8.3 Cosine law (angles)

COSINE LAW DAY 2

Finding an unknown angle when all three sides are known.

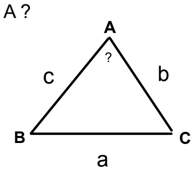
Yesterday we learned the cosine law:

Cosine Law:

$$a^2 = b^2 + c^2 - 2bc\cos(A)$$
$$b^2 = a^2 + c^2 - 2ac\cos(B)$$
$$c^2 = a^2 + b^2 - 2ab\cos(C)$$

We used this to find an unknown side when we knew two sides and a contained angle

How do we find angle A ?



$$a^2 = b^2 + c^2 - 2bc\cos(A)$$
$$b^2 = a^2 + c^2 - 2ac\cos(B)$$
$$c^2 = a^2 + b^2 - 2ab\cos(C)$$

We can rearrange the law of cosines to solve for angle A:

<u>Law of Cosines</u>

1) You can use the cosine law to find a missing side of an acute triangle if the other two sides and their contained angle are known

$$a^2 = b^2 + c^2 - 2bc\cos(A)$$
$$b^2 = a^2 + c^2 - 2ac\cos(B)$$
$$c^2 = a^2 + b^2 - 2ab\cos(C)$$

2) find an unknown angle if you know three side lengths of an acute triangle

$$\text{Cos}(A) = \frac{a^2 - b^2 - c^2}{-2bc}$$

$$\text{Cos}(B) = \frac{b^2 - a^2 - c^2}{-2ac}$$

$$\text{Cos}(C) = \frac{c^2 - a^2 - b^2}{-2ab}$$

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Find an angle given three sides

$$\cos(A) = \frac{a^2 - b^2 - c^2}{-2bc}$$

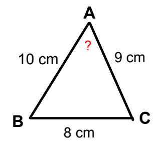
$$\cos(B) = \frac{b^2 - a^2 - c^2}{-2ac}$$

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

Find a side given two sides and a contained angle

$$a^2 = b^2 + c^2 - 2bc\cos(A)$$
$$b^2 = a^2 + c^2 - 2ac\cos(B)$$
$$c^2 = a^2 + b^2 - 2ab\cos(C)$$

1 Solve for the indicated angle

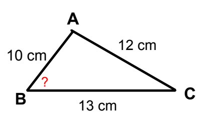


$$\cos(A) = \frac{a^2 - b^2 - c^2}{-2bc}$$

$$\cos(B) = \frac{b^2 - a^2 - c^2}{-2ac}$$

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

2 Solve for the indicated angle

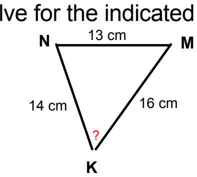


$$\cos(A) = \frac{a^2 - b^2 - c^2}{-2bc}$$

$$\cos(B) = \frac{b^2 - a^2 - c^2}{-2ac}$$

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

3 Solve for the indicated angle



$$\cos(A) = \frac{a^2 - b^2 - c^2}{-2bc}$$

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

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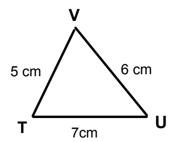
4 On your own!!!! Solve for angle V



$Cos(A) = \frac{a^2 - b^2 - c^2}{-2bc}$

$Cos(B) = \frac{b^2 - a^2 - c^2}{-2ac}$

$Cos(C) = \frac{c^2 - a^2 - b^2}{-2ab}$

5 In acute Δ NBG , n = 15 m, b = 14 m, g = 12 m

$Cos(A) = \frac{a^2 - b^2 - c^2}{-2bc}$

$Cos(B) = \frac{b^2 - a^2 - c^2}{-2ac}$

$Cos(C) = \frac{c^2 - a^2 - b^2}{-2ab}$

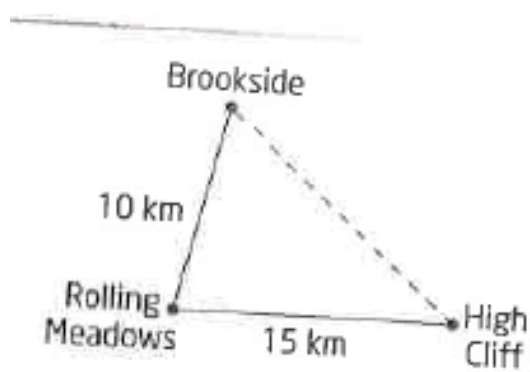
a) sketch the triangle and label it with the given information

b) Solve the triangle

6 Three towns are connected by two roads as shown. A third road is planned that will connect Brookside with High Cliff, which are 16.5 km apart. Find the angle between the new road and the existing road from:

a) High Cliff to Rolling Meadows

b) Brookside to Rolling Meadows



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a)

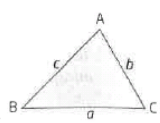
b)

Homework: 8.3 Worksheet

Key Concepts

- You can rearrange the cosine law to find an angle if you know three side lengths of an acute $\triangle ABC$.

  For example, to find the measure of $\angle B$, rearrange the appropriate form of the cosine law.



$$b^2 = a^2 + c^2 - 2ac(\cos B) \Rightarrow \cos B = \frac{b^2 - a^2 - c^2}{-2ac}$$

- Once you have found one angle, you can apply the sine law to find a second angle.
- When applying trigonometry to solve problems involving acute triangles, there is often more than one valid strategy.