1.

Let $\mathbf{u} = \langle 1, 3, -2 \rangle$ and $\mathbf{v} = \langle 1, 1, -1 \rangle$.

(a) Find the projection of $\mathbf{u}$ onto $\mathbf{v}$ and call this vector $\mathbf{w}$.

(b) Find the vector $\mathbf{u} - \mathbf{w}$.

(c) Show that $\mathbf{u} - \mathbf{w}$ is orthogonal to $\mathbf{v}$.

2.

Find the area of the triangle with vertices $(2, 1, 1)$, $(3, 1, -1)$ and $(2, 1, 3)$

3.

Consider the line going through the points $(1, 2, -1)$ and $(3, 2, 1)$.

(a) Find a vector equation for this line.

(b) Determine whether the point $(2, 2, 0)$ belongs to this line or not.

4.

Find the equation of the plane that contains the point $(1, 2, -3)$ and is perpendicular to the line with vector equation $\mathbf{r}(t) = \langle 2 - 3t, 3 + t, -1 \rangle$.

5.

We consider a motion for which:

- its velocity is given by $\mathbf{v}(t) = \langle -2\cos t, 2\sin t, 0 \rangle$.
- the position vector of the corresponding object for $t = 0$ is $\mathbf{r}(0) = \langle -1, 1, 1 \rangle$.

Find the vector equation of the position $\mathbf{r}(t)$ of the above motion.

6.

Find the length of the trajectory of $\mathbf{r}(t) = \left\langle \ln t, \frac{t^2}{2}, \sqrt{2} \cdot t \right\rangle$ from $t = 1$ to $t = 2$.

7.

Use the two path method in order to show that if $f(x, y) = \frac{xy^2}{x^2 + y^4}$, then the limit

$$\lim_{(x,y)\to(0,0)} f(x, y)$$

does not exist.

8.

Consider the plane $2x - 3y + 6z = 1$.

(a) Find a vector normal to the plane.

(b) Find a vector equation of the line which is orthogonal to the plane and passes through the point $(1, 0, -2)$.

9.

Consider the vector-valued function.

$$\mathbf{r}(t) = \langle 10 \cos t, 5 \sin t \rangle$$

(a) Find the derivative $\mathbf{r}'(t)$.

(b) Find the vectors $\mathbf{r}(t)$ and $\mathbf{r}'(t)$ at $t = \pi/4$.

(c) Find the angle between the vectors in (b). Leave your answer in exact form.