

# Lesson 5: Determining Angles and Sides in Right Triangles

Friday, August 31, 2018 2:28 AM

# Trigonometry Lesson #5: Determining Angles and Sides in Right Triangles

## Overview

In Lesson #3 we learned how to calculate the length of a side in a right triangle using the Pythagorean Theorem and using trigonometry.

In Lesson #4 we learned how to calculate the measure of an angle in a right triangle using trigonometry.

In this lesson we combine both procedures in solving right triangles.



Class Ex. #1

In each case, calculate the measure of  $x$  to the nearest whole number.

a)

$\tan^{-1} \frac{12.7}{5.2}$   
 $\tan x = \frac{12.7}{5.2}$   
 $x^\circ = \tan^{-1}(12.7 \div 5.2)$   
 $x^\circ = 68^\circ$

b)

$\tan 24 = \frac{68}{x}$   
 $68 \cdot \tan 24 = x$   
 $x = 30$

c)

$\sin 69 = \frac{126}{x}$   
 $x \sin 69 = 126$   
 $x = \frac{126}{\sin 69}$   
 $x = 135$

d)

$\cos x = \frac{4}{7.2}$   
 $x = \cos^{-1}(4 \div 7.2)$   
 $x = 56^\circ$



Class Ex. #2

A telephone pole is 11 m high, and is supported by a wire 13 m long fixed to the top of the pole and to the ground.

a) Calculate, to the nearest degree, the angle between the wire and the ground.

$\sin x = \frac{11}{13}$   
 $x^\circ = \sin^{-1}(11 \div 13)$   
 $x = 58^\circ$

b) Calculate the distance, to the nearest 0.1 m, between the point where the wire is fixed to the ground and the foot of the pole using

i) the Pythagorean Theorem

$$c^2 - a^2 = b^2$$

$$13^2 - 11^2 = b^2$$

$$\sqrt{48} = \sqrt{b^2}$$

$$6.9 = b$$

ii) trigonometry.

~~$x \tan 58 = \frac{11}{x}$~~   
 $x \tan 58 = 11$   
 $x = \frac{11}{\tan 58} = 6.9$

Complete Assignment Questions #1 - #6

**Solving Right Triangles**

Solving a right triangle means that we have to determine the length of each side and the measure of each angle. In addition to the right angle, we need to know the length of one side and one other piece of information.

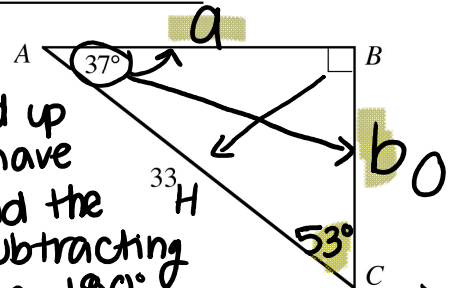
Depending on the information given, we can use the angle sum of a triangle, the Pythagorean Theorem and/or trigonometry to solve the triangle.



Solve the given triangle.  
Give all answers correct to the nearest whole number.

$$\begin{array}{r} \triangle = 180 \\ - 90 \\ - 37 \\ \hline 53^\circ \end{array}$$

\*all triangles add up to 180°, if you have two angles, find the last one by subtracting the angles from 180° (ei. find what is left to make 180)



$$\begin{array}{l} 33 \cos 37 = \frac{a}{33} \\ 33 \cdot \cos 37 = a \\ \boxed{a = 26} \end{array}$$

SOHCAHTOA  
 $\sin 37 = \frac{b}{33}$   
 $33 \sin 37 = b$   
 $\boxed{b = 20}$

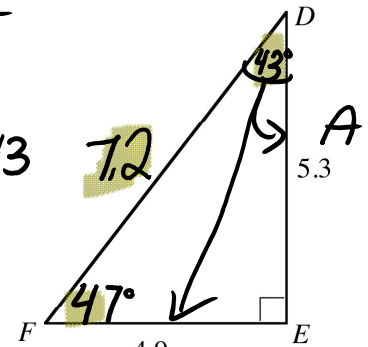


Solve triangle DEF. Give all sides correct to the nearest tenth and all angles correct to the nearest whole number.

unknown side  
 $5.3^2 + 4.9^2 = c^2$   
 $\sqrt{52.1} = c$   
 $\boxed{7.2 = c}$

3<sup>rd</sup> angle  
 $180 - 90 = 90 - 43$   
 $\boxed{47^\circ}$

unknown angle  
 $\tan D = \frac{4.9}{5.3}$   
 $D = \tan^{-1}(4.9 \div 5.3)$   
 $D = 43^\circ$

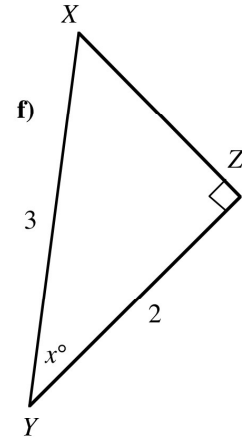
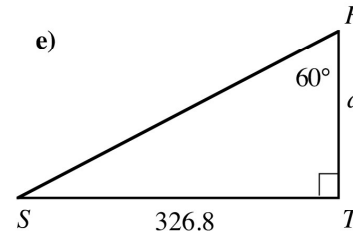
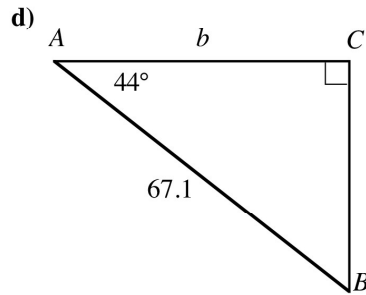
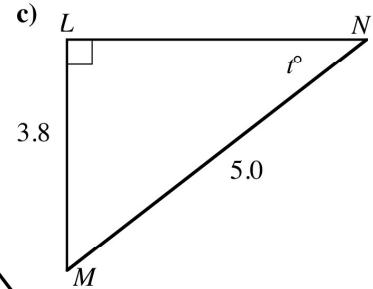
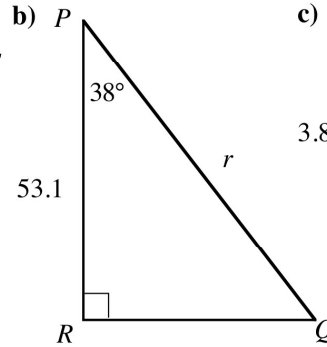
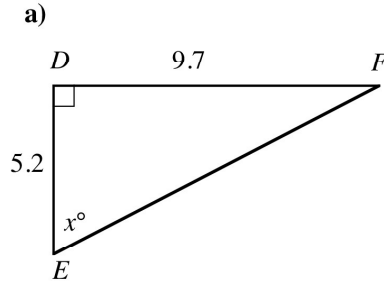


Complete Assignment Questions #7 - #17

# 3, 4, 5, 7, 9

## Assignment

1. In each case calculate the indicated measure. Give angles to the nearest degree and sides to the nearest tenth.



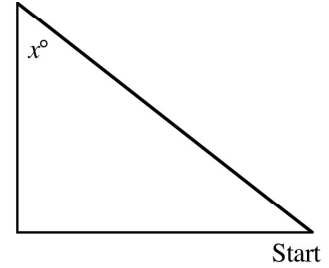
2. A mine shaft which slopes at an angle of  $19^\circ$  to the horizontal is driven into a hillside for 400 m. How much lower, to the nearest metre, is the end of the shaft than the beginning?

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3. In a yacht race over a triangular course the instructions are: “Sail due west to a buoy 6 km away, then due north to a buoy 5 km away, and then return directly to the starting point”.

- a) Calculate the measure of the angle marked  $x$ , to the nearest degree.

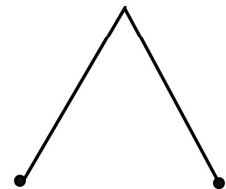


- b) Calculate, to the nearest tenth of a km, the total distance travelled in the race.

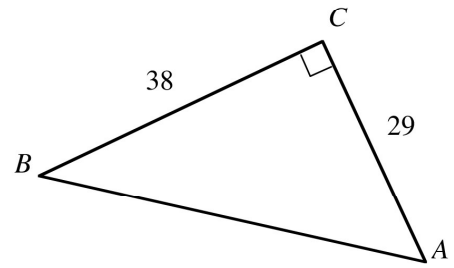
4. The diagonal of a rectangle is 35 cm long and makes an angle of  $58^\circ$  with the shorter side of the rectangle. Determine the length and width of the rectangle to the nearest tenth of a cm.

5. From the top of a building a surveyor determines the angle of depression of a parked car on the street below to be  $33^\circ$ . If the building is 28 m high, calculate the distance from the foot of the building to the parked car. Answer to the nearest metre.

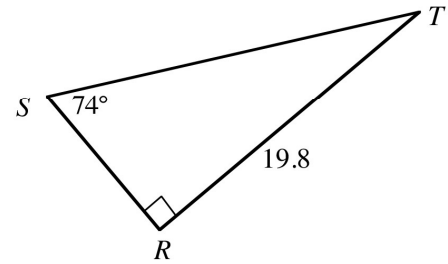
6. A pendulum 65 cm long swings through an angle of  $40^\circ$ . Calculate the distance, to the nearest 0.1 cm, between the two extreme positions of the pendulum bob.



7. Solve triangle  $ABC$  giving each measure correct to the nearest whole number.



8. Solve triangle  $RST$ . Give all sides correct to the nearest tenth and all angles correct to the nearest whole number.



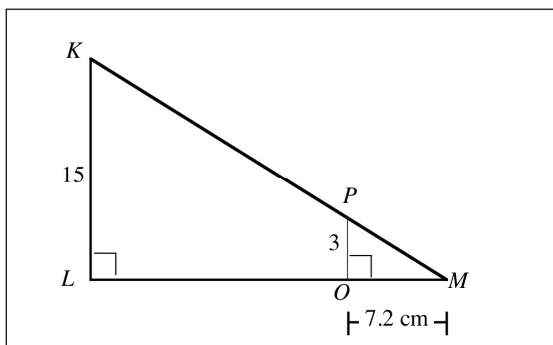
9. Solve triangle  $DEF$  in which angle  $DEF = 90^\circ$ , angle  $EDF = 50^\circ$ , and  $DF = 173$  mm. Give all answers to the nearest whole number.

10. Why is it not possible to solve  $\triangle PQR$  in which  $\angle PQR = 90^\circ$ ,  $\angle PRQ = 67^\circ$  and  $\angle QPR = 23^\circ$ ?

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**Matching**

Use the following information for the matching question



Match each item in List 1 on the left with the equivalent item in List 2 on the right. Each item in List 2 may be used once, more than once, or not at all.

List 1

11. The length of side  $PM$  is
12. Angle  $MPO$  is
13. Angle  $LKM$  is
14. The length of side  $LM$  is
15. The length of side  $LO$  is
16. Angle  $PMO$  is
17. The length of side  $KP$  is

List 2

- |                 |            |            |
|-----------------|------------|------------|
| A. $67.4^\circ$ | B. 31.2 cm | C. 36.0 cm |
| D. $22.6^\circ$ | E. 7.8 cm  | F. 15.8 cm |
| G. 29.3 cm      | H. 28.8 cm | I. 39.0 cm |

**Answer Key**

1. a)  $62^\circ$    b) 67.4   c)  $49^\circ$    d) 48.3   e) 188.7   f)  $48^\circ$    2. 130 m
3. a)  $50^\circ$    b) 18.8 km   4. length = 29.7 cm, width = 18.5 cm   5. 43 m   6. 44.5 cm
7. angle  $ABC = 37^\circ$ , angle  $BAC = 53^\circ$ , angle  $ACB = 90^\circ$ ,  $AB = 48$ ,  $AC = 29$ ,  $BC = 38$
8. angle  $RST = 74^\circ$ , angle  $SRT = 90^\circ$ , angle  $RTS = 16^\circ$ ,  $RT = 19.8$ ,  $RS = 5.7$ ,  $ST = 20.6$
9. angle  $DEF = 90^\circ$ , angle  $EDF = 50^\circ$ , angle  $DFE = 40^\circ$ ,  $DF = 173$  mm,  $DE = 111$  mm,  $EF = 133$  mm
10. No side length is given.   11. E   12. A   13. A   14. C   15. H   16. D   17. B

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