Worksheet

(1) Let $\mathbf{a} = -2\mathbf{i} + 3\mathbf{j}$ and $\mathbf{b} = 2\mathbf{i} - 3\mathbf{j}$ and $\mathbf{c} = -5\mathbf{j}$. Find the following:
(a) $2\mathbf{a} - 4\mathbf{b}$ (b) $\mathbf{a} \cdot \mathbf{b}$ (c) $|\mathbf{a}|\mathbf{c} \cdot \mathbf{a}$

(2) Show that the vectors $< 6, 3 >$ and $< -1, 2 >$ are perpendicular.

(3) Find the scalar and vector projections of $\mathbf{b}$ onto $\mathbf{a}$ where $\mathbf{a} =< 1, 1, 1 >$ and $\mathbf{b} =< 1, -1, 1 >$.

(4) Let $\mathbf{a} = -3\mathbf{i} + 2\mathbf{j} - 2\mathbf{k}$, $\mathbf{b} = -\mathbf{i} + 2\mathbf{j} - 4\mathbf{k}$, and $\mathbf{c} = 7\mathbf{i} + 3\mathbf{j} - 4\mathbf{k}$
- $\mathbf{a} \times \mathbf{b}$
- $\mathbf{a} \times (\mathbf{b} + \mathbf{c})$
- $\mathbf{a} \cdot (\mathbf{b} + \mathbf{c})$

(5) Let $P(-1,3,1)$, $Q(0,5,2)$, and $R(4,3,-1)$. Find a nonzero vector orthogonal to the plane through the points P, Q, and R.

(6) Let $P(-1,3,1)$, $Q(0,5,2)$, and $R(4,3,-1)$. Find the area of the triangle PQR.

(7) Use the scalar triple product to determine whether the points $A(1,3,2)$, $B(3,-1,6)$, $C(5,2,0)$, and $D(3,6,-4)$ lie in the same plane.

(8) Find a parametric equation for the line through $(1,-2,3)$ and $(4,5,6)$.

(9) Let $3x-2y+z=1$ and $2x+y-3z=3$ be two planes. Find the parametric equation for the line of intersection of the planes. Also find the angle between the two planes.

(10) Evaluate the limit.

$$\lim_{t\to 2}\left(\frac{t^2-2t}{t-2}\mathbf{i}+\sqrt{t+4}\mathbf{j}+\frac{\sin(\pi t)}{\ln(t-1)}\mathbf{k}\right)$$

(11) Sketch the curve $\mathbf{r}(t) =< t^2, \sqrt{t}, 1 >$. Use arrows to indicate the direction in which t increases.

(12) Find the unit tangent vector $\mathbf{T}(t)$ of $\mathbf{r}(t) =< \cos(t), -\sin(t), \sin(2t) >$ when $t = \pi/2$.

(13) Find the length of the curve

$$\mathbf{r}(t) = \left\langle 2t, t^2, \frac{1}{3}t^3 \right\rangle$$

for $0 \leq t \leq 1$.

(14) Find the length of the curve intersection of the cylinder $4x^2 + y^2 = 4$ and the plane $x + y + z = 2$.