

Foundation GCSE: Pythagoras and Trigonometry Problems

Name: _____

Class: _____

Instructions: Answer all questions. Questions are ordered from easiest (1) to hardest (20). Working out should be shown where appropriate.

1. A ladder of length 6 m is placed against a wall. The base is 2 m from the wall. Calculate how high up the wall the ladder reaches to 1 decimal place.
2. A right-angled triangle has legs of 5 cm and 12 cm. Calculate the size of the smallest angle in the triangle to 1 decimal place.
3. A kite string is 50 m long and is taut at an angle of 40° to the ground. Calculate the vertical height of the kite to 1 decimal place.
4. A rectangular park measures 40 m by 30 m. Calculate the length of the diagonal path across the park.
5. A ship sails 12 km due East and then 5 km due North. Calculate the direct distance from the start point and the bearing from start to finish to 1 decimal place.
6. A wheelchair ramp has a horizontal length of 8 m and rises to a height of 1.2 m. Calculate the angle of the ramp and the length of the slope to 1 decimal place.
7. An isosceles triangle has equal sides of 13 cm and a base of 10 cm. Calculate its area.
8. A ladder is 7 m long and reaches 6 m up a vertical wall. Calculate the angle the ladder makes with the ground to 1 decimal place.
9. A square field has a diagonal length of 50 m. Calculate the side length of the field to 1 decimal place.
10. A flagpole casts a shadow of length 12 m when the angle of elevation of the sun is 55° . Calculate the height of the flagpole to 1 decimal place.
11. A wire of length 15 m runs from the top of a vertical pole to a point on the ground 9 m from the base. Calculate the height of the pole and the angle the wire makes with the ground.
12. A rhombus has side lengths of 10 cm and one diagonal of length 16 cm. Calculate the length of the other diagonal.
13. A person walks 3 km North, then 4 km East, then 2 km North. Calculate the straight-line distance from the starting position to 1 decimal place.
14. A ladder of length 10 m has its base 6 m from a wall. It slides down the wall so that its top moves down by 2 m. Calculate the new distance of the base from the wall to 1 decimal place.
15. A trapezium has a vertical height of 6 cm, a top parallel side of 8 cm, and a bottom parallel side of 14 cm. Calculate the length of the sloping side.
16. A surveyor wants to find the width of a river. Standing directly opposite a tree on the other bank, she walks 40 m downstream along her bank and measures an angle of 34° back to the tree. Calculate the width of the river to 1 decimal place.
17. A regular pentagon is inscribed in a circle of radius 10 cm. Calculate the exact distance from the center to any side (apothem).
18. An aircraft flies 150 km on a bearing of 045° , then 200 km on a bearing of 135° . Calculate the direct distance back to the starting point to 1 decimal place.
19. A cone has a slant height of 15 cm and a base radius of 6 cm. Calculate the vertical height and internal semi-vertical angle of the cone to 1 decimal place.
20. A pyramid has a square base of side 10 cm and a slant edge of 13 cm. Calculate the vertical height of the pyramid and the angle a slant edge makes with the base to 1 decimal place.

Answers & Worked Solutions

1. 5.7 m : $\sqrt{6^2 - 2^2} = \sqrt{36 - 4} = \sqrt{32} \approx 5.7$.
2. 22.6° : $\arctan\left(\frac{5}{12}\right) \approx 22.6^\circ$.
3. 32.1 m : $50 \times \sin(40^\circ) \approx 32.1$.
4. 50 m : $\sqrt{40^2 + 30^2} = \sqrt{1600 + 900} = \sqrt{2500} = 50$.
5. 13 km, 022.6° : $\sqrt{12^2 + 5^2} = 13$;
 $\arctan\left(\frac{12}{5}\right) \approx 67.4^\circ$ East of North $\Rightarrow$ 022.6° .
6. 8.5° , 8.1 m : $\arctan\left(\frac{1.2}{8}\right) \approx 8.5^\circ$;
 $\sqrt{8^2 + 1.2^2} \approx 8.1$.
7. 60 cm^2 : Height = $\sqrt{13^2 - 5^2} = 12$; Area = $\frac{1}{2} \times 10 \times 12 = 60$.
8. 59.0° : $\arccos\left(\frac{6}{7}\right) \approx 59.0^\circ$.
9. 35.4 m : $\frac{50}{\sqrt{2}} \approx 35.4$.
10. 17.1 m : $12 \times \tan(55^\circ) \approx 17.1$.
11. 12 m, 53.1° : Height = $\sqrt{15^2 - 9^2} = 12$;
 $\arccos\left(\frac{9}{15}\right) \approx 53.1^\circ$.
12. 12 cm : Half diagonals are 8 and x ;
 $\sqrt{10^2 - 8^2} = 6$, so full diagonal is 12.
13. 5.8 km : Total North = 5, East = 4;
 $\sqrt{5^2 + 4^2} = \sqrt{41} \approx 5.8$.
14. 8.0 m : Initial height = $\sqrt{10^2 - 6^2} = 8$ m;
 new height = $8 - 2 = 6$ m; new base = $\sqrt{10^2 - 6^2} = 8$ m.
15. 6.7 cm : Horizontal difference = $\frac{14 - 8}{2} = 3$;
 sloping side = $\sqrt{6^2 + 3^2} = \sqrt{45} \approx 6.7$.
16. 27.0 m : $40 \times \tan(34^\circ) \approx 27.0$.
17. $10 \cos(36^\circ)$ cm : $10 \cos(36^\circ) \approx 8.1$ cm.
18. 250.0 km : Right-angled triangle with legs 150 and 200, hypotenuse $\sqrt{150^2 + 200^2} = 250$.
19. 13.7 cm, 23.6° : Height = $\sqrt{15^2 - 6^2} = \sqrt{189} \approx 13.7$; angle = $\arcsin\left(\frac{6}{15}\right) \approx 23.6^\circ$.
20. 10.9 cm, 57.0° : Half diagonal of base = $\sqrt{5^2 + 5^2} = 5\sqrt{2} \approx 7.07$; height = $\sqrt{13^2 - 5^2} = \sqrt{119} \approx 10.9$; angle = $\arccos\left(\frac{5\sqrt{2}}{13}\right) \approx 57.0^\circ$.