The University of British Columbia

MATH 317

Practice Midterm 1

21 July 2015

TIME: 75 MINUTES

LAST NAME: _	FIRST NAME:
STUDENT $#$:	SIGNATURE:

This Examination paper consists of 8 pages (including this one). Make sure you have all 8.

INSTRUCTIONS:

No memory aids allowed. No calculators allowed. No communication devices allowed.

MARKING:

Q1	/14
$\mathbf{Q2}$	/7
$\mathbf{Q3}$	/5
Q4	/12
Q5	/12
TOTAL	/50

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Q1 [14 marks = 2+3+3+3+3]

A particle is moving through space. Measurement equipment shows that at time t_0 , the particle's acceleration is (2, 1, 1) and its velocity is (3, 4, 0). Find the following quantities associated with the particle's motion at time t_0 :



(Hint: Express \vec{a} as a linear combination of \vec{T} and \vec{N} . What is $\vec{a} \cdot \vec{T}$?)

Extra space for work.

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$\mathbf{Q2}$ [7 marks]

Find the length of the segment of the curve $\vec{\mathbf{r}}(t) = \left\langle 2\sqrt{t}, t, \frac{1}{2}\ln t \right\rangle$ starting at (2, 1, 0) and ending at $(4, 4, \ln 2)$.

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Q3 [5 marks]

Let $\vec{\mathbf{r}}(t)$ be a parameterized curve such that $|\vec{\mathbf{r}}'(t)| = 2$ for all t. Simplify

$$\frac{\mathrm{d}^2}{\mathrm{d}t^2}(\vec{\mathbf{r}}(t)\cdot\vec{\mathbf{r}}'(t))$$

as much as possible. Your answer should not have any derivatives except $\vec{r}', \vec{r}'', \vec{r}'''$, etcetera.

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$\mathbf{Q4} \quad [12 \text{ marks} = 6{+}6]$

Determine whether the following vector fields are conservative. If they are conservative, find a potential function. If not, explain why they are not conservative.

(a)
$$\vec{F}(x,y) = (x^3 + 2xy^2 - y^3)\vec{i} + (2x^2y - 3xy^2 + 2y^3)\vec{j}$$

(b)
$$\vec{F}(x,y) = (xy\cos y)\vec{i} + (-\frac{1}{2}x^2y\sin y - \frac{1}{2}x^2\cos y)\vec{j}$$

 $\mathbf{Q5} \quad [12 \text{ marks} = 4{+}8]$

Let C be the intersection of the surfaces $x + y^2 + z^3 = 1$ and $y + z^2 = 1$.

(a) Find a parameterization of C.

(b) Let *D* be the segment of *C* starting at (0, 1, 0) and ending at (0, 0, 1) (oriented toward (0, 0, 1)). Compute $\int_D (2z^2 - x) dz + e^z dy$.

Extra space for work.