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.** A triangle $ABC$ has $a = 5$ in, $b = 6$ in, and $\hat{A} = 20^\circ$. Find the remaining parts: $\hat{B}$, $\hat{C}$, and $c$. (Express all angles in degrees. Round to two decimal places.)

**Caution:** This problem has two solutions! Find both of them.
Problem 2. A triangle $ABC$ has $b = 5$ in, $c = 12$ in, and $\hat{A} = 60^\circ$. Find the remaining parts: $\hat{B}$, $\hat{C}$, and $a$. (Express all angles in degrees. Round to two decimal places.)

Problem 3. A triangle $ABC$ has $a = 7$ in, $\hat{B} = 40^\circ$, and $\hat{C} = 60^\circ$. Find the remaining parts: $\hat{A}$, $b$, and $c$. (Express all angles in degrees. Round to two decimal places.)

Problem 4. A triangle $ABC$ has $a = 8$ in, $b = 11$ in, and $c = 7$ in. Find the remaining parts: $\hat{A}$, $\hat{B}$, and $\hat{C}$. (Express all angles in degrees. Round to two decimal places.)
Problem 5. In each of the two questions below, compute the area of the triangle $ABC$. Use exact values.

(a) Given $a = \sqrt{3}$ in, $c = 12$ in, and $\hat{B} = 60^\circ$.

(b) Given $a = 5$ in, $b = 5$ in, and $c = 6$ in.

Problem 6. Given two angles $\alpha$ and $\beta$ in the second quadrant, with $\sin \alpha = \frac{8}{17}$, and $\cos \beta = -\frac{12}{13}$, find the exact values of $\sin(\alpha + \beta)$ and $\cos(\alpha + \beta)$.

Problem 7. Find all solutions of $\tan \left(2t + \frac{\pi}{6}\right) = -\sqrt{3}$. Use exact values.
Problem 8. Find all solutions of \( \cos^2 y - \cos y - 2 = 0 \). Use exact values.

Problem 9. Find the geometric angle formed by the vectors \( \vec{u} = \begin{bmatrix} 4 \\ 3 \end{bmatrix} \) and \( \vec{v} = \begin{bmatrix} -7 \\ 1 \end{bmatrix} \). Use exact values.

Problem 10. Consider the polar equation \( r = \frac{6}{r + \sin \theta} \). Find the equation in rectangular coordinates (that is, \( x \) and \( y \)) which has the same graph as the given polar equation.