

Name: _____ ID: _____

Recitation Instructor: _____ Recitation Time: _____

Instructions: Give a complete answer to each problem in the space provided, if necessary. Be sure to **show all your work**. Answers not supported by work will receive little credit. **Write the answer to each question in the box provided.** Write your name and ID number on each page of the exam. Also write your Recitation Instructor's name and Recitation time above. No books, notes or calculators may be used on this exam. This exam has 5 pages.

1. (8 points) Find the angle θ between the vectors $\mathbf{i} + \mathbf{j} - 2\mathbf{k}$ and $\mathbf{i} + 2\mathbf{j} - \mathbf{k}$.

$\theta =$

2. (8 points) Let $(2, 8, 3)$ be the center of the sphere S and let $(-2, 5, 4)$ be a point on S . If

$$x^2 + y^2 + z^2 + Ax + By + Cz = D$$

is an equation of S , find A, B, C , and D .

$A =$	$B =$	$C =$	$D =$
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3. (8 points) Find the area of the parallelogram determined by $\mathbf{i} + \mathbf{j} - 2\mathbf{k}$ and $\mathbf{i} + 2\mathbf{j} - \mathbf{k}$.

area =

4. (10 points) Find the area bounded by the curves $y = e^{-x}$, $y = 1 - x$, and $x = 1$.

area =

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5. (10 points) Find the projection of $\mathbf{a} = \langle 4, 2, -1 \rangle$ onto $\mathbf{b} = \langle -2, 1, 3 \rangle$.

$proj_{\mathbf{b}} \mathbf{a} =$

6. (12 points) Consider the parallelepiped P determined by the three vectors $\langle t, 1, 2 \rangle$, $\langle 5, 2, 1 \rangle$ and $\langle -1, 1, 3 \rangle$. Find t so the volume of P is 2.

$t =$

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7. (24 points) Consider the solid obtained by rotating the region bounded by $y = x^3$ and the x -axis, $0 \leq x \leq 2$ about the y -axis. Set up 2 definite integrals, one using the washer method, another using the shell method, that give the volume of the solid. Then calculate the volume.

definite integral for volume using washer method =

definite integral for volume using shell method =

volume =

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8. (8 points) Set up a definite integral that gives the area of the region bounded by the graphs of $y^2 - 5y - x = 0$ and $6y + 2x = 6$.

definite integral for area =

9. (12 points) Suppose that on June 1, 2002, a lab sample has a temperature which is given by the function $C(t) = 22 - 4 \cos(\pi t/12)$, where t is in hours after midnight, and $C(t)$ is in degrees Celsius. Find the average temperature of the sample between 2 AM and 4 AM on this day.

average temperature =