Answer Key 4

MATH 225: Calculus III Name:____________________

Exam I *Spring 2004* Instructor:____________________

1) There are 10 multiple choice questions worth 6 points each and 3 partial credits problems worth 10 points each. You start with 10 points.

(2) On the partial credit problems *you must show your work and all important steps to receive credit.*

(3) Record your answers to the multiple choice problems by **placing an × through one letter for each problem on this page**.

You may use a calculator if you wish.

1.	a	b	c	•	e	6.	a	b	•	d	e
2.	a	•	c	d	e	7.	a	b	•	d	e
3.	a	b	c	d	•	8.	•	b	c	d	e
4.	a	b	c	•	e	9.	a	b	•	d	e
5.	a	•	c	d	e	10.	a	b	c	•	e

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5.	a	b	c	d	e	10.	a	b	c	d	e

number right times 6 = ____________

11.

12.

13.

You start with: 10 points

Total Score ____________

1. A point moves in space in such a way that at time t its position is given by the vector-valued function $\mathbf{r}(t) = \langle t^2 + 1,\ 2t^2 - 1, 2 - 3t^2 \rangle$. At what time does the point hit the plane $2x + 2y + 3z = 9$?

   (a) $\pm\frac{1}{2}$ (b) ± 2 (c) 9

   (d) does not hit (e) 0

2. Determine the speed at $t = 1$ of an object whose position function is $\mathbf{r}(t) = \langle 2t^3, 3t, 3t^2 \rangle$.

   (a) 18 (b) 9 (c) 0 (d) 8 (e) 14

3. Determine the projection of $\mathbf{a} = \langle 3, 2, 1 \rangle$ onto $\mathbf{b} = \langle 2, 2, 1 \rangle$.

(a) $\langle 2, 2, 1 \rangle$ (b) $11\langle 2, 2, 1 \rangle$ (c) $\frac{1}{9}\langle 3, 2, 1 \rangle$ (d) $\frac{11}{9}\langle 3, 2, 1 \rangle$ (e) $\frac{11}{9}\langle 2, 2, 1 \rangle$

4. Find the distance between the origin and the plane given by the equation $x + y + z = -1$.

(a) 1 (b) 0 (c) $\sqrt{3}$ (d) $\frac{1}{\sqrt{3}}$ (e) $\frac{2}{\sqrt{3}}$

5. Determine the cosine of the angle between P_0P_1 and P_0P_2 at P_0 where $P_0 = (-1, 2, 1)$, $P_1 = (-3, 1, -5)$ and $P_2 = (-4, 3, -4)$.

(a) 0 (b) $\dfrac{35}{\sqrt{41}\sqrt{35}}$ (c) $\dfrac{1}{2}$ (d) $\dfrac{35}{\sqrt{41}}$ (e) $\dfrac{\sqrt{2}}{2}$

6. Find the domain D of the function $f(x, y) = \sqrt{1 - x^2 - y^2}$.

(a) a unit square

(b) $\{(x, y) \,|\, x \leq 1,\ y \leq 1\}$

(c) a unit disk

(d) all (x, y) on the plane

(e) $\{(x, y) \,|\, -1 \leq x \leq 1,\ -1 \leq y \leq 1\}$

7. Find the length of the curve $\mathbf{r}(t) = \langle t^2, \frac{4}{3}t^{\frac{3}{2}}, t\rangle$ for $0 \leq t \leq 1$.

(a) 4 (b) $\frac{3}{2}$ (c) 2 (d) $\frac{4}{3}$ (e) 1

8. Which of the following points are on the line through the points $(-1, 1, 0)$ and $(-1, 5, 7)$?

(a) $(-1, 9, 14)$ (b) $(-1, 11, 14)$ (c) $(-1, 6, 7)$

(d) $(-1, -4, -7)$ (e) $(-1, 7, 7)$

9. A particle moves with position function $\mathbf{r}(t) = \langle 4\sin t,\ 4\cos t,\ 3t\rangle$. Find the tangential and normal components of acceleration.

(a) $a_T = \frac{4}{5}$, $a_N = \frac{4}{5}$ (b) $a_T = 0$, $a_N = 0$ (c) $a_T = 0$, $a_N = 4$

(d) $a_T = 4$, $a_N = 3$ (e) $a_T = 4$, $a_N = 0$

10. Evaluate the integral $\int (\mathbf{i} + 2t\mathbf{j} + 3t^2\mathbf{k})dt$

(a) $2\mathbf{j} + 6t\mathbf{k} + \mathbf{c}$ (b) $t + t^2 + t^3 + C$ (c) $t\mathbf{i} + t^2\mathbf{j} + t^3\mathbf{k}$

(d) $t\mathbf{i} + t^2\mathbf{j} + t^3\mathbf{k}t + \mathbf{c}$ (e) $\mathbf{i} + t^2\mathbf{j} + t^3\mathbf{k}$

11. Let ℓ be the intersection of the two planes. Find an equation for ℓ in the form of $\mathbf{r}(t) = \mathbf{r}_0(t) + t\mathbf{v}$, where two planes are given by equations $x - y = 1$ and $x - z = 1$.

12. Find the unit tangent, the unit normal and binormal vectors for the circular helix $\mathbf{r}(t) = \langle \cos 3t,\, \sin 3t,\, 4t \rangle$.

13. The initial position and velocity of an object moving with acceleratio $\mathbf{a} = \langle e^t,\ 0,\ 0\,\rangle$ are $\mathbf{r}(0) = \langle 2, 3, 2\rangle$ and $\mathbf{v}(0) = \langle 1,\ 1,\ 1\,\rangle$. Find its position at time t.