

## 2012 MATH FIELD DAY : TRIGONOMETRY - TEAM

Name: \_\_\_\_\_

School: \_\_\_\_\_

In questions 1 to 10, use exact values, for example,  $\pi$  NOT 3.1416 and  $\sqrt{2}$  NOT 1.414. Simplify your answers and rationalize all denominators.

- \_\_\_\_\_ Evaluate exactly  $\frac{\tan \frac{\pi}{8} - \tan \frac{3\pi}{8}}{1 + \tan \frac{\pi}{8} \tan \frac{3\pi}{8}}$ .
- \_\_\_\_\_ Find the exact value of  $\sin \theta$  if  $\tan \theta = -\frac{17}{19}$  and  $\theta$  is located in Quadrant IV.
- \_\_\_\_\_ Convert  $\left(\frac{7\pi}{6}\right)^\circ$  to radians.
- \_\_\_\_\_ Find the length of an arc that subtends a central angle of 5 radians in a circle of radius 6.5 miles.
- \_\_\_\_\_ Find the area of a triangle with sides of length 14 inches and 56 inches and included angle  $30^\circ$ .
- \_\_\_\_\_ Find the length of the side  $a$  in a triangle if  $b = 60$  feet,  $c = 30$  feet, and  $\angle A = 15^\circ$ .
- \_\_\_\_\_ Simplify the expression  $\frac{\tan x - \cot x}{\tan x + \cot x} + 2 \cos^2 x$  as much as possible.
- \_\_\_\_\_ Find all exact solutions to  $4 \csc 2x + 8 = 0$ .
- \_\_\_\_\_ Simplify the following expression:  $(4\sqrt{3} + 4i)^7$ .
- \_\_\_\_\_ An observer notes that a tracking station has two telescopes that are 1.0 mile apart with telescope  $A$  to the left of telescope  $B$ . Each telescope can lock onto a rocket after it is launched to the left of the two stations from the observer's point of view and then each records its angle of elevation to the rocket. If the angles of elevation from telescopes  $A$  and  $B$  are  $80^\circ$  and  $30^\circ$ , respectively, then how far is the rocket from telescope  $B$ ?