Zworski - Fall 2014

NAME: STUDENT ID:

MATH 53 1st MIDTERM

Please answer each question on a separate page – you can write on the back of the page. Remember to write your name and section number on EVERY page you turn in. Thanks! Good Luck!

Problem 1. Let $\mathbf{a}$ and $\mathbf{b}$ be two vectors.

a) Simplify the expression $(\mathbf{a}+\mathbf{b}) \times \mathbf{a}$.

b) Suppose that $\mathbf{a} = \langle 2, 6, 2\rangle$ and $\mathbf{b} = \langle -1, 1, -1\rangle$. What is the area of the triangle with sides $\mathbf{a}$, $\mathbf{b}$, and $\mathbf{b} - \mathbf{a}$?

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Problem 2. Determine the type (ellipsoid, paraboloid etc.) of the following quadric: $xy - z^2 + 1 = 0$. Sketch the intersections of this quadric with the planes $x = 0$, $y = 0$, and $z = 0$.

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Problem 3. Sketch the curve, $r = 4\cos\theta - \sec\theta$, $-\pi/2 < \theta < \pi/2$, and find the area enclosed by its loop. (Note that you have to find the limits in θ corresponding to the loop; recall that $\cos(\pi/3) = 1/2$.)

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Problem 4. Match the following planar curves to their parametrization, with $-4 \leq t \leq 4$:

a) $x = \cos(5t)$, $y = \sin^2(3t) + t\cos(2t)$;

b) $x = t^2$, $y = \sin(t^3)$;

c) $x = (e^t - e^{-t})\sin(5t)/2$, $y = (e^t + e^{-t})\cos(5t)/2 + 10e^{-0.2t}\sin(5t)$;

d) $x = \sin(5t)$, $y = \sin^2(3t) + |t|\cos(2t)$.

Please do not guess: negative points will be given for wrong matches. We have three versions of the exam with different arrangements of answers!

Figure I

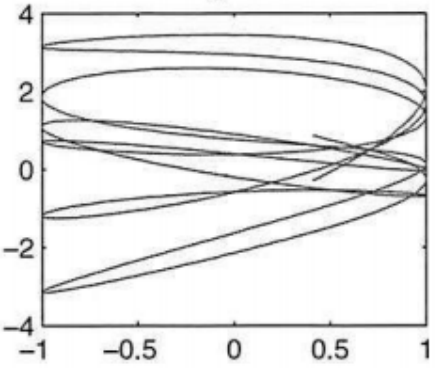

Figure II

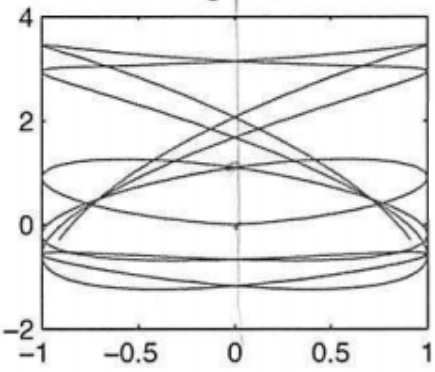

Figure III

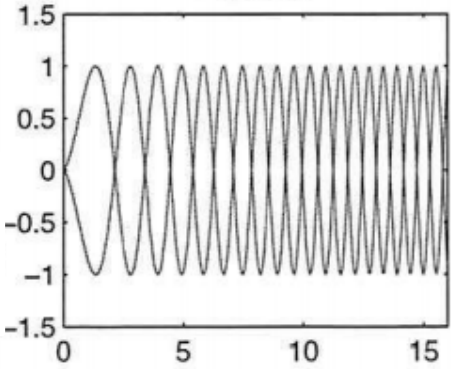

Figure IV