Math 126 - Spring 2011
Exam 1
April 21, 2011

Name: ______________________________

Section: ______________________________

Student ID Number: ______________________________

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- You are allowed to use a scientific calculator (**NO GRAPHING CALCULATORS**) and one **hand-written** 8.5 by 11 inch page of notes. Put your name on your sheet of notes and turn it in with the exam.
- Check that your exam contains all the problems listed above.
- Clearly put a box around your final answers and cross off any work that you don't want us to grade.
- Show your work. The correct answer with no supporting work may result in no credit. Guess and check methods are not sufficient, you must use appropriate methods from class.
- Unless otherwise indicated, your final answer should be given in exact form whenever possible and correct to two digits if given as a decimal.
- Cheating will not be tolerated. Keep your eyes on your exam!
- You have 50 minutes to complete the exam. Use your time effectively, spend less than 10 minutes on each page and make sure to leave plenty of time to look at every page. Leave nothing blank, show me what you know!

GOOD LUCK!

1. (14 pts) Consider the surface $z = x^2 + 2y^2$.

   (a) Describe the traces parallel to the given plane (no work needed, just circle your answer).

      i. Parallel to the yz-plane (when x is fixed):
      PARABOLAS CIRCLES ELLIPSES HYPERBOLAS NONE OF THESE

      ii. Parallel to the xz-plane (when y is fixed):
      PARABOLAS CIRCLES ELLIPSES HYPERBOLAS NONE OF THESE

      iii. Parallel to the xy-plane (when z is fixed, $z > 0$):
      PARABOLAS CIRCLES ELLIPSES HYPERBOLAS NONE OF THESE

   (b) Clearly circle the name of the surface given by $z = x^2 + 2y^2$:

CONE	SPHERE	ELLIPSOID
PARABOLIC CYLINDER	CIRCULAR CYLINDER	ELLIPTICAL CYLINDER
HYPERBOLIC CYLINDER	HYPERBOLOID	CIRCULAR PARABOLOID
ELLIPTIC PARABOLOID	HYPERBOLIC PARABOLOID	NONE OF THESE

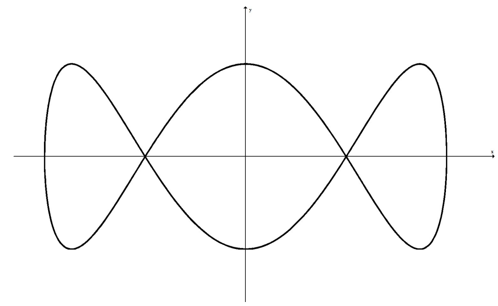
   (c) A plane, P, is determined by the points P(0,1,7), Q(-3,2,4), and R(1,3,8). A beam of light follows a straight-line path that passed through the point $(0, 1, 4)$ and is orthogonal to the plane, P. Find the two points when the path of the beam of light intersects the surfaces $z = x^2 + 2y^2$.

2. (12 points) Olivo is running on a path. His location (x, y) (each in feet) at time t seconds is given by the vector function

$$\mathbf{r}(t) = \langle x(t), y(t) \rangle = \langle \cos(\pi t),\ \sin(3\pi t) \rangle .$$

(a) Calculate the following quantities at $t = 1/6$.

- $(x(1/6), y(1/6)) =$

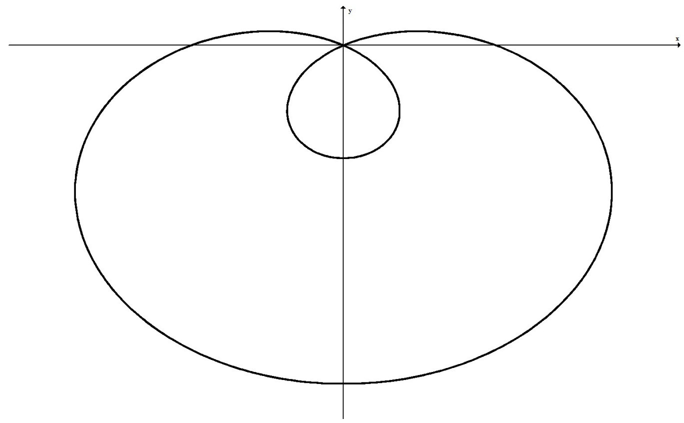


- $\dfrac{dy}{dx} =$

- $\dfrac{d^2y}{dx^2} =$

(b) Find Olivo's speed at the first positive time he passes through the point $(x, y) = (\frac{1}{2}, 0)$. (Recall: Speed is the magnitude of the velocity/derivative vector)

3. (12 pts) Consider the polar curve given by the equation $r = 3 - 6\sin(\theta)$. The graph of the curve is given below.



(a) The curve intersects the origin at two different values of θ (for $0 \le \theta < 2\pi$). Find the equations for the tangent lines to the curve at both of these values of θ. Put your answers in the form $y = mx + b$.

(b) Give all four (x, y)-coordinates at which the curve has a horizontal tangent. (Hint: You can get (x, y) without explicitly calculating θ.)

4. (12 points) The motion of a particular fly in three-dimensions is described by the vector position function $\mathbf{r}(t) = \langle t^2, 3t + 6, -2t^2 \rangle$.

   (a) Find the curvature at $t = 0$.

   (b) Find all points on the curve at which the tangent line at that point also travels through the origin.