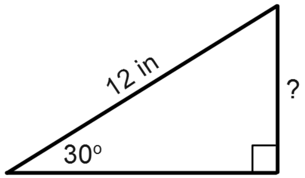
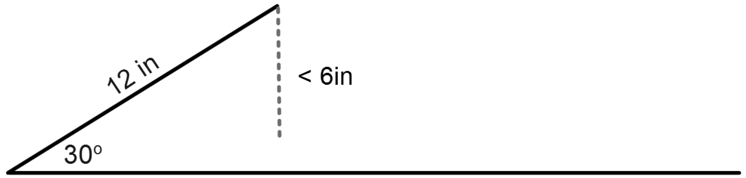
What is the length of the side opposite the 30° angle?



6in

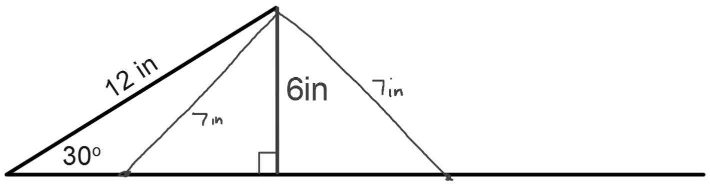
this is the short leg of a 30-60-90 triangle. The short leg is equal to half of the hypotenuse.

What would the triangle look like if the side opposite the 30° was less than 6 inches long?



It wouldn't even form a triangle!

What could the triangle look like if the side opposite the 30° was 7 inches long?

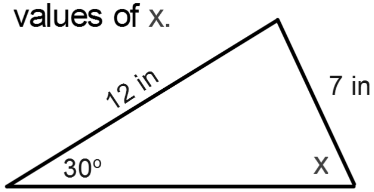


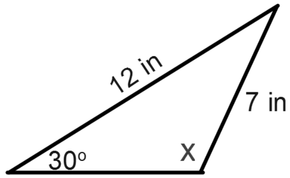
it could touch the bottom side in two different spots creating two possible triangles.

This is called the "ambiguous case" because we aren't really sure which of the two triangles we are dealing with.

There are two possible triangles if the side opposite the 30° was 7 inches long.

Use the Law of Sines to calculate the TWO possible values of x.



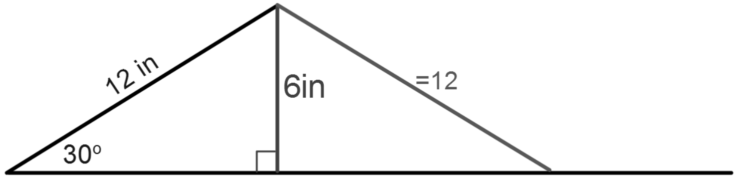


$$\frac{\sin 30^\circ}{7\text{in}} = \frac{\sin x}{12\text{in}}$$

$$x = \sin^{-1}\left(\frac{12\sin 30}{7}\right) = 59^\circ \rightarrow \therefore 180^\circ - 59^\circ$$

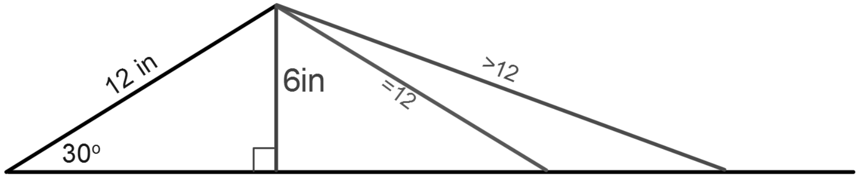
$$= 121^\circ$$

What would the triangle look like if the side opposite the 30° was exactly 12 inches long?



If this side were exactly 12 in long it would create an isosceles triangle.

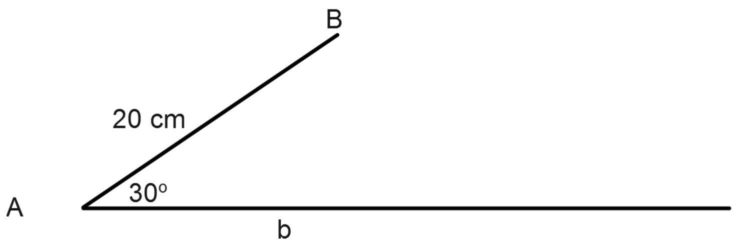
What could the triangle look like if the side opposite the 30° was longer than 12 inches long?



You would get one triangle where this side would touch the base farther to the right than if it were an isosceles triangle.

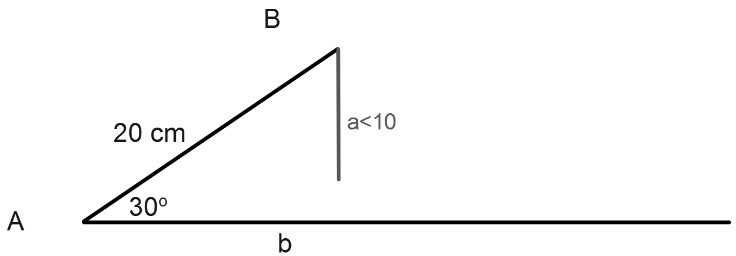
For what lengths of side a will there be only one possible triangle?

If a=10 you could form a right triangle (30-60-90), this is the shortest distance that would form a triangle. If a=20 you would have an isosceles triangle. And if a>20 you would form a triangle that touches side b farther to the right than the isosceles triangle.



The values of a for one triangle: $a = 10$ or $a \geq 20$

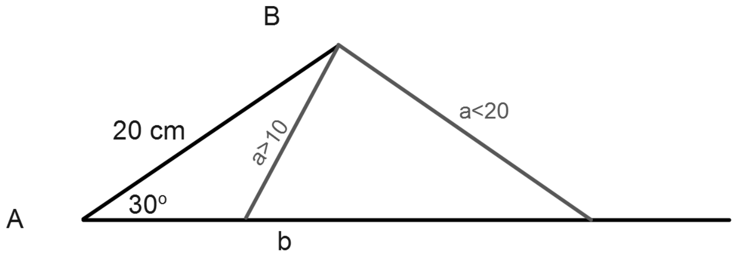
For what lengths of side a will it be impossible to form a triangle?



if a is less than the shortest length to connect and form a triangle then a triangle is impossible.

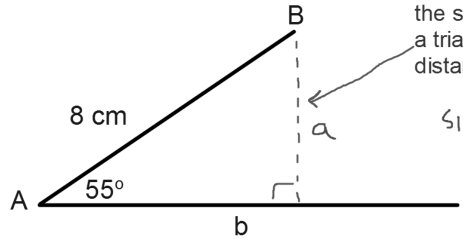
$a < 10$

For what lengths of side a will there be two possible triangles?



if side a is greater than the shortest length (10) but less than the length to create an isosceles triangle (20) two triangles are possible.

For what lengths of side a will it be impossible to form a triangle?

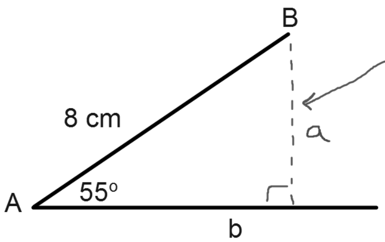


the shortest length to form a triangle would be the perpendicular distance from angle B to side b.

$\sin 55 = \frac{a}{8}$ $\quad a = 6.55$

Therefore, if a<6.55 a triangle couldn't even be formed.

For what lengths of side a will there be only one possible triangle?

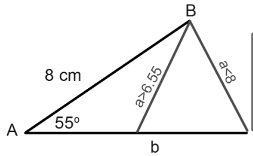


the shortest length to form a triangle would be the perpendicular distance from angle B to side b.

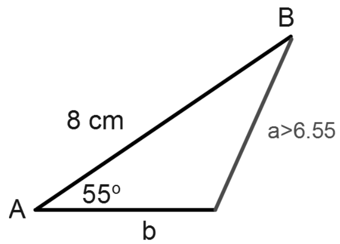
- $\sin 55 = \frac{a}{8}$ $\quad a = 6.55$
- if a were exactly 8 you would have an isosceles triangle.
- if a were greater than 8 you would also only get one triangle.

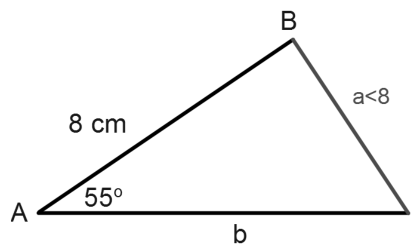
Therefore, to get only one triangle a = 6.55 or a $\geq$ 8

For what lengths of side a will there be two possible triangles?

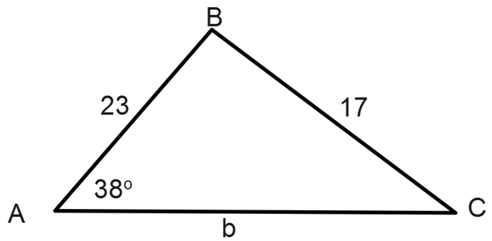


if a is greater than the shortest length (6.55) but less than the length to create an isoscees triangle (8), two triangles are possible.





"Solve" this triangle.   Round to the nearest tenth.



$$\frac{\sin 38^\circ}{17} = \frac{\sin C}{23}$$

$$C = \sin^{-1}\left(\frac{23 \sin 38}{17}\right)$$

$C = 56.4^\circ$

$B = 85.6^\circ$

$b = 27.5$

$$\frac{\sin 38}{17} = \frac{\sin 85.6}{b}$$

$\longrightarrow$ ¿

OR

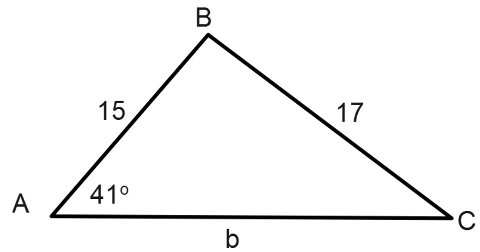
$C = 123.6^\circ$

$B = 18.4$

$b = 8.7$

$$\frac{\sin 38}{17} = \frac{\sin 18.4}{b}$$

"Solve" this triangle.   Round to the nearest tenth.



$$\frac{\sin 41^\circ}{17} = \frac{\sin C}{15}$$

$$C = \sin^{-1}\left(\frac{15 \sin 41}{17}\right)$$

$C = 35.4^\circ$

$B = 180 - 41 - 35.4 = 103.6^\circ$

$b = 25.19$

$$\frac{\sin 41}{17} = \frac{\sin 103.6}{b}$$

$\longrightarrow$ ¿

$C = 180 - 35.4$

$= \cancel{144.6^\circ}$

This isn't possible because the 3 angles would add to more than 180°