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: _____

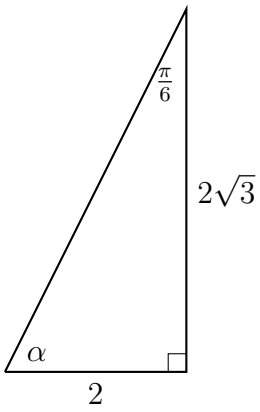
Problem Number	Points Possible	Points Made
1	15	
2	15	
3	15	
4	15	
5	15	
6	15	
7	10	
Total:	100	

- 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. For each diagram below determine the values of the requested quantities. All angles are in radians. (Figures are not drawn to scale.)

_____ (a) [7 pts]

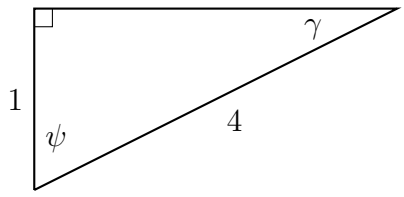


α =

$\sin(\alpha)$ =

$\tan(\alpha)$ =

_____ (b) [8 pts]



$\cos(\psi)$ =

$\sin(\psi)$ =

$\tan(\gamma)$ =

2. Given the information below determine the values of the requested quantities.

   (a) [7 pts] The point $(x, 0.3)$ is on the unit circle and in the first quadrant. Determine the value of x.

   (b) [8 pts] The point $(0.2, y)$ is on the unit circle, and the associated angle, θ, is formed by the angle in standard position whose terminal line goes through the point. The angle is between $\frac{3\pi}{2}$ and 2π radians. Determine the value of $\tan(\theta)$.

3. Given the angles in each question below, determine the values of their associated reference angles.

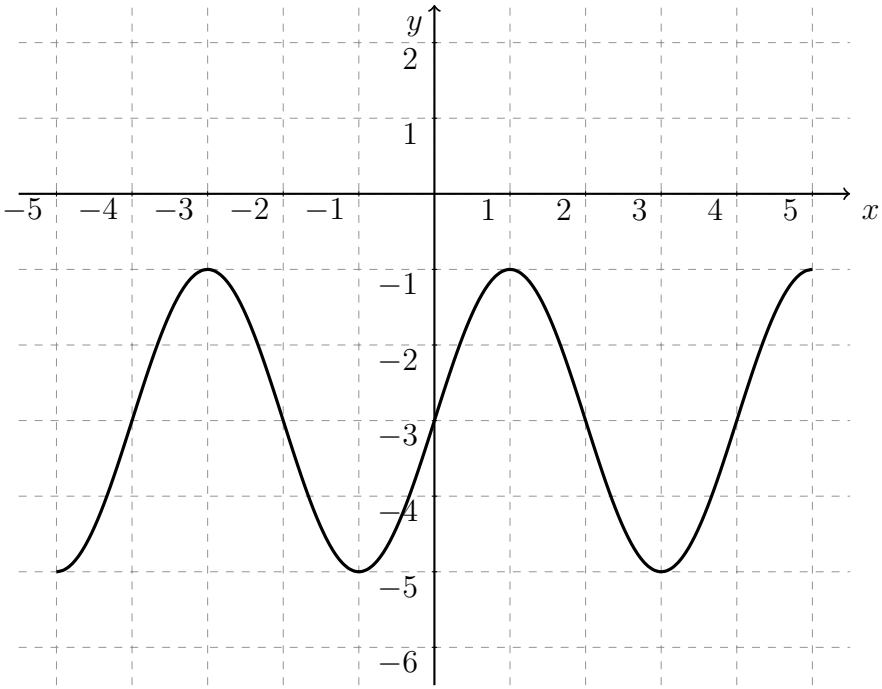
   (a) [7 pts] $\theta = \frac{5\pi}{6}$ radians.

   (b) [8 pts] $\theta = 3.5$ radians.

4. [15 pts] The function below is defined by

$$f(x) = A\cos(Bx - C) + D.$$

Determine the values of the constants A, B, C, and D where A and B are positive numbers.



A	$=$
B	$=$
C	$=$
D	$=$

5. A metronome is constructed to provide an audible and a visual cue for the tempo in a piece of music. Part of the metronome's construction includes a shaft with a weight on the shaft. The angle, in degrees, the shaft forms with a vertical line changes in time and is given by the formula

$$\text{Angle}(t) \;=\; 28\sin\left(\sqrt{\frac{9.8}{L}}\;\cdot\; t\right),$$

where L is the distance of the weight along the shaft and t is the time in seconds.

_____ (a) [6 pts] What is the minimum and maximum values for the angle?

_____ (b) [9 pts] The metronome will emit a click when it hits the minimal angle as well as when it hits the maximum angle. A musician wishes to play a piece of music so that there are 72 clicks per minute, at what length should she set the weight?

6. [15 pts] A track and field meet will have an area marked off where objects of destruction will be thrown. The area is the shape of a wedge (sector) with a radius of 150m, and objects are thrown from the vertex of the sector towards the outer arc. A line is drawn with a radius of 100m from the vertex which forms another sector within the larger sector, and there are two areas, the inner and outer area. Between events an official will walk around the outer area. How far will the official walk?

7. [10 pts] Verify that the following equation represents an identity:

$$\sin\left(\theta + \frac{\pi}{4}\right) + \sin\left(\theta - \frac{\pi}{4}\right) \;=\; \sqrt{2}\,\sin(\theta).$$

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: _____