KING FAHD UNIVERSITY OF PETROLEUM & MINERALS

DEPARTMENT OF MATHEMATICS & STATISTICS

MATH201 – Section 16 (Term 171)

Date: October 19, 2017 **Test 2** Duration: 50 minutes

Family Name: ______________________ **ID #:** 2 0 1 _ _ _ _ _ 0 **Serial #:** _ _

1. Find an equation of the sphere that passes through the point $A(1, 4, -2)$ and whose center is $C(-3, 2, 0)$. **(6 points)**

2. Suppose that a 3-D vector $\vec{u}$ lies below the $xy-$ plane and has the direction angles α, β and γ with x, y and z axes, respectively. If $\alpha = \pi/4$ and $\beta = \pi/3$, determine the value of γ. **(6 points)**

3. Consider the vectors:

$$\vec{u} = \langle -3, 1, 2 \rangle, \qquad \vec{v} = \langle 1, 2, -3 \rangle$$

(a) Find the vector $\overrightarrow{3u - 2v}$.

(b) Find the angle between $\vec{u}$ and $\vec{v}$.

(c) Find the direction angles of $\vec{u}$ with x, y and z axes.

(d) Find the scalar projection of $\vec{v}$ onto $\vec{u}$.

(e) Find the vector projection of $\vec{u}$ onto $\vec{v}$.

(f) Determine the value of the constant k such that $\vec{w} = \langle k, 7, 7 \rangle$ is perpendicular to $\vec{v}$.

(g) Determine the value of the constant k such that $\vec{w} = \langle k, 7, 7 \rangle$ is perpendicular to $\vec{u}$ and $\vec{v}$.

(2 + 5 + 3 + 2 + 3 + 3 + 4 = 22 points)

4. Let $P(1,3,2)$, $Q(3,-1,6)$, $R(5,2,0)$ and $S(3,6,-4)$ be four points in three dimensional space.

(a) Find the area of the triangle with the vertices P, Q, and R.

(b) Find a unit vector perpendicular to the plane that passes through the points P, Q, and R.

(c) Find the volume of the parallelepiped with the vertices P, Q, R and S.

(7 + 4 + 5 = 16 points)

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DEPARTMENT OF MATHEMATICS & STATISTICS

MATH201 – Section 19 (Term 171)

Date: October 19, 2017 **Test 2** Duration: 50 minutes

Family Name: ____________________ **ID #:** 2 0 1 _ _ _ _ _ 0 **Serial #:** _ _

1. Consider the sphere whose end points of *diameter* lie at the points $A(1, 4, -2)$ and $B(-7, 0, 2)$.

(a) Find the center and radius of the sphere.

(b) Write the equation of the sphere.

(c) Describe the intersection of this sphere with the $yz-$ plane.

(4 + 3 + 4 = 11 points)

2. Consider the vectors:

$$\vec{u} = \langle -1, 2, -2 \rangle, \qquad \vec{v} = \langle 2, 0, -10 \rangle, \qquad \vec{w} = \langle 1, k, 0 \rangle$$

(d) Find the vector $\overrightarrow{u - 4v}$.

(e) Find the angle between $\vec{u}$ and $\vec{v}$.

(f) Find the direction angles of $\vec{u}$ with x, y and z axes.

(g) Find the scalar projection of $\vec{v}$ onto $\vec{u}$.

(h) Find the vector projection of $\vec{u}$ onto $\vec{v}$.

(i) Verify that $\vec{u} - \mathrm{Proj}_{\vec{v}}\,\vec{u}$ is orthogonal to $\vec{v}$.

(j) Determine the value(s) of the constant k such that the angle between the vectors $\vec{u}$ and $\vec{w}$ is $\pi/4$.

(2 + 4 + 3 + 2 + 3 + 3 + 5 = 22 points)

3. Let $O(0,0,0)$, $P(2,0,-3)$, $Q(1,4,5)$ and $R(7,2,9)$ be four points in three dimensional space.

(a) Find the area of the triangle with the vertices P, Q, and R.

(b) Find two unit vectors perpendicular to the plane that passes through the points P, Q, and R.

(c) Find the volume of the parallelepiped with the vertices O, P, Q and R.

(7 + 5 + 5 = 17 points)

KING FAHD UNIVERSITY OF PETROLEUM & MINERALS

DEPARTMENT OF MATHEMATICS & STATISTICS

MATH201 – Section 21 (Term 171)

Date: October 19, 2017 **Test 2** Duration: 50 minutes

Family Name: ______________________ **ID #:** **2 0 1** _ _ _ _ _ **0** **Serial #:** _ _

1. Find the center and radius of the sphere whose equation is given by:

$$x^2 + y^2 + z^2 + 6x - 4y = 11$$

(6 points)

2. Suppose that a 3-D vector $\vec{u}$ lies below the $xy-$ plane and has the direction angles α, β and γ with x, y and z axes, respectively. If $\alpha = \pi/4$ and $\beta = \pi/3$, determine the value of γ. **(6 points)**

3. Consider the vectors:

$$\vec{u} = \langle 1, 2, -3 \rangle, \qquad \vec{v} = \langle -3, 1, 2 \rangle$$

(a) Find the vector $\overrightarrow{2u - 3v}$.

(b) Find the angle between $\vec{u}$ and $\vec{v}$.

(c) Find the direction angles of $\vec{u}$ with x, y and z axes.

(d) Find the scalar projection of $\vec{v}$ onto $\vec{u}$.

(e) Find the vector projection of $\vec{u}$ onto $\vec{v}$.

(f) Determine the value of the constant k such that $\vec{w} = \langle k, 7, 7 \rangle$ is perpendicular to $\vec{u}$.

(g) Determine the value of the constant k such that $\vec{w} = \langle k, 7, 7 \rangle$ is perpendicular to $\vec{u}$ and $\vec{v}$.

(2 + 5 + 3 + 2 + 3 + 3 + 4 = 22 points)

4. Let $P(5, 2, 0)$, $Q(3, 6, -4)$, $R(1, 3, 2)$ and $S(3, k, 6)$ be four points in three dimensional space.

(a) Find the area of the triangle with the vertices P, Q, and R.

(b) Find a unit vector perpendicular to the plane that passes through the points P, Q, and R.

(c) Find the value of the constant k such that the volume of the parallelepiped with the vertices P, Q, R and S is equal to zero.

(7 + 4 + 5 = 16 points)