Calculus Homework Assignment 5

Class: ______________________________

Student Number: ______________________________

Name: ______________________________

1. Identify the symmetries of the curve $r = \sin\left(\frac{\theta}{2}\right)$. Then sketch the curves in the xy-plane.

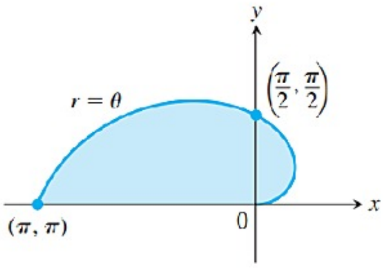
[§10.4 − 7]

2. Sketch the region defined by the inequalities

$$-1 \leq r \leq 2 \text{ ,and } -\frac{\pi}{2} \leq \theta \leq \frac{\pi}{2}.$$

[§10.4 − 29]

3. Find the areas of the blue regions. Which bounded by the spiral $r = \theta$ for $0 \leq \theta \leq \pi$.



[§10.5 − 1]

4. Find the lengths of polar curve

$$r = \theta^2,\ 0 \leq \theta \leq \sqrt{5}.$$

[§10.5 − 21]

5. Give the position vectors of particles moving along various curves in the xy-plane. In each case, find the particle's velocity and acceleration vectors at the stated times and sketch them as vectors on the curve. Motion on the circle $x^2 + y^2 = 1$.

$$\mathbf{r}(t) = (\sin t)\mathbf{i} + (\cos t)\mathbf{j}, \quad t = \frac{\pi}{4} \text{ and } \frac{\pi}{2}.$$

[§12.1 − 9]

6. As mentioned in the text, the tangent line to a smooth curve $r(t) = f(t)\mathbf{i} + g(t)\mathbf{j} + h(t)\mathbf{k}$ at $t = t_0$ is the line that passes through the point $(f(t0), g(t0), h(t0))$ parallel to $v(t_0)$, the curve's velocity vector at t_0. Find parametric equation for the line that is tangent to the given curve at the given parameter value $t = t_0$.

$$\mathbf{r}(t) = (\sin t)\mathbf{i} + (t^2 - \cos t)\mathbf{j} + e^t\mathbf{k}, \; t_0 = 0$$

[§12.1 − 23]

7. Evaluate the integral

$$\int_0^{\frac{\pi}{2}} \left[\cos t\mathbf{i} - \sin 2t\mathbf{j} + \sin^2 t\mathbf{k}\right] \, dt.$$

[§12.2 − 9]

8. At time $t = 0$, a particle is located at the point $(1, 2, 3)$. It travels in a straight line to the point $(4, 1, 4)$, has speed 2 at $(1, 2, 3)$ and constant acceleration $3\mathbf{i} - \mathbf{j} + \mathbf{k}$. Find an equation for the position vector $\mathbf{r}(t)$ of the particle at time t.

[§12.2 − 21]

(The end)