

DO NOT WRITE ABOVE THIS LINE!!

MATH 210 Exam 1

September 29, 2016

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.

Name: _____

UIN: _____

University Email: _____

Check next to your instructor's name:

Lukina	10am	
Lukina	11am	
Steenbergen	11am	
Steenbergen	12pm	
Kobotis	8am	
Sparber	2pm	
Leslie	2pm	
Awanou	3pm	
Heard	9am	
Woolf	9am	
Abramov	12pm	
Sinapova	3pm	
Hong	10am	
Freitag	1pm	
Greenblatt	1pm	

- All of your work must fit within the boxes on each page for each question. Nothing outside of the box will be graded! If you write outside of the box, there is a good chance that your solution will not be read and therefore not graded.
- 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.

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1. (10pt)

- (a) Find an equation of the plane containing the points $A(1, -4, -2)$, $B(-1, -3, -5)$ and $C(2, -1, 3)$.
- (b) Find an equation of the line, perpendicular to the plane in a), and passing through the point $A(1, 4, -2)$.

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2. **(10 pt)** The position function of a particle moving on the plane is given by

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

Find the velocity and acceleration of the particle.

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3. **(15pt)** Are the following pairs of vectors parallel, orthogonal or neither?

(a) $\langle 1, 2, -1 \rangle$ and $\langle 4, 1, 6 \rangle$.

(b) $\langle 1, 1, 2 \rangle$ and $\langle 1, 1, -2 \rangle$.

(c) $\langle \sqrt{2}, 1, 0 \rangle$ and $\langle -1, -\frac{\sqrt{2}}{2}, 0 \rangle$.

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4. **(15 pt)** A particle is moving in space with velocity described by the function

$$\mathbf{v}(t) = \langle te^t + 2, t^2, t \rangle.$$

Time t is measured in seconds. At time $t = 0$ the particle is located at the origin $(0, 0, 0)$.

- (a) Compute the position function $\mathbf{r}(t)$.
- (b) Write down an integral that will give the total distance traveled by the particle during the first second of its travel. Do not evaluate.

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5. **(10 pt)** Find an equation of the line of the intersection of the planes

$$Q : x + y = 2 \quad \text{and} \quad R : x - 2y = 5.$$

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6. (10 pt) Find the domain of the function

$$f(x, y) = \sqrt{x^2 + y^2 - 1}.$$

Find the equations of the level curves for $z = \sqrt{3}$ and $z = \sqrt{8}$, and sketch the domain and the level curves in the same picture.

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7. **(15 pt)** Find all four second order partial derivatives of the function

$$f(x, y) = 3 \cos y - ye^{2x} + 5.$$

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8. (15 pt) Consider the function

$$f(x, y) = 3x - y\sqrt{x}$$

- (a) Compute the gradient function.
- (b) Find the directional derivative of the function at the point $(1, 2)$ in the direction of the vector $\mathbf{u} = \langle -1, 0 \rangle$.
- (c) Find the unit vector in the direction of the steepest ascent and the rate of the steepest ascent at $(1, 2)$.