NAME		
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10-DIGIT PUID	Page 2	/32
RECITATION INSTRUCTOR	Page 3	/24
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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, calculators, or any electronic devices may be used on this test.
- (10) 1. Find the center and radius of the sphere with equation:

$$2x^2 + 2y^2 + 2z^2 = 8x - 24z + 1$$

center	
radius	

(4) 2. If $\vec{a} = \langle 5, -12 \rangle$ and $\vec{b} = \langle -3, -6 \rangle$, find the following:

$\vec{a} + \vec{b} =$	
$2\vec{a} + 3\vec{b} =$	
$ \vec{a} =$	
$ \vec{a} - \vec{b} =$	

(8) 3. Find all values of t for which the angle between the vectors $\vec{a} = t\vec{i} + \vec{j} + \vec{k}$ and $\vec{b} = \vec{i} + t\vec{j} + \vec{k}$ is $\frac{\pi}{3}$.

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t =

- (8) 4. Let $\vec{a} = \langle 1, 2, 1 \rangle$ and $\vec{b} = \langle 3, -4, 2 \rangle$.
 - (i) Find all unit vectors \vec{u} that are perpendicular to both \vec{a} and \vec{b} .

 $ec{u} =$

(ii) The area A of the parallelogram determined by \vec{a} and \vec{b} is

A =

- (8) 5. Let $\vec{a} = \langle 6, 3, 1 \rangle$, $\vec{b} = \langle 0, 1, 2 \rangle$, $\vec{c} = \langle 4, -2, 5 \rangle$.
 - (i) The scalar triple product $\vec{a} \cdot (b \times c)$ is

 $ec{a}\cdot(ec{b} imesec{c})=$

(ii) True or False:

The vectors $\vec{a}, \vec{b}, \vec{c}$ are coplanar. (circle one)

T F

(8) 6. Set up, but do not evaluate, an integral for the area A of the region bounded by the curves $y = \ln x$, $x = y^2 - 2$, y = -1, y = 1.

$$A = \int$$

(8) 7. Let R be the region bounded by the curves $y = x^2$ and y = -2x. Use the method of washers to set up an integral for the volume V of the solid obtained by rotating R about the x-axis. Do not evaluate the integral.

$$V = \int_{-\infty}^{\infty}$$

(8) 8. Let R be the region bounded by the curves $y = x^4$ and y = x. Use the method of cylindrical shells to set up an integral for the volume V of the solid obtained by rotating R about the line y = -4. Do not evaluate the integral.

$$V = \int$$

(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?

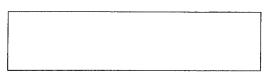
$$W =$$
ft-lbs

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(11) 10. An aquarium 5 ft long, 4 ft wide and 2 ft deep is full of water. Find the work needed to pump half of the water out of the aquarium. (Use the fact that water weighs $62.5 \, \mathrm{lb/ft^3}$).

ft-lbs

(8) 11. $\int \sin^{-1} x dx =$



(11) 12. First make a substitution x=? and then use integration by parts to evaluate the integral $\int \theta^3 \cos(\theta^2) d\theta$. Your answer in the box must be in terms of θ .