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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.
- (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)
$$ec{a}\cdotec{b}=ec{b}\cdotec{a}$$

(ii)
$$\vec{a} imes \vec{b} = \vec{b} imes \vec{a}$$

(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

$$({
m v}) \; (ec a imes ec b) imes ec a = ec 0$$

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



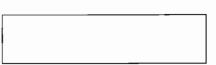
(c) $\cos\theta$ where θ is the angle between \vec{a} and \vec{b}



(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



(b) parallel



(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

$$V = \int$$

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(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, $y = \sin x$, $0 \le x \le \pi$ 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 $\int (\ln x)^2 dx$.