DO NOT WRITE ABOVE THIS LINE!!

MATH 210 Exam 1

October 03, 2019

Directions. Fill in each of the lines below. Then read the directions that follow before beginning the exam. YOU MAY NOT OPEN THE EXAM UNTIL TOLD TO DO SO BY YOUR INSTRUCTOR.

- All of your work must fit within the boxes. Nothing outside of the box will be graded!

Name (print) _____

netid _____ **UIN** _____

- A solution for one problem may not go on another page.
- Show all your work. Unjustified answers are not correct. Make clear what your final answer is.
- Have your student ID ready to be checked when submitting your exam.

Check next to your instructor's name (and lecture time, if applicable):

Abramov 11AM		Sparber 2PM		Einstein 1PM	
Sparber 1PM		Kobotis 8AM		Lear 10AM	
Hamdan 4PM		Dai 11AM		Pourarian 1PM	
Greenblatt 12PM		Kashcheyeva 3PM		Chow 10AM	
Pourarian 3PM		Einstein 2PM		Whyte 12PM	
Shulman 9AM		Lear 9AM		Switala 2PM	
Michelen 2PM		Datta 1PM		Hamdan 5PM	
Chu 11AM		Switala 9AM		Protsak 10AM	
Datta 2PM					

Write solution only inside the box

1. **(15pt)** Let $\mathbf{u} = \langle 1, 3, -2 \rangle$ and $\mathbf{v} = \langle 1, 1, -1 \rangle$.

(a) Find the projection of $\mathbf{u}$ onto $\mathbf{v}$ and call this vector $\mathbf{w}$.

(b) Find the vector $\mathbf{u} - \mathbf{w}$.

(c) Show that $\mathbf{u} - \mathbf{w}$ is orthogonal to $\mathbf{v}$.

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2. **(10pt)** Find the area of the triangle with vertices $(2, 1, 1)$, $(3, 1, -1)$ and $(2, 1, 3)$.

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3. **(15pt)** Consider the line going through the points $(1, 2, -1)$ and $(3, 2, 1)$.

(a) Find a vector equation for this line.

(b) Determine whether the point $(2, 2, 0)$ belongs to this line or not.

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4. **(10 pt)** Find the equation of the plane that contains the point $(1, 2, -3)$ and is perpendicular to the line with vector equation $\mathbf{r}(t) = \langle 2 - 3t, 3 + t, -1 \rangle$.

Write solution only inside the box

5. **(15 pt)** We consider a motion for which:

- its velocity is given by $\mathbf{v}(t) = \langle -2\cos t, 2\sin t, 0\rangle$.
- the position vector of the corresponding object for $t = 0$ is $\mathbf{r}(0) = \langle -1, 1, 1\rangle$.

Find the vector equation of the position $\mathbf{r}(t)$ of the above motion.

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6. **(10 pt)** Find the length of the trajectory of $\mathbf{r}(t) = \left\langle \ln t, \frac{t^2}{2}, \sqrt{2} \cdot t \right\rangle$ from $t = 1$ to $t = 2$.

Write solution only inside the box

7. **(10 pt)** Use the two path method in order to show that if $f(x,y) = \dfrac{xy^2}{x^2+y^4}$, then the limit

$$\lim_{(x,y)\to(0,0)} f(x,y)$$

does not exist.

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8. **(15 pt)** Let $f(x,y) = \dfrac{x}{x+3y}$. Compute $f_x(-2,1)$ and $f_y(-2,1)$.