

Test
Acute Triangle Trigonometry

T

36 / 37



Learning Goals

I will be able to:

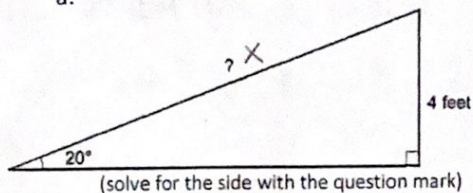
- Use the Pythagorean theorem and the primary trigonometric ratios to solve problems involving right triangles. (T2)
- Use the sine and cosine laws to solve problems involving acute triangles. (T3)

Instructions and Hints:

- All word problems need clearly defined variables and a concluding statement, as well as a labeled diagram!
- Please show work for all questions so that I can give part marks if something goes badly!
- READ ALL INSTRUCTIONS! Stop losing marks for rounding to the wrong decimal place or forgetting statements!!

1. Determine the value of the measure indicated in each of the following triangles. Round your answer to one decimal place. (10 marks)

a.



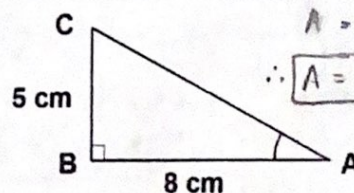
(solve for the side with the question mark)

$$\sin 20^\circ = \frac{4}{x}$$

$$x = \frac{4}{\sin 20^\circ}$$

$$\therefore x = 11.7 \text{ feet}$$

b.



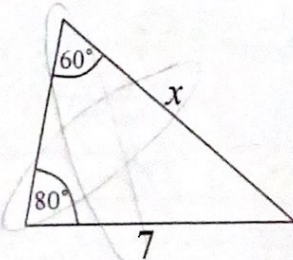
(solve for angle A)

$$\tan A = \frac{5}{8}$$

$$A = \tan^{-1}\left(\frac{5}{8}\right)$$

$$\therefore A = 32^\circ$$

c.

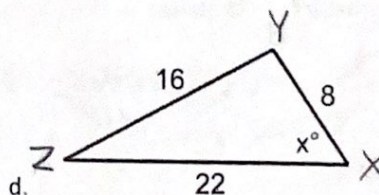


$$\frac{x}{\sin 80^\circ} = \frac{7}{\sin 60^\circ}$$

$$x = \frac{7 \sin 80^\circ}{\sin 60^\circ}$$

$$\therefore x = 8.0 \text{ units}$$

d.



$$x^2 = y^2 + z^2 - 2yz \cos X$$

$$16^2 = 22^2 + 8^2 - 2(22)(8) \cos X$$

$$256 = 548 - 352 \cos X$$

$$352 \cos X = 548 - 256$$

$$\frac{352 \cos X}{352} = \frac{292}{352}$$

$$\cos X = 0.83$$

$$X = \cos^{-1}(0.83)$$

$$\therefore X = 33.9^\circ$$

2. Explain why the values of the sine and cosine ratios cannot be greater than one. Think about the primary trig ratios and side lengths in right triangles! (3 marks)

$$\sin = \frac{\text{opp}}{\text{hyp}}$$

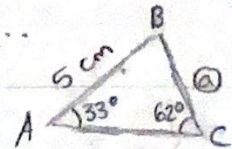
$$\cos = \frac{\text{adj}}{\text{hyp}}$$

In a right triangle, the hypotenuse is always the largest side. The other two sides in a right triangle will always be shorter than the hypotenuse. Sin and cos involve dividing a side in a right triangle by the hypotenuse. Since these sides are always less than the hypotenuse, the result is always between 0 and 1, and therefore cannot be greater than 1.

3. State the two situations where you must use the sine law to solve for an unknown value in an acute triangle. Include a diagram to illustrate each case. (4 marks)

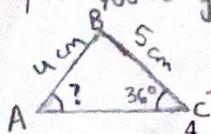
The two situations you should use Sine law in are...

1) If you're given two angles and any side.



$$\frac{a}{\sin 33^\circ} = \frac{5}{\sin 62^\circ}$$

2) If you're given two sides and an opposite angle.

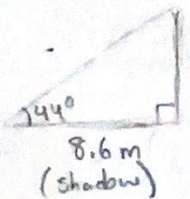


$$\frac{\sin A}{5} = \frac{\sin 36^\circ}{4}$$

(solve to find the measure of Angle A)

(solve to find length of side "a")

4. A tree casts a shadow that is 8.6 m long. The angle of elevation to the sun is 44° . Determine the height of the tree. (4 marks)



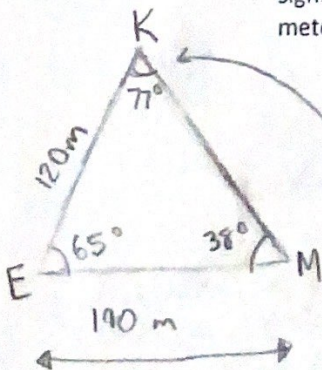
$$\tan 44^\circ = \frac{t}{8.6}$$

$$8.6 \tan 44^\circ = t$$

$$\boxed{8.3 \text{ m} = t}$$

(*) Let t rep. the height of the tree
 \therefore the height of the tree is 8.3 m.

5. Eva is flying a kite. She has released the entire 120 m ball of string, and notices that it forms an angle of 65° with the ground. Matthew is on the other side of the kite and sights it at an angle of elevation of 38° . How far is Eva from Matthew, to the nearest meter? (5 marks)



$$\angle K = 180^\circ - 65^\circ - 38^\circ$$

$$\boxed{\angle K = 77^\circ}$$

(*) Use Sine Law to find EM (*)

$$\frac{k}{\sin 77^\circ} = \frac{120}{\sin 38^\circ}$$

$$k = \frac{120 \sin 77^\circ}{\sin 38^\circ}$$

$$\boxed{k = 190 \text{ m}}$$

\therefore Eva is 190 m away from Matthew.

4.5

$k \rightarrow$ distance between them.

6. Two joggers choose different sides of a fork in the trail. The fork diverges at an angle of 34° . The first jogger is traveling at a rate of 5.4 km/h while the second is traveling at a rate of 7.6 km/h . How far apart are they, to the nearest tenth of a kilometer, after 45 minutes? (Hint: 45 minutes is a fraction of an hour, so their distance travelled should be less than their speed!) (5 marks)

Use Cosine Law to find missing side

$$x^2 = y^2 + z^2 - 2yz \cos X$$

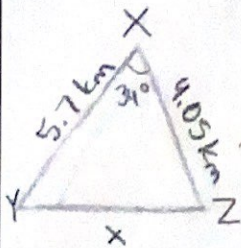
$$x^2 = 4.05^2 + 5.7^2 - 2(4.05)(5.7) \cos 34^\circ$$

$$x^2 = 10.62$$

$$x = \sqrt{10.62}$$

$$x = 3.3 \text{ km}$$

\therefore the two joggers are 3.3 km apart.



$$\frac{45}{60} = 0.75$$

$$\textcircled{1} 5.4 \text{ km/h} \times 0.75 = 4.05 \text{ km}$$

$$\textcircled{2} 7.6 \text{ km/h} \times 0.75 = 5.7 \text{ km}$$

* Let x rep. the distance between the joggers after 45 mins.

7. Claire and Grace are standing 45 m apart in a field. There is a cat caught in a tree between them. The angle of elevation from Claire to the cat is 65° and the angle of elevation from Grace to the cat is 48° . Determine the height of the tree to the nearest meter. (6 marks)

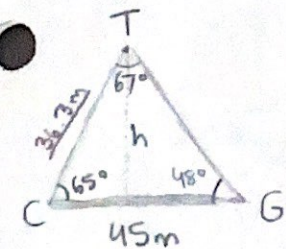
find side g/c first then use primary trig ratios to get height

$$\frac{g}{\sin 48^\circ} = \frac{45}{\sin 67^\circ}$$

$$g = \frac{45 \sin 48^\circ}{\sin 67^\circ}$$

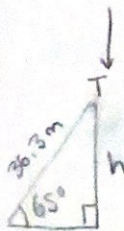
$$g = 36.3 \text{ m} \quad (\text{distance from Claire to the cat})$$

$h \rightarrow$ height of tree



$$\angle T = 180^\circ - 65^\circ - 48^\circ$$

$$\angle T = 67^\circ$$



$$\sin 65^\circ = \frac{h}{36.3}$$

$$36.3 \sin 65^\circ = h$$

$$32.9 \text{ m} = h$$

$$\sim 33 \text{ m} = h$$

\therefore the tree is around 33m tall.