Time limit: 60 minutes.
Instructions: This test contains 10 short answer questions. All answers must be expressed in simplest form unless specified otherwise. Only answers written inside the boxes on the answer sheet will be considered for grading.
No calculators.

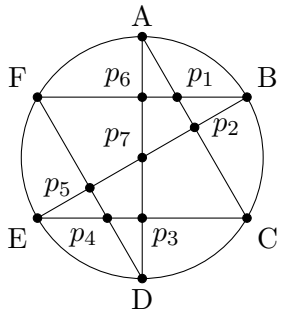
1. Clyde is making a Pacman sticker to put on his laptop. A Pacman sticker is a circular sticker of radius 3 in with a sector of 120° cut out. What is the perimeter of the Pacman sticker in inches?

2. In a right triangle, dropping an altitude to the hypotenuse divides the hypotenuse into two segments of length 2 and 3 respectively. What is the area of the triangle?

3. Consider a triangular pyramid $ABCD$ with equilateral base ABC of side length 1. $AD = BD = CD$ and $\angle ADB = \angle BDC = \angle ADC = 90°$. Find the volume of $ABCD$.

4. Suppose you have 15 circles of radius 1. Compute the side length of the smallest equilateral triangle that could possibly contain all the circles, if you are free to arrange them in any shape, provided they don't overlap.

5. Points $ABCDEF$ are evenly spaced on a unit circle and line segments AD, DF, FB, BE, EC, CA are drawn. The line segments intersect each other at seven points inside the circle. Denote these intersections $p_1, p_2, \ldots, p_7$, where p_7 is the center of the circle. What is the area of the 12-sided shape $Ap_1Bp_2Cp_3Dp_4Ep_5Fp_6$?



6. Consider the parallelogram $ABCD$ such that $CD = 8$ and $BC = 14$. The diagonals $\overline{AC}$ and $\overline{BD}$ intersect at E and $AC = 16$. Consider a point F on the segment $\overline{ED}$ with $FD = \frac{\sqrt{66}}{3}$. Compute CF.

7. Triangle ABC is isoceles with $AB = AC$. Point D lies on AB such that the inradius of ADC and the inradius of BDC both equal $\frac{3-\sqrt{3}}{2}$. The inradius of ABC equals 1. What is the length of BD?

8. In a triangle ABC, let D and E trisect BC, so $BD = DE = EC$. Let F be the point on AB such that $\dfrac{AF}{FB} = 2$, and G on AC such that $\dfrac{AG}{GC} = \dfrac{1}{2}$. Let P be the intersection of DG and EF, and X be the intersection of AP and BC. Find $\dfrac{BX}{XC}$.

9. In a triangle ABC, two angle trisectors of A intersect with BC at D and E respectively so that B, D, E, C comes in order. If we have $BD = 3$, $DE = 1$ and $EC = 2$, find $\angle DAE$.

10. A unit sphere is centered at $(0, 0, 1)$. There is a point light source located at $(1, 0, 4)$ that sends out light uniformly in every direction but is blocked by the sphere. What is the area of the sphere's shadow on the xy plane?