MATH 53 PRACTICE EXAM

For full credit, please show all your work and reasoning. Your work and explanations are your only representative when your work is being graded. Illegible, messy, and mysterious work could be perceived as an error that undermines the grader's ability to understand your work. If you add false statements to a correct argument, you will lose points.

(1) Solve for $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ for $x(t) = 2t+1$, $y(t) = t^3 - 3t + 4$, and find where the graph has horizontal tangents in the range $-2 \leq t \leq 2$.

(2) What is the equation of the intersection of the surface given by $\frac{x^2}{9} + \frac{y^2}{16} + \frac{z^2}{25} = 1$ with the xz-plane? What are the foci of this curve? Sketch the curve and surface on different graphs and label your axes.

(3) Find the area bounded in the first and second quadrant outside $r = \theta$ and inside $r = \pi - \sin\theta$ for $0 \leq \theta \leq \pi$. Sketch this bounded region. Hint: These two curves only intersect at $\theta = \pi$.

(4) Sketch the surfaces given by $x = (y+1)^2$ and $x^2+y^2 = 1$ in $\mathbb{R}^3$. Describe in words the intersection of these two surfaces and write down the parametric equations that describes the intersection.

(5) Find the area of one pedal defined by $r = 7\sin(2\theta)$.

(6) Find the equation of the plane containing the point $(2, 0, -3)$ and the line L given by $x(t) = 1+t$, $y(t) = 3 + 2t$, $z(t) = -t$.

(7) Since $\mathbf{u} \cdot \mathbf{v} = |\mathbf{u}||\mathbf{v}| \cos \theta$, show the inequality $|\mathbf{u} \cdot \mathbf{v}| \leq |\mathbf{u}||\mathbf{v}|$ holds for any vectors $\mathbf{u}$ and $\mathbf{v}$.