Math 53 Homework 1

Due Wednesday 1/27/16 in section

Important notes:

• Homework assignments for this class can be lengthy, but a lot of practice solving problems is essential for learning the material. Be organized, and don't leave things for a marathon session on Tuesday night. Instead, get a good start on the homework over the weekend (or even earlier!) so you can ask questions in discussion on Monday.

• You may check your answers to odd-numbered problems in the back of the book, but you need to turn in solutions, not just answers. You may discuss the homework problems with your classmates, but **you must write your solutions on your own**. I am aware that it is not hard to find solutions manuals on the internet. Copying said solutions on a homework assignment will result in a negative grade for that assignment. (It also won't help you learn the material).

• The problems in parentheses are for extra practice and **optional**. You only need to turn in the underlined problems.

• Bonus problems are substantially harder and worth a small amount of extra credit. You're better off starting with the regular problems first.

• Page and problem numbers refer to the 8th edition of Stewart. When there is a difference, footnotes give the numbers for the 6th and 7th editions.

Wednesday 1/20 – Parametric equations

• **Read:** section 10.1; section 10.2 to end of Example 2.

• **Work:** 10.1: (9), (11), <u>13</u>, <u>19</u>[1], (21), (24), <u>31</u>, <u>33</u>, (37), (41), <u>45</u>.

10.2: (3), <u>7</u>, (17), <u>73</u>.

Friday 1/22 – Parametric equations continued; Polar coordinates

• **Read:** section 10.2 to end of Example 5; section 10.3.

• **Work:** 10.2: (31), <u>32</u>, (33), <u>41</u>, (43), (51), (53).

<u>Problems 1 and 2</u> (next page).

<u>Problem 3</u>.

10.3: (11), (25), (29), (37), (49), <u>51</u>, <u>61</u>, (65), (73).[2]

[1] **6th and 7th eds:** do the 8th ed problem: $x = 5 + 2\cos \pi t$, $y = 3 + 2\sin \pi t$, $1 \leq t \leq 2$.

[2] **6th ed:** 10.3: (11), (25), (31), (37), (51), <u>53</u>, <u>63</u>, (69), (77). **7th ed:** same as 8th ed.

Problem 1. Consider the parametric curve given by: $x = 2\cos t$, $y = \sin 2t$.

a) Find the points on the curve where the tangent is horizontal or vertical.

b) Show that the curve has two tangents at $(0, 0)$ and find their equations.

c) Sketch the curve.

d) Calculate the total area enclosed by the curve.

Problem 2. One circle has radius a and center at the origin. A second circle of same radius a has a point P marked on it, which is initially at $(a, 0)$. The second circle rolls without slipping counterclockwise around the first, until it has returned to its starting position.

a) Write parametric equations for the motion of P, using as parameter θ, the angle by which the contact point has turned.

(Hint: first find the position of the center of the moving circle; then determine the distance and direction from the center to P. If you have trouble visualizing the problem, try it out experimentally with two coins).

b) Find the length of the trajectory of P. (Hint: the integrand simplifies to a constant times $\sqrt{2 - 2\cos\theta}$; use the half angle $\theta/2$ for further simplification.)

Problem 3. For each of the given curves, find a Cartesian equation for it, and sketch it.

a) $r = 3\sin\theta$. b) $r = \csc\theta$. c) $\theta = -\pi/3$. d) $r^2 - 3r + 2 = 0$.