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.** Convert the units as indicated:

(a) $12.345^\circ$ to degrees, minutes and seconds.

(b) $\frac{7\pi}{24}$ (radians) to degrees, minutes and seconds.
Problem 2. Find two positive coterminal angles and one negative coterminal angle for each of the following angles:

(a) $-240^\circ$ (use degrees);

(b) $\frac{11\pi}{6}$ (use radians).

Problem 3. An angle $\theta$, in standard position, is located in the third quadrant and has $\cot \theta = \frac{20}{21}$. Find the exact values of $\sin \theta$ and $\cos \theta$.

Problem 4. Find the exact values of $\sin \left(-\frac{5\pi}{4}\right)$ and $\cos \left(-\frac{5\pi}{4}\right)$. 

Problem 5. Find the length of the arc that subtends the angle $120^\circ$ on a circle of diameter 10 in.

Problem 6. Prove the identity:

$$\cot t (\sec^2 t - 1) = \tan t.$$ 

Problem 7. The angle $\theta$ is an acute angle in the right triangle shown in the figure.

Find the exact values of all six trigonometric functions of $\theta$. 

\[ \begin{array}{c}
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30 \\
\theta \\
24
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Problem 8. Find the exact values of $t$, in the interval $[-2\pi, 4\pi]$, which satisfy the equation
\[
\sin t = \frac{\sqrt{2}}{2}.
\]

Problem 9. Find the side labeled $x$ in the right triangle:

Problem 10. Let $\theta$ be an angle in standard position, such that the point $P(2, -3)$ is on its terminal side. Find the exact values of all the six trigonometric functions of $\theta$. 