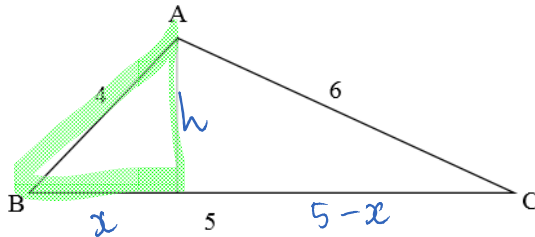


# The Cosine Law

Can the following triangle be solved using the sine law? Why?

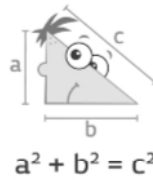


No since you need one pair of opposite side and angle.

Use the Pythagorean Theorem to help solve the triangle. (Hint: Don't simplify exponents.)

Find an equation to determine the value of  $h$  in the left triangle.

$$h^2 + x^2 = 4^2$$

$$h^2 = 4^2 - x^2$$


Find an equation to determine the value of  $h$  in the right triangle.

$$h^2 + (5-x)^2 = 6^2$$

$$h^2 = 6^2 - (5-x)^2$$

Put the equations together since  $h^2 = h^2$ .

$$4^2 - x^2 = 6^2 - (5-x)^2$$

$$4^2 - x^2 = 6^2 - (5^2 - 5x - 5x + x^2)$$

$$4^2 - x^2 = 6^2 - (5^2 - 10x + x^2)$$

$$4^2 - x^2 = 6^2 - 5^2 + 10x - x^2$$

$$4^2 - x^2 + 5^2 - 10x + x^2 = 6^2$$

$$4^2 + 5^2 - 10x = 6^2$$

$$4^2 + 5^2 - 10(4 \cos B) = 6^2$$

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

SOL CAN TOA

$$\cos B = \frac{x}{4}$$

$$4 \cos B = x$$

The cosine law

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

S.A.S.

can be used to calculate an unknown:

- **side** when two sides and a contained angle (the angle between two given sides) are given
- **angle** when three sides are given

S.S.S.

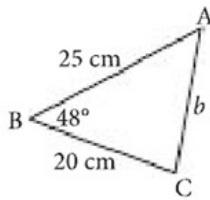
$$\cos C = \frac{a^2 + b^2 - c^2}{2ab}$$

When using the cosine law, the unknown angle or side will either be the first or last variable in the formula.

**MBF 3C1**

**Example 1**

Find  $b$ .



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

$$b^2 = 20^2 + 25^2 - 2(20)(25)\cos 48^\circ$$

$$\sqrt{b^2} = \sqrt{355.869\dots}$$

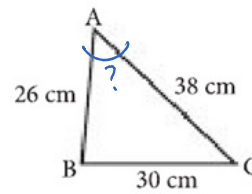
$$b = 18.9 \text{ cm}$$

start at end  
if your calculator  
will not do  
BEDMAS

Name: \_\_\_\_\_

**Example 2**

Find  $A$ .



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

OR

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

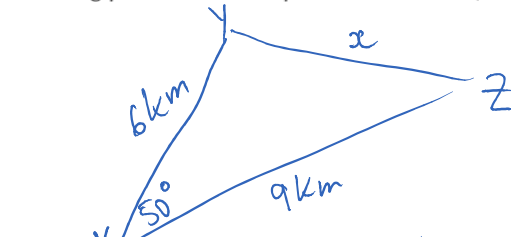
$$\cos A = \frac{38^2 + 26^2 - 30^2}{2(38)(26)}$$

$$\cos A = \frac{1220}{1976}$$

$$A = 52^\circ$$

**Example 3**

Two hikers set out in different directions from a marked tree on the Bruce Trail. The angle formed between their paths measures  $50^\circ$ . After 2 hours, one hiker is 6 km from the starting point and the other is 9 km from the starting point. How far apart are the hikers, to the nearest tenth of a kilometre?



$$x^2 = z^2 + y^2 - 2(z)(y)\cos X$$

$$x^2 = 6^2 + 9^2 - 2(6)(9)\cos 50^\circ$$

$$\sqrt{x^2} = \sqrt{47.5789\dots}$$

$$x = 6.9$$

∴ hikers are 6.9 km apart

**Q** A TRAIN FILLED WITH MATH EXPERTS LEAVES SACRAMENTO GOING 50 MPH. 42% ON THE TRAIN RECOMMEND TRADITIONAL FORMS OF TEACHING MATH, WHILE 48% ADVOCATE A MODERN "INTERACTIVE" APPROACH. THERE IS A 25 MPH HEADWIND AS THE 2 GROUPS WRESTLE FOR CONTROL OF THE THROTTLE. HOW LONG BEFORE A STUDENT AT BRAINT B IS PROFICIENT IN MATH?

