

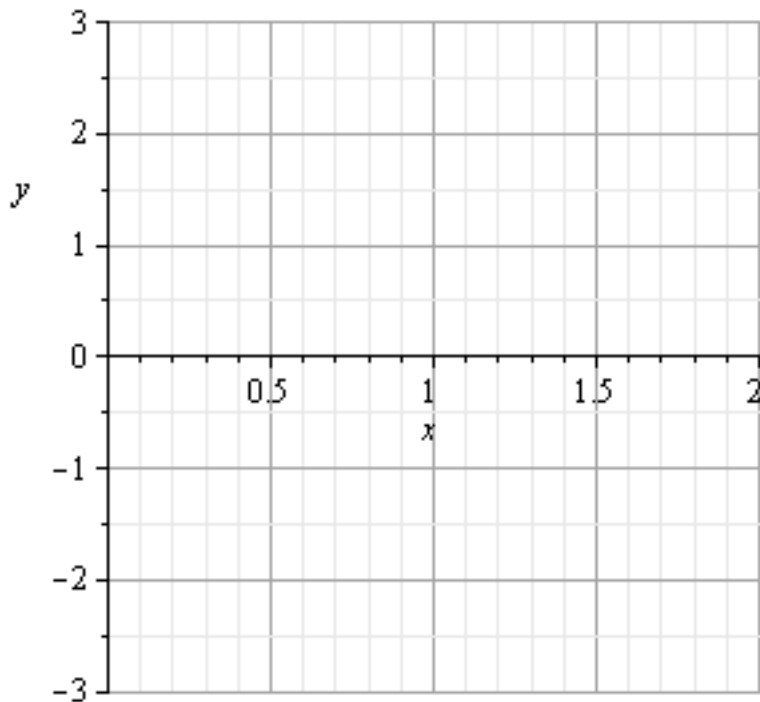
Name: \_\_\_\_\_

**Math 235 - Calculus III - Spring 2012**

**Exam 2**

INSTRUCTIONS: Show all your work to receive full credit. Books and notes are not allowed.

1. (10 points) Sketch the graph of  $\mathbf{r}(t) = t\mathbf{i} + (2 - t/2)\mathbf{j}$



2. (12 points) Find an arc length parametrization of  $\mathbf{r}(t) = e^t \cos t \mathbf{i} + e^t \sin t \mathbf{j}$ ;  $0 \leq t \leq \pi/2$

3. (34 points)

(a) (12 points) Solve the initial value problem  $\mathbf{r}'(t) = \mathbf{i} + e^t\mathbf{j}$ ,  $\mathbf{r}(0) = \mathbf{i} + \mathbf{j}$

(b) (10 points) Find the equation of the tangent line to the curve when  $t = \ln 2$

(c) (12 points) Calculate  $\mathbf{T}(t)$  and  $\mathbf{N}(t)$  for the function  $\mathbf{r}(t)$  at  $t = \ln 2$

4. (4 points each) Answer true or false
- (a) A circle of radius 3 has constant curvature  $1/3$
  - (b) If the vector-valued function  $\mathbf{r}(t)$  describes the motion of an object over the time interval  $[a, b]$ , then the displacement of the object over that time interval is the arc length of  $\mathbf{r}(t)$  over that time interval.
  - (c) If  $f(x, y) \rightarrow L$  as  $(x, y)$  approaches  $(0, 0)$  along the  $x$ -axis and  $f(x, y) \rightarrow L$  as  $(x, y)$  approaches  $(0, 0)$  along the  $y$ -axis then  $\lim_{(x,y) \rightarrow (0,0)} f(x, y) = L$
5. (12 points) A shell is fired from ground level at an elevation angle of  $45^\circ$ . If the shell hits the ground 24,500 feet away, what is its muzzle speed?

6. (10 points) The equation of motion of an object moving along an elliptic path is  $\mathbf{r}(t) = a \cos t \mathbf{i} + b \sin t \mathbf{j}$ . Show that the acceleration is directed toward the origin.

7. (10 points) Find the level curve of the function  $f(x, y) = x^2 - 2x^3 + 3xy$  that passes through the point  $(2, -1)$