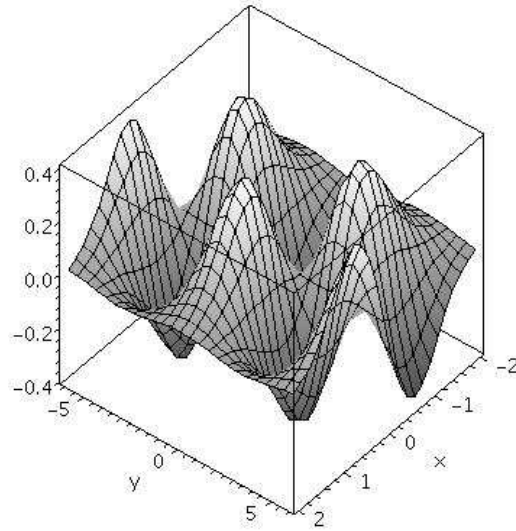


1. Sums of vectors, lengths, dot product, cross product
2. Rope problems, work problems, torque problems
3. Derivatives/integrals of vector functions
4. Arc length, curvature, normal, binormal, tangent vectors
5. Motion in space; cannon problem
6. Contour plots from surfaces
7. Parametric surface
8. Limits, limits, limits!
9. Partial derivatives and tangent planes and tangent approximations

Example test

- Let $a = (1, 2, -3), b = (-1, 0, 4), c = (2, 2, 2)$. Find $a + 2 * b$, $a \cdot c$, a unit vector perpendicular to both a and b .
- A mass hangs from a fishline forming angles of 30 and 45 degrees. The line is rated at 80 pounds. What is the maximum mass that can be placed on the line?
- A wrench 10 in long lies along the positive x -axis. A force of 50 lbs is applied in the xy plane from the end of the wrench in the direction $\langle 2, -3 \rangle$. What is the torque on the wrench?
- Let the velocity of a particle be given by $v(t) = \langle \sin(2t), t, \cos(t) \rangle$. Find its acceleration. Find its speed. Given that at $t = 0$, the particle is at the origin, find its position. At $t = 2\pi$, how far away is it from its initial position?
- Find the unit tangent, normal, binormal vectors and the curvature for $r(t) = \langle 8t, \sin(4t), \cos(4t) \rangle$. At $t = \pi/4$, find the equation for the tangent plane.
- A football is thrown at a height of 7 feet, a speed of 6 feet per second at an angle of 45 degrees from the horizontal plane. Neglecting friction, how far does it go before it lands?

- Plot the contours for the illustrated surface.



- Find parametric equations for the surface obtained by rotating the curve, $y = x^3$ for $0 \leq x \leq 3$ about the x -axis.
- Does the following limit exist?

$$\lim_{(x,y) \rightarrow (0,0)} \frac{x^3y - xy^3}{x^2 + y^2}$$

- Let $z = f(x, y) = x^3y - x^2 + y^3$. Find the equation for the tangent plane at the point $(1, 1, 1)$. Use the linear approximation to estimate z when $x = 1.2, y = 1.1$. Find f_{xx}, f_{xy}, f_{yy} .