Quiz List

Quiz 1. (Sept. 1)

1. What is the equation of the xy-plane in 3-space, $\mathbb{R}^3$?
2. What is the equation of a sphere in 3-space with center $(1, 2, p)$ and radius 9?

Quiz 2. (Sept. 2)

1. Prove that for any vector $\mathbf{u} = \langle u_1, u_2, u_3 \rangle$, $|\mathbf{u}| = \sqrt{\mathbf{u} \cdot \mathbf{u}}$.
2. Find the unit vector in the direction of $\mathbf{w} = \langle 1, 2, -2 \rangle$.

Quiz 3. (Sept. 8)

1. Find the area of the parallelogram determined by the vectors $\mathbf{a} = \langle 1, 3 \rangle$ and $\mathbf{b} = \langle 1, -3 \rangle$.
2. Find the volume of the parallelepiped generated by the vectors $\mathbf{u} = \langle 1, 3, 0 \rangle$, $\mathbf{v} = \langle 1, -3, 0 \rangle$, and $\mathbf{w} = \langle -1, -1, -1 \rangle$.

Quiz 4. (Sept. 10)

1. What is the difference among these?

$$\langle 2, -3 \rangle, \qquad (2, -3), \qquad \langle 2\mathbf{i}, -3\mathbf{j} \rangle, \qquad 2\mathbf{i} - 3\mathbf{j}, \qquad \langle 2\mathbf{i} - 3\mathbf{j} \rangle$$

2. Given points $P = (1, 2, 3)$ and $Q = (1, 1, 1)$:
   (a) Find a parametric equation of the line PQ.
   (b) Find the coordinates of the point R such that $\overrightarrow{PR} = 3\overrightarrow{PQ}$.

Quiz 5. (Sept. 16)

1. (a) Find a vector that is normal to the plane with the equation $x - y + 4z = 2$.
   (b) Find a unit vector that is normal to the plane.
2. Find a vector that is normal to the plane that contains the points $P(1, 0, 0)$, $Q(1, 2, 3)$, and $R(2, 2, 2)$.

Quiz 6. (Sept. 18)

1. Find the vector projection of $\mathbf{u} = 3\mathbf{i} - 4\mathbf{j}$ onto $\mathbf{v} = \mathbf{i} + \mathbf{j} + \mathbf{k}$.

Quiz 7. (Sept. 25)

1. What is the domain of the function $\mathbf{r}(t) = \dfrac{t}{\sin t}\mathbf{i} + \ln(t^2 - 3)\mathbf{j} + 3(\tan t)\mathbf{k}$?
2. For the curve $\mathbf{r}(t) = t^2\mathbf{i} + t^3\mathbf{j} + 12t\mathbf{k}$:
   (a) What is the point of the curve at $t = 1$?
   (b) What is the unit tangent vector to the curve at $t = 1$?

Quiz 8. (Oct. 2) Given a curve $\mathbf{r}(t)$ in $\mathbb{R}^3$.

1. Write the definition of the curvature of $\mathbf{r}(t)$.
2. Write a formula for the curvature other than the definition.
3. Write the definition of the unit normal vector to the curve $\mathbf{r}(t)$.

Quiz 9. (Oct. 23) Here is a plane: $2x - y - 3z + 4 = 0$. Here is a point $P = (9, -9, 0)$.

(a) Find the line through P that is perpendicular to the plane.
(b) Find a line through P that is parallel to the plane.

Quiz 10. (Oct. 30)

1. Simplify as far as possible: $\sqrt{4 + 9t^2 + t^4}$.
2. (a) Evaluate as far as possible: $\begin{vmatrix} 2 & 0 & 4 \\ -1 & -3 & 4 \end{vmatrix}$.
   (b) Is your result a number, a vector, or neither?
3. Evaluate the integrals:
   (a) $\displaystyle\int_0^{x^2} \int_x^3 xy^2 \, dy \, dx.$
   (b) $\displaystyle\int_0^{y^2} \int_x^3 xy^2 \, dy \, dx.$
   (c) What would you say if I told you they were supposed to give numerical values?

Quiz 12. () $\mathbf{F}(x, y)$ is a vector field in $\mathbb{R}^2$.

1. Define the property of being conservative.
2. Is $\mathbf{F}(x, y) = x\mathbf{i} + xy\mathbf{j}$ conservative?

Quiz 13. ()

1. Which of the following expressions is integrated in Green's Theorem?
   (a) $\dfrac{\partial P}{\partial x} - \dfrac{\partial Q}{\partial y}$
   (b) $\dfrac{\partial P}{\partial y} - \dfrac{\partial Q}{\partial x}$
   (c) $\dfrac{\partial Q}{\partial y} - \dfrac{\partial P}{\partial x}$
   (d) $\dfrac{\partial Q}{\partial x} - \dfrac{\partial P}{\partial y}$
2. In which direction does the curve go in Green's Theorem?
   a. Clockwise.
   b. Counterclockwise.

Quiz 14. (Nov. 20) Is this vector field conservative?

$$\mathbf{F}(x,y) = \left\langle \frac{y}{\sqrt{x^2+y^2}}, \frac{-x}{\sqrt{x^2+y^2}} \right\rangle$$

Quiz. 15 (Nov. 23)

1. A region D is $\{(x,y) \in \mathbb{R}^2 \mid 4 \le x^2+y^2 \le 9,\ y > -1\}$.
   Give a precise reason for every answer, as far as you are able to.
   (a) Sketch D.
   (b) Is D open?
   (c) Is D closed?
   (d) Is D connected?
   (e) Is D simply connected?
2. What does the following sentence mean to you? (This is a separate question; it has nothing to do with D.)
   "The set is not open, connected, and simply connected."

Quiz 15a. (Nov. 23, not collected)
Is the vector field $\mathbf{F}(x,y) = \dfrac{-y}{\sqrt{x^2+y^2}}\mathbf{i} + \dfrac{x}{\sqrt{x^2+y^2}}\mathbf{j}$ conservative?