

# Constructing Triangles

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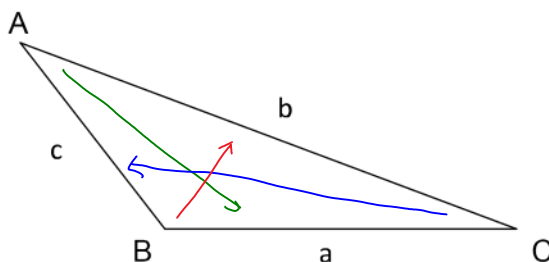
## PRE-CALCULUS 11 TRIGONOMETRY CONSTRUCTING TRIANGLES

When constructing triangles you need to pay attention to the sides and angles that are given. Depending on the information given, there are 3 possible scenarios for the triangles that can be created:

- 1) No triangle can be created. The information creates an impossible situation.
- 2) One triangle can be created. This is the most common case.
- 3) Two triangles can be created. This is called the **ambiguous case**.

### A. Exploring Triangle Construction

Look at the following triangle and notice the way the triangle is configured.



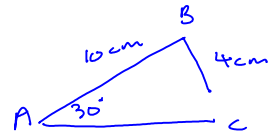
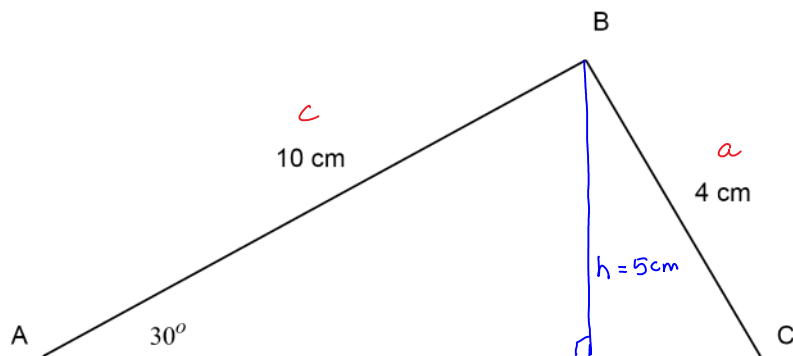
The angles of the triangle are identified using the endpoints identified:

$$\angle A, \angle B, \angle C$$

The corresponding sides are located opposite the angles and identified using the same letter in its lower case version:

Side  $a$ , Side  $b$ , Side  $c$

- 1) The following triangle dimensions are not drawn to scale. Based on the information presented how many triangles can be created using this configuration?



$$10 \left( \sin 30^\circ = \frac{h}{10} \right)$$

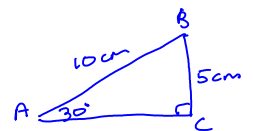
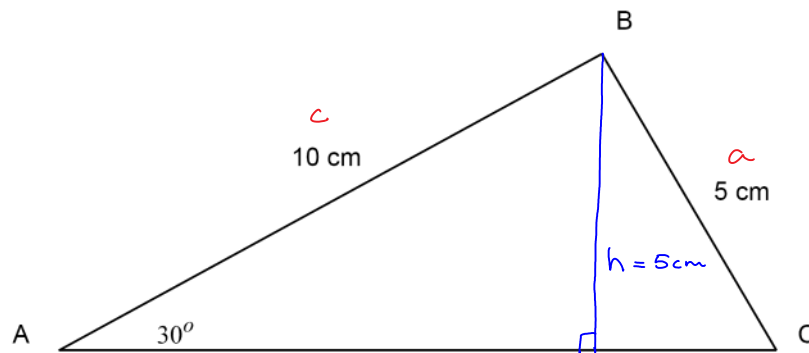
$$(10)(\sin 30^\circ) = h$$

$$h = 5 \text{ cm}$$

$$a < h$$

No Triangle.

- 2) The following triangle dimensions are not drawn to scale. Based on the information presented how many triangles can be created using this configuration?



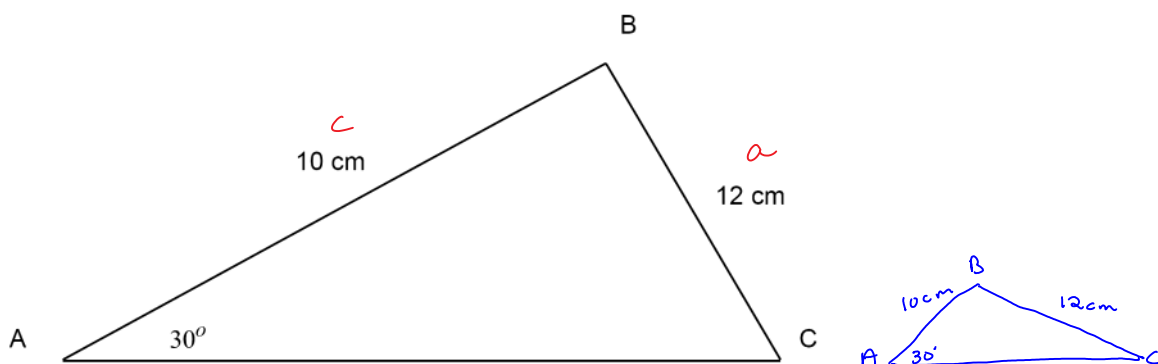
$$\sin 30^\circ = \frac{h}{10}$$

$$\underline{h = 5 \text{ cm}}$$

$$a = h$$

One Right Triangle

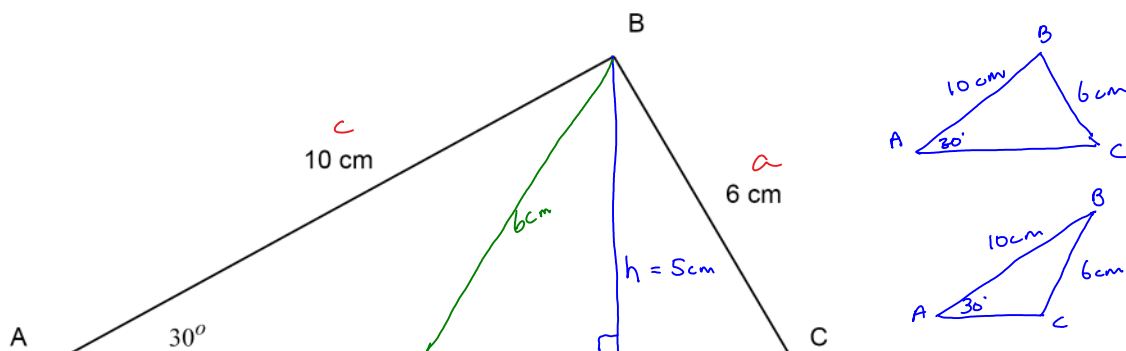
- 3) The following triangle dimensions are not drawn to scale. Based on the information presented how many triangles can be created using this configuration?



$$a \geq c$$

One Unique Triangle

- ★ 4) The following triangle dimensions are not drawn to scale. Based on the information presented how many triangles can be created using this configuration?



$$\sin 30^\circ = \frac{h}{10}$$

$$h = 5\text{ cm}$$

$$h < a < c.$$

2 triangles

So to summarize:

Triangles can be configured by comparing the sides given against the height of the triangle.

No Triangles

If  $a < h$

One Triangle

If  $a = h$  *Right Triangle*  
or  
 $a \geq c$

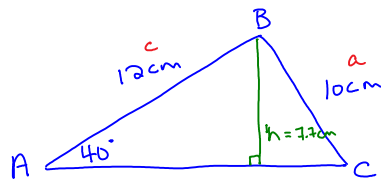
Two Triangles

If  $h < a < c$

B. Examples

Given the following information about each possible  $\triangle ABC$ , determine how many triangles can be constructed.

1)  $\angle A = 40^\circ$ ,  $a = 10$  cm,  $c = 12$  cm

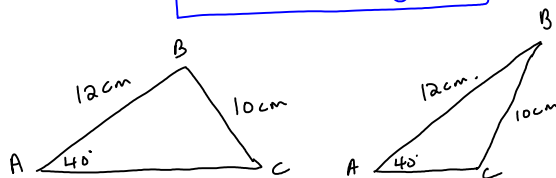


$$12 \left( \sin 40^\circ = \frac{h}{12} \right)$$

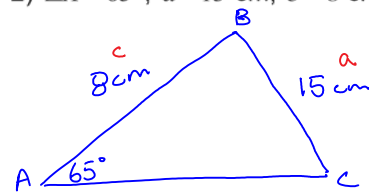
$$(12)(\sin 40^\circ) = h$$

$$h = 7.7 \text{ cm}$$

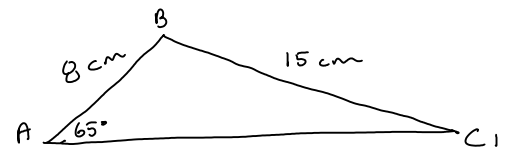
**2 Triangles**



2)  $\angle A = 65^\circ$ ,  $a = 15$  cm,  $c = 8$  cm



**One Triangle.**



Assignment:

Constructing Triangles Assignment #1 & 2

PRE-CALCULUS 11  
TRIGONOMETRY  
CONSTRUCTING TRIANGLES ASSIGNMENT

1. How many triangles can be created in  $\triangle ABC$  if:

a)  $a = 8, c = 12, \angle A = 40^\circ$

b)  $a = 20, c = 25, \angle A = 20^\circ$

c)  $a = 12, c = 10, \angle A = 50^\circ$

d)  $a = 4, c = 10, \angle A = 70^\circ$

e)  $a = 6, c = 8, \angle A = 60^\circ$

f)  $a = 25, c = 20, \angle A = 80^\circ$

g)  $a = 15, c = 10, \angle A = 30^\circ$

2. In  $\triangle ABC$ ,  $AB = 10$  cm and  $BC = 8$  cm. To the nearest degree determine the possible measure(s) of  $\angle A$  in each situation.

a) One Triangle

b) No Triangle

c) Two Triangles

Answers

1. a) 2   b) 2   c) 1   d) 0   e) 0   f) 1   g) 1

2. a)  $\angle A = 53^\circ$    b)  $\angle A > 53^\circ$    c)  $\angle A < 53^\circ$