Math 9 Learning Guide #9

Trigonometry (Part 1 of 2) - Sections 4.1 to 4.3

Introduction

The next two learning guides look at a branch of geometry called **trigonometry**. Trigonometry is based on the properties of a right angle triangle. It is a very useful branch of math and can be applied in day to day life. Any problem that involves an angle can probably be solved by trigonometry.

What is the angle of the slope of the roof of your house?; what is the angle a ladder makes with a wall?; what angle should you throw a ball to get maximum distance?; how do design stairs to get the angle you want? These questions and many, many more can easily be answered using trigonometry.

Learning Outcomes

On completion of this guide you will be able to:

[1] define and calculate the tangent ratio in right angle triangles

[2] use the tangent function to find the values of angles.

[3] define and calculate sine and cosine ratios in right angle triangles.

Student Directions

[1] define and calculate the tangent ratio in right angle triangles (Text section 4.1)

Do the "Activity" on page 232 (you will need graph paper, ruler and a protractor. This activity leads you into the concept of the "tangent ratio".

Read page 233 to 236 and study each of the examples carefully. Be sure your calculator is in "degree" mode.

Math 8 Review of **Pythagorus' Theorem**

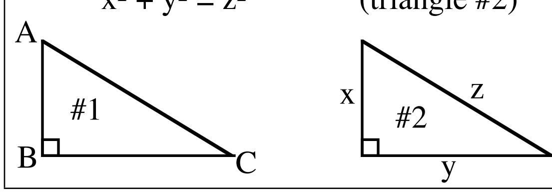
Pythagorus' theorem is probably to most famous triangle property in high school math. I guarantee that you will use it in every math course you take.

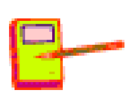
In English, the theorem states that: in any right angle triangle, the squares of the lengths of the two short sides is equal to the square of the length of the long side (ie, the hypotenuse).

In math language, the theorem may be stated slightly differently depending on how the triangle is labeled. For example:

$AB^2 + BC^2 = AC^2$ (triangle #1)

$x^2 + y^2 = z^2$ (triangle #2)





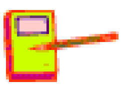
Page 237: #6, 7, 8ab, 9ab, 10, 11.
Page 238-239: #12i, 16, 17, 21a, 22, 23, 24a.

[2] use the tangent function to find the values of angles. (Text section 4.2)

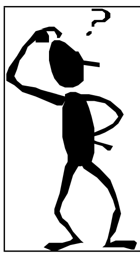
Study the three example questions on pages 240 to 242. (see note1)

Note 1: know the difference between the tan and the $\tan^{-1}$ buttons on your calculator.

- Pressing the tan button always gives the tangent ratio (ie, opposite / adjacent) for whatever angle you enter
  eg tan 35 = 0.70
- Pressing the $\tan^{-1}$ button always gives the angle for whatever ratio you enter.
  eg $\tan^{-1}$ 0.70 = 35 degrees.



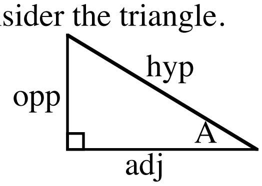
Page 243-244: #2aceg, 3aceg, 4i, 7, 8, 10a, 12.



The puzzle on page 245 is a classic geometry problem sometimes called "the case of the missing square". One way of solving the mystery is with trigonometry. Can you do it?

[3] define and calculate sine and cosine ratios in right angle triangles. (Text section 4.3)

Note 2: - Consider the triangle.



There are only 6 possible ways of taking ratios of two sides. They are:

$$\frac{opp}{adj},\ \frac{opp}{hyp},\ \frac{adj}{hyp},\ \frac{adj}{opp},\ \frac{hyp}{opp} \text{ and } \frac{hyp}{adj}$$

the 1st one is the tangent ratio, the next two are the sine and cosine ratios which you will study this section. The last three are simply 'flips' (ie, reciprocals) of the first three and you don't have to worry about them until grade 12.

Read page 246 (starting from the "Through Instruction" section) to page 249. As usual, study the examples carefully.

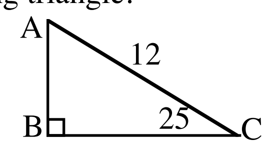
Page 250: #4, 5, 6, 7abc, 8, 9a.
Page 251-252: #14, 16, 19, 20, 21, 22.

Vocabulary

Tangent ratio	Pythagorus Theorem
Opposite, Adjacent	Hypotenuse
Sine ratio	Cosine ratio

<u>Sample Test Question</u>

Q) Every triangle has a total of 6 pieces of information – 3 angles and 3 sides. Find the values of all the missing pieces of information in the following triangle. (5 marks)



A)
- Since all triangles contain 180°, then
  $\angle A = 180° - 90° - 25° =$ **65°**
- Since $\sin 25 = \frac{opp}{hyp} = \frac{AB}{12}$

  then AB = 12 x sin 25 = 12(0.423) = **5.07**
- Since $\cos 25 = \frac{adj}{hyp} = \frac{BC}{12}$

  then BC = 12 x cos 25 = 12(0.906) = **10.88**

** End of Learning Guide 9 **