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10-DIGIT PUID	Page 2	/23
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RECITATION TIME	TOTAL	/100

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)
$$\vec{a} \cdot \vec{a} = |\vec{a}|^2$$

 \mathbf{T} \mathbf{F}

(ii)
$$\vec{a} \cdot (\vec{b} \cdot \vec{c}) = (\vec{a} \cdot \vec{b}) \cdot \vec{c}$$

 \mathbf{T} \mathbf{F}

(iii)
$$\vec{a} \cdot (\vec{b} + \vec{c}) = (\vec{a} + \vec{b}) \cdot \vec{c}$$

T F

(iv)
$$\vec{a} \times \vec{b} = -\vec{b} \times \vec{a}$$

T F

(v) If
$$\vec{a} \times \vec{c} = \vec{b} \times \vec{c}$$
, then $\vec{a} = \vec{b}$

 \mathbf{T} \mathbf{F}

(6) 2. For what values of b are the vectors < 2, -1, b > and $< b^2, 3, b >$ orthogonal?

b =

(4) 3. Find $\vec{a} \cdot \vec{b}$ if $|\vec{a}| = 3$, $|\vec{b}| = 6$ and the angle between \vec{a} and \vec{b} is $\frac{\pi}{3}$ radians.

 $ec{a}\cdotec{b}=$

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(6) 4. Find a vector that has the same direction as <-2,4,2> but has length 6.



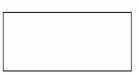
(4) 5. Are the vectors < 1, -2, 3 > and < 3, -6, 9 > orthogonal, parallel or neither?



(13) 6. Consider the three points A(1,1,1), B(2,0,2), C(1,1,2). (a) Find $\vec{AB} \times \vec{AC}$

$$\vec{AB} \times \vec{AC} =$$

(b) Find the area of the triangle with vertices A, B, C.



(c) Find a unit vector orthogonal to the plane that passes through the points A,B,C.

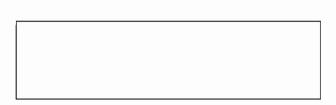


(10) 7. Find the area of the region bounded by the curves

$$y = \sqrt{x+2}, \quad y = \frac{1}{x+1}, \quad x = 0, \quad x = 2.$$

(16) 8. Let R be the region bounded by y = x, y = 2 - x, and y = 0.

(a) Set up, but do not evaluate, an integral for the volume of the solid obtained by rotating R about the line x = 5, using the method of disks/washers.



(b) Set up, but do not evaluate, an integral for the volume of the solid obtained by rotating R about the line y=2, using the method of cylindrical shells.

(10) 9. The base of a solid is a triangular region with vertices A(0,0), B(1,0), and C(0,1). Cross-sections perpendicular to the y-axis are semicircles. Find the volume of the solid.

V =

(6) 10. Find the average value of $f(x) = \sqrt{x}$ on the interval [0, 4].



- (15) 11. Evaluate the integrals
 - (a) $\int x^3 \ln x dx$



(b) $\int_0^{\pi} t \sin 3t dt$