2023 MATH FIELD DAY ***NAME_____***

Trigonometry Team ***SCHOOL_____***

All answers must be exact unless otherwise stated, i.e., they may contain π, radicals, fractions, terminating or repeating decimals, but they may NOT contain decimal approximations. Fractions must be expressed in lowest terms (e.g., $\frac{1}{2}$ instead of $\frac{4}{8}$) and radicals must be expressed in simplest radical form (e.g., $2\sqrt{2}$ instead of $\sqrt{8}$). Place all answers in the blank space provided.

1. _____ ***1.*** One of the Seven Wonders of the Ancient World was a lighthouse on the Island of Pharos in Alexandria, Egypt. It is the first lighthouse in recorded history and was built about 280 BC. It survived for 1500 years until it was completely destroyed by an earthquake in the 14th century. On a sunny day, 2-meter-tall man casts a shadow approximately 5 centimeters (0.05 meters) long, and the lighthouse approximately a 3-meter shadow, how tall was this fantastic structure?

2. _____ ***2.*** If the line $y = mx$ make an angle, θ, with the x −axis, find the slope, m, in terms of a single trigonometric function.

3._____ ***3.*** A lighthouse in the middle of channel rotates its light in a circular motion with constant speed. If the beacon of light completes one rotation every 10 seconds, what is the angular speed of the beacon in radians per minute?

4. _____ ***4.*** The length of the minute hand of an analog clock is 6 inches. If the minute hand rotates from 12 noon to 12:40 P.M., then how far does its point move? Solve in terms of π.

5. _____ ***5.*** Given $sin\theta = -\frac{2}{3}$ and $cos\theta = \frac{\sqrt{5}}{3}$, find $tan\theta$.

6. _____ ***6.*** Evaluate the expression $\cot(-450^o) - \sin(-450^o)$

7. _____ ***7.*** Write the expression $cos^2\left(\frac{5\pi}{8}\right) - sin^2\left(\frac{5\pi}{8}\right)$ in terms of a single trigonometric function.

8._____ ***8.*** Evaluate exactly: $tan\left(cot^{-1}\left(\frac{6}{7}\right)\right)$

9. _____ ***9.*** The Tower of Pisa was originally built 56 meters tall. Because of poor soil in the foundation, it started to lean. At a distance of 44 meters from the base of the tower, the angle of inclination is 55^o. How much is the Tower of Pisa leaning away from the vertical position (What is the angle with the ground)? (Round to the nearest degree.)

10. _____ ***10.*** Peg and Meg live one mile apart. The school that they attend lies on a street that makes 60^o angle with the street connecting their houses when measured from Peg's house. The street connecting Meg's house and the school makes a 50^o angle with the street connecting them. How far, in miles, is it from Peg's house to the school? (Round answer to the nearest tenth.)