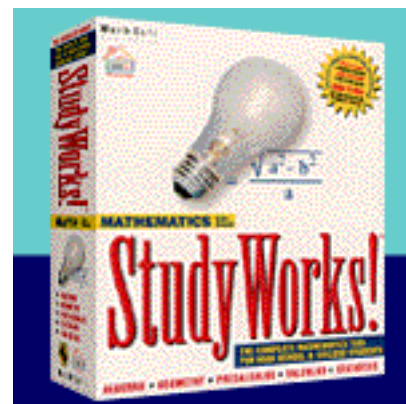


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Platform: Windows and Macintosh

Available on CD-ROM only

Available for ground shipment



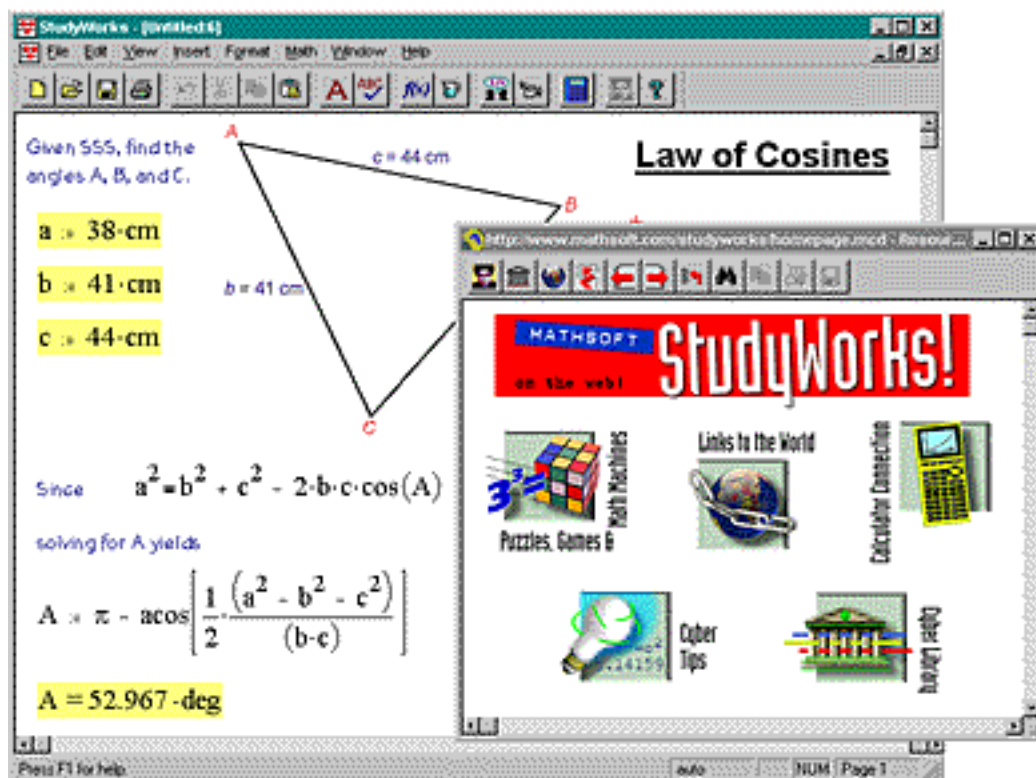
Imagine a full-screen graphing calculator and a math-smart word processor combined into one integrated tool. Now imagine an electronic encyclopedia of facts and formulas at your fingertips and a built-in Web link that lets you connect with other students and pick up hints on your homework. StudyWorks is an all-in-one study tool that helps you work faster, more accurately -- and learn more at the same time. Calculate, graph, access helpful information - - then create great-looking documents that combine text, formulas and graphics. You'll find hundreds of drag-and-drop equation, in-depth explanations, worked-out examples and lots of great illustrations, graphs, and animations to strengthen problem-solving skills.

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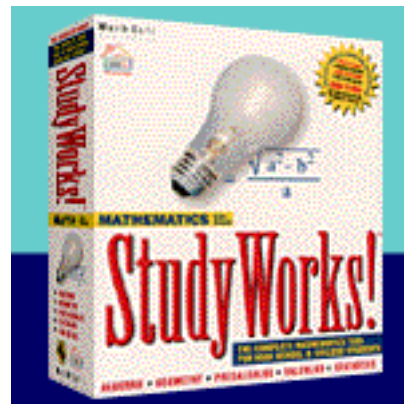


In a StudyWorks worksheet, you can write equations, perform calculations, create graphs, even add text -- anywhere you want.

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- Linear functions
- Factoring
- Quadratic equations
- Graphing
- Polynomials
- Inequalities
- Systems of equations
- Conic sections
- Areas and volumes
- Polar coordinates
- Logs and exponential functions
- Sequences and series
- Circular functions
- Trigonometric identities
- Parametric curves
- Vectors
- Matrices
- Probability
- Data Analysis
- Complex numbers
- Limits
- Derivatives and integrals

Perform all the numeric and symbolic calculations you'll ever need

- Work with numbers, variables, functions, equations, vectors, matrices.
- Units of measurement and dimension checking.
- Statistics and data analysis functions.
- Matrix operations including determinants, dot products, cross-products, inverse, and transpose.
- Derivatives, integrals, summations and products.
- Find roots of a polynomial.

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- Solve equations and systems of equations.
- Trigonometric, exponential and hyperbolic functions.
- Symbolic integration and differentiation.
- Expand, simplify and factor expressions.

Turn data and functions into powerful graphs

- X-Y and polar plots, vector plots, 3-D scatter, bar, contour, surface and parametric surface plots.
- Annotate and format graphs.
- Trace and zoom.
- Animation.

StudyWorks is live and interactive

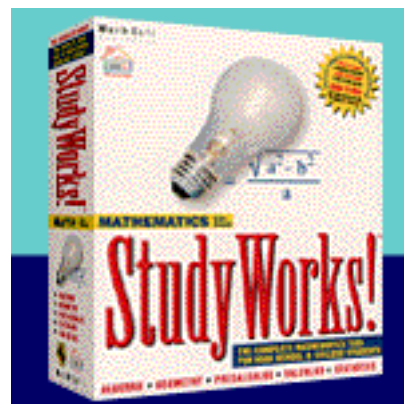
- Change inputs and watch StudyWorks recalculate the result.
- A unique environment for exploring and understanding math and science concepts.

Get the online help you need

- Online math reference book includes standard formulas, research material and information on algebra, geometry, precalculus, calculus, and statistics.
- Move information from the reference book to a StudyWorks worksheet with drag-and-drop ease.
- Online animated tutorial and context-sensitive help provide answers to a wide range of questions and problems.
- A special section offers help in preparing for the SAT II tests.

Create great-looking documents in seconds

- WYSIWYG report writer makes it easy to prepare presentation-quality homework papers and lab reports.
- Includes print preview and technical spell checker.
- Export worksheets to Microsoft Word for full word-processing capabilities.

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System Requirements

Windows

IBM PC or compatible (486 or higher)

Microsoft Windows 3.1 (or higher) or Windows '95, 8 MB of RAM and 10 MB of swap space

14 MB of free disk space

SVGA color monitor

CD-ROM drive

Web link requires internet access

Macintosh

PowerMac or 68040 (PowerMac recommended)

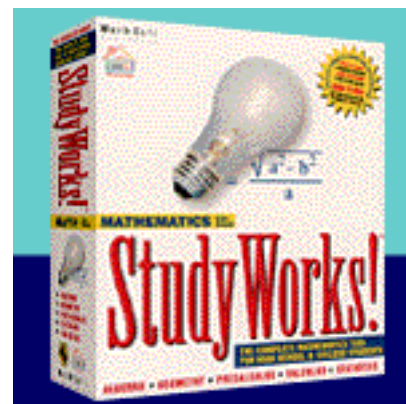
8 MB of RAM

16 MB of disk space

CD-ROM drive

Macintosh System 7.1 or later

Web link requires internet connection and MacTCP



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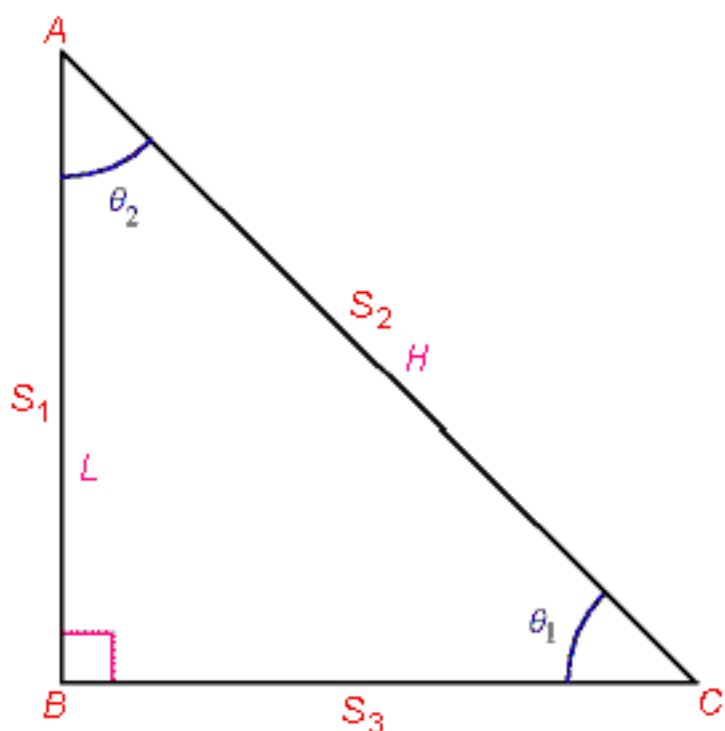
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Trigonometry: Law of Sines and Law of Cosines

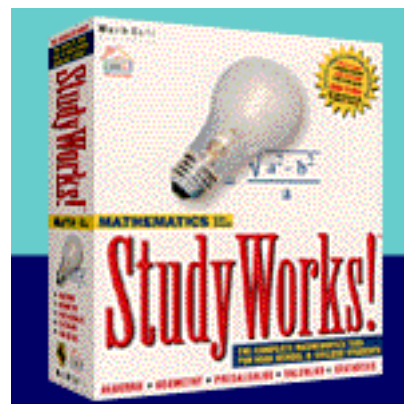
If you've already taken a geometry course you know that in order to construct a triangle there is a minimum amount of information that you need to know about the triangle. You must know one of the following:



SSS	three sides
ASA	two angles and the included side
SAS	two sides and the included angle
AAS	two angles and a non-included side
HL	the hypotenuse and one leg of a right triangle

If you are given two sides and a non-included angle (SSA), this information is *not sufficient* to define a unique triangle.

The Law of Cosines is a formula that you can use to determine the remaining legs or angles of a triangle if you are given SSS, SAS, or HL. Similarly, the Law of Sines can be used if you are given ASA, AAS or HL. See **Tips and Techniques** for more on working with trigonometric laws in StudyWorks.



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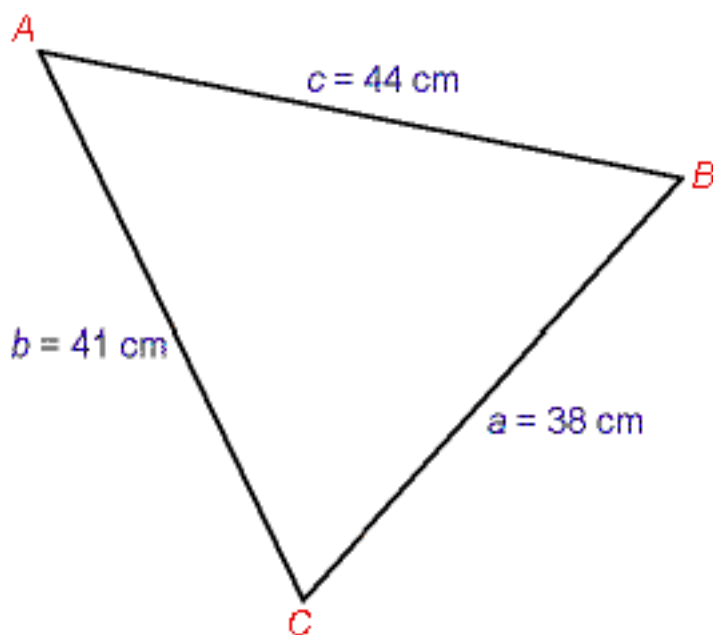
Equations

Law of Cosines: $a^2 = b^2 + c^2 - 2 \cdot b \cdot c \cdot \cos(A)$

Law of Sines: $\frac{\sin(A)}{a} = \frac{\sin(B)}{b} = \frac{\sin(C)}{c}$

Example 1

Given SSS, find the angles A, B, and C.



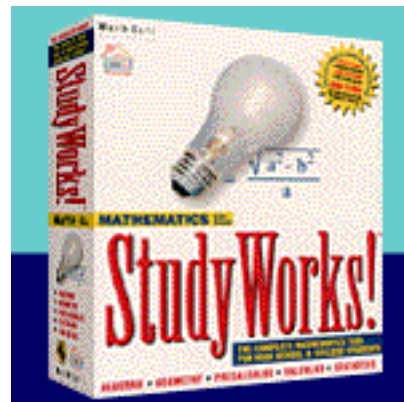
$a := 38 \text{ cm}$

$b := 41 \text{ cm}$

$c := 44 \text{ cm}$

Since

$$a^2 = b^2 + c^2 - 2 \cdot b \cdot c \cdot \cos(A)$$



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solving for A yields

$$A := \pi - \arccos \left[\frac{1}{2} \cdot \frac{(a^2 - b^2 - c^2)}{(b \cdot c)} \right] \quad A = 52.967 \cdot \text{deg}$$

Since

$$b^2 = a^2 + c^2 - 2 \cdot a \cdot c \cdot \cos(B)$$

solving for B yields

$$B := \pi - \arccos \left[\frac{1}{2} \cdot \frac{(b^2 - a^2 - c^2)}{(a \cdot c)} \right] \quad B = 59.464 \cdot \text{deg}$$

Therefore

$$C := 180 \cdot \text{deg} - A - B \quad C = 67.568 \cdot \text{deg}$$

Where does the p come from in the results above for A and B? If we check by solving for the cosine of A instead of A, we get

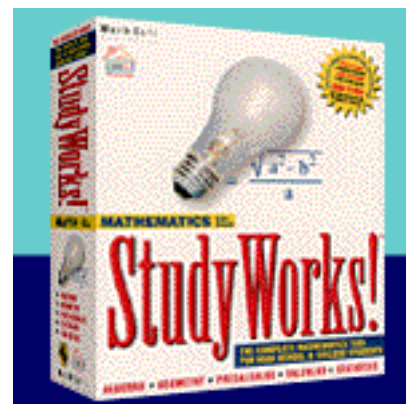
$$a^2 = b^2 + c^2 - 2 \cdot b \cdot c \cdot \cos(A)$$

has solution(s)

$$\frac{-1}{2} \cdot \frac{(a^2 - b^2 - c^2)}{(b \cdot c)}$$

O.K. so far. The difference comes in applying the acos function to each side. The symbolic processor uses the identity $\arccos(-x) = \pi - \arccos(x)$ and returns its preferred representation of the solution.

$$\arccos(\cos(A)) = \arccos \left[\frac{-1}{2} \cdot \frac{(a^2 - b^2 - c^2)}{(b \cdot c)} \right]$$



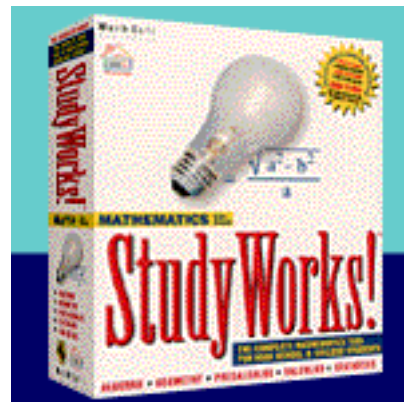
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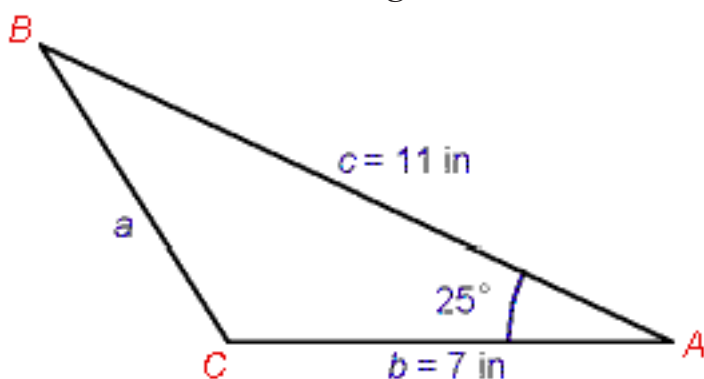


simplifies to

$$A = \pi - \arccos \left[\frac{1}{2} \cdot \frac{(a^2 - b^2 - c^2)}{(b \cdot c)} \right]$$

Example 2

Given SAS, find the length of the remaining side and angles.



$$b := 7 \cdot \text{in} \quad c := 11 \cdot \text{in} \quad A := 25 \cdot \text{deg}$$

Since

$$a^2 = b^2 + c^2 - 2 \cdot b \cdot c \cdot \cos(A)$$

solving for a yields

$$a := \left[\begin{array}{l} \frac{1}{2} \cdot \sqrt{4 \cdot b^2 + 4 \cdot c^2 - 8 \cdot b \cdot c \cdot \cos(A)} \\ \frac{-1}{2} \cdot \sqrt{4 \cdot b^2 + 4 \cdot c^2 - 8 \cdot b \cdot c \cdot \cos(A)} \end{array} \right]$$

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(Only the positive value makes sense!)

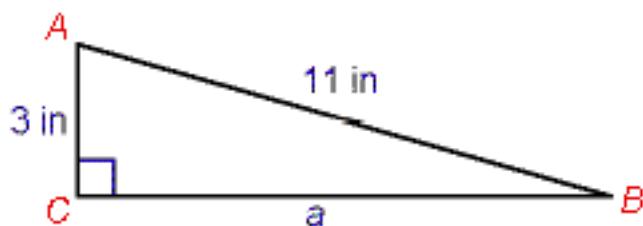
$$a = \begin{bmatrix} 5.516 \\ -5.516 \end{bmatrix} \cdot \text{in} \quad a := a_1 \quad a = 5.516 \cdot \text{in}$$

$$b^2 = a^2 + c^2 - 2 \cdot a \cdot c \cdot \cos(B)$$

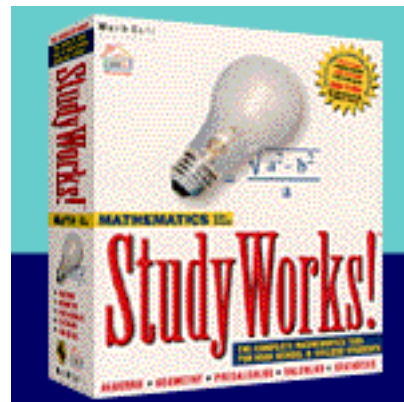
$$B := \pi - \arccos \left[\frac{1}{2} \cdot \frac{(b^2 - a^2 - c^2)}{(a \cdot c)} \right] \quad B = 32.432 \cdot \text{deg}$$

$$C := 180 \cdot \text{deg} - A - B \quad C = 122.568 \cdot \text{deg}$$

Example 3



$$b := 3 \cdot \text{in} \quad c := 11 \cdot \text{in} \quad C := 90 \cdot \text{deg}$$



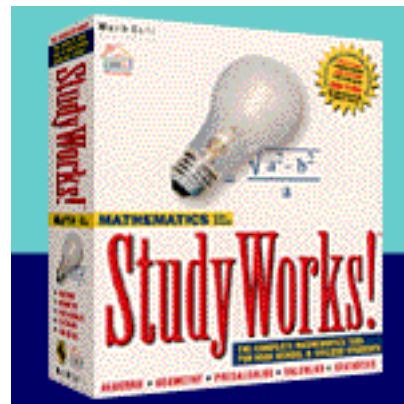
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Once you find side a (using the **Pythagorean Theorem**) you then have SAS. From there you can proceed with the Law of Cosines.

$$a := \sqrt{c^2 - b^2}$$

$$a = 10.583 \cdot \text{in}$$

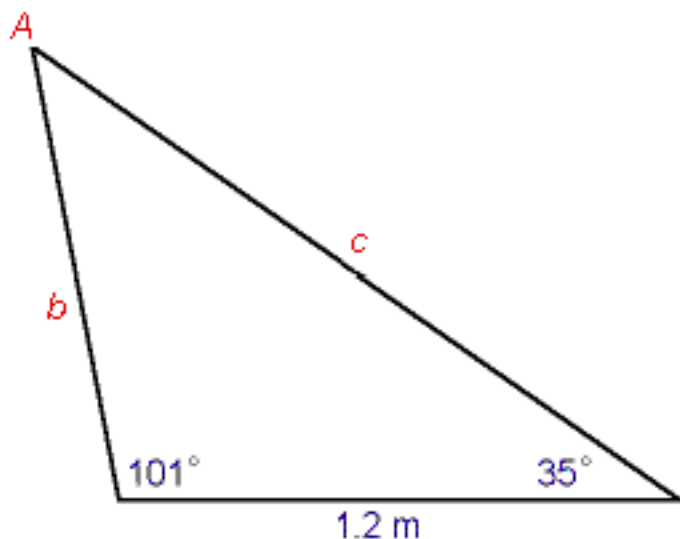
$$B := \pi - \arccos\left[\frac{1}{2} \cdot \frac{(b^2 - a^2 - c^2)}{(a \cdot c)}\right]$$

$$B = 15.827 \cdot \text{deg}$$

$$A := 90 \cdot \text{deg} - B$$

$$A = 74.173 \cdot \text{deg}$$

Example 4



$$a := 1.2 \cdot \text{m}$$

$$B := 35 \cdot \text{deg}$$

$$C := 101 \cdot \text{deg}$$

$$A := 180 \cdot \text{deg} - B - C$$

$$A = 44 \cdot \text{deg}$$

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Use the Law of Sines to find b and then c. Since

$$\frac{\sin(A)}{a} = \frac{\sin(B)}{b} \quad \text{and} \quad \frac{\sin(A)}{a} = \frac{\sin(C)}{c}$$

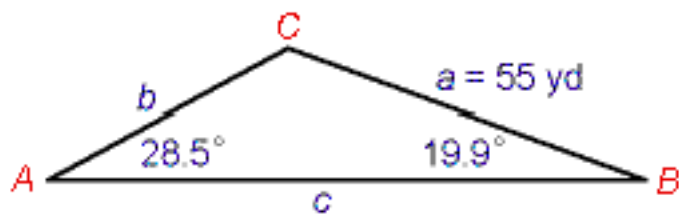
Solving for b and c yields

$$b := \sin(B) \cdot \frac{a}{\sin(A)} \quad b = 1 \cdot \text{m}$$

$$c := \sin(C) \cdot \frac{a}{\sin(A)} \quad c = 1.7 \cdot \text{m}$$

Example 5

Given AAS, find the remaining angle and sides.



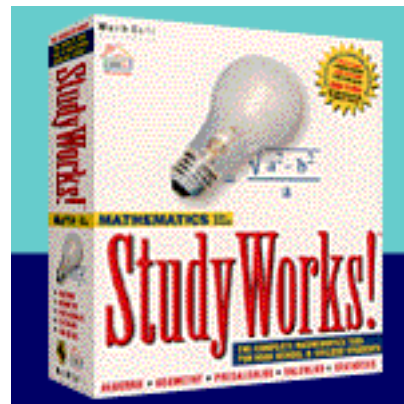
$$A := 28.5 \cdot \text{deg}$$

$$B := 19.9 \cdot \text{deg}$$

$$a := 55 \cdot \text{yd}$$

The third angle is

$$C := 180 \cdot \text{deg} - A - B$$



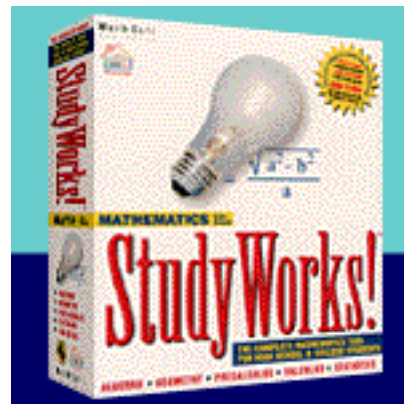
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Since

$$\frac{\sin(A)}{a} = \frac{\sin(B)}{b} \quad \text{and} \quad \frac{\sin(A)}{a} = \frac{\sin(C)}{c}$$

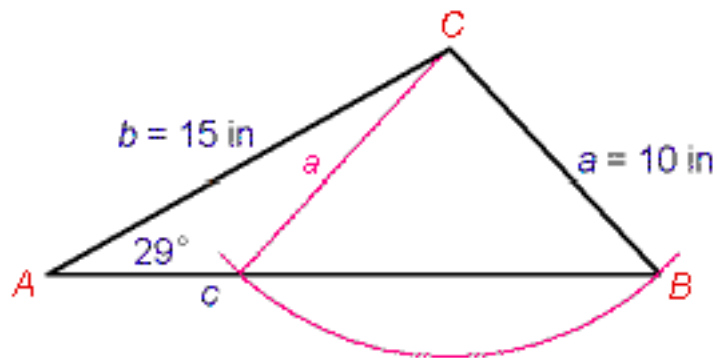
solving for b and c yields

$$b := \sin(B) \cdot \frac{a}{\sin(A)} \quad b = 39.234 \cdot \text{yd}$$

$$c := \sin(C) \cdot \frac{a}{\sin(A)} \quad c = 86.195 \cdot \text{yd}$$

It is important that you understand why SSA is insufficient to determine a unique triangle. To gain a better understanding of this, read the following carefully.

Given SSA, use the Law of Cosines to find the possible lengths of c.



$$a := 10 \cdot \text{in}$$

$$b := 15 \cdot \text{in}$$

$$A := 29 \cdot \text{deg}$$

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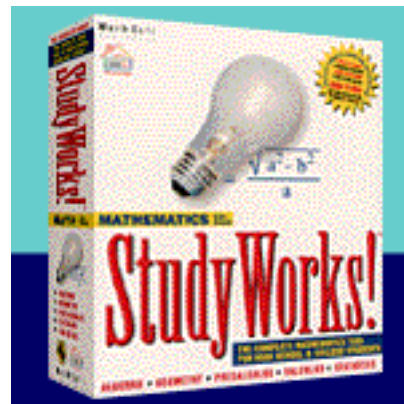
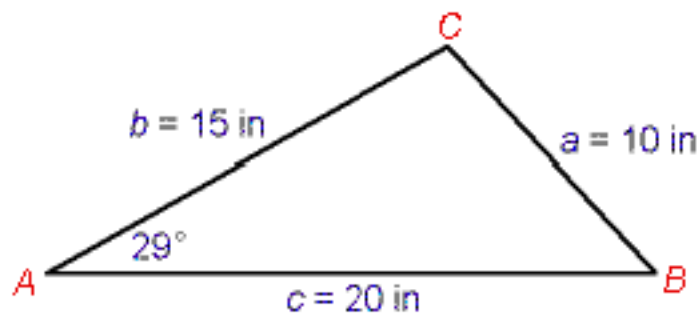
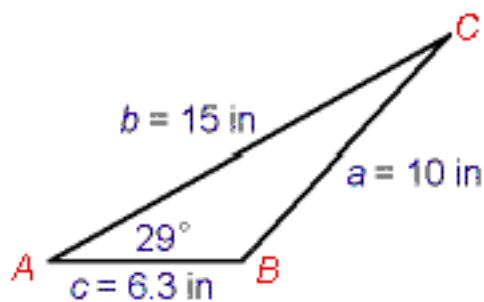
Using the Law of Cosines to solve for c yields

$$c := \begin{bmatrix} b \cdot \cos(A) - \frac{1}{2} \sqrt{4 \cdot b^2 \cdot \cos(A)^2 + 4 \cdot a^2 - 4 \cdot b^2} \\ b \cdot \cos(A) + \frac{1}{2} \sqrt{4 \cdot b^2 \cdot \cos(A)^2 + 4 \cdot a^2 - 4 \cdot b^2} \end{bmatrix}$$

Therefore, there are two different solutions for c!

$$c = \begin{bmatrix} 6.3 \\ 20 \end{bmatrix} \text{ in}$$

And the triangle could have two different shapes:



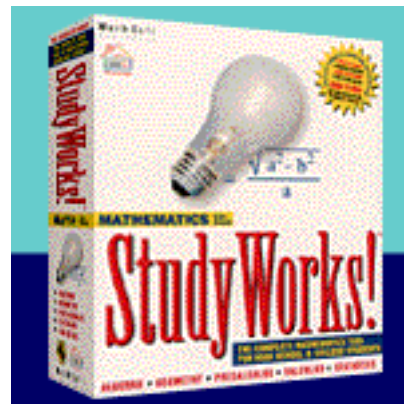
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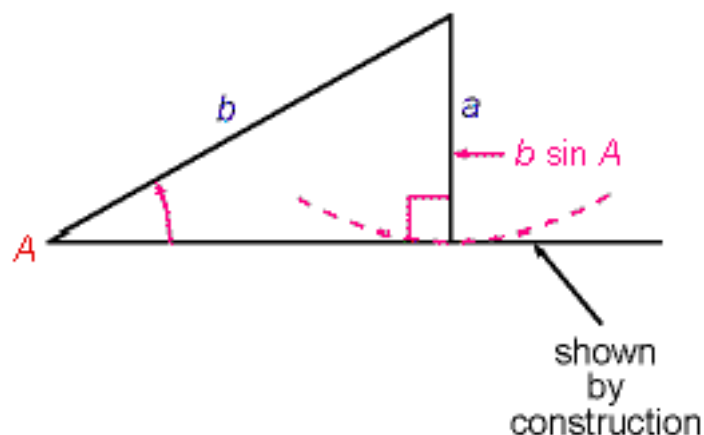
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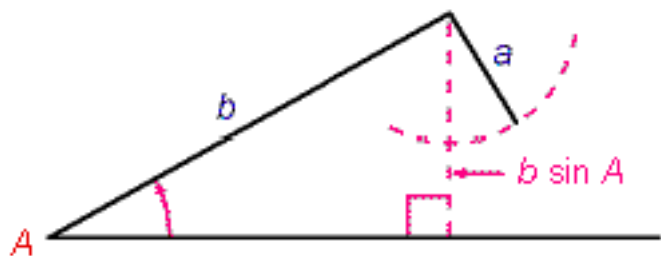
There is a way of determining how many solutions there will be for SSA. There are several cases:

Case 1: $A < 90^\circ$

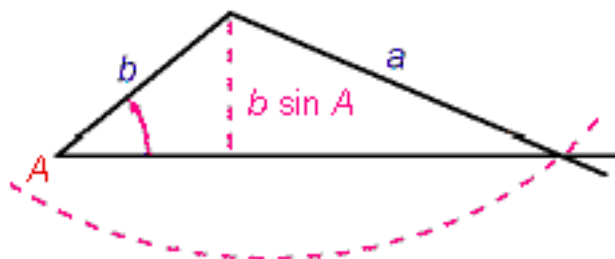
If $a = b \cdot \sin(A)$, one solution exists, a right triangle:



If $a < b \cdot \sin(A)$, there is no solution:



When $a > b$ and $a > b \cdot \sin(A)$, there is one solution:



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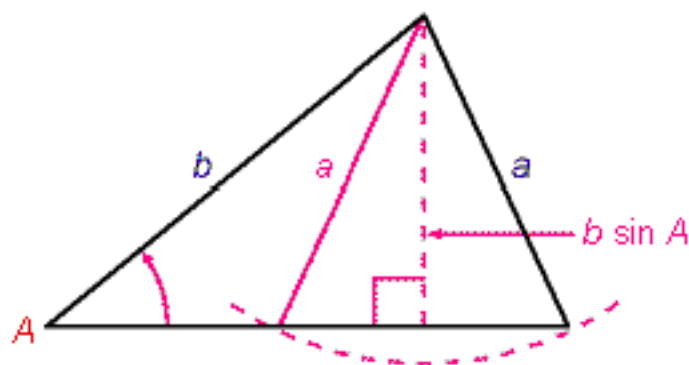
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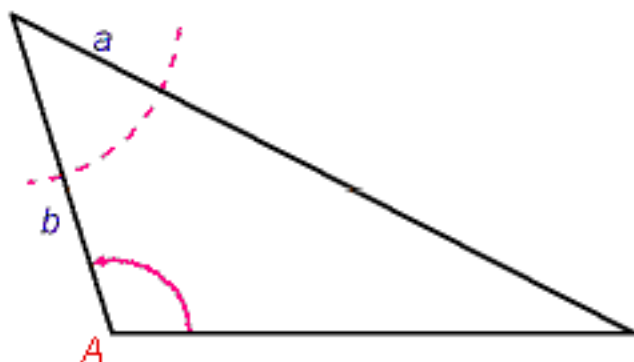
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If $b \cdot \sin(A) < a < b$, there are two solutions:

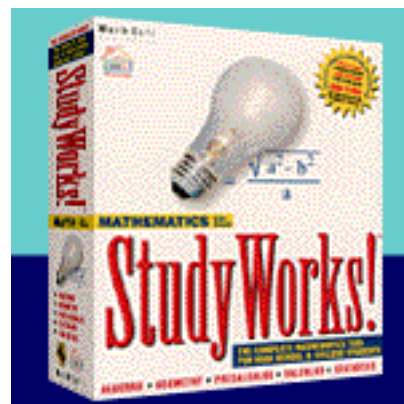
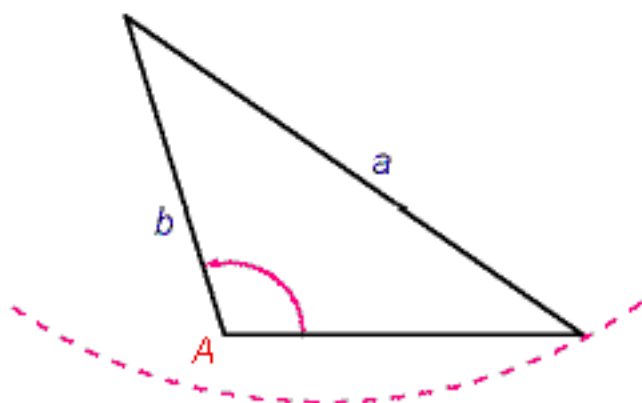


Case 2: $A \leq 90^\circ$

When $a \leq b$, there is no solution:



When $a > b$, one solution exists:



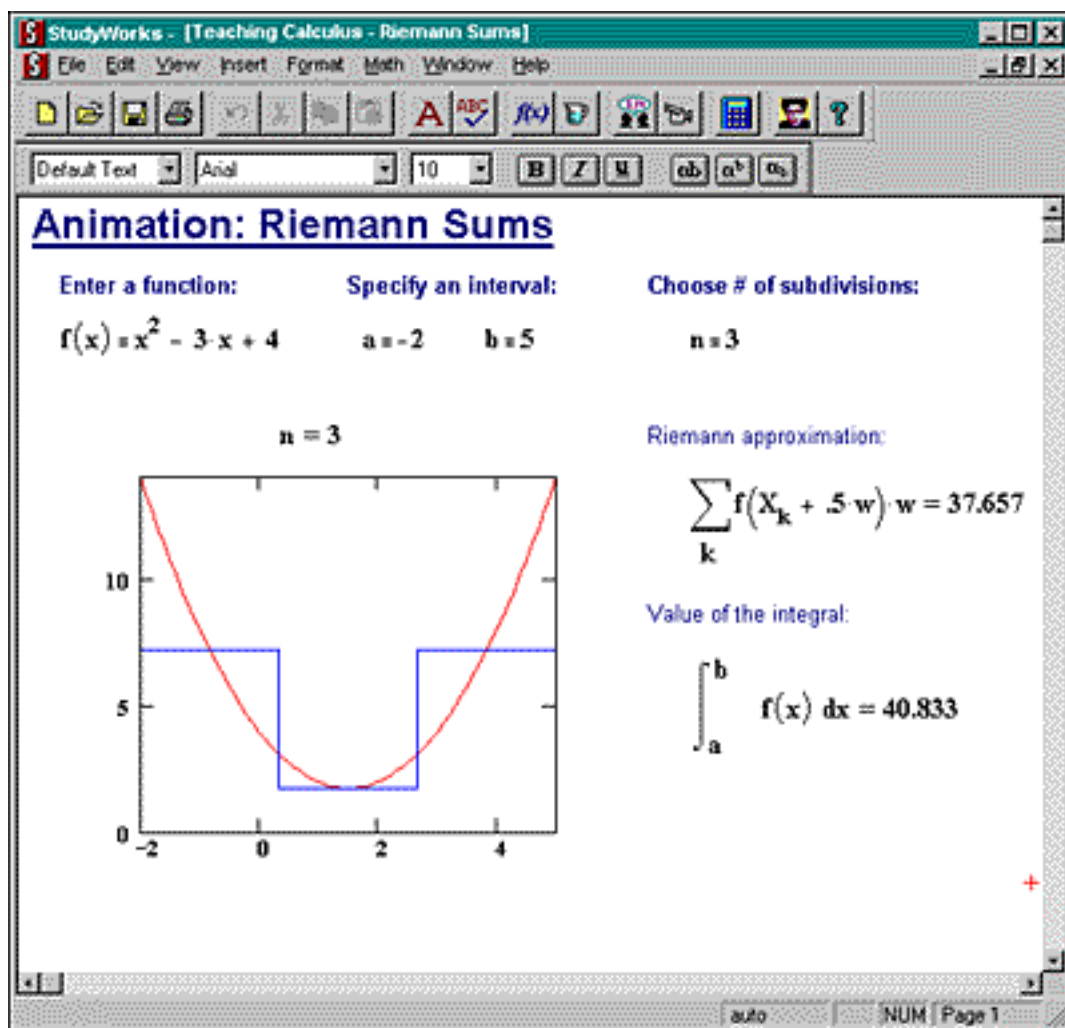
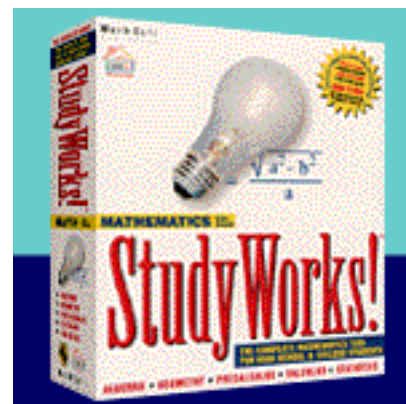
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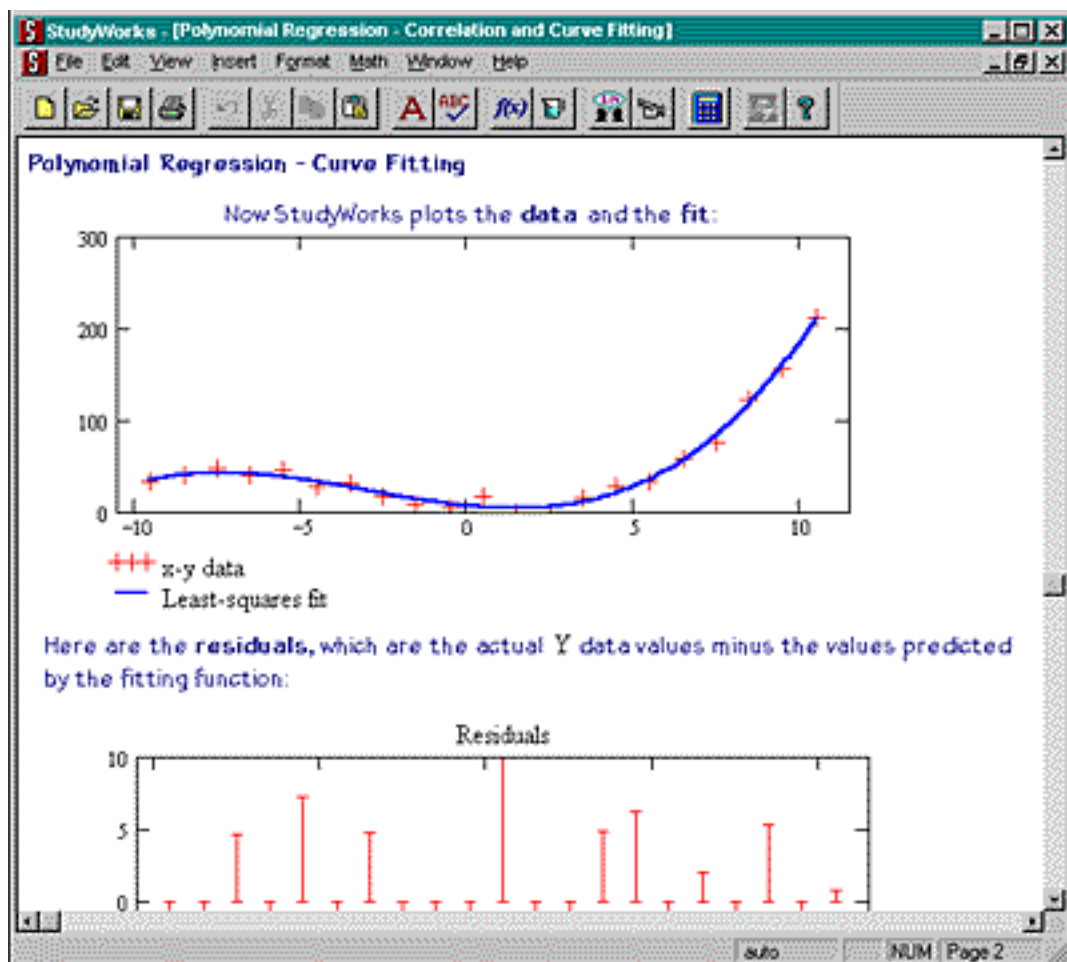
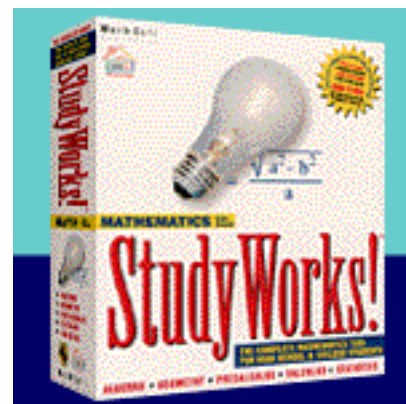
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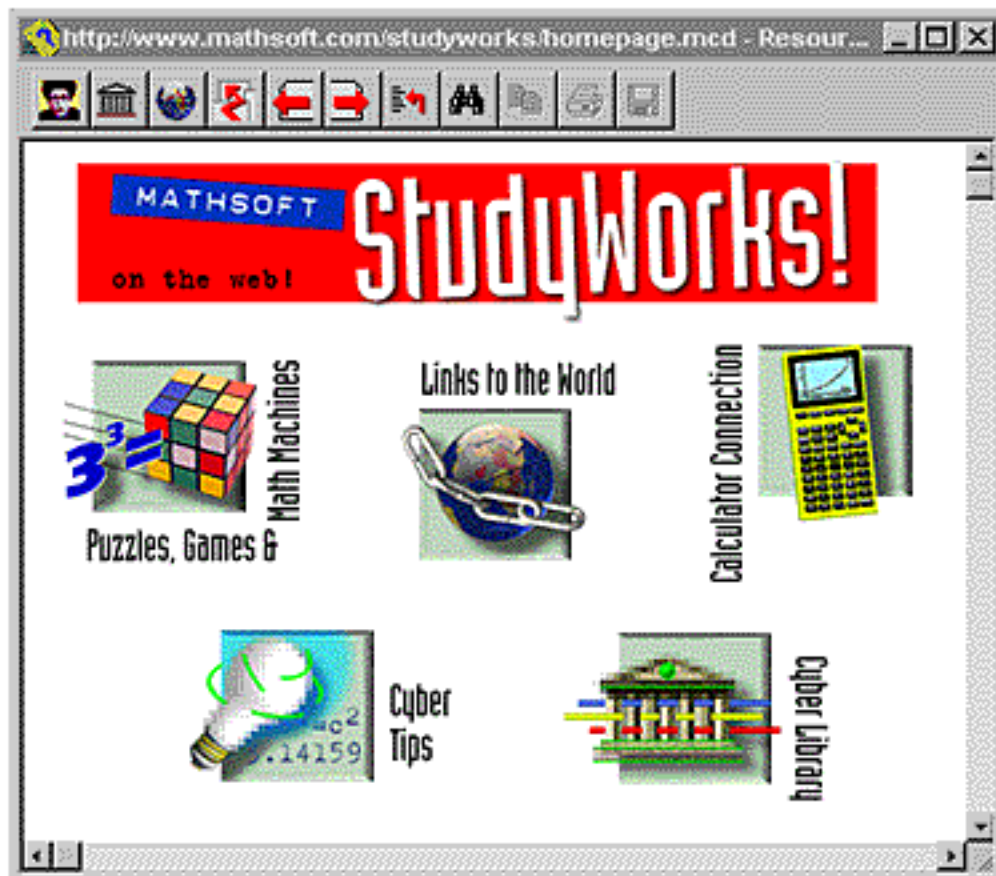
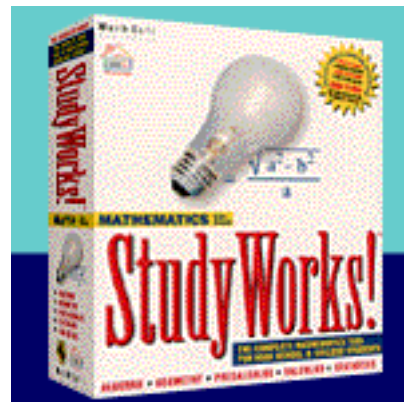
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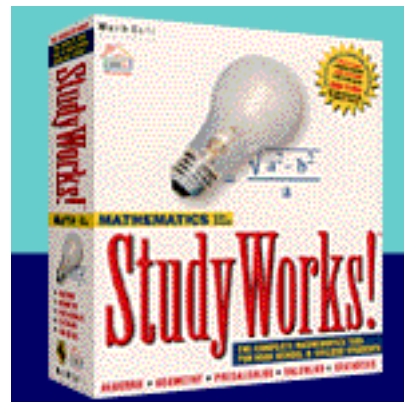
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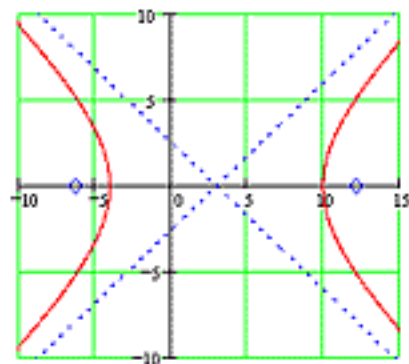
Jennifer Moore

Precalculus Assignment 3 10/19/96

I'm going to use the formulas from the section on hyperbolas to set up these homework graphing problems. I'll need both sets because some of these hyperbolas go vertically.

Problem 1. center: $h := 3$ $k := 0$ **a and b:** $a := 7$ $b := 6$

$$hy(x) := a \cdot \frac{\sqrt{x^2 + b^2}}{b} \quad F := \sqrt{a^2 + b^2} \quad y1(x) := \frac{b}{a} \cdot x + \left(k - \frac{b}{a} \cdot h\right) \quad y2(x) := -\frac{b}{a} \cdot x + \left(k + \frac{b}{a} \cdot h\right)$$



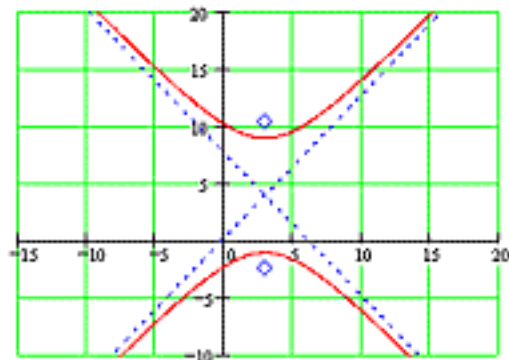
$$\frac{(x-3)^2}{7^2} - \frac{y^2}{6^2} = 1$$

This is a "horizontal" hyperbola.

Problem 2. This one is vertical, so I'll use the other formula.

Center: $h := 3$ $k := 4$ **a and b:** $a := 5$ $b := 4$

$$hy(x) := a \cdot \frac{\sqrt{x^2 + b^2}}{b} \quad F := \sqrt{a^2 + b^2} \quad y1(x) := \frac{a}{b} \cdot x + \left(k - \frac{a}{b} \cdot h\right) \quad y2(x) := -\frac{a}{b} \cdot x + \left(k + \frac{a}{b} \cdot h\right)$$



$$\frac{(y-4)^2}{5^2} - \frac{(x-3)^2}{4^2} = 1$$

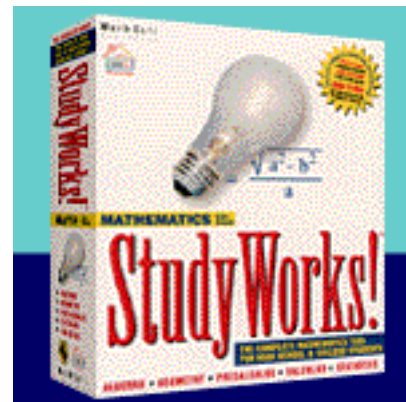
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