By providing my signature below I acknowledge that I abide by the University’s academic honesty policy. This is my work, and I did not get any help from anyone else during the exam:

Name (sign): __________________________ Name (print): __________________________

Student Number: __________________________

Instructor’s Name: __________________________ Class Time: __________________________

- If you need extra space use the last page.
- Please show your work. An unjustified answer may receive little or no credit.
- If you make use of a theorem to justify a conclusion then state the theorem used by name.
- Your work must be neat. If I can’t read it (or can’t find it), I can’t grade it.
- The total number of possible points that is assigned for each problem is shown here. The number of points for each subproblem is shown within the exam.
- Please turn off your mobile phone.
- A calculator is not necessary, but numerical answers should be given in a form that can be directly entered into a calculator.

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<th>Problem Number</th>
<th>Points Possible</th>
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<td>Total:</td>
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Common identities:

\[
\cos(\alpha + \beta) = \cos(\alpha)\cos(\beta) - \sin(\alpha)\sin(\beta),
\]

\[
\sin(\alpha + \beta) = \sin(\alpha)\cos(\beta) + \cos(\alpha)\sin(\beta).
\]
1. Determine the values of the requested quantities in each question below. Numerical values should be to within 0.01 of the true value. *(All angles are given in radians and should be expressed in radians if you have to determine their value.)*

(a) [7 pts] Determine the radian measure of the angle $\alpha$ in the diagram below:

(b) [7 pts] Determine the cosine, sine, and tangent of the angle, $\gamma$, in the diagram below.
(c) [7 pts] Determine a numerical approximation to the measure of the side $a$ in the diagram below. Your answer should be to within 0.01 of the true value. The angle $\omega$ is 0.80 radians.

(d) [7 pts] The measure of the angle $\theta$ is 0.4 radians, and the measure of $\phi$ is 0.3 radians. Determine the value of $x$ to within 0.01.
2. [6 pts] Determine the reference angle for θ = 4.1 radians.

3. [6 pts] A car travels along a straight line that starts six miles east and eight miles south of downtown Athens until it reaches a point that is two miles east and two miles south of downtown Athens. It then gets on the loop road which is a perfect circle centered at downtown Athens. The car travels around a sector whose angle is 1.3 radians. What is the total distance that the car traveled?
4. [12 pts] Given that

\[ \cos \left( \frac{11\pi}{12} \right) = -\frac{\sqrt{2} + \sqrt{6}}{4} \]

determine the exact value of \( \sin \left( \frac{11\pi}{12} \right) \).
5. [12 pts] Please determine a formula for the function below expressed as a sine function.
6. [12 pts] The elevation of a plane is 450m above the ground. The pilot is looking at the control tower of the airport, and the angle of depression is 9.5°. What is the horizontal distance between the airport and the point on the ground directly below the plane?
7. [12 pts] A pendulum is included as part of a science exhibit. For any time, \( t \) given in seconds, the height of the pendulum above the floor in meters is determined to be

\[
h(t) = 0.3 + 0.2 \cos(0.2t + 0.8).
\]

Determine two times that the height is at a maximum and determine two times that the height is at a minimum. What are the heights at those times?
8. [12 pts] Two weights are attached to one another using a rope that goes over a pulley. Initially the two weights are at the same level. The pulley has a radius of 0.2m, and it turns through some angle. The ropes does not slip nor stretch. The sector representing the angle it turns has an area of 0.007 m². What is the vertical distance between the two weights?
Extra space for work. **Do not detach this page.** If you want us to consider the work on this page you should print your name, instructor and class meeting time below.

Name (print): _______________ Instructor (print): _______________ Time: _______________