

For the curve defined by the parametric equations

$$x = t^3 - 3t, y = t^2 - 3$$

1. Find the points on the curve where the tangent line is horizontal and where the tangent line is vertical.
2. Find the slope of the tangent line at $(2, 1)$ hint: make sure to find t first.
3. Convert the rectangular coordinates $(-6, 6)$ to polar coordinates
4. Convert the polar coordinates $(2, -\frac{\pi}{3})$ to rectangular coordinates
5. Graph $r = 1 + 2 \cos(\theta)$ and label at least 6 points on the graph
6. Find the area enclosed by the inside loop of $r = 1 + 2 \cos(\theta)$
7. Find the equation of the ellipse with foci $(-2, 0), (2, 0)$ and vertices $(-3, 0), (3, 0)$
8. Find the vertices, foci, center, and eccentricity of the hyperbola $9x^2 - 36x - 16y^2 = 108$
9. Find the eccentricity, identify the conic, find the directrix of $r = \frac{5}{2 - 4 \cos(\theta)}$, then graph the conic in polar coordinates.