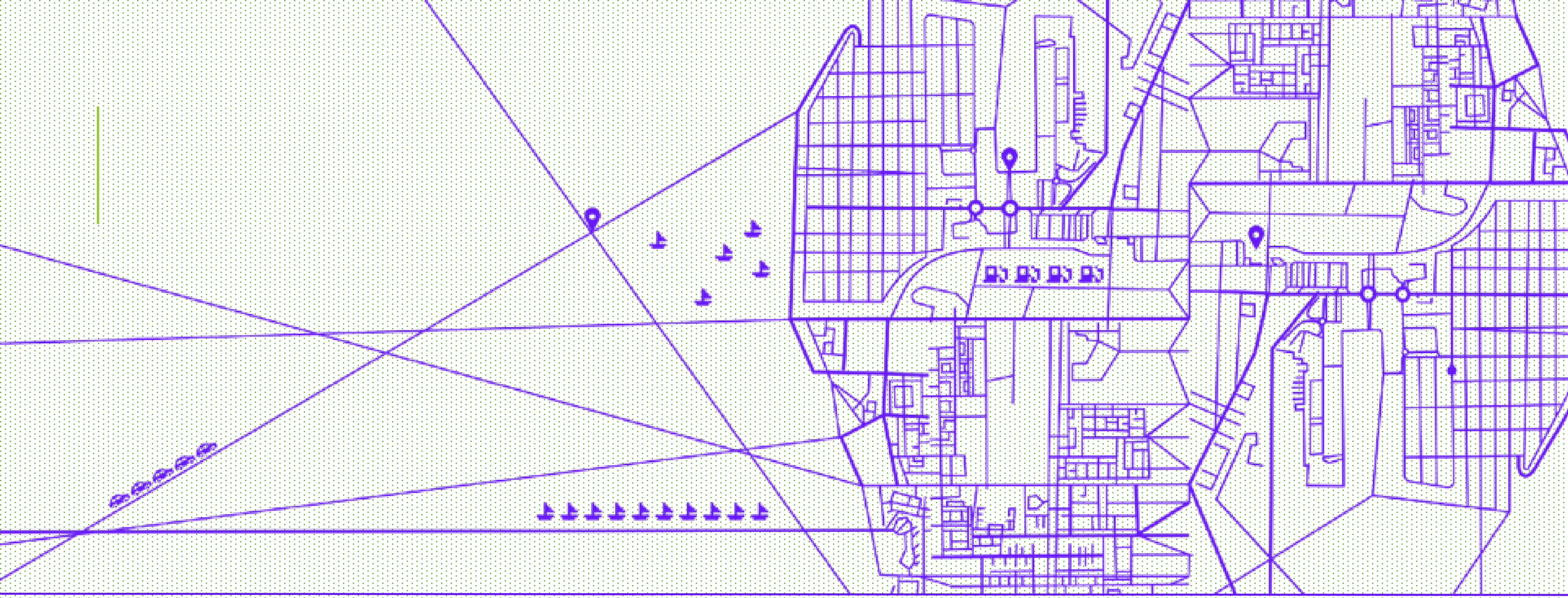


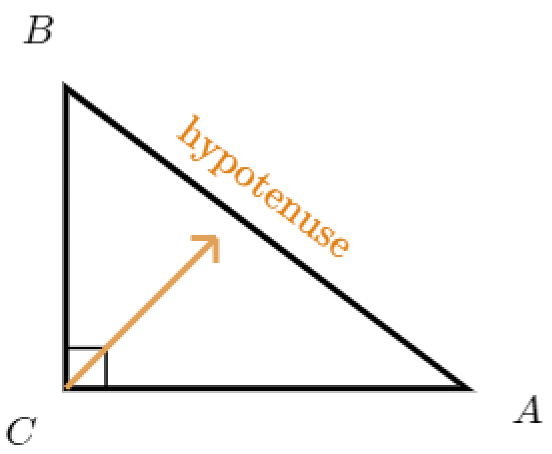
TOPIC 2: TRIGONOMETRY

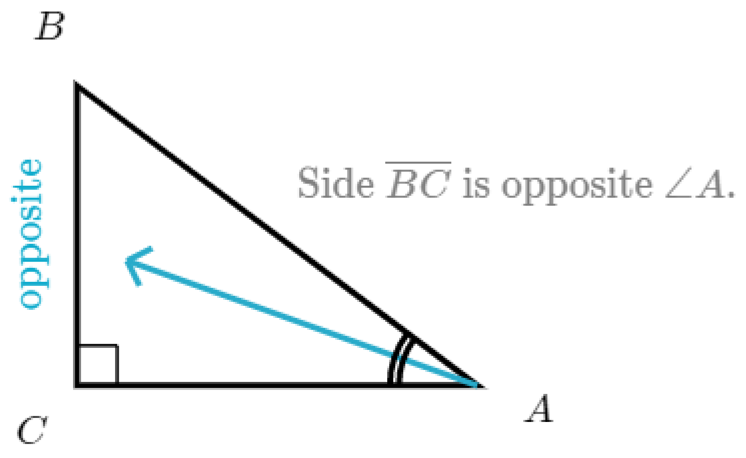
OUTLINE

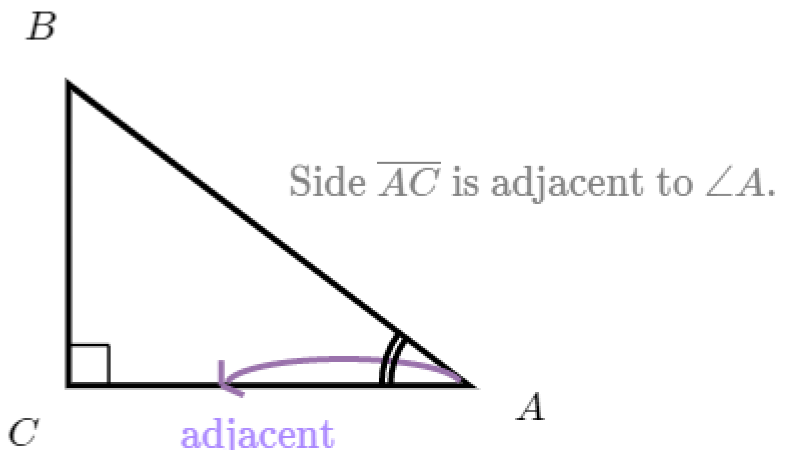
- Pythagoras Theorem
- Trigonometric ratios
- Inverse Trigonometric Functions
- Reciprocal Trigonometric Ratios
- Law of Sines
- Law of Cosines

PYTHAGORAS THEOREM

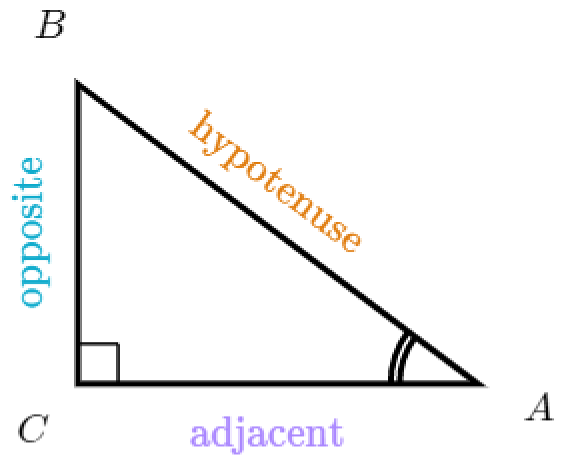
- Hypotenuse
  Opposite
  Adjacent



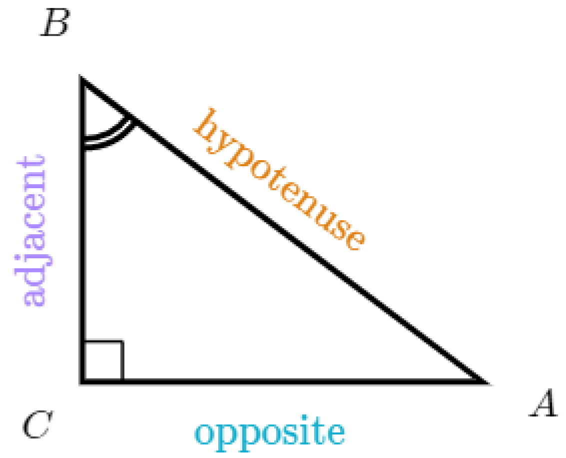




from the perspective of $\angle A$



from $\angle B$



- Finding an unknown side in a right angle triangle:

$$h^2=a^2+b^2$$

TRIGONOMETRIC RATIOS:

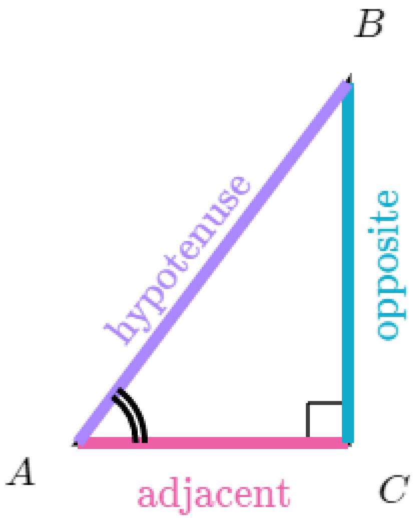
- The ratios of the sides of a triangle are called trigonometric ratios. Three common trigonometric ratios are the **sine (sin)**, **cosine (cos)**, and **tangent (tan)**.

- Using SOH CAH TOH:

SOH, $\sin\theta$ = Opposite/Hypotenuse

CAH, $\cos\theta$ = Adjacent/Hypotenuse

TOA, $\tan\theta$ = Opposite/Adjacent



$$\sin(A) = \frac{\text{opposite}}{\text{hypotenuse}}$$

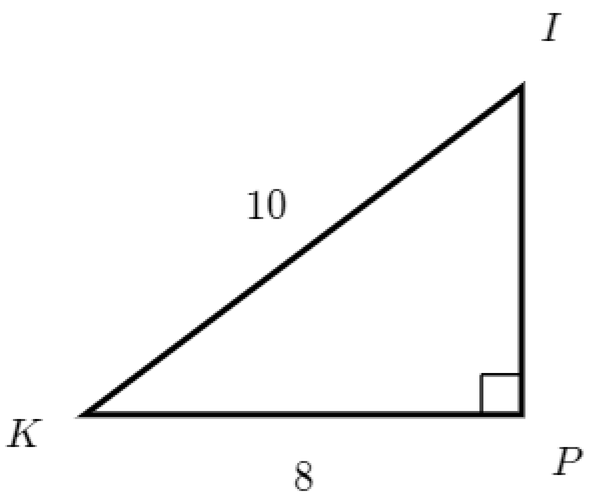
$$\cos(A) = \frac{\text{adjacent}}{\text{hypotenuse}}$$

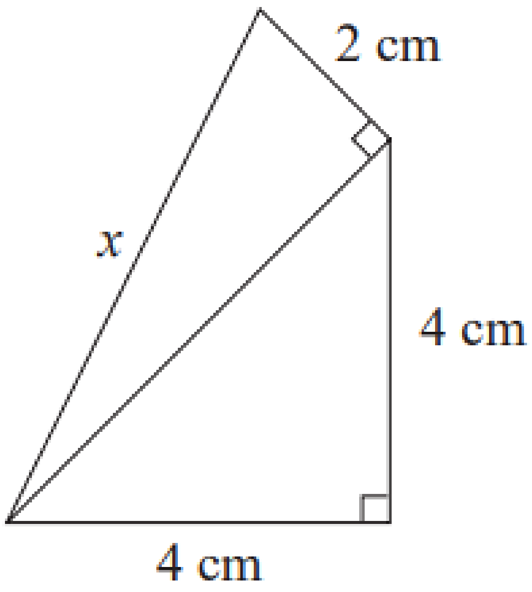
$$\tan(A) = \frac{\text{opposite}}{\text{adjacent}}$$

INVERSE TRIGONOMETRIC FUNCTIONS

Trigonometric functions input angles and output side ratios		Inverse trigonometric functions input side ratios and output angles
$\sin(\theta) = \dfrac{\text{opposite}}{\text{hypotenuse}}$	$\rightarrow$	$\sin^{-1}\left(\dfrac{\text{opposite}}{\text{hypotenuse}}\right) = \theta$
$\cos(\theta) = \dfrac{\text{adjacent}}{\text{hypotenuse}}$	$\rightarrow$	$\cos^{-1}\left(\dfrac{\text{adjacent}}{\text{hypotenuse}}\right) = \theta$
$\tan(\theta) = \dfrac{\text{opposite}}{\text{adjacent}}$	$\rightarrow$	$\tan^{-1}\left(\dfrac{\text{opposite}}{\text{adjacent}}\right) = \theta$

Example 1: Find all the unknowns in the following triangles.





Question 1: In the following triangle, (a) calculate the length of AD, (b) calculate the size of angle DCB.

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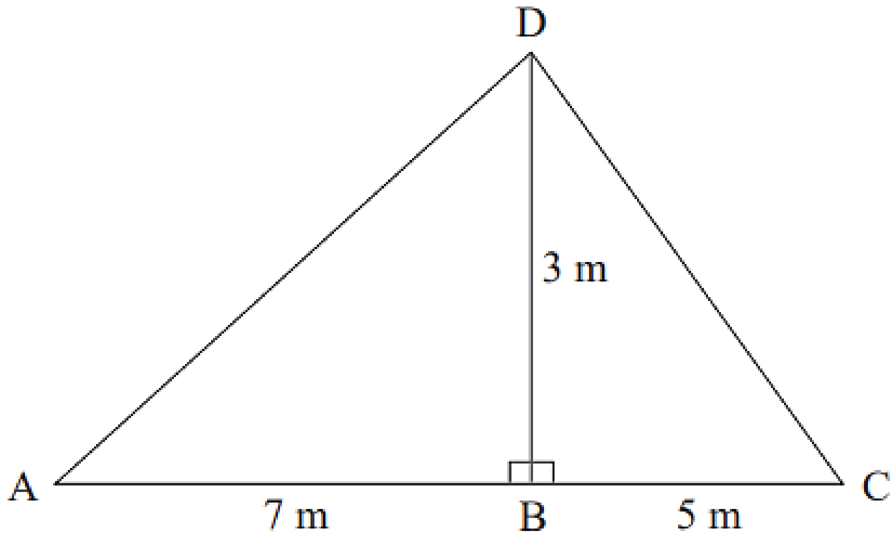
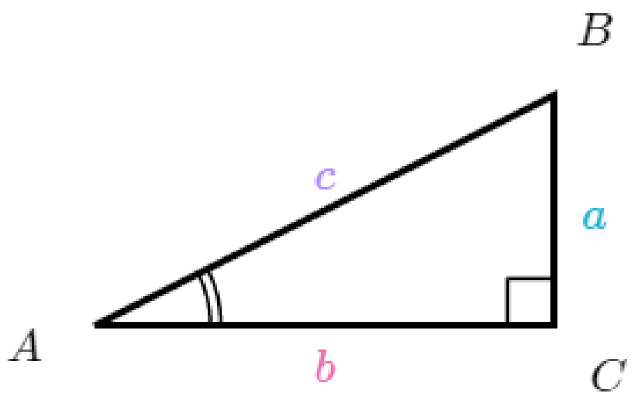


RECIPROCAL TRIGONOMETRIC RATIOS



$$\sin(A) = \frac{a}{c}$$

$$\cos(A) = \frac{b}{c}$$

$$\tan(A) = \frac{a}{b}$$

Cosecant (csc)

$$\sin(A) = \frac{\text{opposite}}{\text{hypotenuse}} = \frac{a}{c}$$

$$\csc(A) = \frac{\text{hypotenuse}}{\text{opposite}} = \frac{c}{a}$$

Secant (sec)

$$\cos(A) = \frac{\text{adjacent}}{\text{hypotenuse}} = \frac{b}{c}$$

$$\sec(A) = \frac{\text{hypotenuse}}{\text{adjacent}} = \frac{c}{b}$$

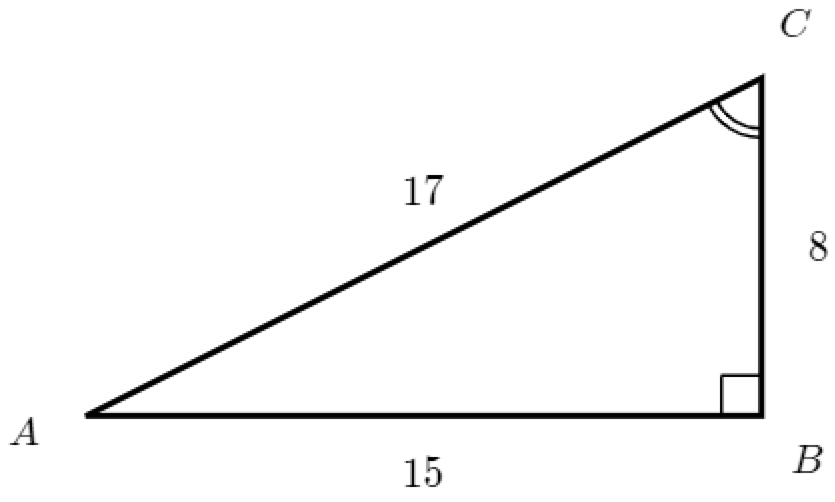
Cotangent (cot)

$$\tan(A) = \frac{\text{opposite}}{\text{adjacent}} = \frac{a}{b}$$

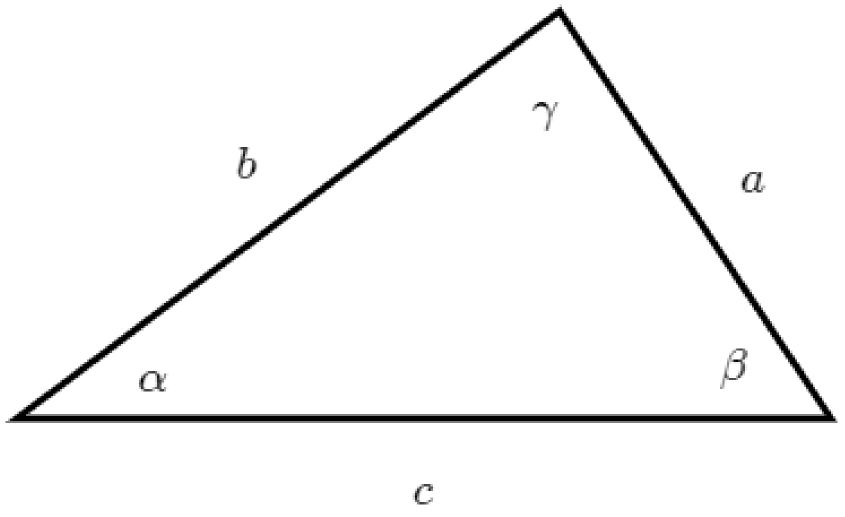
$$\cot(A) = \frac{\text{adjacent}}{\text{opposite}} = \frac{b}{a}$$

	Verbal description	Mathematical relationship
cosecant	The *cosecant* is the *reciprocal of the sine.*	$\csc(A) = \dfrac{1}{\sin(A)}$
secant	The *secant* is the *reciprocal of the cosine.*	$\sec(A) = \dfrac{1}{\cos(A)}$
cotangent	The *cotangent* is the *reciprocal of the tangent.*	$\cot(A) = \dfrac{1}{\tan(A)}$

Example 2: In the triangle below, find csc (c), sec (c), and cot (c).



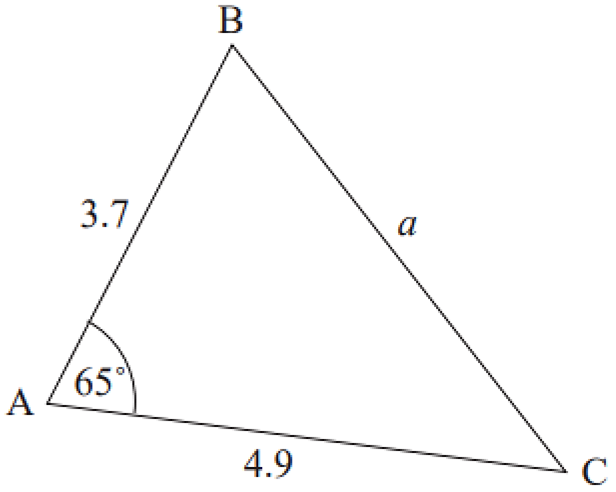
LAW OF SINES AND COSINES



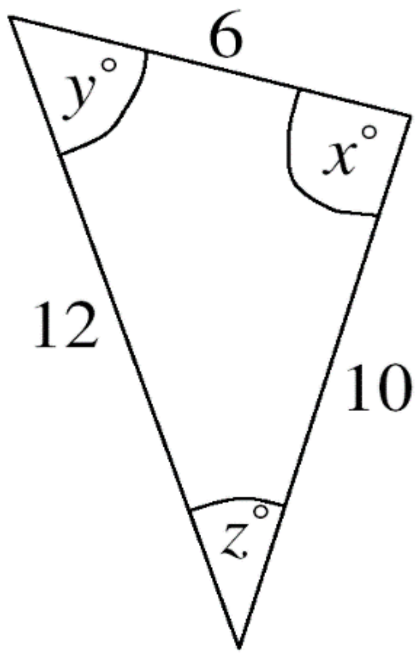
Law of Sines: $\dfrac{a}{\sin(\alpha)} = \dfrac{b}{\sin(\beta)} = \dfrac{c}{\sin(\gamma)}$

Law of Cosines: $c^2 = a^2 + b^2 - 2ab\cos(\gamma)$

Example 3: Find all the unknowns of the triangle shown:



Question 2: Find all the unknowns of the triangle shown?



Question 3: An airplane is approaching point *A* along a straight line and at a constant altitude *h*. The angle of elevation of the airplane changes from 20° to 60° in 2 minutes. What is the altitude *h* of the airplane if the speed of the airplane is constant and equal to 600 km/hr?

Resource:

https://www.raywenderlich.com/2736-trigonometry-for-game-programming-part-1-2

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ABU DHABI