

Maple Homework 1 Spring 2008

Due Date: Monday, March 17th

1. Vectors, dot and cross product

- Given $\mathbf{a} = \langle 5, -3, 2 \rangle$, $\mathbf{b} = \langle -2, 6, 7 \rangle$, compute $\mathbf{a} \cdot \mathbf{b}$, $|\mathbf{a}|$, $\mathbf{a} \times \mathbf{b}$ and $\mathbf{c} = 3\mathbf{a} - \frac{1}{2}\mathbf{b}$
- Compute a vector perpendicular to the plane that passes through the three points $P = (1, -2, 0)$, $Q(4, 1, -3)$, $R(5, 3, 1)$
- Compute the area of the triangle with vertices $P(6, 3, 1)$, $Q(0, 1, 2)$ and $R(4, -2, 5)$
- Show that the vectors $\mathbf{a} = \langle 1, 4, -7 \rangle$, $\mathbf{b} = \langle 2, -1, 4 \rangle$, and $\mathbf{c} = \langle 0, -9, 18 \rangle$ are coplanar by computing the scalar triple product
- Let $\mathbf{a} = \langle a_1, a_2, a_3 \rangle$, $\mathbf{b} = \langle b_1, b_2, b_3 \rangle$. Prove that $\mathbf{a} \times (\mathbf{b} \times \mathbf{c}) = (\mathbf{a} \cdot \mathbf{c})\mathbf{b} - (\mathbf{a} \cdot \mathbf{b})\mathbf{c}$

2. Quadric surfaces in 3D

- Plot the sphere defined by $x^2 + y^2 + z^2 = 4$ for $-2 \leq x, y, z \leq 2$
- Plot the “ellipsoid” defined by $x^2 + 4y^2 + 9z^2 = 1$ for $-1 \leq x \leq 1$, $-1/2 \leq y, z \leq 1/2$
- Plot the “hyperboloid of one sheet” defined by $x^2 - y^2 + z^2 = 1$ for $-7 \leq x, y, z \leq 7$
- Plot the “elliptic paraboloid” defined by $y = 2x^2 + z^2$ for $-5 \leq x, z \leq 5$, $0 \leq y \leq 15$
- Plot the “cylinder” defined by $x^2 + 2z^2 = 1$ for $-1 \leq x, y, z \leq 1$
- Plot the “hyperboloid of two sheets” defined by $-x^2 + y^2 - z^2 = 1$ for $-5 \leq x, y, z \leq 5$
- Plot the “cone” defined by $y^2 = x^2 + 2z^2$ for $-5 \leq x, y, z \leq 5$
- Plot the “hyperbolic paraboloid” defined by $x^2 - y - z^2 = 0$ for $-10 \leq x, y, z \leq 10$
- Plot the two planes defined by $x + y + z = 1$ and $x - 2y + 3z = 1$ on the same graph