

TWENTY OF MY NEAREST AND DEAREST!

If this were a graded worksheet, the instructions would be as follows:

On your own paper, draw a suitable, large-enough, well-labelled diagram. Then write appropriate equation(s) involving one or more trig functions and/or the Laws of Sines and Cosines. Finally solve the problem. Computations should be done on a calculator and need not be written out.

RIGHT TRIANGLES (You should not use Law of Sines or Cosines here, even if you need to work harder to set them up with right triangles)

1. Two flag poles are known to be 40 and 60 feet tall. A person stands beyond the shorter pole and moves back from the poles until she finds a position so that when she looks at the top of the nearer (shorter) pole, it is in line with the top of the farther (taller) pole. The angle of elevation to the tips of the poles is 42° . Find the distance between the poles, and the distance from the observer to the nearer pole.
2. A circle is inscribed in a regular pentagon. The perimeter of the pentagon is 150 cm. Find the area of the circle.
3. What is the angle of elevation of the sun if a 5ft 8 in man casts a shadow 4 ft 3 in long?
4. An airplane is flying at an altitude of 15,000 ft. The angle of depression from the plane to an observation post (on the ground) is 21° . How far must the plane travel to be directly over the observation post?
5. From the top of a 3000 ft tall observation tower, I can look out my window and see two buildings (in a line with one another along my line of sight). The angles of depression from my position to the bottoms of the two buildings are 13° and 20° . Find the distance between the two buildings.
6. Find a formula for the area of a right triangle ABC (rt angle at B) using only the length of the hypotenuse b and values associated with the measure of the acute angle C and any constants (real numbers) that are appropriate.
7. In a trapezoid, the base angles are 72° and 41° . The top is 25 cm long and the bottom is 75 cm long. Find the area of the trapezoid.
8. An antenna 25 ft tall stands on the top of a (flat-roofed) building. From a point on the ground, the angles of elevation to the top and the bottom of the antenna are 58° and 47° respectively. Find the height of the building (without the antenna).

OBLIQUE TRIANGLES

9. An isosceles triangle has a base of length 50. The vertex angle measures 27° . What is the perimeter of the triangle?
10. How long is a diagonal of a regular pentagon whose sides are each 21 cm long? Why is the pentagon the only regular polygon (other than a square) for which we can state this question in this way?

11. A tree grows straight up (vertically) on the slope of a hill. The hill slopes upward from the horizontal at an angle of 5° . When the angle of elevation of the sun (measured, naturally, from the horizontal) is 29° , the shadow of the tree falls along the hill and extends 35 ft down the slope. How tall is the tree?
12. What is the measure of the smallest angle in a triangle with sides measuring 23, 17, and 31? What is the largest angle? How do you know which angle to solve for without solving for all three angles and then choosing?
13. Find the three missing parts of this triangle. If there is more than one solution (and there probably is or I wouldn't be asking) find both sets of solutions.
 $\angle A = 73^\circ$, $a = 58$, $b = 60$
14. Find the lengths of the sides of a parallelogram in which the diagonals are 14 and 20 cm and one of the angles formed at the intersection of the diagonals is 35° .
15. Two points A and B are on opposite sides of a pond. A third point C is located on land 420 ft from A and 380 ft from B. The angle at C measures 142° . What is the distance across the pond from A to B?
16. A building 50 ft tall stands at the upper end of a street that slopes down at an angle of 4° from the horizontal. How far down the street is a point from which the angle of elevation (from the horizontal, as usual) to the top of the building is 45° ?
17. One diagonal of a parallelogram is 25 cm long, and it forms angles of 37° and 21° with the sides. What is the perimeter of the parallelogram? (Recall that diagonals of a parallelogram do NOT necessarily bisect the angles)
18. Regular polygon ABCDEFGHI has perimeter 72 in. Find the length of chord AC? How about chord AD? How about a generalization for any chord (based on how many vertices apart they are)?
19. A rhombus (look it up if you don't remember) has perimeter 64. One diagonal is 20. Find the measures of the interior angles of the rhombus (not the angles formed with the diagonals).
20. An isosceles trapezoid has bases 12 and 30. Its legs are 15. Find the length of a diagonal. Can you do this one without any trig?

ANSWERS

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| 1. 23 ft, 44 ft | 11. 16 ft |
| 2. between 426° and 441° sq cm | 12. 33° |
| 3. 53° | 13. $\angle B = 82^\circ$, $\angle C = 25^\circ$, $c = 26$ or $\angle B = 98^\circ$, $\angle C = 9^\circ$, $c = 9$ |
| 4. 39,076 ft (7.4 mi) | 14. 6 in and 16 in |
| 5. 4752 ft | 15. 756 ft |
| 6. $A = \frac{b^2 \cos C \sin C}{2}$ | 16. 54 ft |
| 7. 1695 sq cm | 17. 58 cm |
| 8. 51 ft | 18. 15 in |
| 9. 264 | 19. 77° and 103° |
| 10. 34 cm | 20. 24 |