

University of Toronto
Faculty of Engineering
MAT 187H1S TERM TEST
WEDNESDAY, MARCH 7, 2001
Duration: 50 minutes

Aids Allowed: Calculator, to be supplied by student.

Instructions: Fill in the information on this page, and make sure this test contains 4 pages. Present your **solutions** in the space provided. Use the back of the preceding page if you need more space. The value for each question is indicated in square brackets beside each question number.

TOTAL MARKS: 40

NAME: _____

STUDENT NUMBER: _____

SIGNATURE: _____

TUTORIAL: (eg Tut0107) _____

TUTOR: _____

MARKER'S REPORT:

QUESTIONS	MARKS
Question 1	
Question 2	
Question 3	
TOTAL	

1. [15 marks] Consider the curve with parametric equations

$$x = \cos^3 t; y = \sin^3 t, \text{ for } t \geq 0$$

(a) [7 marks] Find both $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$

(b) [8 marks] Find the length of the curve for $0 \leq t \leq \frac{\pi}{2}$

2. [12 marks] Plot the two curves with polar equations

$$r = \sqrt{2} \cos(2\theta) \text{ and } r = 1$$

and find the area inside $r = \sqrt{2} \cos(2\theta)$ but outside $r = 1$.

3. [13 marks] Let $\mathbf{u} = t^2\mathbf{i} - t^3\mathbf{j} + 6\mathbf{k}$, and let $\mathbf{v} = \left(t + \frac{1}{t}\right)\mathbf{i} + \left(t - \frac{1}{t}\right)\mathbf{j} + \sqrt{30}t\mathbf{k}$, for $t > 0$. Find the following:

(a) [4 marks] $\mathbf{v} \cdot \frac{d\mathbf{v}}{dt}$

(b) [4 marks] $\frac{d\mathbf{u}}{dt} \times \mathbf{v}$

(c) [5 marks] the minimum value of $|\mathbf{v}|$