NAME _____

10–DIGIT PUID _____

RECITATION INSTRUCTOR _____

RECITATION TIME _____

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DIRECTIONS

1. Write your name, 10–digit PUID, recitation instructor's name and recitation time in the space provided above. Also write your name at the top of pages 2, 3, and 4.
2. The test has four (4) pages, including this one.
3. Write your answers in the boxes provided.
4. You must show sufficient work to justify all answers unless otherwise stated in the problem. Correct answers with inconsistent work may not be given credit.
5. Credit for each problem is given in parentheses in the left hand margin.
6. No books, notes or calculators may be used on this test.

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(10) 1. Let $\vec{a}$, $\vec{b}$, $\vec{c}$ be three-dimensional vectors. For each statement below, circle T if the statement is always true, or F if it is not always true.

(i) $\vec{a} \cdot \vec{b} = \vec{b} \cdot \vec{a}$ T F

(ii) $\vec{a} \times \vec{b} = \vec{b} \times \vec{a}$ T F

(iii) $\vec{a} \cdot (\vec{b} \times \vec{c}) = (\vec{a} \cdot \vec{b}) \times (\vec{a} \cdot \vec{c})$ T F

(iv) $\vec{a} \cdot (\vec{b} + \vec{c}) = \vec{a} \cdot \vec{b} + \vec{a} \cdot \vec{c}$ T F

(v) $(\vec{a} \times \vec{b}) \times \vec{a} = \vec{0}$ T F

(7) 2. Find the center and radius of the sphere

$$x^2 + y^2 + z^2 - 2x + 6z = 15$$

center:

radius:

(15) 3. If $\vec{a} = \vec{i} + 2\vec{j} - \vec{k}$ and $\vec{b} = 3\vec{j} + \vec{k}$, find the following

(a) $\vec{a} \cdot \vec{b}$

(b) $\vec{a} \times \vec{b}$

(c) $\cos\theta$ where θ is the angle between $\vec{a}$ and $\vec{b}$

(d) the area of the parallelogram determined by $\vec{a}$ and $\vec{b}$

(e) a unit vector orthogonal to both $\vec{a}$ and $\vec{b}$

(6) 4. Let $A(1,2)$ and $B(2,0)$ be two points in the plane. Find the coordinates (p,q) of the point $C(p,q)$ such that $\vec{AC} = 2\vec{AB}$.

$(p,q) =$

(8) 5. Find the value of the number c such that the vectors $\langle 1, c, 2\rangle$ and $\langle -2, -1, -4\rangle$ are

(a) orthogonal

$c =$

(b) parallel

$c =$

(10) 6. Find the area of the region enclosed by the curves
$y = x^2$ and $y = x + 2$.

(16) 7. Set up, but do not evaluate, an integral for the volume V of the solid obtained by rotating the region bounded by the curves $y = x^4$, $y = 0$, and $x = 1$, about the x–axis,
(a) using the method of disks/washers

$V = \int$

(b) using the method of cylindrical shells

$V = \int$

(8) 8. Using the method of disks/washers, set up, but do not evaluate, an integral for the volume V of the solid obtained by rotating the region bounded by the curves $y = 0$, $y = \sin x$, $0 \leq x \leq \pi$ about the line $y = 1$.

$V = \int$

(8) 9. A force of 10 lb. is required to hold a spring stretched 4 in. beyond its natural length. How much work is done in stretching it from its natural length to 6 in. beyond its natural length?

ft-lb

(12) 10. Find $\int (\ln x)^2 \, dx$.