Worksheet

For each problem construct an integral which solves the given problem.

Polar Area

1. Find the area enclosed in one loop of the four-leaf rose given by \( r = 3 \sin 2\theta \)

2. Find the area enclosed in one loop of the three-leaf rose given by \( r = 5 \sin 3\theta \)

3. Find the area the region which is inside the circle \( r = 4 \cos \theta \) but outside the circle \( r = 2 \)

Arc Length

1. Find the length of the curve given by \( y = f(x) = \frac{1}{3} \left( 2 + x^2 \right)^{\frac{3}{2}} + 1 \) where \( 0 \leq x \leq 3 \).
   Simplify the integrand, where possible.

2. Find the length of the curve given by \( y = f(x) = \frac{1}{3} x^3 + \frac{1}{4} x^{-1} \) where \( 1 \leq x \leq 4 \).
   Simplify the integrand where possible.

3. Find the length of the curve \( x^3 = y^2 \) from the point \((0,0)\) to the point \((4,8)\)

Surface Area

1. Find the surface area of the surface generated by revolving the arc given by
   \( y = f(x) = \frac{2}{3} x^{\frac{3}{2}} + 1 \), \( 0 \leq x \leq 4 \), about
   
   A. \( x \)-axis       B. \( y \)-axis

2. Find the surface area of the surface generated by revolving the arc given by
   \( y = f(x) = 4 - x^2 \), \( 0 \leq x \leq 2 \), about
   
   A. \( x \)-axis       B. \( y \)-axis
   
   C. Line \( x = -3 \)   D. Line \( y = 6 \)