

Exam #1
Math 275
February 24, 2000

Name _____

§1 Calculation

1. Graph the prolate cycloid $x(\theta) = \theta - 2 \sin \theta$, $y(\theta) = 1 - 2 \cos \theta$. Be sure that your graph illustrates all of the main features of the graph. Find (exactly!) the points at which the tangent line to the curve is vertical, and where it is horizontal.
2. Convert the polar equation $r = 3 \cos \theta$ into Cartesian form, and graph the result.
3. Find the area (exactly!) of the region common to the two regions bounded by the polar curves $r = -6 \cos \theta$ and $r = 2 - 2 \cos \theta$.
4. Let P be the point $(1,2,3)$, let Q be the point $(-1,-1,2)$, and let R be the point $(3,0,-1)$. What is the line through P and Q ? What is the equation of the plane through P , Q , and R ?
5. Identify and sketch the surface.
 - a. $4x^2 - 3y^2 + 12z^2 + 12 = 0$,
 - b. $x - y^2 - 4z^2 = 0$,
 - c. $3x^2 + y^2 + 9z^2 - 36 = 0$.

§2 Comprehension

6. What is the dot product of two vectors? What is the cross product of two vectors? Explain each algebraically and geometrically.
7. What is the projection of one vector onto another vector? Describe the geometry, and explain how to compute the projection. Include an example.
8. Use vectors to prove that the diagonals of a rhombus are perpendicular.

§3 Application

9. What is the distance from the plane $3x - y + 2z = 6$ and the point $(1,0,-4)$?
10. Find the equation of the plane containing the line through the points $(-4,-5,-3)$ and $(0,-1,2)$ that is parallel to the line through $(2,0,-3)$ and $(3,4,3)$. Use that information to find the distance between these two lines.