1. This is an open notes and open book quiz. You may also use resources available on ELC or the class website, as well as a calculator (although a calculator should not be necessary).
2. You may not use any other resources and may not consult with any person other than the course instructor.
3. **All answers should be exact**, i.e. no numerical approximations unless otherwise specified.
4. You are graded on your solution, but **more importantly you also graded on your supporting arguments and work you use to justify your answers**.
5. **Please submit your completed quiz on Gradescope by Friday, 2 April.**

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:

Name (sign): _____ Name (print): _____

---

1. (20 points) Let θ be some unknown abstract angle in the first quadrant.

    1. Write a **proportionality relationship** between the abstract angle θ, the number θ_D corresponding to measuring θ in degrees, and the number θ_R corresponding to measuring θ in radians.

    2. Suppose you make contact with an alien race, and they tell you that they refer to "1 revolution" around the circle as 7Π **AU** ("alien units"), where Π is some unknown alien constant. Write a formula that converts an angle θ_{AU} measured in alien units to θ_D in degrees, and a separate formula that converts θ_{AU} to θ_R in radians.

2. (20 points) Let θ be an abstract angle in the first quadrant.

   1. Let θ_R be the number corresponding to measuring θ in **radians**. Write down 2 new angles $\theta_{R1}, \theta_{R1}, \theta_{R3}$ measured in radians which are **coterminal** to θ_R.

   2. Let θ_D be the number corresponding to measuring θ in **degrees**. Write down 2 new angles $\theta_{D1}, \theta_{D1}, \theta_{D3}$ measured in degrees which are **coterminal** to θ_D.

3. (20 points) Let θ_R be an abtract angle in the first quadrant measured in radians.

    1. Draw a large, detailed diagram of the Cartesian plane with the following clearly labeled:
        (a) An origin O.
        (b) The coordinate axes $\hat{x}, \hat{y}$.
        (c) A circle C of unknown radius r.
        (d) A vector $\mathbf{p}(r, \theta_R)$ of length r at an angle of θ_R, starting at O and ending on the circle C.
        (e) The angle θ_R between $\vec{\mathbf{p}}(r, \theta_R)$ and the horizontal axis $\hat{x}$.
        (f) The circular arc $s(r, \theta_R)$ corresponding to $\vec{\mathbf{p}}(r, \theta_R)$.
        (g) The sector area $A(r, \theta)$ corresponding to $\vec{\mathbf{p}}(r, \theta_R)$.

2. Write a **proportionality relationship** that relates $\theta_R, s(r, \theta_R)$, and $A(r, \theta_R)$.

3. Suppose that we measure θ and find it to be $\theta_R = \pi/3$ in radians. Now supposing that $r = 1$ so we are on the unit circle, solve for the sector area $A(r, \theta_R)$ and arc length $s(r, \theta_R)$ corresponding to $\vec{\mathbf{p}}(r, \theta_R)$.

   Note: this should end up being a number with no unknowns! You do not need to evaluate this with a calculator, an exact answer is preferable.

You may continue your work for the previous question here.

4. (10 points) **(Extra Credit): Find a cool math video.**

   Note: if you did this on the last quiz, you can do it again! Just choose a different video.

   Find an online video which discusses a mathematical topic that might be of interest to people outside of a math class. This can be from sites like Youtube or other social media (provided it's publicly viewable).

   Write 3-4 precise sentences explaining or summarizing the mathematical idea, as though you were explaining it to a friend or relative. If you use words that fall under "mathematical vocabulary" or terminology, try to explain what those words mean.

   Here are a few places you can look to get started:

   1. Vihart
   2. Numberphile
   3. 3Blue1Brown
   4. Mathologer
   5. Stand-up Maths
   6. Henry Segerman
   7. Tipping Point Math