5.2: Pythagorean Theorem

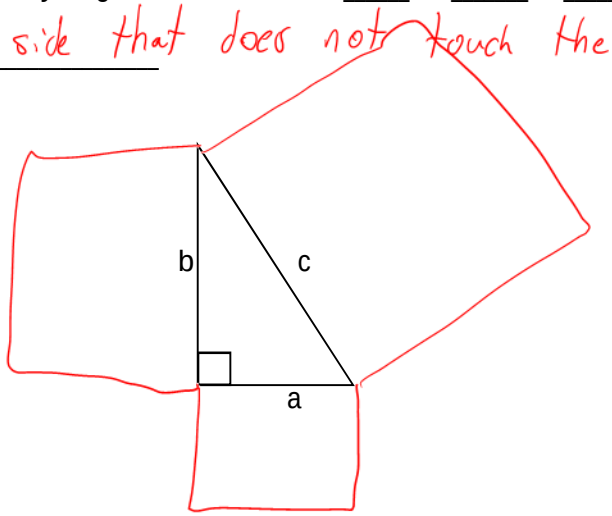
Learning Goal: We are learning to use the Pythagorean theorem to solve problems involving right triangles. And we are learning how to use the *sin, cos, and tan* buttons on our calculators.

Pythagorean theorem is used on right triangles. The Pythagorean theorem is: $a^2 + b^2 = c^2$

Your hypotenuse is always the longest side / the side that does not touch the 90° (c)

In words, it means that...
-If you make a square on each side of the triangle
-The area of the two smaller squares
equals the area of the largest square

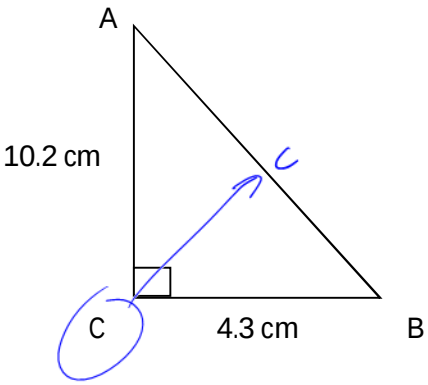
It ONLY works on right triangles



Here is a visual proof:
https://www.youtube.com/watch?v=CAkMUdeB06o

Example #1: Solve for the unknown side length

Solve for c



$a^2 + b^2 = c^2$

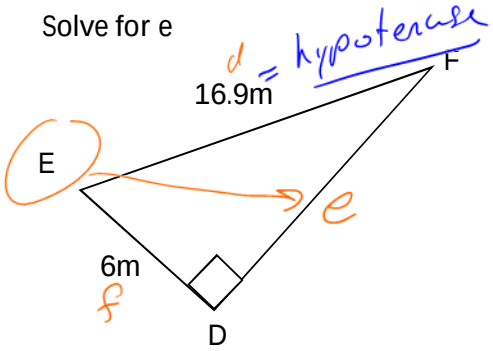
$(4.3)^2 + (10.2)^2 = c^2$

$18.49 + 104.04 = c^2$

$\sqrt{122.53} = \sqrt{c^2}$

$11.1\text{ cm} = c$

Solve for e



$a^2 + b^2 = c^2$

$e^2 + f^2 = d^2$

$e^2 + 6^2 = 16.9^2$

$e^2 + 36 = 285.61$

$-36 \quad -36$

$\sqrt{e^2} = \sqrt{249.61}$

$e = 15.8\text{m}$

Remember the biggest angle corresponds with the biggest side, and

the smallest angle corresponds with the smallest side.

Introduction to doing Trigonometry on a calculator

Trigonometry is the branch of mathematics dealing with the relationships between the **sides** and **angles** of any triangle.

It is common practice in trigonometry to label unknown angles with the Greek letter *theta*: θ

On your calculator are three important buttons: "*sin*" "*cos*" and "*tan*". Each of these is a special trigonometric relationship.

sine cosine tangent

It works like this: sin 50° = 0.7660

Relationship | Angle (*degrees*) | Ratio (*remember ratios can be decimals OR fractions*)

So sin 50 means that there is a scale factor (relationship) of 0.766 between two sides.

Which two sides? That is a lesson for tomorrow! For today, we learn how to use our calculators.

What is the ratio for: Give answers to three decimal places.

tan 70 = 2.7474 cos 36 = 0.8090 sin 13 = 0.2250

But what if we need to go backwards? What if we want to find the angle that gives the ratio? Just like solving equations that you learnt in grade 9, we use "inverse operations".

In math, the exponent of -1 means inverse.

÷ inverse of × | $\sqrt{\ }$ inverse of $()^2$

What is the unknown angle? Round to the nearest whole degree.

sin θ = 0.984

$\sin^{-1}(\sin\theta) = \sin^{-1}(0.984)$

$\theta = 80°$

cos θ = 0.970

$\theta = \cos^{-1}(0.970)$

$\theta = 14°$

tan θ = 1

$\theta = \tan^{-1}(1)$

$\theta = 45°$

cos θ = 0.891

$\theta = \cos^{-1}(0.891)$

$\theta = 27°$

tan θ = 1.600

$\theta = \tan^{-1}(1.6)$

$\theta = 58°$

sin θ = 0.529

$\theta = \sin^{-1}(0.529)$

$\theta = 32°$

Success Criteria

- I can use the Pythagorean theorem to solve for an unknown side length in a right angled triangle.
- I can find the value of a trigonometric ratio by plugging it into my calculator
- I can calculate an unknown angle by using the inverse trigonometric ratio on my calculator.