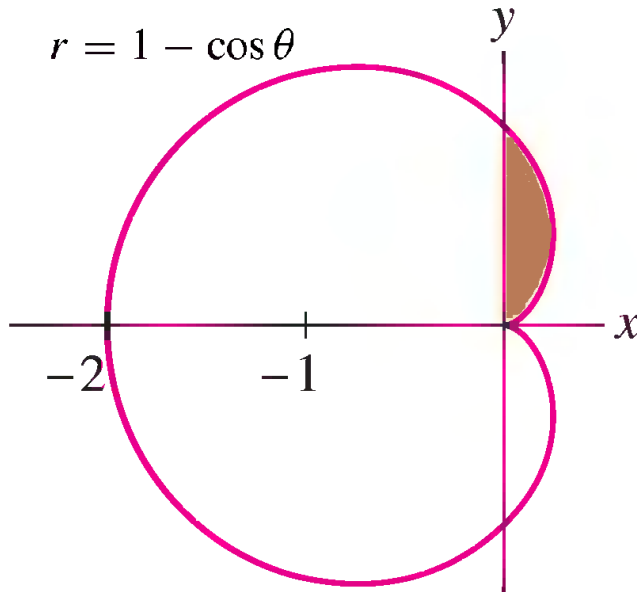


YOUR NAME: \_\_\_\_\_

George Voutsadakis

Read each problem **very carefully** before starting to solve it. Each problem is worth 10 points. It is necessary to show **all** your work. Correct answers without explanations are worth 0 points. GOOD LUCK!!

1. Compute the area of the shaded region in the following figure:



2. (a) Find a cartesian equation for the hyperbola in the standard position that has focus at  $F_1 = (10, 0)$  and one of whose asymptotes is  $y = \frac{4}{3}x$ .

- (b) Identify the conic with polar equation  $r = \frac{45}{9 + 5 \cos \theta}$ . Find its eccentricity, its focus and its directrix.

3. Find a unit vector along the direction of the component  $\mathbf{a}_\perp$  of  $\mathbf{a} = \langle 4, -1, 5 \rangle$  perpendicular to the vector  $\mathbf{b} = \langle 2, 1, 1 \rangle$ .

4. Find a system of parametric equations for the straight line passing through the point  $(1, 2, 3)$  that is perpendicular to the plane that is determined by the three points  $P = (1, 1, 1)$ ,  $Q = (1, 0, 7)$  and  $R = (5, -3, -2)$ .

5. Sketch the triangle with vertices  $P = (0, 0, 1)$ ,  $Q = (5, 5, 0)$  and  $R = (0, 3, 3)$  and compute its area using cross-products.

