Ch 11 Study Guide Your Name: _____ Class: 9am / 1pm

Calculus III - Math 2630 - Spring 2013 Instructor: Steven Clontz

Draw a box around your answer. Show your work. Calculators not allowed.

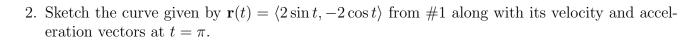
1. Find the velocity and acceleration functions associated with the position function

$$\mathbf{r}(t) = \langle 2\sin t, -2\cos t \rangle$$

which corresponds to the circle

$$x^2 + y^2 = 4$$

- (a) Compute correct velocity function (5 points)
- (b) Compute correct acceleration function (5 points)



- (a) Sketch correct curve (2 points)
- (b) Mark $t = \pi$ accurately (2 points)
- (c) Sketch v correctly (3 points)
- (d) Sketch a correctly (3 points)

- 3. Evaluate $\int_0^{\pi/4} (\sec^2 t) \mathbf{i} + (6) \mathbf{j} + (e^t) \mathbf{k} dt.$
 - (a) (3, 6, or 10 points for 1, 2, or 3 correctly evallated components)

4.	Find $\mathbf{r}(t)$	given $\mathbf{r}'(t) =$	$\langle 2t, 2t - t^2, 2e^{2t} \rangle$	and $\mathbf{r}(0) = (0, 7, -1)$.

(a) (3, 6, or 10 points for 1, 2, or 3 correctly evaulated components)

- 5. Assume g = 10 m/s². What is the flight time of a projectile launched from the ground with an initial speed of 100 m/s and launch angle of $\frac{\pi}{6}$?
 - If using formula:
 - (a) Write correct formula (2 points)
 - (b) Compute corect answer (8 points)
 - If using calculus:
 - (a) Write correct position function (2 points)
 - (b) Attempt to use correct method to find answer (6 points)
 - (c) Compute correct answer (2 points)

- 6. Give the length of the arc on the curve $\mathbf{r}(t) = \langle 3\sin t, -4t, 3\cos t \rangle$ between t = 0 and t = 1.
 - (a) Use arclength formula $\int_{a}^{b} |\mathbf{v}(t)| dt$ (2 points)
 - (b) Compute $\mathbf{v}(t)$ correctly (2 points)
 - (c) Simplify $|\mathbf{v}(t)|$ correctly (3 points)
 - (d) Compute arclength correctly (3 points)

- 7. Write the equation of the circle of curvature to a curve at a point (4,0) with curvature $\frac{1}{10}$ and normal vector $\mathbf{N} = \left\langle -\frac{3}{5}, \frac{4}{5} \right\rangle$.
 - (a) Calculate the radius $a = \frac{1}{\kappa}$ correctly (3 points)
 - (b) Calculate the center $\langle x_0, y_0 \rangle = \mathbf{r}(t_0) + a\mathbf{N}$ correctly (3 points)
 - (c) Write a correct equation for the circle (4 points)

8. Find **T**, **N** for $\mathbf{r}(t) = \langle 3\sin t, -4t, 3\cos t \rangle$.

- (a) Compute **v** correctly (2 points)
- (b) Compute T correctly (3 points)
- (c) Compute $\frac{d\mathbf{T}}{dt}$ correctly (2 points)
- (d) Compute ${\bf N}$ correctly (3 points)

- 9. Given a point (1, 1, 0) on a curve where $\mathbf{v} = \left\langle \frac{3\sqrt{2}}{2}, -4, -\frac{3\sqrt{2}}{2} \right\rangle$, $\frac{d\mathbf{T}}{dt} = \left\langle -\frac{3\sqrt{2}}{10}, 0, -\frac{3\sqrt{2}}{10} \right\rangle$, $\mathbf{N} = \left\langle -\frac{\sqrt{2}}{2}, 0, -\frac{\sqrt{2}}{2} \right\rangle$, $\frac{d\mathbf{B}}{dt} = \left\langle -\frac{4\sqrt{2}}{5}, 0, -\frac{4\sqrt{2}}{5} \right\rangle$, compute κ , τ , and \mathbf{B} at that point.
 - (a) Write a correct formula for each of κ , τ , and **B** (1, 2, or 4 points)
 - (b) Compute κ , τ , and **B** correctly (2, 4, or 6 points)

- 10. Given the polar parametric equations $r(t) = 2 \cos t$ and $\theta(t) = 2t$, find \mathbf{v} in terms of \mathbf{u}_r and \mathbf{u}_{θ} at t = 0.
 - (a) Write correct formula $\mathbf{v} = \dot{r}\mathbf{u}_r + r\dot{\theta}\mathbf{u}_{\theta}$ (2 points)
 - (b) Compute \dot{r} correctly (3 points)
 - (c) Compute $\dot{\theta}$ correctly (3 points)
 - (d) Compute correct expression for ${\bf v}$ (2 points)

Include extra scratch work below:

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