MATH 214 (R1) Winter 2008
Intermediate Calculus I

Problem Set #5

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Question 1. **[Sec. 11.1, # 10]** Given the parametric equations $x = t^2,\ y = t^3$

(a) Sketch the curve by using the parametric equations to plot points. Indicate with an arrow the direction in which the curve is traced as t increases.

(b) Eliminate the parameter to find a Cartesian equation of the curve.

Question 2. **[Sec. 11.1, # 12]** Given the parametric equations

$$x = 4\cos\theta, \quad y = 5\sin\theta, \quad -\pi/2 \le \theta \le \pi/2$$

(a) Eliminate the parameter to find a Cartesian equation of the curve.

(b) Sketch the curve and indicate with an arrow the direction in which the curve is traced as the parameter increases.

Question 3. **[Sec. 11.1, # 16]** Given the parametric equations

$$x = \ln t, \quad y = \sqrt{t}, \quad t \ge 1$$

(a) Eliminate the parameter to find a Cartesian equation of the curve.

(b) Sketch the curve and indicate with an arrow the direction in which the curve is traced as the parameter increases.

Question 4. **[Sec. 11.1, # 22]** Describe the position of a particle with position (x, y) where

$$x = \cos^2 t, \quad y = \cos t, \quad 0 \le t \le 4\pi$$

as t varies in the given interval.

Question 5. **[Sec. 11.2, # 8]** Find an equation of the tangent to the curve

$$x = \tan\theta, \quad y = \sec\theta$$

at the point $(1, \sqrt{2})$ by 2 methods: (a) without eliminating the parameter and (b) by first eliminating the parameter.

Question 6. **[Sec. 11.2, # 16]** Find $\dfrac{dy}{dx}$ and $\dfrac{d^2y}{dx^2}$ if $x = \cos 2t,\ y = \cos t,\ 0 < t < \pi$. For which values of t is the curve concave upward?

Question 7. **[Sec. 11.2, # 18]** Find the points on the curve

$$x = 2t^3 + 3t^2 - 12t,\ y = 2t^3 + 3t^2 + 1$$

where the tangent is horizontal or vertical.

Question 8. **[Sec. 11.2, # 34]** Find the area of the region enclosed by the astroid

$$x = a\cos^3\theta, \quad y = a\sin^3\theta.$$

Question 9. **[Sec. 11.2, # 44]** Find the length of the curve

$$x = e^t + e^{-t}, \quad y = 5 - 2t, \quad 0 \le t \le 3.$$

Question 10. **[Sec. 11.2, # 60]** Find the area of the surface obtained by rotating the curve

$$x = 3t - t^3, \quad y = 3t^2, \quad 0 \le t \le 1$$

about the x-axis.

Question 11. **[Sec. 11.2, # 66]** Find the surface area generated by rotating the curve

$$x = e^t - t, \quad y = 4e^{t/2}, \quad 0 \le t \le 1$$

about the y-axis.