Math 210 – Fall 2014 Name: _____

Midterm Exam 1
Duration: 2 hours
Total: 100 points

The following rules apply:

- You are expected to abide by the University's rules concerning Academic Honesty.
- You may *not* use your books, notes, or any electronic device including cell phones.
- You must show all of your work. An answer, right or wrong, without the proper justification will receive little to no credit.
- You must complete your work in the space provided.

Check next to your instructor:

Kobotis	
Slutskyy	
Dai	
Xie @ 11am	
Xie @ noon	
Heard	
Steenbergen @ noon	
Steenbergen @ 2pm	
Woolf	
Cheskidov	
Shvydkoy	

Problem	Points	Score
1	6	
2	9	
3	10	
4	10	
5	15	
6	5	
7	15	
8	10	
9	10	
10	10	
Total	100	

(6 pts) **1.** Two vectors are given by $\mathbf{u} = \langle 1, 1\rangle$, $\mathbf{v} = \langle -1, 2\rangle$. Draw the vectors on a coordinate grid. Find coordinates of the vectors $\mathbf{u}+\mathbf{v}$, $\mathbf{u}-\mathbf{v}$ and plot this couple of vectors on the same grid.

(9 pts) **2.** For each of the couples below determine whether the angle between the vectors is acute, obtuse, or right?

(a) $\mathbf{u} = \langle 3, 1, 2\rangle$, $\mathbf{v} = \langle -1, 0, 1\rangle$.

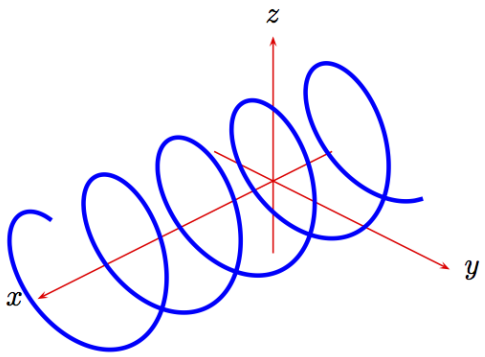
(b) $\mathbf{u} = 4\mathbf{i} - 2\mathbf{j}$, $\mathbf{v} = -\mathbf{j} + \mathbf{k}$.

(c) $\mathbf{u} = \langle -\frac{1}{2}, 3\rangle$, $\mathbf{v} = \langle 2, \frac{1}{3}\rangle$.

(10 pts) **3.** Find an equation of the line perpendicular to two vectors $\mathbf{u} = \langle 1, 1, 4 \rangle$, $\mathbf{v} = \langle 0, -1, 2 \rangle$ and passing through the point $P(0, 1, 3)$.

(10 pts) **4.** Find an equation of the tangent line to the curve $\mathbf{r}(t) = \langle \frac{2}{t}, t, 2 \rangle$ at the point $t = 1$.

(15 pts) **5.** Find the area of the triangle with vertices at $P(1, 0, 2)$, $Q(3, 1, 0)$, $R(0, 0, 2)$.



(5 pts) **6.** Determine which one of these equations fits best for the curve pictured above. Explain your reasons, do not just give a guess.

(a) $\mathbf{r}(t) = \langle \cos t, \sin t, 3t \rangle$,

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

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

(d) $\mathbf{r}(t) = \langle t, 1 + t, -3t \rangle$.

(15 pts) **7.** An object is hit at 8 feet from the ground with an initial velocity $\mathbf{v}_0 = \langle 2, 8 \rangle \frac{ft}{s}$. Assuming $g = 32 \frac{ft}{s^2}$ answer the following questions:

(a) Write down a parametric equation of the trajectory.

(b) Determine the time of flight and range of the object.

(c) What was the maximum hight of the object during its flight?

(10 pts) **8.** Find the arc length of the curve given by

$$\mathbf{r}(t) = \left\langle \frac{t^2}{2}, \frac{t^3}{3} \right\rangle,$$

on the range $0 \leq t \leq 1$.

(10 pts) **9.** For the curve given by

$$\mathbf{r}(t) = \langle e^t, \sqrt{2}t, e^{-t} \rangle,$$

compute the curvature at $t = 0$.

(10 pts) **10.** Find the principal unit normal vector at time t to the curve

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