University of Delaware - Department of Mathematical Sciences MATH 243 Midterm Exam 1 - Spring 2024

Tuesday 12th March, 2024

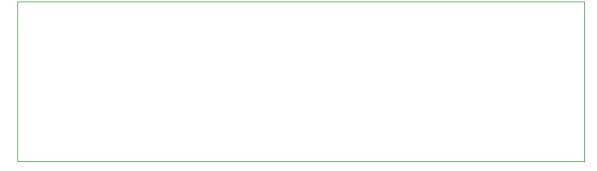
Instructions:

- The time allowed for completing this exam is **75** minutes in total.
- Check your examination booklet before you start. There should be 4 questions on 5 pages.
- Turn off your cell phone and put it away. Headsets, earbuds and any other electronic devices are prohibited.
- No calculators.
- Answer the questions in the space provided. If you need more space for an answer, continue your answer on the back of the page and/or the margins of the test pages. No extra paper. Do not separate the pages from the exam booklet.
- For full credit, sufficient work must be shown to justify your answer.
- Partial credit will not be given if appropriate work is not shown.
- Write legibly and clearly; indicate your final answer to every problem. Cross out any work that you do not want graded. If you produce multiple solutions for a problem, indicate clearly which one you want graded.
- Any form of academic misconduct will result in a failing grade.

Question:	1	2	3	4	Total
Points:	25	25	25	25	100
Score:					

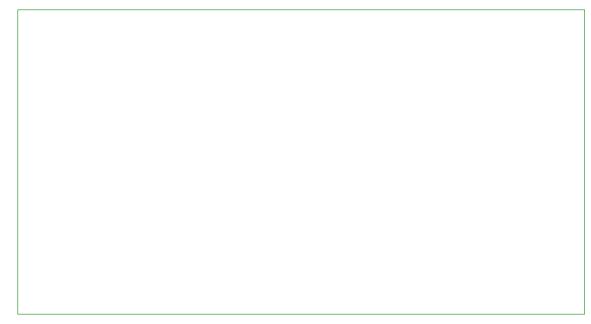
1. Let the curve $\mathcal C$ be given by the vector function $\mathbf r(t)$ =	$= \frac{1}{t^2+1}\mathbf{i} + \sin\left(2t + \frac{\pi}{3}\right)\mathbf{j} + (\sqrt[3]{t+8})\mathbf{k}.$
--	--

(a)	(6 points)	Find the c	oordinates o	of the po	oint P o	on the curve of	\mathcal{C} corresponding	to $t = 0$
-----	------------	------------	--------------	-----------	------------	-----------------	-----------------------------	------------



(b) (6 poi	nts) Determine th	ne vector function	n $\mathbf{r}'(t)$. Fully si	mplify your a	answer.	

(c)	(6 points)	Find a scalar	aquation	of the	normal	plane to	the	curve (7 at	the	noint	where
(0)	(o points)	r mu a scarar	equation	or the	normai	plane to	one	cui ve t	au	one j	pomi	WILCIC
	t=0.											



(d) (7 points $P\left(1, \frac{\sqrt{3}}{2}\right)$	Write paramet : $(3, 2)$.	ric equations of	the tangent line to	the curve $\mathcal C$ at the poin

Give and	en that the that the ir	velocity vector function of a particle is $\mathbf{v}(t) = 2\mathbf{i} + (te^{3t-3})\mathbf{j} + (4t^3 - 2t - \mathbf{i})\mathbf{j}$ nitial position of the particle is $\mathbf{r}(0) = \mathbf{i} + \mathbf{j} + \mathbf{k}$, find the following.
(a)	(8 points)	The speed of the particle at the point corresponding to $t = 1$.
(b)	(8 points)	The acceleration of the particle at the point corresponding to $t = 1$.
(c)	(9 points)	The position of the particle at any time t , given that $\mathbf{r}(0) = \mathbf{i} + \mathbf{j} + \mathbf{j}$

3.	Given	the	points

$$A(2,0,1), B(-1,1,2), C(4,1,-1),$$

find the following.

					\longrightarrow
(a)	(3	points) The	vector	AB

<u>→</u>

(b) (3 points) The vector \overrightarrow{AC} .

(c) (6 points) A unit vector that has the same direction as the vector \overrightarrow{AC} .

(6 points) A unit vector that has the same direction as the vector AC.

(d) (7 points) The vector projection of \overrightarrow{AB} onto \overrightarrow{AC} . Fully simplify your answer.

(e) (6 points) The area of the triangle ABC.

Let	z = f(x, y)	$=2x\ln(x+y^2)$ be a function of two variables. Find the following.
(a)	(5 points)	$f\left(e,0\right)$
(b)	(5 points)	$\frac{\partial z}{\partial y}$
(c)	(5 points)	The rate of change of $f(x, y)$ with respect to x when y is held fixed.
		02
(d)	(5 points)	$\frac{\partial^2 z}{\partial y \partial x}$
(e)	(5 points) $z = f(x, y)$	The slope of the tangent line to the curve of intersection of the surface $f(x) = 2x \ln(x+y^2)$ with the vertical plane $f(x) = 0$, at the point $f(x) = 0$.