NAME ______________________________

STUDENT ID ______________________________

RECITATION INSTRUCTOR ______________________________

RECITATION TIME ______________________________

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DIRECTIONS

1. Write your name, student ID number, 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. 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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(12) 1.(a) Find the center and radius of the sphere with equation $x^2+y^2+z^2-2x-4y+8z+17=0$.

center:

radius:

(b) Is the origin inside, outside, or on the sphere in part (a)?

(6) 2. Find a unit vector $\vec{u}$ in the direction opposite that of $\vec{a} = 2\vec{i} - j - 2\vec{k}$.

$\vec{u} =$

(10) 3. A constant force with vector representation $\vec{F} = 10\vec{i} + 18\vec{j} - 6\vec{k}$ moves an object along a straight line from the point $P(2, 3, 0)$ to the point $Q(4, 9, 15)$. Find the work done if the distance is measured in meters and the magnitude of the force is measured in newtons.

(10) 4. Use the cross product to find the area of the parallelogram with vertices $A(0, 1)$, $B(3, 0)$, $C(5, -2)$, and $D(2, -1)$.

(10) 5. If $\vec{a} = \vec{j} + 2\vec{k}$ and $\vec{b} = 3\vec{i} + \vec{j}$, find a vector $\vec{c}$ that is perpendicular to both $\vec{a}$ and $\vec{b}$, has length 2, and has positive z-component.

$\vec{c} =$

(8) 6. Find the number c such that the vertical line $x = c$ divides the region bounded the curves $y = \sqrt{x}$, $x = 1$ and the x–axis into two regions with equal area.

$c =$

(10) 7. Use washers to find the volume of the solid obtained by rotating about the y–axis the region bounded by the curves $y^2 = x$ and $x = 2y$.

(10) 8. The base of a solid is the region bounded by the curves $y = 1+e^{-x}$, $y = x^2$, $x = 0$ and $x = 1$. Cross–sections perpendicular to the x–axis are semicircles with diameter on the base. Set up an integral for the volume of the solid. Do not evaluate the integral.

$V = \int$

(8) 9. Using the method of cylindrical shells, set up an integral for the volume of the solid obtained by rotating the region bounded by the curves $y = x - 1$, $x = 2$, and $y = 0$ about the line $x = 3$. Do not evaluate the integral.

$V = \int$

(8) 10. A force of 10 lbs is required to hold a spring stretched 4 in beyond its natural length of 1 ft. How much work is done in stretching the spring 6 in beyond its natural length?

$ft - lbs$

(8) 11. Find $\int x^{\frac{3}{2}} \ln x dx$.