Read each question carefully and be sure to SHOW ALL WORK. Correct answer without proper justification will not receive a "Complete" grade. Paç fat! Good luck!

Name: _____

Polar/Parametric and Conic Sections Challenge. I can use polar, parametric and conic sections creatively in new situations that require a deep understanding of them.

Criteria for Success: I can solve conceptual questions related to Polar and Parametric equations that lie on the top half of Bloom's Taxonomy (analyze, evaluate, and create).

Question: A space rocket is moving with coordinates $x(t) = \dfrac{1-t^2}{1+t^2}$, $y(t) = \dfrac{t}{1+t^2}$, where t is measured in hours and the coordinates in miles.

(a) Compute the following quantities at $t = 1$:

(i) $x(t) =$

(ii) $y(t) =$

(iii) $x'(t) =$

(iv) $y'(t) =$

(v) $\dfrac{dy}{dx} =$

(vi) Speed =

(b) Interpret the meaning of the above rates of change related to the movement of the particle at $t = 1$, i.e., $x'(1), y'(1), \dfrac{dy}{dx}$, and speed.

(c) Eliminate the parameter t to find the Cartesian equation in the standard form $x^2 + 4y^2 = 1$. **Hint:** Solve for t^2 in terms of x and plug into y^2. See graph on Desmos: `https://www.desmos.com/calculator/ahg8qhvg8a`.

(d) Determine the type of conic section this graph represents, find the x and y intercept(s), the center, the focus(foci), directrix (if applicable), asymptotes (if applicable), and eccentricity.

(e) Consider a mirror in the shape of this conic section, and draw/describe the path of a light ray shot from the point $(0, 1/2)$ towards one of the focii for two bounces/reflections on the conic mirror.