The Tangent Ratio

Lesson objectives

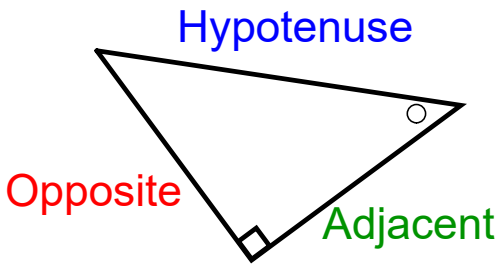
- I know how to identify the opposite and adjacent sides in a right triangle
- I know how to use the tangent ratio to calculate a side length
- I know how to use the tangent ratio to calculate an angle

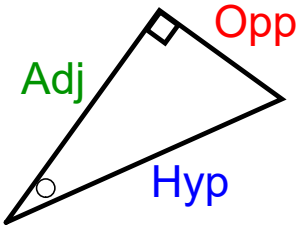
1.1 Lesson objectives | Teachers' notes | Lesson notes

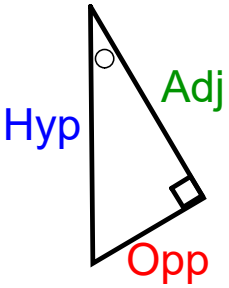
MHR Page 362 #s 1, 2, 5ac, 6bd, 7bc, 8, 10, 11, 15, 21, & 25

Warm up

Label the sides of the following triangles:







The Primary Trigonometric Ratios

We have three Primary Trigonometric Ratios:

Sine - the ratio between the opposite and hypotenuse sides

Cosine - the ratio between the adjacent and the hypotenuse sides

Tangent - the ratio between the opposite and adjacent sides

We have seen previously that when we have similar triangles (reference angle the same) the ratio of the corresponding sides is the same.

This sets up the following formulas:

$$\sin\theta = \frac{opp}{hyp} \qquad \cos\theta = \frac{adj}{hyp} \qquad \tan\theta = \frac{opp}{adj}$$

where θ is the measure of the reference angle in the question.

In other words, in any right angle triangle with the same reference angle, the ratio (for example) of the opposite side divided by the hypotenuse will be the same.

This ratio changes when we change the measure of the reference angle.

These ratios are the basis of trigonometry, and are actually stored on our scientific calculators:

sin, cos and tan buttons

So, regardless of the exact measurements of the sides of a triangle, if we know the reference angle we can at minimum give the ratio between two sides.

Choosing a Trigonometric Ratio

When solving a problem using trig, we need to choose the appropriate ratio to solve the problem.

We will always be given 2 of the following 4, and thenneed to find 1 of the four:

- Hypotenuse (side)
- Opposite (side)
- Adjacent (side)
- Reference Angle

Remember from the last lesson:

If we are solving for an angle we need to use the inverse ratio

For each question we can set up the following:

Have: -
Need: -
Use: -

This will help us easily determine which ratio to use!

One of the most commonly used acronyms in Math is

SOH CAH TOA

SOH: sine, opposite, hypotenuse

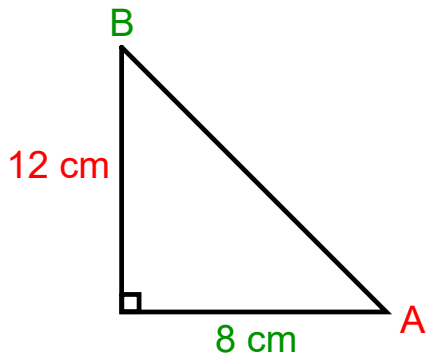
CAH: cosine, adjacent, hypotenuse

TOA: tangent, opposite, adjacent

This is the most common memory aid for trigonometry!

In the last section, we looked at using the calculator to find an angle or ratio. We will look to extend this to finding a missing angle or side length of a triangle.

Today we will focus on using the tangent ratio: $\tan\theta = \frac{opp}{adj}$



Have: opp, adj
Need: angle A
Use: tan

$\tan\theta = \frac{opp}{adj}$

$\tan(A) = \frac{12}{8}$

$A = \tan^{-1}(12 \div 8)$

$A = 56.3^{o}$

Have: opp, adj
Need: angle B
Use: tan

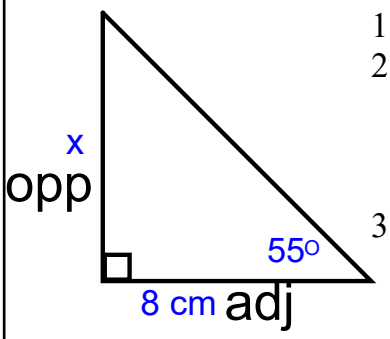
$\tan\theta = \frac{opp}{adj}$

$\tan(B) = \frac{8}{12}$

$B = \tan^{-1}(8 \div 12)$

$B = 33.7^{o}$

Example: Determine the length of the missing side



1. Label your sides
2. Fill in
   Have:
   Need:
   Use:
3. Sub and solve!

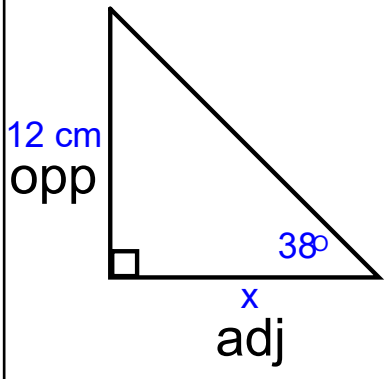
Have: angle, adj
Need: opp
Use: $\tan\theta = \frac{opp}{adj}$

$\tan(55) = \frac{x}{8}$

$8\tan(55) = x$

$11.4 \text{ cm} = x$

Example: Determine the measure of the missing side



1. Label your sides
2. Fill in
   Have:
   Need:
   Use:
3. Sub and solve!

Have: opp, angle
Need: adj
Use: $\tan\theta = \frac{opp}{adj}$

$\tan(38) = \frac{12}{x}$

$\frac{x\tan(38)}{\tan(38)} = \frac{12}{\tan(38)}$

$x = 15.4 \text{ cm}$