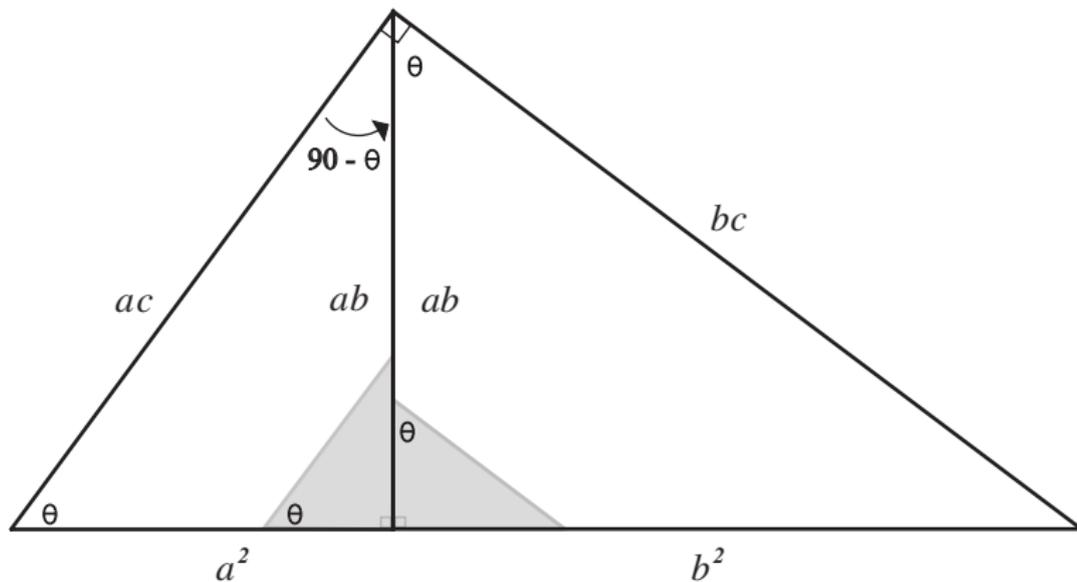


The display of the graph of  $\sin(x)$  with its Taylor Polynomials up to degree 5 (excluding  $T_{0,0}(x)$  since its graph is the  $x$ -axis). For  $k \geq 0$ ,

$$T_{2k+1,0}(x) = T_{2k+2,0}(x) = x - \frac{x^3}{3!} + \frac{x^5}{5!} + \cdots + (-1)^{k-1} \frac{x^{2k+1}}{(2k+1)!}$$

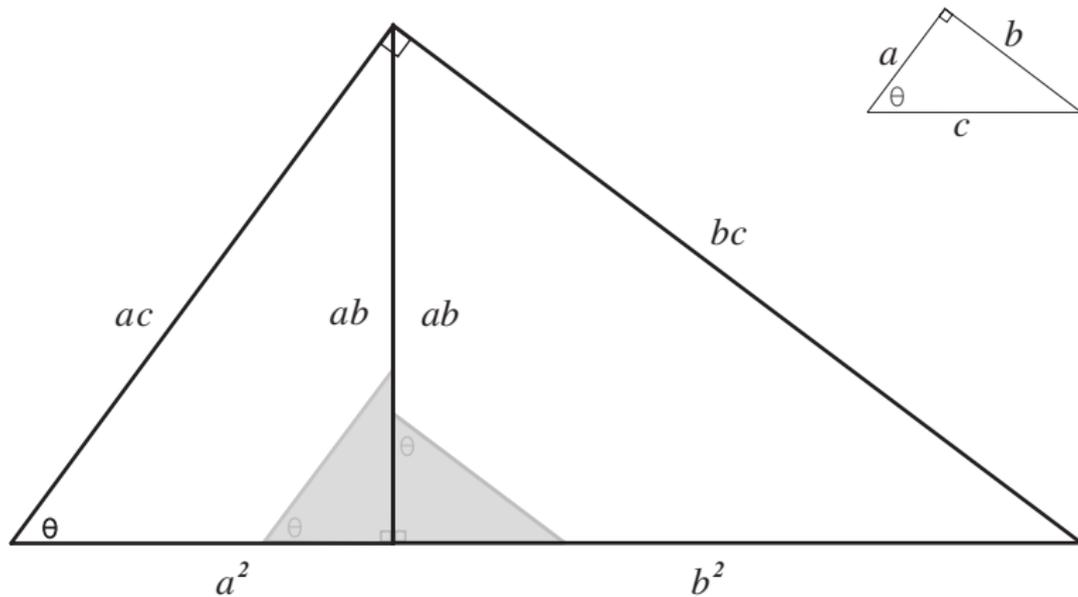
# Outreach Resources: Visual Proof of the Pythagorean Theorem

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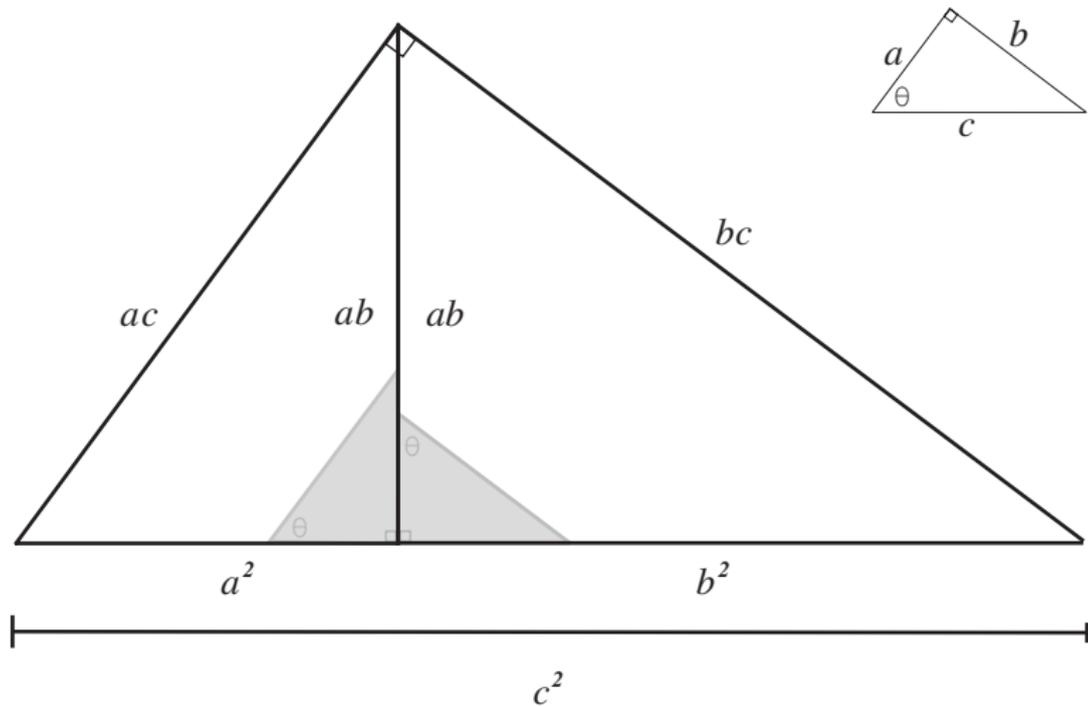
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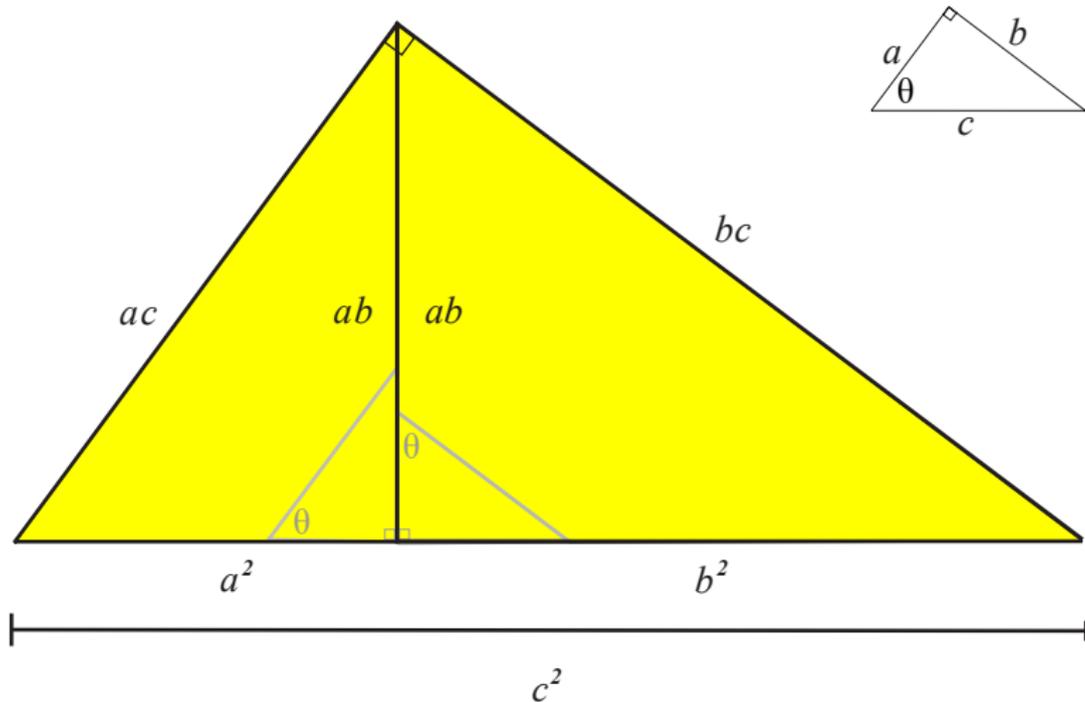
# Outreach Resources: Visual Proof of the Pythagorean Theorem

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# Outreach Resources: Visual Proof of the Pythagorean Theorem

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# Free No-Login Access

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- ▶ **Math Problem of the Week**
  - math problems with solutions and teacher notes
- ▶ **Invitations to Mathematics**
  - free booklets with activities, worksheets, solutions and teacher notes
- ▶ **LaTeX Tutorial** (~ 8 hours)
  - document preparation including math typesetting
- ▶ **Inkscape Tutorial** (~ 6 hours)
  - learn to draw pictures for use in other documents
- ▶ **Clip Art Library** (~ 175,000; new art added daily)
  - free public domain downloadable clip art
- ▶ **Calculus 1 and 2 Course Notes and Lectures**
  - for first- and second-term undergraduate Calculus

**Access At:**

**<http://www.math.uwaterloo.ca/~baforres/BIRS2023.html>**