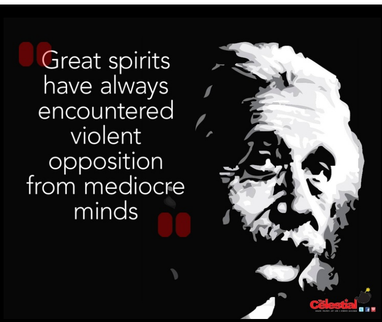
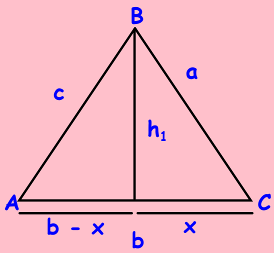


St. Peter Catholic High School
MCT4C
Mr. M. Couturier
@tansincosine

Jan 27-10:05 AM

§9.6 The Cosine Law
Pythagorean Theorem 2.0

To derive the Cosine Law, let us look at h_1 in two ways.



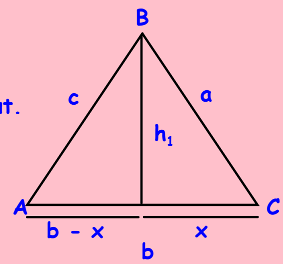
$(b-x)^2 + h_1^2 = c^2$
Hence $h_1^2 = c^2 - (b-x)^2$

We can also say:
$x^2 + h_1^2 = a^2$
Hence $h_1^2 = a^2 - x^2$
Ergo ... $c^2 - (b-x)^2 = a^2 - x^2$

Nov 1-3:23 PM

Let's simplfy this statement

$c^2 - (b-x)^2 = a^2 - x^2$
$c^2 - (b^2 - 2bx + x^2) = a^2 - x^2$
$c^2 - b^2 + 2bx - x^2 = a^2 - x^2$
Notice that the x^2's cancel out.
$c^2 = a^2 + b^2 - 2bx$



How do we get rid of x = ?

We can say that cosC=x/a, hence, x = acosC, ergo;

$$c^2 = a^2 + b^2 - 2ab\cos C$$

Nov 1-3:32 PM

Hence the Cosine Law

$$c^2 = a^2 + b^2 - 2ab\cos C$$

which can also be written as:

$$a^2 = b^2 + c^2 - 2bc\cos A$$

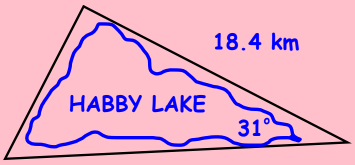
$$b^2 = a^2 + c^2 - 2ac\cos B$$

This law is essential for SAS and SSS situations.

Jan 27-10:04 AM

Case 1: SAS (side angle side)

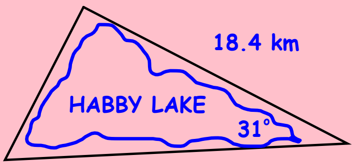
A triangular hiking trail surounds a large lake. The distance of the southern trail is 12.6 km while the northern eastern trail is 18.4 km. If the lake meets at a point such that it makes an angle of 31°, what is distance of the western side?



Jan 27-10:08 AM

$$c^2 = a^2 + b^2 - 2ab\cos C$$

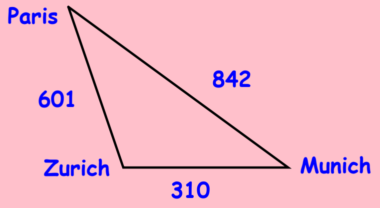
$$c^2 = (12.6)^2 + (18.4)^2 - 2(12.6)(18.4)\cos 31$$
$$c^2 = 158.76 + 338.56 - 463.68\cos 31$$
$$c^2 \approx 497.32 - 397.45$$
$$c^2 \approx 99.9$$
$$c \approx 10.0 \text{ km}$$



Feb 27-12:39 PM

Case 2: SSS (side side side)

While on a European vacation, a couple travelled 310 km from Munich, Germany to Zurich, Switzerland. They then travelled 601 km to Paris, France. They then had to travel 842 km to go back to Munich, Germany. From Munich, Germany, what is the angle that spans Zurich and Paris?



Feb 27-12:47 PM

Case 2: SSS

$c^2 = a^2 + b^2 - 2ab\cos C$

$2ab\cos C = a^2 + b^2 - c^2$

$\frac{2ab\cos C}{2ab} = \frac{a^2 + b^2 - c^2}{2ab}$

$\cos C = \frac{a^2 + b^2 - c^2}{2ab}$

$\cos C = \frac{(842)^2 + (310)^2 - (601)^2}{2(842)(310)}$

$\cos C \approx \frac{708964 + 96100 - 361210}{522040}$

$\cos C \approx 0.8502$

$C \approx \cos^{-1}(0.8502)$

$C \approx 31.8^\circ$

Feb 27-12:52 PM

What if we looked at Zurich's perspective?

$\cos C = \frac{a^2 + b^2 - c^2}{2ab}$

$\cos C = \frac{(601)^2 + (310)^2 - (842)^2}{2(601)(310)}$

$\cos C \approx \frac{361210 + 96100 - 708964}{372620}$

$\cos C \approx -0.6754$

$C \approx \cos^{-1}(-0.6754)$

$C \approx 132.5^\circ$

This means that from Paris' perspective the angle between Zurich and Munich is 15.7°.

Feb 1-12:10 PM

Exit Ticket: Complete & hand-In. §9.6 #25,27

Homework:
§9.6 #7,11,19,24,28

Jan 28-08:35