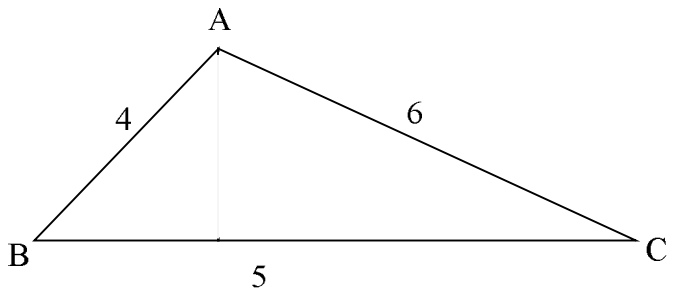
MBF 3C1 Name: _____

The Cosine Law

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

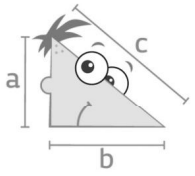


Use the Pythagorean Theorem to help solve the triangle. *(Hint: Don't simplify exponents.)*

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

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

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



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

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 $h^2 = h^2$.

$$4^2 - x^2 = 6^2 - (5-x)^2$$
$$4^2 - x^2 = 6^2 - (5^2 - 5x - 5x + x^2)$$
$$4^2 - x^2 = 6^2 - (5^2 - 10x + x^2)$$
$$4^2 - x^2 = 6^2 - 5^2 + 10x - x^2$$
$$4^2 - x^2 + 5^2 - 10x + x^2 = 6^2$$
$$4^2 + 5^2 - 10x = 6^2$$
$$4^2 + 5^2 - 10(4\cos B) = 6^2$$
$$c^2 + a^2 - 2ac\cos B = b^2$$

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

$4\cos B = x$

The **cosine law**

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

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

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

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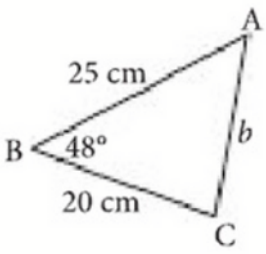
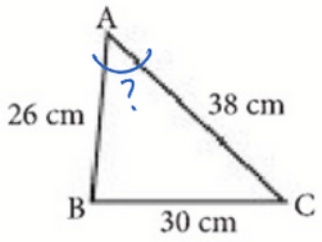
Example 1

Find *b*.



Example 2

Find *A*.



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°. 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?