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	0	
2	16	
3	16	
4	12	
5	6	
6	20	
7	10	
8	10	
9	10	
Total:	100	

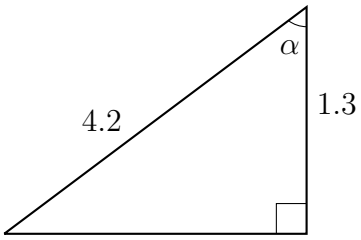
- If you need extra space use the last page.
- Please show your work. **An unjustified answer may receive little or no credit.**
- If you make use of a theorem to justify a conclusion then state the theorem used by name.
- Your work must be **neat**. If I can't read it (or can't find it), I can't grade 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:

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

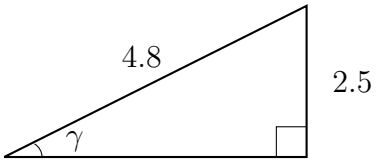
1. [2 Bonus] Common Knowledge: Who is the better sprinter, Elisa Balsamo or Lorena Wiebes?

2. Determine the numerical values of the requested quantities in each question below. All 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) [8 pts] Determine the value of the tangent of the angle α in the diagram below.

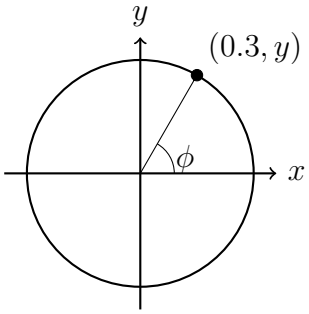


_____ (b) [8 pts] Determine the numerical value of the angle γ in radians in the diagram below.

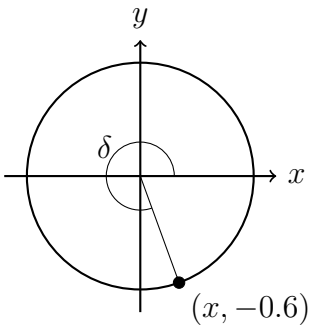


3. Determine the numerical values of the requested quantities in each question below. All values should be to within 0.01 of the true value. (**All angles are given in radians and should be expressed in radians if you have to determine their value**.)

_____ (a) [8 pts] Determine the value of $\sin(\phi)$ in the diagram below where the point shown is on the unit circle.



_____ (b) [8 pts] Determine the value of the angle δ in radians in the diagram below where the point shown is on the unit circle.



4. A company, Momma Jane's, will sell awful pizzas and will charge nine cents per square inch. The pizzas will have a diameter of sixteen inches and will be cut into slices. Each piece will be a sector with an angle θ.

_____ (a) [6 pts] Determine the price of each slice as a function of θ.

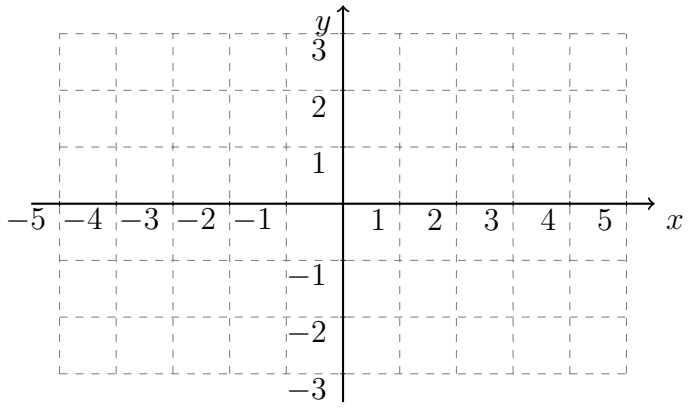
(b) [6 pts] If the price for a slice will be two dollars, what will be the angle θ?

_____

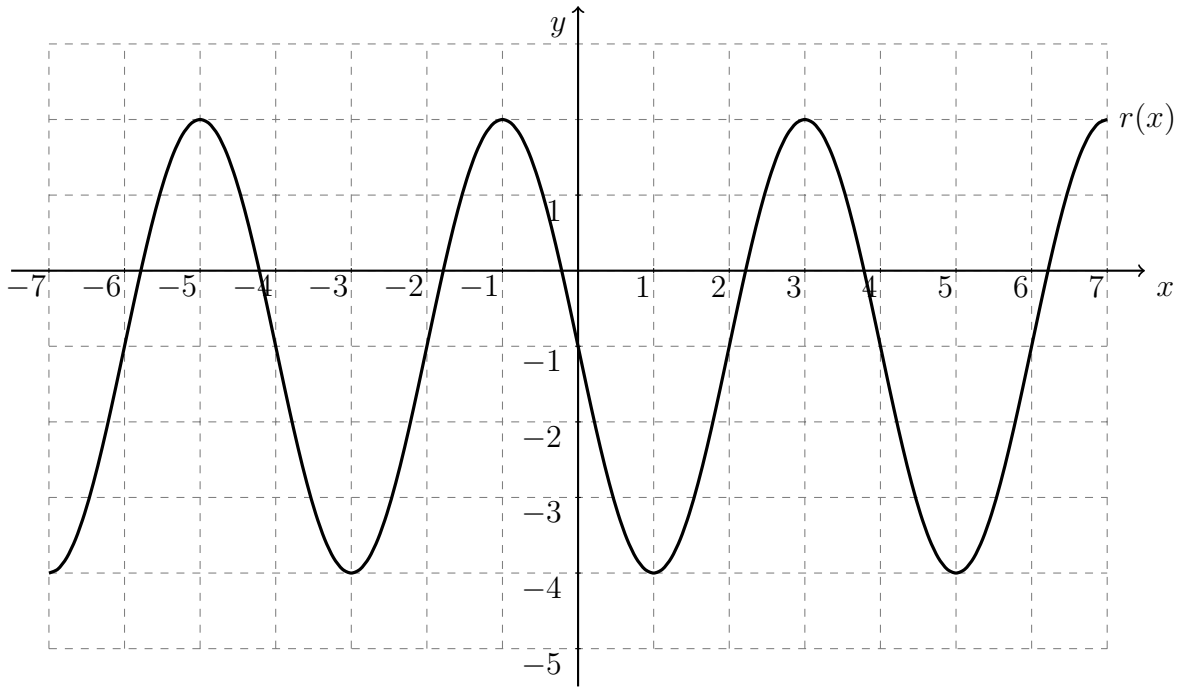
5. [6 pts] Determine the reference angle for $\theta = \frac{5\pi}{3}$.

6. (a) [10 pts] Use the axes below to make a sketch of the graph of the function

$$A(x) = \sin\left(\pi x + \frac{\pi}{2}\right) + 1$$



(b) [10 pts] Express the function whose graph is shown below as a sine function.



7. [10 pts] Show that the following equation is an identity,

$$\frac{1}{1+\sin(t)} + \frac{1}{1-\sin(t)} \quad = \quad 2\sec^2(t).$$

8. [10 pts] A surveyor stands on a road near Brasstown Bald, and the estimated straight line distance from where the surveyor is standing to the peak of the mountain is 4,605m. If the angle of elevation is 8° what is peak's vertical rise above the road?

9. [10 pts] An experiment will be conducted. An electrode will be inserted next to a frog's sciatic nerve[1]. The voltage in the electrode will vary, and the voltage at time t will be

$$V(t) = A\sin(\omega t).$$

It was reported that the sciatic nerve stopped functioning when the total difference between the maximum and the minimum voltage, $V(t)$, was between 3 and 4 volts and the period of oscillations was between 0.0002 and 0.0004 seconds. Assuming this is true, what are the possible set of values for A and ω that can be used in the experiment in order to stop the sciatic nerve from functioning?

[1]K.L. Kilgore, N. Bhadra, Reversible nerve conduction block using kilohertz frequency alternating current, Neuromodulation, 17 (2014), pp. 242-254.

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: _____