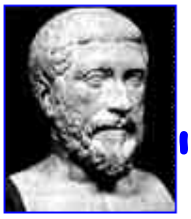


's Theorem...

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

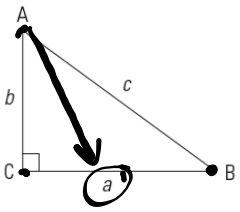
Euclid (born circa 300 BCE) is called the Father of Modern Geometry. In his famous book *The Elements*, he generalized the Pythagorean theorem by stating that if one erects similar figures on the sides of a right triangle, then the sum of the areas of the two smaller figures will equal the area of the larger figure.

right triangle: a triangle with one right angle

hypotenuse: the longest side of a right triangle, opposite the 90° angle

leg: in a right triangle, the two sides that intersect to form a right angle

Pythagorean theorem: in a right triangle, the sum of the squares of the lengths of the legs is equal to the square of the length of the hypotenuse



Leg AC, or *b*, is adjacent to angle A and opposite angle B

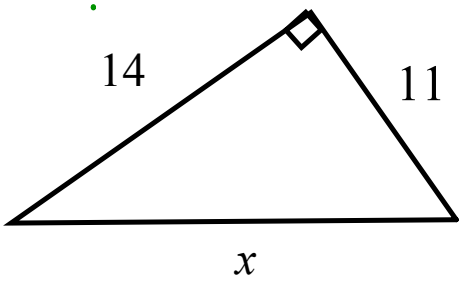
Leg BC, or *a*, is adjacent to angle B and opposite angle A

OPTIONS...

#1. Finding the unknown hypotenuse:

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

ex:



$x^2 = 14^2 + 11^2$

$x^2 = 196 + 121$

$\sqrt{x^2} = \sqrt{317}$

$x = 17.8$

#2. Finding an unknown side

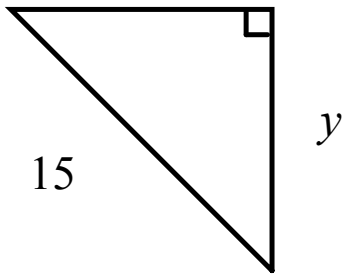
3-4-5

9-?-15 (x3)

12

$$a^2 = c^2 - b^2$$

ex:

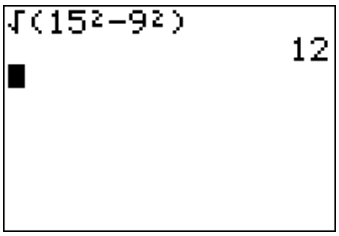


$\sqrt{y^2} = \sqrt{15^2 - 9^2}$

$y^2 = 225 - 81$

$\sqrt{y^2} = \sqrt{144}$

$y = 12$



Remember... Common Pythagorean Triples

1) 3 - 4 - 5
2) 5 - 12 - 13
3) 8 - 15 - 17
4) 7 - 24 - 25

"Multiple any of these by a constant and you will have another triple..."

Verifying a Pythagorean Triple...

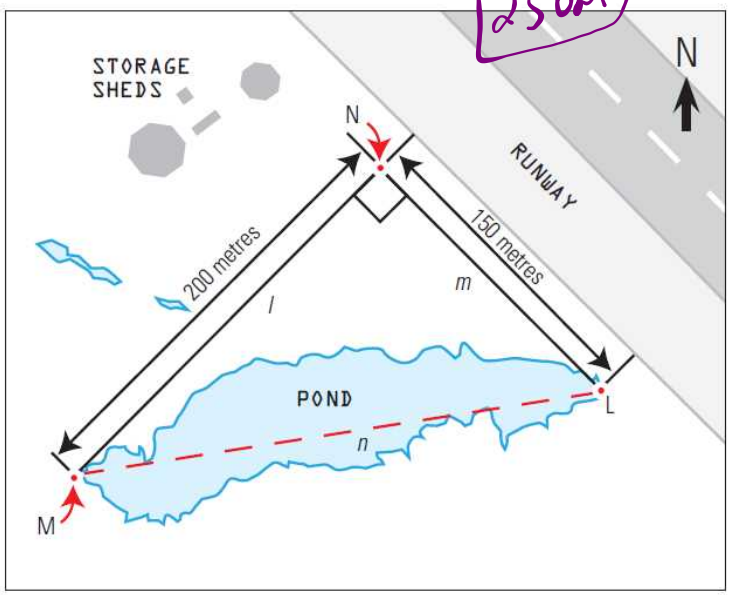
LS	RS
$7^2 + 24^2$ $49 + 576$ 625	25^2 625 ✓

LS	RS

ACTIVITY 8.1
INDIRECT MEASUREMENT

3-4-5 x50
150-200-?
250m

Cam is a surveyor working in Prince Edward Island. He needs to estimate the length of a small pond beside the Summerside Airport. He decides to use a right triangle, as shown in the diagram, as an indirect method of measurement.



1. Why might a surveyor use an indirect method of measurement in the example above?
2. What is the length of the pond?

SOLUTION

1. The surveyor can measure directly on dry land, but he cannot necessarily walk across the pond to measure it.
2. Students will recognize the right triangle and should write the Pythagorean theorem as follows.

$n^2 = l^2 + m^2$

$n^2 = 200^2 + 150^2$

$n^2 = 40000 + 22500$

$n^2 = 62500$

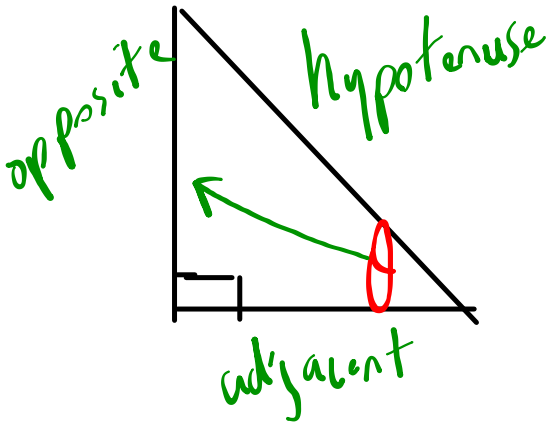
$n = \sqrt{62500}$

$n = 250$

The pond is 250 m long.

SOH CAH TOA

sine cosine tangent



$\sin\theta = \frac{opp}{hyp}$

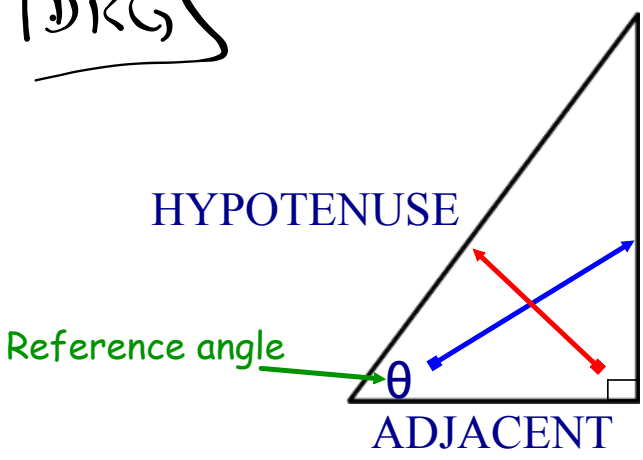
$\cos\theta = \frac{adj}{hyp}$

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

Trigonometric Ratios

*** Must have calculator in DEGREE mode ***

DRG



$$\sin\theta = \frac{opp}{hyp}$$

$$\cos\theta = \frac{adj}{hyp}$$

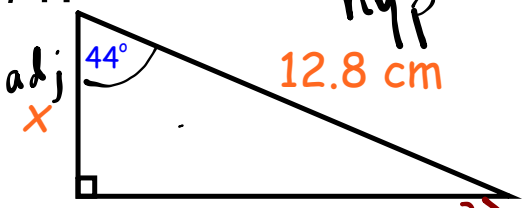
$$\tan\theta = \frac{opp}{adj}$$

"These are called the *Primary Trig Ratios*"

REMEMBER: "SOH CAH TOA"

EXAMPLES - Finding an unknown side SOHCAHTOA

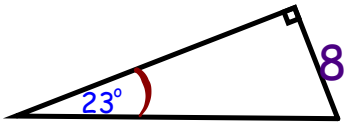
#1.



$12.8\cos 44° = \frac{x}{12.8}(12.8)$

$9.21 = x$

#2.



$y\sin 23° = 8$

$\frac{y\sin 23°}{\sin 23°} = \frac{8}{\sin 23°}$

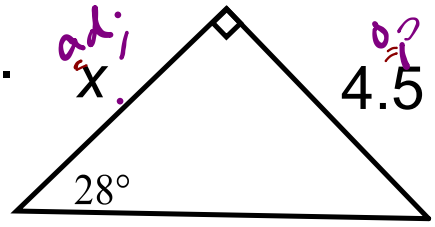
$y = \frac{8}{\sin 23°}$

$y = 20.5$

YOUR TURN...

SOH CAH TOA

#3.



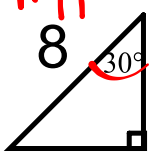
adj
opp

$\tan 28° = \frac{4.5}{x}$

$x = \frac{4.5}{\tan 28}$

$x = 8.46$

#4.



hyp
opp

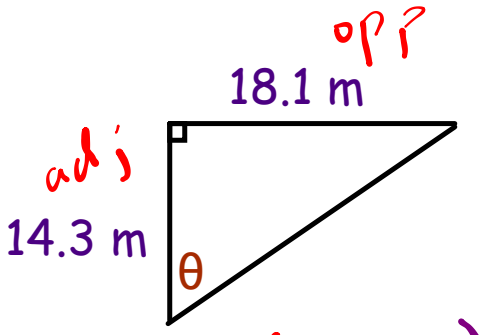
$\sin 30 = \frac{x}{8}$

$8 \sin 30 = x$

$4 = x$

EXAMPLES - Finding an unknown angle

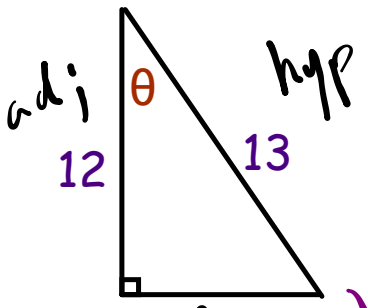
a)



$\tan^{-1}\tan\theta = \tan^{-1}\left(\frac{18.1}{14.3}\right)$

$\theta = 52°$

b)



$\cos^{-1}\cos\theta = \cos^{-1}\left(\frac{12}{13}\right)$

$\theta = 23°$

HW: 10.7 #2, #3, #4, 5, 6, 7ab

4a) $\angle Q = 90^\circ$

$\angle P = 61^\circ$

P $8 = 14$