Below you will find 10 problems, each worth 10 points. Solve the problems in the space provided. When writing a solution to a problem, show all work. No books or notes are allowed. Sign and submit your formula sheet with the exam.

**Problem 1.** Use the following steps to find the sine and cosine of $\theta = \frac{11\pi}{6}$.

(a) Draw the angle $\theta$ in standard position, and specify the quadrant.

(b) Find the reference angle $\theta_R$ and the exact values of $\sin \theta_R$ and $\cos \theta_R$. (Do not use a calculator.)

(c) Use the previous steps to determine $\sin \theta$ and $\cos \theta$. 


Problem 2. Given \( \tan \theta = \frac{4}{5} \), with \( \pi < \theta < 2\pi \), find the value of \( \tan(\theta/2) \).

Problem 3. A miniature rocket is launched vertically. Ten seconds after launching the rocket has reached an altitude of 500 m. At that time an observer, positioned 1000 m from the launch site, starts tracking the rocket, and the measurement shows that the angle of elevation has increased by 30° in the next ten seconds of flight. What is the altitude of the rocket at that time?

Problem 4. Find the amplitude, period, and phase shift for the equation

\[
y = 5 \sin \left( \pi x - \frac{\pi}{4} \right).
\]
Problem 5. Given α and β in the first quadrant, with \( \sin \alpha = \frac{3}{5} \) and \( \cos \beta = \frac{8}{17} \), find \( \sin(\alpha + \beta) \) and \( \cos(\alpha + \beta) \).

Problem 6. Prove the identity: \( (\csc \alpha - \cot \alpha)(1 + \sec \alpha) = \tan \alpha \).

Problem 7. The graph of the equation \( y = a \sin(bx + c) \), with \( a > 0 \) and \( b > 0 \), is shown in the figure below.

(a) Find the amplitude and the period.

(b) Find the coefficients \( a \), \( b \) and \( c \).
Problem 8. Find all solutions of the equation
\[ \sin\left(2t - \frac{\pi}{4}\right) = 0. \]

Problem 9. Find the exact values of \( \sin 105^\circ \) and \( \cos 105^\circ \).

Problem 10. Find the solutions of the equation
\[ 2 \cos^2 t - 5 \cos t + 2 = 0, \]
that are in the interval \([0, 2\pi)\).