1. Which statement is correct? (choose only one answer.)
(A) $|\mathbf{A} \times \mathbf{B}| = |\mathbf{A}| \cdot |\mathbf{B}| \cdot \cos \theta$; (B) $|\mathbf{A} \cdot \mathbf{B}| \leq |\mathbf{A}| \cdot |\mathbf{B}|$;
(C) $\mathbf{A} \cdot (\mathbf{B} \times \mathbf{C}) = -(\mathbf{A} \times \mathbf{B}) \cdot \mathbf{C}$; (D) $\mathbf{i} + \mathbf{j}$ is parallel to $\mathbf{i} - \mathbf{j}$.

2. The plane of through $(-3, 4, 1)$ and lying in a plane parallel to $xy$-plane is
(A) $z = 1$; (B) $y = 4$; (C) $x = -3$; (D) $x = -3, y = 4$; (E) $x = -3, z = 1$;
(F) $y = 4, z = 1$; (G) None of the above.

3. Let $\mathbf{v}(t)$ be a differentiable function. If $|\mathbf{v}(t)| = 3$ for all $t$, then which is always true?
(A) $\mathbf{v}'(t) = 0$ for all $t$; (B) the path of $\mathbf{v}(t)$ must be a circle;
(C) $\mathbf{v}(t) \cdot \mathbf{v}'(t) = 0$ for all $t$; (D) the path of $\mathbf{v}(t)$ must be a line;

4. The domain of
$$f(x, y) = \sqrt{x} - \frac{1}{y}$$
is
(A) $x > 0, y > 0$; (B) $x \geq 0, y > 0$; (C) $x \geq 0, y \neq 0$; (D) $x > 0, y \neq 0$.

5. Let $\mathbf{A} = 2\mathbf{i} + \mathbf{j} - \mathbf{k}, \mathbf{B} = \mathbf{i} + \mathbf{j} - 5\mathbf{k}$.
   (a) Find the area of the parallelogram determined by $\mathbf{A}$ and $\mathbf{B}$.
   (b) Find a vector perpendicular to both $\mathbf{A}$ and $\mathbf{B}$.
   (c) Find the projection of $\mathbf{A}$ along $\mathbf{B}$.

6. Find the equation of the plane passing through the point $(0, 1, -2)$ and containing the line $\mathbf{r}(t) = (0, 2, -3) + t(1, 0, -1)$.

7. Suppose that the plane $M$ contains points $P(3, 0, 4), Q(2, -3, 1)$ and $R(0, 0, 1)$, and the line $L$ contains points $P$ and $R$.
   (a) Find the equation of plane $M$.
   (b) Find the equation of line $L$.
   (c) Find the angle $\angle PQR$.
   (d) Find the equation of the line where $M$ and plane $2x - y - z = 4$ intersect.
   (e) Find the area of the triangle $\triangle PQR$.

8. The motion of a particle is $\mathbf{r}(t) = (2 + t)\mathbf{i} + (t - t^2)\mathbf{j} + (t^2 - 3)\mathbf{k}$.
   (a) Find the velocity $\mathbf{v}(t)$ and the speed $s(t)$ of the motion;
   (b) Find the acceleration $\mathbf{a}(t)$ of the motion;
   (c) Find the equation of the tangent line of $\mathbf{r}(t)$ at $t = 1$; speed.

9. Find the length of the curve $\mathbf{r}(t) = t\mathbf{i} + (2/3)t^{3/2}\mathbf{k}, 0 \leq t \leq 8$. 
10. Evaluate the limit or show that it does not exist.

\[ \lim_{(x,y) \to (2,2), x+y \neq 4} \frac{x+y-4}{\sqrt{x+y}-2}, \quad \lim_{(x,y) \to (0,0)} \frac{2xy}{x^2 + 2y^2} \]

11. Find all second partial derivatives of \( f(x,y) = 4x^3 - xy^2 \).

12. (a) Find the partial derivatives \( z_x \) and \( z_y \) if \( z + x^2 - 4y^2 - 1 = 0 \)

(b) Find the equation of the tangent plane to the surface \( z + x^2 - 4y^2 - 1 = 0 \) at the point \( (2,1,1) \).

13. Let \( y = uv \), where \( u \) and \( v \) are positive independent variables. If \( u \) measured with an error of 2% and \( v \) with an error of 3%, about what is the percentage error in the calculated value of \( y \)?