University of Georgia   Math 1113
Department of Mathematics   **Test 3**   Fall 2025

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: _____

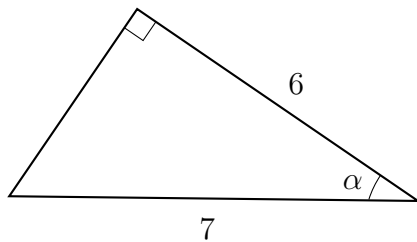Instructor's Name: _____   Class Time: _____

- 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**. This will make it easier to properly grade and give you the credit you deserve.

- 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:

$$\cos(\alpha + \beta) = \cos(\alpha)\cos(\beta) - \sin(\alpha)\sin(\beta),$$
$$\sin(\alpha + \beta) = \sin(\alpha)\cos(\beta) + \cos(\alpha)\sin(\beta).$$

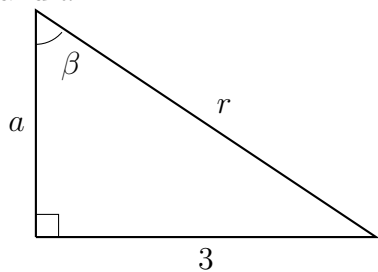| Problem Number	Points Possible	Points Made
1	0	
2	15	
3	25	
4	20	
5	10	
6	15	
7	15	
Total:	100	

1. [2 Bonus] Common Knowledge: Will Remco Evenepoel become a better GC contender after moving to Red Bull-Bora-Hansgrohe? (Provide a brief justification for your answer.)

2. Determine the values of the requested quantities in each question below. All values should be either exact or 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.**)

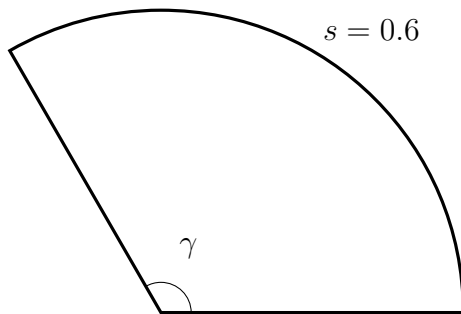(a) [7 pts] Determine the sine, cosine, and tangent of the angle α in the diagram below.

(b) [8 pts] The radian measure of the angle β is 0.4 radians. Determine the values of r and a.
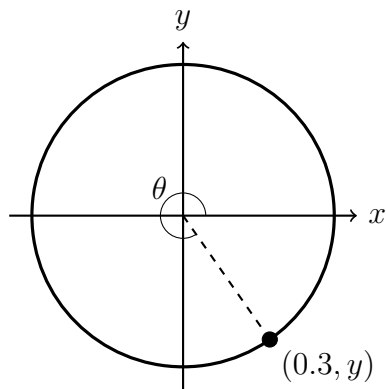
out of a possible 15 points

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

(a) [10 pts] A sector is shown below, and the angle subtended by the sector is γ. The radian measure of γ is $\frac{7\pi}{12}$ radians. Determine the radius of the sector as well as the area of the sector (Provide an exact answer. You do not have to "simplify" your answer.)

$s = 0.6$

γ

(b) [10 pts] The point $(0.3, y)$ lies on the unit circle as shown in the diagram below. Determine the value of y and the radian measure of the angle, θ.

y

θ

x

$(0.3, y)$

(c) [5 pts] Determine the reference angle associated with the angle whose radian measure is $\frac{6\pi}{7}$.

4. Determine the exact value of the requested quantity. Show your work and leave your answer as an exact expression and not a numerical approximation from a calculator. Do not just write an answer but show each step and provide a brief justification when a function is evaluated.

(a) [10 pts] Determine the value of $\sec(\phi)$ where $\tan(\phi) = 7.1$ and $\pi < \phi < \frac{3\pi}{2}$.
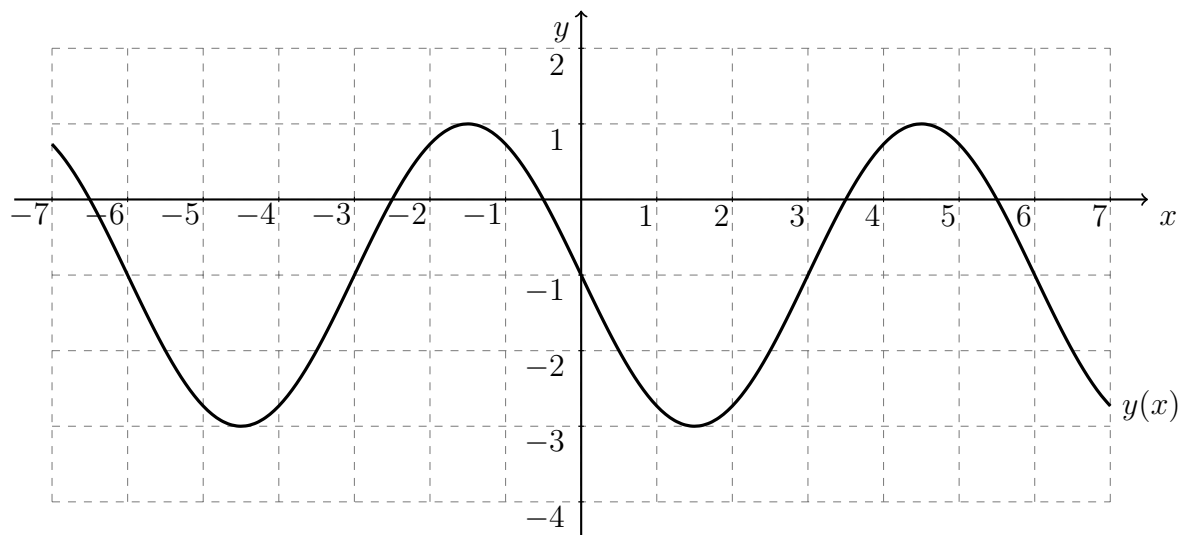
(b) [10 pts] Determine the value of $\cos(\arcsin(x))$ as a function of x, where $-1 \leq x \leq 1$. Your final expression should not have any trigonometric functions.

5. [10 pts] The track in the Barcelona velodrome has a high bank at both ends so that riders can maintain a high speed. The surface on the top of the bank forms an elevation angle of 41° (degrees). The top of the bank is 4.7 meters above the base of the track. What is the width of the track in the turns? (The width is measured as the part of the track the riders use.)

6. [15 pts] Express the function whose graph is shown below as a cosine function,

$$y(x) \;=\; A\cos(Bx + C) + D,$$

where $A > 0$ and $B > 0$.

A=

B=

C=

D=

7. [15 pts] A marine buoy floats on the surface of the water, and it rises and lowers in sync with the waves. The height of the buoy above the seafloor goes between 4m and 6m, and at the initial time the buoy is at the minimum level. The buoy rises and falls through two full cycles every 7 seconds. Determine a cosine function that approximates the height of the buoy above the seafloor as a function of the time in seconds.

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: _____

Points earned: _____
out of a possible 0 points