PRACTICE6 Name____________________________________ Section______

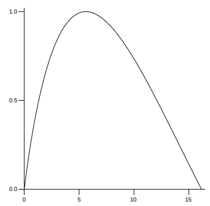
1. A ball rolls along a marked table and its position at any time can be determined by the parametric equations: $x(t) = t^3 - t^2$ and $y(t) = t^3 - 3t$. Determine $\frac{dy}{dx}$ when $t = 3$.

2. The paths $\vec{r_1}(t) = \langle t, t^2 \rangle$ and $\vec{r_2}(t) = \langle \sin(t), \sin(2t) \rangle$ intersect when $t = 0$. Determine the angle of intersection by determining the angle between their tangent vectors.

3. Determine the angle of intersection of the paths $\vec{r}(t) = \langle t^2 + t + 2, \sin(\sqrt{3}\,t) \rangle$ and $\vec{s}(t) = \langle 2e^{\sqrt{3}t}, 2t \rangle$ as they cross at the time $t = 0$ through the point $(2, 0)$.

4. Determine the arc length of the path $x(t) = e^t + e^{-t}$, $y(t) = 5 - 2t$ on $0 \le t \le 4$.

5. Determine the area bounded by the curve $x(t) = t^2 + 2t$, $y(t) = \sin(t)$ on $0 \le t \le \pi$.



6. Convert the given points or fuctions from polar to rectangular (Cartesian).

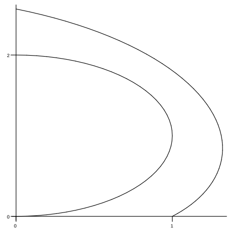
   (a) $(2, \pi) =$ ________________ $\left(3, \frac{2\pi}{3}\right) =$ ________________

   (b) $\left(4, -\frac{\pi}{6}\right) =$ ________________ $\left(-2, \frac{3\pi}{4}\right)$ ________________

   (c) $r = 4$

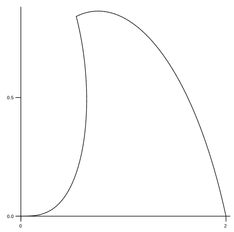
   (d) $r = 3\cos(\theta) + 3\sin(\theta)$ (multiply both sides by r)

7. Determine the area between the polar curves $r(\theta) = 1 + \theta$ and $r(\theta) = 2\sin(\theta)$ in the first quadrant.



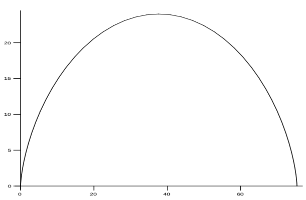
8. Determine the unit tangent vector to $r(\theta) = 2\sin\theta$ at $\theta = \dfrac{\pi}{6}$ and add it to the picture above. Note: $x(\theta) = r\cos\theta$ and $y(\theta) = r\sin\theta$.

9. Determine the area between the polar curves $r(t) = \sqrt{t}$ and $r(t) = 2 - t$ as shown.



10. When a bicycle wheel with radius 12 inches turns, the path that is taken by a spot on the tire is called a cycloid and its parametric equations are given as:

$$\begin{aligned} x(t) &= 12t - 12\sin t \\ y(t) &= 12 - 12\cos t \end{aligned}$$



Determine the arc length of one arch of the cycloid.