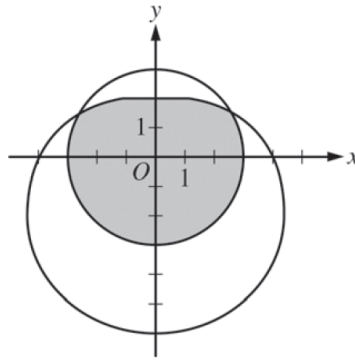


FRQ Practice: polar, volume, vector, arc length.

Calculator allowed: 2013

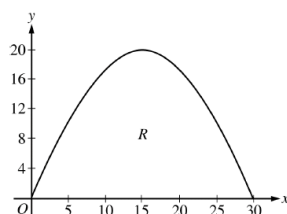


2. The graphs of the polar curves $r = 3$ and $r = 4 - 2\sin \theta$ are shown in the figure above. The curves intersect when $\theta = \frac{\pi}{6}$ and $\theta = \frac{5\pi}{6}$.
- (a) Let S be the shaded region that is inside the graph of $r = 3$ and also inside the graph of $r = 4 - 2\sin \theta$. Find the area of S .
 - (b) A particle moves along the polar curve $r = 4 - 2\sin \theta$ so that at time t seconds, $\theta = t^2$. Find the time t in the interval $1 \leq t \leq 2$ for which the x -coordinate of the particle's position is -1 .
 - (c) For the particle described in part (b), find the position vector in terms of t . Find the velocity vector at time $t = 1.5$.

Extra add ons:

- (d) Find the perimeter of the shaded region
- (e) Find the time when the particle described in part b has a speed of 5

Calculator allowed: 2009

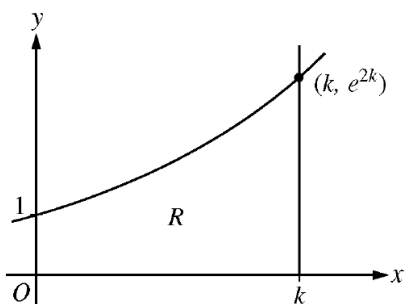


1. A baker is creating a birthday cake. The base of the cake is the region R in the first quadrant under the graph of $y = f(x)$ for $0 \leq x \leq 30$, where $f(x) = 20\sin\left(\frac{\pi x}{30}\right)$. Both x and y are measured in centimeters. The region R is shown in the figure above. The derivative of f is $f'(x) = \frac{2\pi}{3}\cos\left(\frac{\pi x}{30}\right)$.
 - (a) The region R is cut out of a 30-centimeter-by-20-centimeter rectangular sheet of cardboard, and the remaining cardboard is discarded. Find the area of the discarded cardboard.
 - (b) The cake is a solid with base R . Cross sections of the cake perpendicular to the x -axis are semicircles. If the baker uses 0.05 gram of unsweetened chocolate for each cubic centimeter of cake, how many grams of unsweetened chocolate will be in the cake?
 - (c) Find the perimeter of the base of the cake.

Add on for practice:

- (d) find the volume of the solid when region R is revolved around the y -axis.
- (e) find the volume of the solid when region R is revolved around the horizontal line $y=50$

No Calculator allowed: 2011



3. Let $f(x) = e^{2x}$. Let R be the region in the first quadrant bounded by the graph of f , the coordinate axes, and the vertical line $x = k$, where $k > 0$. The region R is shown in the figure above.
 - (a) Write, but do not evaluate, an expression involving an integral that gives the perimeter of R in terms of k .
 - (b) The region R is rotated about the x -axis to form a solid. Find the volume, V , of the solid in terms of k .
 - (c) The volume V , found in part (b), changes as k changes. If $\frac{dk}{dt} = \frac{1}{3}$, determine $\frac{dV}{dt}$ when $k = \frac{1}{2}$.