

Practice Exam

1. Prove that if $\vec{a} \cdot \vec{b} = \vec{a} \cdot \vec{c}$ and $\vec{a} \times \vec{b} = \vec{a} \times \vec{c}$, then $\vec{b} = \vec{c}$, provided that $\vec{a} \neq \vec{0}$,

2. Compute the volume of the tetrahedron with the vertices (a, a, a) , $(-a, -a, a)$, $(-a, a, -a)$, $(a, -a, -a)$.

3. Find the distance between two skew lines, L_1 and L_2 , where L_1 is a diagonal in one of the faces of the unit cube, and L_2 is one of the diagonals of the cube that does not meet L_1 .

4. How many axes of symmetry does the function $x^2 + y^2$ have?

5. Which of the functions can be transformed into each other by linear changes of coordinates:

$$3xy + y^2, \quad x^2 + 3xy + 2y^2, \quad x^2 + 3xy - 2y^2 ?$$

6. Describe all those quadratic curves which *cannot* be obtained as conic sections.

7. Find the foci of the hyperbola $xy = 1$.

8. Identify and sketch the surface given in spherical coordinates by the equation $\rho^2 \cos 2\phi = 1$.