Tangent

Topic	Trigonometry
Learning objectives	Application of trigonometric functions in practical tasks
Age group	14-18 years (to be adapted in each country)
Estimated duration	2 hours
Activities	Use of trigonometric functions to solve practical tasks
Related visits	Warsaw, Agrinio, Athens, Lille, Pisa

Previous knowledge required

Knowledge of the trigonometric functions of a right triangle and how to use them.

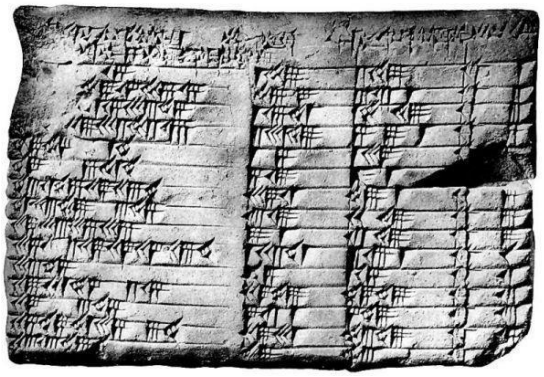
Step by step: the sequence in the classroom

Step 1: Introducing the topic

Short presentation of the heritage elements in this sequence

The name trigonometry comes from two Greek words: "trigonon" - triangle and "metreo" - I measure. In ancient Egypt and Babylon, theorems concerning the relations of the sides of similar triangles had been known for centuries. The first trigonometric tables are attributed to the Greek mathematician Hipparchus (180-125 BC). He compiled tables of corresponding chord and arc lengths for different angles.

The translation of Arabic and Greek texts led to the adoption of the discipline as a subject in the Latin West. The development of modern trigonometry

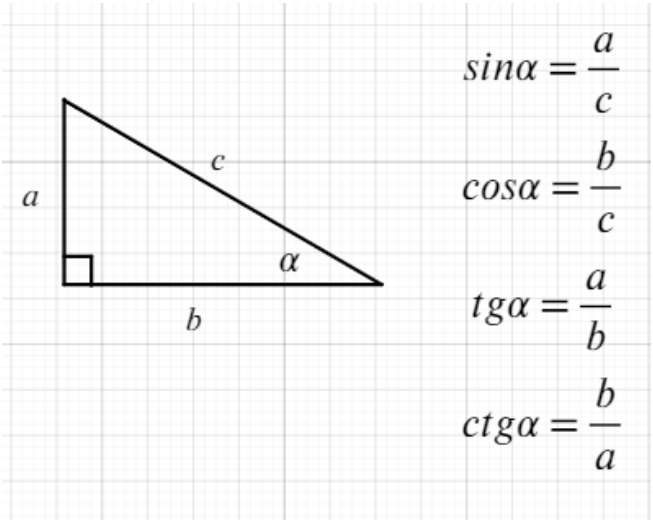


Babylonian trigonometric table known as 'Plimpton 322' (public domain)

changed during the Enlightenment Period in the West, beginning in 17th-century mathematics and culminating in the form we know today.

Links between these elements and math topics

An extension of basic trigonometry are the trigonometric functions, which often appear in mathematical analysis.
In some simplification, we can say that:
- There are 4 trigonometric functions:
sine, cosine, tangent and cotangent.
- These functions operate on angles.
- They are defined in a right triangle as the ratios of the corresponding sides.



Trigonometry has very wide applications in many areas of life where it is necessary to measure and calculate real quantities. With just a simple tape measure and a protractor, we can calculate the height of any mountain, or the width of a river.
Trigonometry is present all around us in simple elements of everyday life: in the design of wheelchair ramps, the roofs of buildings, ski lifts. A knowledge of trigonometry can help a firefighter to position a ladder correctly, and after all, the life of anyone in danger may depend on it.

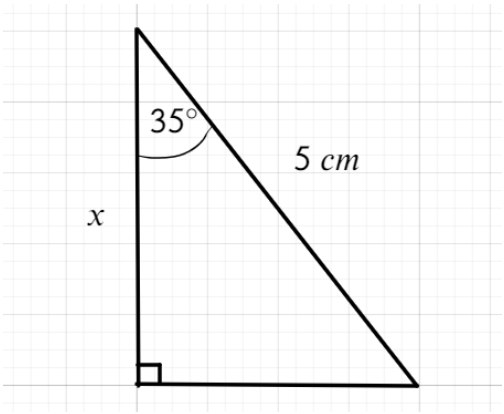
In trigonometry, the tangent of an angle is the ratio of the length of the opposite side to the length of the adjacent side. The tangent function is used to find the slope of a line between the origin and a point representing the intersection between the hypotenuse and the altitude of a right triangle.

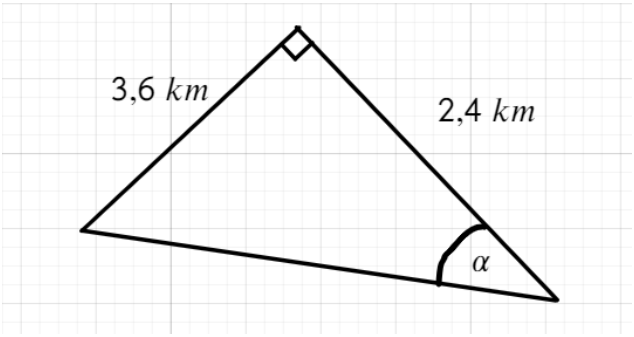
Step 2: Class activities

For some calculations, trigonometric tables are needed (students are given maths formula sheets or textbooks) or a scientific calculator to determine a fairly accurate angle measure from the values of the trigonometric functions of that angle.

Warm up

Calculate the length of side x and the measure of angle α. Give the results to the nearest centimetre and 1 degree.





The fire ladder

a) A 6.5 m long fire ladder is leaned against the wall of a building and reaches a height of 6.5 m. Calculate the angle the ladder makes with the ground.

b) A 4.5 m long fire ladder is leaned against the wall of the building, and its end resting on the ground is 1 m from the wall. Calculate the angle the ladder makes with the ground.

The wheelchair ramp

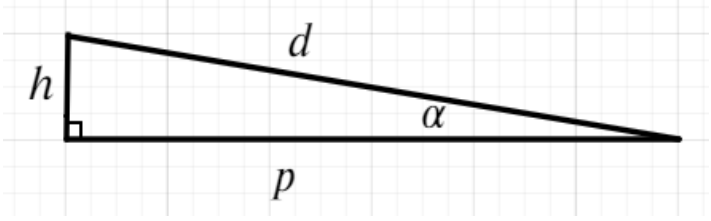
The figure shows a diagram of a wheelchair ramp.

The letters indicate:

d - length of driveway,

h - height of driveway,

p - length of driveway base



α- angle of inclination of the driveway

(a) What is the length of a driveway with an angle of inclination of 3° and a height of 50 cm? Give the result with an accuracy of 1 cm.

(b) Calculate, with an accuracy of 1 degree, the angle of slope of a driveway with a length of 5.15 m and a base length of 7 m.

(c) The gradient of a driveway is often given as the ratio of the height of the driveway to the length of its base $\frac{h}{p}$ expressed as a percentage. According to building regulations, the gradient of a wheelchair ramp must not exceed 15%. Calculate, to the nearest tenth of a degree, the maximum permissible angle of inclination of such a ramp.

Road signs

While driving you can come across signs like these. At what angle is the street if the sign is showing an 8% slope?

Important! The slope of a driveway expressed as a percentage is actually the tangent of the slope angle of that driveway.

Attention! As in the case of a driveway, the slope of the road expressed as a percentage is the tangent of the angle of the road to the horizontal.

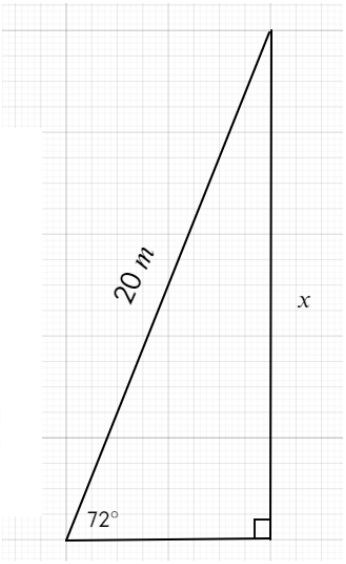
Road gradient = $\frac{h}{p} * 100\%$

Adam's cycling adventure

Adam really enjoys cycling. There are many steep streets in Warsaw's Old Town.
Adam avoids such places, but recently he had to cycle down Obożna Street from the bottom of the street to the top.
What height did Adam cover if the length of the street is 390 m?

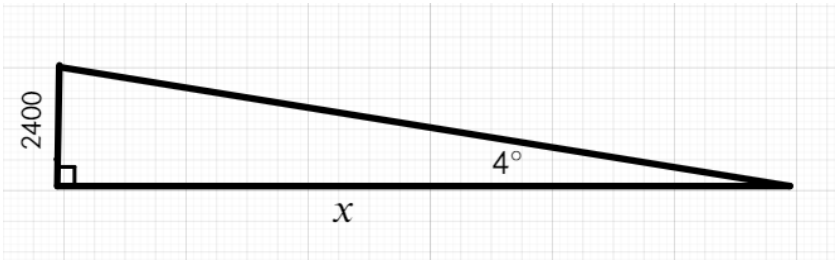
Fire engine

The ladder of a fire engine can be extended to a length of 20 m and raised to an angle of 72°. To what height will the ladder reach if it is fixed 2.4 m above the ground?



Step 3: Homework and development ideas

An airplane approaching the airport flies at an altitude of 2400 m. For landing it has to descend at an angle of 4°. How far from the beginning of the runway should it start this manoeuvre?



Materials needed for the tour

Trigonometric tables.

VISIT MATH

Co-funded by the European Union

This project has been funded with support from the European Commission. This publication reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

Project code: 1-FR01-KA220-SCH-00027771

Learn more about Visit Math at: https://visitmath.eu

FERMAT SCIENCE
Une autre idée des maths

5th High School
Agrinio · Greece

ISTITUTO STATALE "E. MONTALE" PONTEDERA

LogoPsyCom

ZS 31

YuzuPulse