

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: _____

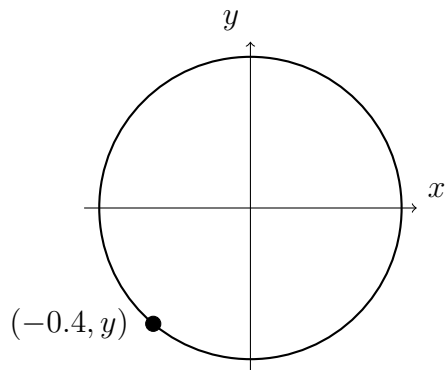
Problem Number	Points Possible	Points Made
1	20	
2	6	
3	6	
4	12	
5	16	
6	10	
7	15	
8	15	
Total:	100	

- 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.
- Common identities:

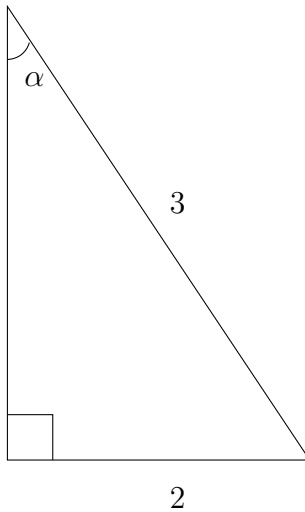
$$\begin{aligned}\cos(\alpha + \beta) &= \cos(\alpha)\cos(\beta) - \sin(\alpha)\sin(\beta), \\ \sin(\alpha + \beta) &= \sin(\alpha)\cos(\beta) + \cos(\alpha)\sin(\beta).\end{aligned}$$

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.)**

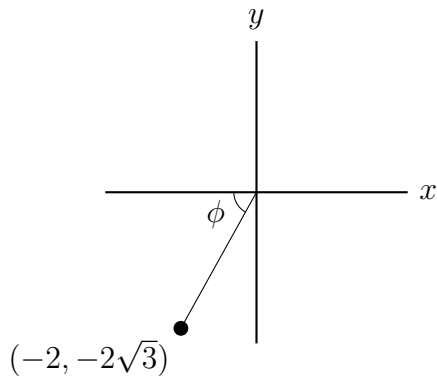
_____ (a) [5 pts] Determine the value of y in the diagram below. The point is on the unit circle.



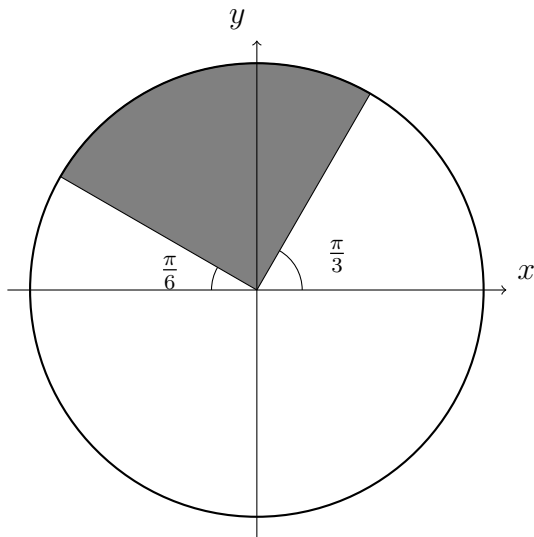
_____ (b) [5 pts] Determine the angle α in the diagram below.



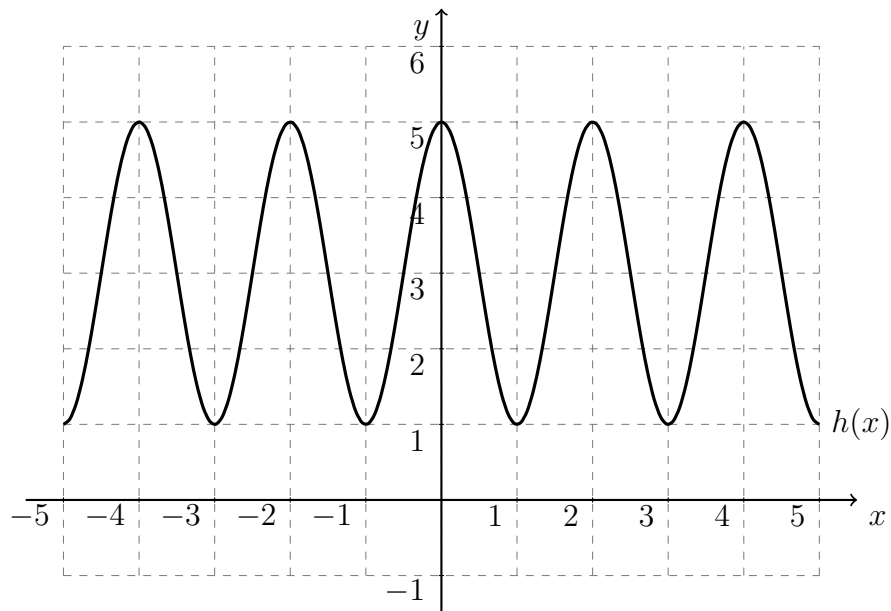
- (c) [5 pts] Determine the value of ϕ associated with the coordinate in the figure below. (Numerical answers should be to within 2 decimal digits.)



- (d) [5 pts] Determine the area of the shaded area below. The circle has a radius of three.

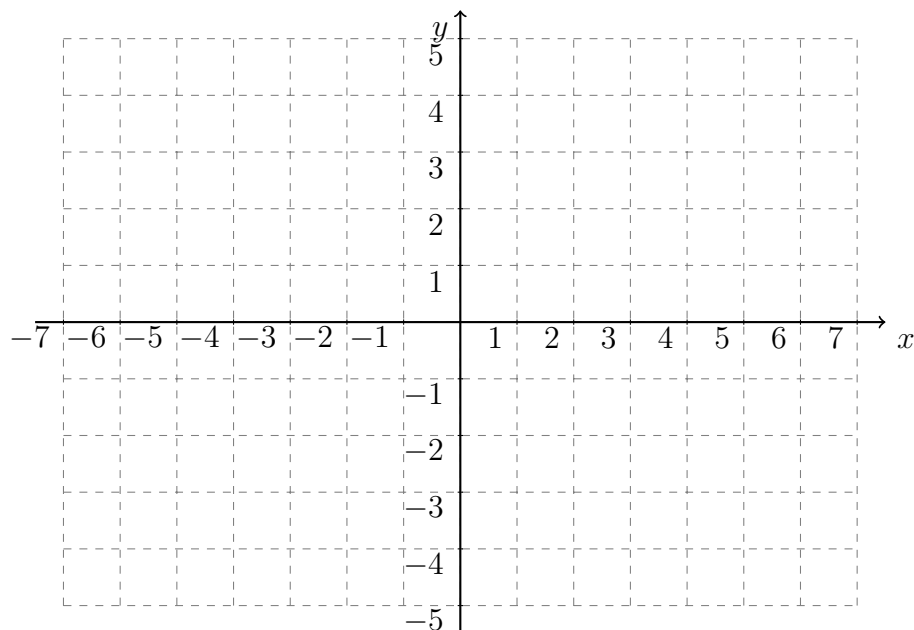


2. [6 pts] Determine a formula for the function below expressed as a sine function.



3. [6 pts] Use the axes below to make a sketch of the function

$$w(x) = 3 \cos\left(\frac{\pi}{2}x - \frac{\pi}{4}\right) - 2$$



4. Determine the **exact** values of each of the expressions below.

(a) [6 pts] $\sin(\arctan(0.22))$

_____ (Do not use a value from a calculator but derive the true value.)

(b) [6 pts] $\cos(\pi + \arcsin(x))$

_____ (Your answer should be a function of x .)

5. Two ants start at $(1, 0)$ and both begin to walk around the circle of radius one meter that is centered at the origin. They walk counter-clockwise around the circle. After a few minutes the first ant walks two meters and the second walks one meter.

_____ (a) [8 pts] Determine the angles associated with the ants' positions on the circle. (The angle should be measured from the positive x axis.)

(b) [8 pts] What quadrants are the ants located?

6. [10 pts] Show that the following relationship is an identity:

$$\sin(\theta) (1 + \tan^2(\theta)) = \tan(\theta) \sec(\theta).$$

Show your work and justify your conclusions.

7. [15 pts] Prince William stands atop the White Cliffs of Dover and waves at his true love, Kate. Kate is cleaning fish on a boat in the Channel. The cliff is 107 meters tall, and the angle of depression for the Prince's creepy gaze is six degrees. How far away is Kate from the base of the cliff?

8. [15 pts] A person is standing forty meters from the base of a building, and the person is looking directly at a point halfway to the top of the building. The angle of elevation is 38° .
_____ What will the angle of elevation be when the person is looking at the top of the building?

(5 points extra credit: show that in general it is not necessary to know the distance the person is standing from the base of the building to answer the question.)

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: _____