MAT 397 CAL III Josh Stangle Fall 2016

TEST 1

Your Name (please PRINT): _____

Student ID Number: _____

INSTRUCTIONS

- Fill in the above items.
- There is a total of 5 problems, for a maximum possible total value of 50 points. **Make sure you have all 6 test pages (this cover page + 5 test pages)**. You are responsible to check that your test booklet has all 6 pages. Alert a proctor if your copy is missing any pages.
- **Show all your work.** Only minimal credit will be given for answers without supporting work.
- **Write your answer in the box** at the bottom of pages 2-6.
- **Use the back of test pages if additional space is needed**, and for scratch paper.
- **No calculators or other electronic devices; no outside notes; no outside tables** are allowed on this exam. Any use of calculators or electronic devices, or outside notes is a violation of the Academic Integrity Policy.

Do not write below this line

Pb. #	Max Points	Your Score
1	10	
2	10	
3	10	
4	12	
5	8	
Total	(50)	

1. (10 pts) Consider the two vectors

$$\vec{a} = \langle 1, -1, 2 \rangle, \qquad \text{and} \qquad \vec{b} = \langle -1, -1, 3 \rangle.$$

(a) Find the **cosine of the angle** between $\vec{a}$ and $\vec{b}$.

(b) Find a unit vector $\vec{c}$ that is **perpendicular** to both $\vec{a}$ and $\vec{b}$.

(c) Which vector is longer, $\vec{a} + \vec{b}$ or $2\vec{a} - \vec{b}$?

Answer for part (a):
Answer for part (b):
Answer for part (c):

2. (10 pts)

(a) Find the **scalar** equation of the **plane** that goes through the point $(2, 0, 1)$ and is **perpendicular** to the line with symmetric equations

$$\frac{x-1}{3} = \frac{y+2}{1} = \frac{z}{4}.$$

(b) Find the **parametric equations** of the **line** of intersection of the planes $x-3y+2z = 0$ and $-x + y + 4z = 0$.

Answer for part (a):
Answer for part (b):

3. (10 pts)

(a) Find the position vector $\vec{r}(t)$ of a particle that has the given acceleration $\vec{a}(t)$ and the specified initial velocity $\vec{v}(0)$ and initial position $\vec{r}(0)$.

$$\vec{a}(t) = \langle 3t^2, 2\sin(t), 2\cos(t)\rangle, \quad \vec{r}(0) = \langle 1, 0, 0\rangle, \quad \vec{v}(0) = \langle 1, 1, 0\rangle$$

(b) Find $\overrightarrow{r}'(t)$. where

$$\vec{r}(t) = t^5\vec{i} + (e^{2t} - 1)\vec{j} + \frac{1}{t^2}\vec{k}.$$

Answer for part (a):
Answer for part (b):
Answer for part (c):

4. (12 pts)

(a) Describe the traces and sketch the surface given by the equation $x = 2y^2 + 3z^2$. Recall, a sketch includes labelled axes!

(b) Find the tangent line to the curve associated to the vector function $\vec{r}(t) = \langle \sin(t), \cos(t), t^3 + e^{3t} \rangle$ at the point $(0, 1, 1)$.

Answer for part (a):
Answer for part (b):

5. (8 pts) Let $P = (0, 1, 2)$, $Q = (1, 2, 1)$, $R = (1, 2, -3)$ and $S = (0, 1, 0)$ be points.

(a) Are these 4 points coplanar?

(b) The force $\vec{F} = \vec{i} + 3\vec{j} - 5\vec{k}$ moves a particle from point P to point Q. Find the work done in moving this particle. The force is in Newtons and the distance in Meters. Include the appropriate units, Joules.(Hint: Joules=(Newtons)(Meters)).

Answer for part (a):
Answer for part (b):